Intellectual Property System, particularly Patents, utilized in University – Industry Collaboration and Start-up Company – Experiences in Japan

Final Report

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Abstract

More often Patent holders find it difficult to commercialize their Patents. Patents held by Universities and educational institutions are no exception. In the top 100 revenue generating industries for 2015 published by Reuters almost half of the Universities are from United States of America. With Japan ranking second in the above list there are valuable lessons that can be learned to achieve success in utilization of Patents by studying the methodology adapted in Universities in Japan. Further in India there is lot of support to start-ups with the intention to build a strong ecosystem for nurturing innovation and startup in the Country.

The methodology adapted involves study of literature, Quantitative and Qualitative analysis. Quantitative analysis is carried out with the number of forward citations as an indicator of technological impact and IP value. The trend for the same is analyzed for the Indian Institute of Technology and Tokyo Institute of technology. From the Quantitative analysis where it is found that there are more occurrence of forward citations for joint applications with the Universities, it can be fairly concluded that the more active an University engages in joint research the more valuable patents it will generate.

Qualitative analysis relies on mainly on the expert opinion obtained through the in depth interviews from the representatives of some of the supporting organizations and SMEs and their experience in the supporting activity and running the SMEs successfully. The scheme of the interview questions are as below.

1. What is the most important IP support to Universities and Start-up companies from Government?
2. How should University IP office or its TLO work for growing the start-up companies from the aspect of IP?
3. What is the most important IP skills the leaders of the university IP office/TLO/Start-up companies must have?

The experts interviewed are from the three broad following categories.

1. Governmental Agency – Japan Science and Technology Agency (JST), National Center for Industrial Property Information and Training (INPIT)
2. University TLO / Venture Plaza
3. SMEs – Two from Engineering and Two from Pharma / life sciences

The study recommends for providing a platform for creators and innovators as per the Indian National IPR policy 2016 similar to New Technology Presentation Meetings, University Technology Exhibitions and Open Innovation Seminars conducted by JST in addition to providing databases like J-store of JST and PLID of INPIT and also a portal Site for Industry-Academia-Government Collaboration. Experts interviewed during the interview conducted as part of the research are also of the opinion that networking similar to that of University Network for Innovation and Technology Transfer (UNITT) has to be established and University IP offices should have full-fledged and dedicated IP personnel as early as possible. Those with experience in setting up the industry like TLO, incubation plaza and owners of the company are of the view that support is necessary for business development and more assistance in gap funding.

Table of Contents

List of Figures

List of Tables

1. Introduction

More often Patent holders find it difficult to commercialize their Patents. Patents held by Universities and educational institutions are no exception. In the top 100 revenue generating industries for 2015 published by Reuters almost half of the Universities are from United States of America. It seems these Universities have achieved the break even with lots of constant efforts and money and time spent on continuous research. Universities in India are yet to reach that level where they can be self-sustaining. With Japan ranking second in the above list there are valuable lessons that can be learned to achieve success in utilization of Patents by studying the methodology adapted in Universities in Japan.

In India there is lot of support to start-ups with the intention to build a strong ecosystem for nurturing innovation and startup in the Country. There are lot of initiatives that aim to empower Startups to grow through innovation and design and aim to accelerate the spreading of the Startup movement. In India an industry which is a small entity enjoys a benefit of 50% in Patent filing fees and a startup company can opt for expedited examination as per the provisions of the Patents Act, 1970.

In order to sustain and grow, Startup companies are to cultivate the culture of research and innovation and should know how to protect their innovation and also to commercialize their inventions. However the awareness level of startups were generally low so far. Lessons from other countries especially from Japan where innovation is part of the culture is valuable for the startups and they can learn a lot from the success stories of Japan. Developing an aptitude for IPRs in the beginning can lay a strong foundation for successful long sustainability and growth.

It is my sincere ambition that the startups in India learn the valuable lessons from the Japanese Counterparts of this study and reap the full benefits for themselves and for the Country.

In an article published at World Intellectual Property Organization (WIPO), it is mentioned that some European countries have tended to favor start-ups as opposed to licensing strategies [WIPO, 2017]. In India an industry which is a small entity enjoys benefit in Patent filing fees by 50% and a start-up company can opt for expedited examination as per the Patents Act, 1970 which is a big boost to Universities working in the direction to create spin-off companies with their Patent portfolio. It would be quite interesting to find out how Japanese Universities encourage start-ups for example like a team of Mentors in residence of the Tech transfer division of University of Michigan U.S.A. [University of Michigan, 2017] or Indian Institute of technology, Madras [IITM Incubation Cell, 2017] where seasoned entrepreneurs and Alumni working within bringing a wealth of entrepreneurial experiences and connections to help a start-up project.

Further in an article ‘does University Patent licensing pay off ?’ by Mr. Joseph Allen [IPWatchdog, Inc., 2017] it is emphasized that Technology transfer offices are actually service centers serving the public rather than serving their Universities as academic profit centers. As mentioned in this article Association of University Patent Administrators (AUTM) U.S.A. found in its study that University Patent licensing supported 3 million jobs from 1996 to 2010 and also created 10000 companies since Bayh-Dole was enacted and in 2012 alone 705 new academic start-ups launched. With lots of encouragement to start-ups in India a study on the progress made in Japan to help start-ups and the role of Universities will be very interesting.

This Study cum Research is conducted with a view to understanding the role played by the supporting organizations in Japan which provides a valuable information to a lot of Universities in India in setting up an Intellectual Property division in their campus to help them manage IP portfolios and to participate actively in commercializing of the Patents acquired. In the process

they will be helping the researchers or students in developing the entrepreneurship skills while establishing a startup and creating lots of job opportunities.

1.1 The Problem Consciousness of the Research

Japan has made significant improvements in encouraging Universities to commercialize the Patents held by them. With the formulation of the Act on the Promotion of Technology Transfer from Universities to Private Industry (the TLO Act), Japan promoted the establishment of Technology Licensing Organizations. This is followed by the Act on Special Measures for Industrial Revitalization (the "Japanese Bayh–Dole Act"), which was enacted in 1999 and modelled on the Bayh–Dole Act enacted in the US in 1980. This allowed universities to retain title to inventions resulting from state-funded research. In Japan with many research universities being national universities there was restrictions on retaining rights to invention. Universities rarely filed patent applications, and in cases where inventing was a part of a university research scientist's academic duties, the rights to inventions were generally vested in the individual, i.e., the professor, and not the organization. With the Implementation of the National University Corporation Law in 2004 the restrictions on technology transfers were relaxed significantly. A mechanism was introduced to create competition among universities: University budget were paid in a lump sum as an institutional discretionary fund for operating expenses [Motohashi Muramatsu, 2011].

In 2002, Japan presented a fundamental concept of shifting invention ownership to Universities (emphasizing the exploitation of inventions). In response to this concept, Universities should draft a policy for acquiring invention ownership. Further in the following year, 2003, Ministry of Education, Culture, Sports, Science and Technology (MEXT) reviewed the plans submitted by the Universities for vesting IP ownership in them, the management and exploitation of created IPs, on-campus awareness raising, IP creation promotion initiatives, and cooperation with Technology Transfer Offices. MEXT then decided to support 34 universities for up to five years [Hatori, 2016].

In India Protection and Utilization of Public Funded Intellectual Property (IP) Bill was presented by the Ministry of Science and Technology in 2008. It was considered that the creation of new products and processes through technological innovation is essential for a country's economic growth and India lags behind due to a variety of reasons such as low level of commercialization, lack of funding from industry, and government control of the right to intellectual property developed in research institutions through public funds. This Bill seeks to boost research and development in public funded research institutes by permitting the sharing of the right to intellectual property with the institutes and scientists who created them.

The highlights of the bill are

- The Protection and Utilization of Public Funded Intellectual Property (PFIP) Bill, 2008 seeks to provide incentives for creating and commercializing intellectual property from public funded research.
- The Bill requires the scientist who creates an intellectual property to immediately inform the research institution. The institution shall disclose this information to the government within 60 days.
- The institution is required to inform the government of the countries in which it proposes to retain the title to the PFIP. The title in all other countries will vest in the government.
- The scientist shall be paid a minimum of 30 per cent of net royalties received from the PFIP.

· Failure of the scientist to intimate the institution, and of the institution to inform the government carries penalties, which include fines and recovery of the grant funds.

The bill was withdrawn in 2010 with some of the criticism against the bill being it does not address why such why such legislation is required and does not address the actual issues that block technology transfer. The critics were also of the view that the Bill also lacks safeguards to ensure that exclusive licensing of publicly funded technologies does not create a market monopoly for private players [PRS Legislative Research (PRS), 2017] [Unnikrishnan, 2009] [Centre for Internet & Society, 2017].

They were also questioning its relevance to India and point out that the Bayh-Dole Act was passed when publicly funded scientific institutions in the US had no intellectual property rights over their discoveries and under the Indian Patents Act, IP rights are with the scientists automatically, unless the institution signs an employment agreement stating that rights vest with the organization [Unnikrishnan, 2009].

Further in India the Union Cabinet approved the National Intellectual Property Rights (IPR) Policy that will lay the future roadmap for intellectual property in India on 12th May 2016. The Policy recognizes the abundance of creative and innovative energies that flow in India, and the need to tap into and channelize these energies towards a better and brighter future for all [Department of Industrial Policy & Promotion, 2017].

The Policy lays down the following seven objectives:

1. IPR Awareness: Outreach and Promotion - To create public awareness about the economic, social and cultural benefits of IPRs among all sections of society.
2. Generation of IPRs - To stimulate the generation of IPRs.
3. Legal and Legislative Framework - To have strong and effective IPR laws, which balance the interests of rights owners with larger public interest.
4. Administration and Management - To modernize and strengthen service-oriented IPR administration.
5. Commercialization of IPRs - Get value for IPRs through commercialization.
6. Enforcement and Adjudication - To strengthen the enforcement and adjudicatory mechanisms for combating IPR infringements.
7. Human Capital Development - To strengthen and expand human resources, institutions and capacities for teaching, training, research and skill building in IPRs.

The Policy also seeks to facilitate domestic IPR filings, for the entire value chain from IPR generation to commercialization. It aims to promote research and development through tax benefits. A Cell for IPR Promotion and Management (CIPAM) [CIPAM, 2017-1] has been created as a professional body under the aegis of Department of Industrial Policy and Promotion (DIPP), Ministry of Commerce and Industry as envisaged in the National Intellectual Property Rights (IPR) Policy to facilitate promotion, creation and commercialization of IP assets. Some of the steps to be taken up as per the said policy with respect to commercialization are:

1. Provide a platform for IPR owners and users of IPRs by acting as a facilitator for creators and innovators to be connected with potential users, buyers and funding agencies; (5.1.1)
2. Establish links among different organizations for exchange of information and ideas as also to develop promotional/ educational products and services; (5.1.3)
3. Study and facilitate implementation of best practices for promotion and commercialization of IP within the country and outside; (5.1.5)

4. Promote licensing and technology transfer for IPRs; devising suitable contractual and licensing guidelines to enable commercialization of IPRs; promote patent pooling and cross licensing to create IPR based products and services. (5.2)
5. Provide support for MSMEs, Individual Inventors and Innovators from the informal sectors with enablers like facilitation centers for single window services to help them commercialize their IPRs. (5.3)
6. Incentivize Indian inventors, MSMEs and start-ups to acquire and commercialize IPRs in other countries also. (5.4)
7. Promote collaborative IP generation and commercialization efforts between R&D institutions, Industry, Academia and Funding Agencies. (5.7)

Hence this research aims at comparing the trend of commercialization of Patents in the Japan's Universities and in Indian Universities and analyze how the above goals are achieved. It focuses on the area of technology that the Universities consider as valuable or more revenue generating and how to channelize the process to achieve it. Many of the studies including Trajtenberg, Henderson and Jaffe (1997) used the number of forward citations as a measure of the technological impact and its economic value by comparing the University Patents and Corporate Patents with the assumption that University Patents are more basic and hence have greater technological value. Here comparative study is undertaken between randomly chosen Indian University and a University in Japan to understand the gaps in progress of Patent commercialization by Indian Universities.

1.2 Focus of the study:

This research is aimed at finding the
1. Key ingredients for Universities to adopt in order to generate revenue from Patents
2. Reasons and analysis for increase or decrease in ranking of the Universities
3. Technical field wise ranking of Patents that generated significant revenue or perceived to be valuable.
4. Suggestions from experts for start-up companies and University IPR divisions.

1.3 Expected Findings and benefits:

This Research helps to learn the practices / strategies adapted in University and Industry collaboration and the Role of the JPO and other supporting agencies viz. To what extent the assistance is provided by JPO for commercialization of Patents.

This study further helps to learn how Indian Patent Office and / or CIPAM can be an Interface or Intermediary between University and Industry or an Individual and Industry as a facilitator. It also helps Patent Office to be continuously conscious about the development of University and industry collaboration for making use of the Patenting System and also can be used as a tool to create awareness in Indian Universities and Institutions about the best practices followed in Japan in line with the plans and strategies formed by CIPAM, especially where Universities are yet to develop their Patent portfolios sufficiently.

2. Basic Information and Previous Studies

2.1 Information available through literature

In Japan since the 1990s, while its economy slowed down, during a remarkable activation of the industries through the development of industry-academia-government collaboration in

the United States, the structural reformative technology policies were emerging, such as support measures for industry-academia-government collaboration and deregulation reform policy [1, 2]. The most important relevant laws are:

1995: Basic Law on Science and Technology (1996 first basic plan)
1997: Act on the term of office of the faculty of the University
1998: Act on technology transfer from Universities (TLO Act)
1999: Law on special measures for Industrial Revitalization (Japanese version of Bayh-Dole Act)
2004: Incorporation of National Universities

In addition to the advantages provided under the TLO Promotion law, the Japan Patent Office (JPO) send, at their expense, intellectual property advisors to facilitate establishment of technology license offices in universities and research institutions. Intellectual property advisors are those who worked in patent and legal departments of Japanese companies and have experience in procuring and licensing patents and other intellectual property. These advisors train staff in technology transfer offices regarding patent application preparation, conduct prior-art searches, and develop a system within the universities to discover patentable subject matter and file patent applications. Further, the JPO also send, at their own expense, patent attorneys who give legal advice in licensing and litigation [Takenaka, 2004].
The role of Ministry of Education, Culture, Sports, Science and Technology (MEXT) in starting the program of establishing the "Intellectual Property Department" in Universities in July'2003 is considered significant and Tokyo Institute of Technology (Tokyo Tech.) subsequently established the Office of Research and innovation in Oct'2003 [1, 2].
With the passing of the National University Corporation Act, 2004 the restrictions of the National Universities arising from Government agency status is eased and Tokyo Tech is considered as National University Corporation and could independently manage their administration. This resulted in internalization of Tokyo Tech's Technology Licensing Office function into Office of the Industry Liaison and started the Industry Liaison membership program in April'2007. With the initiation of MEXT Program 'Promotion of International Industry-Academia-Government Collaboration' in June'2008 and Tokyo Tech's Collaborative Research Chair/Division Program in April'2009 collaborative research program with companies and organization started. As on June'2017 under this program 12 companies are active with Tokyo Tech's Office of Industry Liaison and also under the scheme to support startup 80 ventures were granted the title Tokyo Tech venture.

The Japanese Bayh-dole Act which is called the Industry Revitalization Law was enacted in 1999 with the aim of giving ownership to Universities and research institutions and to promote technology transfer to industry for commercialization. This law requires Ministry of Economy, Trade and Industry (METI) and MEXT to implement measures to promote technology transfer from research activities to private industries through licenses and assignments. METI enacted the law for promoting University-Industry Technology transfer (TLO promotion law) to promote the progress of industry and creation of new industry and research activities through technology transfer to industry by Universities. The law requires METI and MEXT to develop guidelines for encouraging technology transfer by Universities. While anyone can create a TLO without an approval, METI-MEXT approved TLOs are entitled to receive grants from METI and also METI guarantees the TLO debts with respect to approved business which facilitates to obtain bank loans. Further the approved TLOs were eligible for discount, exemption or deferral of Patent annual fees and official fees for requesting Examination [Takenaka, 2004].

The key challenges faced by India's innovation ecosystem and entrepreneurship in general before the National IPR Policy'2016 were perceived to be

1. Fragmented policy and policy implementation
2. Inadequate funding of R&D
3. Difficult and lengthy funding procedures
4. Lack of angel, venture capital, and seed funding
5. Weak linkages between stakeholders
6. Non-conducive education system
7. Poor infrastructure facilities in villages
8. Risk aversion among entrepreneurs
9. Inadequate protection of intellectual property rights [Abhyankar, 2014]

From the point of view of researchers and professors the question that usually props up is about the field or area of the technology where they should enter and how technology develops in that area. There is no straight forward answer to this. One of the well-known methods is to examine the importance of Patents as measured by the forward citations. While examining and analyzing the University Industry collaboration policy in Japan Mr. Motohashi Kazayuki (REITI) and Mr. Muramatsu Shingo (The University of Tokyo) observed that in US, subsequent to the enactment of Bayh-dole Act in 1980 the number of University Patents increased sharply, the quality of these Patents were less certain. They observed that Henderson et al. (1998) evaluated changes in the quality of university patents by examining changes in importance and generality, as measured by forward citations and indicated that while the number of university patents had increased sharply, their importance and generality declined in relative terms. They also mentioned about Sampat et al. (2003) advancing a counterargument using the same sample as Henderson et al. (1998), but expanded the estimate beyond 1992 to include citation data through 1999. They observed no decline in the importance indicator and argued that the result obtained by Henderson et al. reflected a truncation problem in the citation data. Characteristically, university patents tend to have a longer citation lag compared to company patents, so the data must be obtained over an extended period to clearly assess the number of citations. Further Mr. Adam B. Jaffe and Mr. Gaetan de Rassenfosse in their article "Patent citation data in Social Science and Research: Overview and best practices" indicate that the use of forward citations as a measure of technological impact and economic value.

2.2 Previous Studies

For improving the Intellectual Property System and innovation for the purpose of economic development three aspects of Policy making, supporting activities and practical aspects are generally considered [Trinh, 2015].

It is emphasized in the previous studies that policy making agencies such as National Council or headquarters should be established similar to MEXT and METI of Japan as it is seen that they play very important role in promoting the system and also supports IP divisions and TLOs at Universities [Trinh, 2015].

Supporting agencies are considered necessary as the financial support from the government for first five years is considered very important for TLOs / University IP divisions so that they become independent gradually. Further the experience from the developed countries also shows that it need at least 15 to 20 years for TLOs to have benefit. Support is also necessary for human resource development and TLOs / IP divisions need experienced persons from industry and academia and training the young people [Trinh, 2015].

In 2003 MEXT started to support the establishment of intellectual property offices (IPOs) at Universities up to 2007 in the form of subsidization. In 2008 MEXT started to support universities in promoting international collaboration between industry, academia and the government. This support encouraged many universities to conduct international joint research and licensing activities with overseas companies. In 2011, MEXT started to support the setting up of the posts of University Research Administrators (URAs) at Universities and its goal was to create an environment that ensured that researchers could concentrate on their research. As a result of MEXT having continuously supported universities in this way since 2003 to give research results back to society, a platform for university-industry collaboration and technology transfer has been established, with many universities grasping the importance thereof [Hatori, 2016].

From the practical aspect it is also required to be considered for Universities to choose which model of TLO system best suits them. In Japan TLOs can be external or internal. In case of external TLOs, it can be solely catering to a single University or to a multiple universities. They should also prioritize the type of commercialization i.e., licensing or creating a spin off or startup company. It is also considered important to have connection network among TLOs [Trinh, 2015].

Policy on IP and legislations on technology transfer and University IP management in Japan and the supporting mechanisms and activities by Japan Science and Technology Agency (JST), Japan Patent Office (JPO) and National Center for IP information and Training (INPIT) are considered vital. Mission of JST to maximize research achievements by integrating the world's knowledge as a 'network-type research institute' is of vital importance to maximize the benefits of the research results. JPO sending IP advisors to facilitate the establishment of TLOs in Universities and train them and conducting Patent licensing fairs are seen as essential to provide "meeting opportunity" for companies, Universities and research institutes [Trinh, 2015].

Japans IP policies have focused on supporting SMEs to promote regional IP utilization, strengthen IP management and effectively resolve IP disputes. For IP utilization and support for IP management by SMEs "Comprehensive IP support counters" have been established in various prefectures. Support for SMEs by JPO includes assistance from application status, utilization and overseas expansion. J-Plat Pat developed by JPO is an extremely useful digital tool for IP search. IP experts in Japan are preparing and implementing IP finance under the scheme called "Chizai-kinyu". "Evaluation report of IP based business" enables local financial institutions to grasp the actual conditions of a company and its growth through its own IP. There are support provided to SMEs by local (prefectural) support centers, private law firms and other supporting services such as linkers and Patent score [Nguyen, 2016].

JPO has setup IP total support centers as one stop service to help solve IP-related problems faced by SMEs during each step from conception to commercialization in an integrated manner in collaboration with IP specialists and other support organizations. The support also includes accelerated examination / appeal system and use of fee reduction / exemption system. Financial support includes subsidy for filing foreign applications, for counter measures against overseas IP right infringements and creation of IP business valuation report [Yoshida, 2016].

2.3 Necessity of Startups

When University produces an innovative research result and also files a patent application with high expectations it offers licensing to an existing company. The company may consider but in most cases declines the offer as University generated technologies are considered high risk and prefers to manage with the existing projects. This may be favorable at the individual

company level but not favorable from the perspective of national policy. This is because any industry that operates simply by continuing as before to follow existing business models without embracing new ones, will eventually go into decline under global mega competition. The Japanese government is therefore promoting business startups as its policy, while METI and MEXT are playing important roles in developing new industries and encouraging research based universities respectively [Hatori, 2016].

Japanese giants Toyota, Panasonic, Sony and Honda were founded less than 100 years ago, all starting as small startups. Nowadays, few startups exist in Japan with the potential to grow into such giants. To remedy this situation, the Japanese government is placing priority on setting up startups [Hatori, 2016].

University-Industry collaboration and its success being a complex phenomenon with lot of players involved in it. The role played by each one of the agencies is vital and hence there is an increased necessity to understand the process of growing startups from the aspect of IP especially the IP generated from Universities and the government support required therefor and the role of universities. This necessitates lot of interaction with people with research and academic background with less exposure to business knowledge and people with good practical knowledge and business related skills and ensuring the match between them. It has become vital to understand the skill sets required by those who are in the middle, typically the people working in IP divisions of Universities and companies including SMEs.

Collaboration between academia and industry is increasingly a critical component of efficient national innovation systems. It is useful to examine the experience of developed countries to better understand the different types of university-industry collaboration, motivations to form these agreements and barriers to cooperation, as well as the role of public policy in fostering such linkages. Developing countries face even greater barriers to such alliances, calling for a differentiated approach to promoting university-industry collaboration [Guimón, 2013].

The most appropriate approach to promoting university-industry collaboration depends on the country's technological and institutional endowments and its willingness to consider the promotion of university-industry linkages as part of a broader science, technology, and innovation policy program. The challenge for governments is to select policy instruments that best serve national needs, in consultation with key stakeholders. Facing limited budgets, governments along with firms and universities must make complex choices between collaboration in education or in research, between university collaboration with established firms or new firms (spin-offs, incubators), and between providing grants or developing science parks, among other factors [Guimón, 2013].

Business driven patents derive their value from the extent to which they fit the needs of the market. Rather than developing a technology and hoping the market will accept it, business driven inventing turns this process around. It determines what the market wants and then finds a unique and perhaps a patentable solution to fill the need. Even in today's information driven environment, scientists, technologists, and engineers still receive surprisingly little direction from their companies about problems that need to be solved. They often focus on what intrigues them, not necessarily what can be commercialized profitably. Technology-driven inventing is riskier and less efficient than its Market-driven counter-part and is less likely to reward companies and their investors. In this new paradigm, an understanding of the needs of the market precedes and directs the development of innovations. Instead of researchers pursuing a technology in the hope of making product improvements, marketing experts analyze customer needs and then present these needs to the researchers. These consumer needs then act to filter out innovations without market motivation, resulting in fewer patents sitting on the shelf and fewer new product failures [Jorasch, 2008].

It is important to have people who work closely with various departments in the University to find out what new things are happening. All department researchers and faculty members should know about the activities of the IP divisions and should understand that regular interactions with them is beneficial to them. It is desirable to have a monthly review meeting where inventors meet with the group of IP division personnel, Patent Counsel and expert advisors to determine if an invention is patentable, if it has a commercial value, whether patent application is to be filed or whether the inventor has to do some more work and whether the licensing strategy should involve forming a start-up or partnering with an established company. The inventor should be involved all along the way because his input is extremely valuable [Granowitz, 2008].

But the University IP divisions must be aware of the long process from identification of technology for research to successful commercialization and ascertaining the research strengths of the University that can be taken to the corporate world early in the process.

Jack Granowitz emphasized it in his own words of which is worth repeating.

> "… I think the reason that Columbia's technology transfer has been successful is that, at the beginning, we focused on licensing rather than start-ups. Second, we realized that the pharmaceutical industry was tremendously interested in patents and licensing. It was also the early days of biotechnology so we had something very unique, which we could put on the table. So part of what Columbia did well was to ascertain what strengths we had that we could take out to the corporate world. The deals done in the 1980s led to the development of products that by the 1990s were producing large royalty streams.
>
> Some of our start-ups pay us royalties; some have milestone payments. We try to get a flow of revenue. But the major sorts of money will come from royalties when the product is introduced, in combination with the equity interests… Sometimes you get front end payments which are spread out over a period of time. In addition to milestone payments, there could be performance payments. Sometimes on the start-up we will also do research, for which we receive funds. All of this allows some money to flow into the university which we can distribute back to the researcher [Granowitz, 2008]."

Technology transfer program in a university is a healthy ecology. Revenues generated through research that flow back to the university in the form of payments, partnerships and equity provide the basis for funding new research and education, which in turn create opportunities for innovation and new inventions. It helps the university to remain relatively independent and to prosper. But in order for it to work, it needs to be managed and marketed like a business [Granowitz, 2008].

Generally Universities fix certain percentage of income as royalty to the inventors and to the University. It may be 30% each or 20% to inventor and 30% to University etc. depending on the technology and market conditions. But they need to be aware that the royalty scheme can be a sliding up or a sliding down. In case of sliding up scheme both parties share the risk of market introduction. The licensor is not receiving royalties during the initial marketing stages as licensee uses initial investment in development and marketing. However as the sales of the product increases the licensee recoups the initial investment and licensors share of royalty increases.

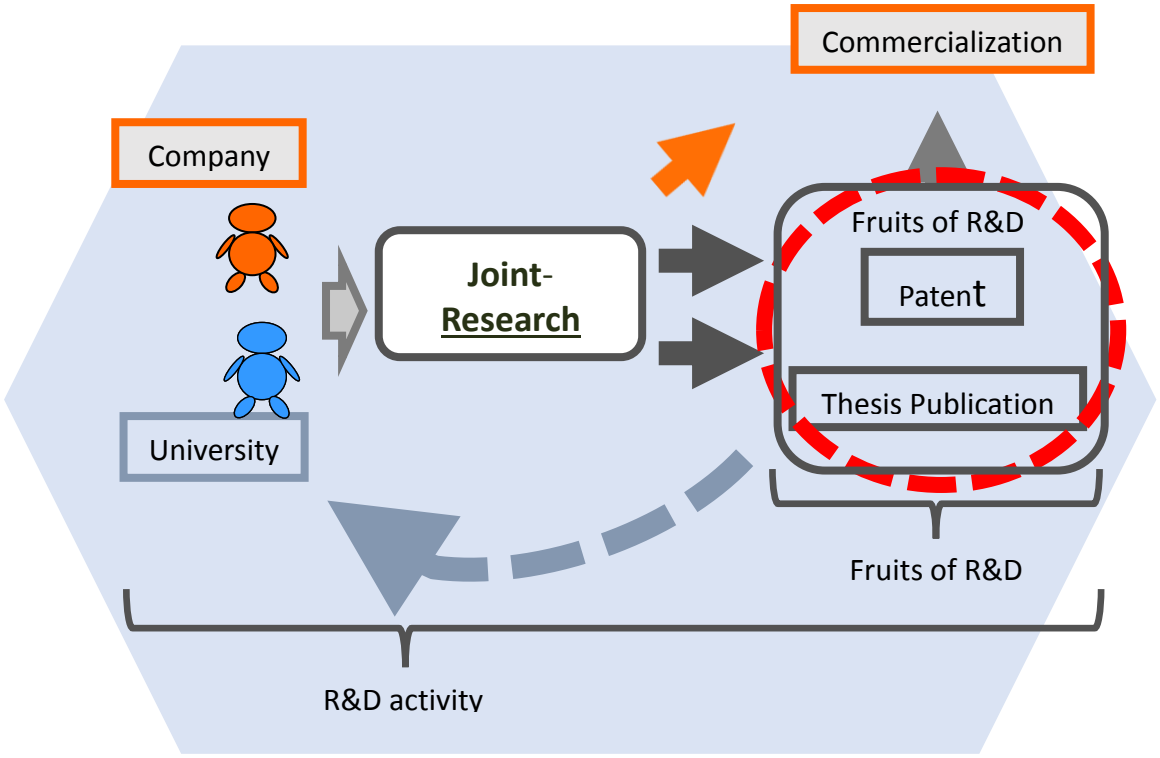


Figure 1 The U-I Collaborative scheme [3]

Table 1 Example of the royalty scheme [3]

Sliding up Royalty scheme	
Sales Quantity	**Royalty %**
0 to 999	0
1000 to 4999	3
5000 to 9999	5
10000 to 99999	7
100000 and more	10

Sliding down Royalty scheme	
Sales Quantity	**Royalty %**
0 to 999	10
1000 to 4999	7
5000 to 9999	5
10000 to 99999	3
100000 and more	2

Conversely when the product is being offered to the public at a high price because the product is so unique and novel that a certain percentage of public will pay a higher price for the product. As sales increases the licensee drops the price of the product not only to appeal to the larger market segment but also to frustrate the possible competitors coming out with similar products. In this situation as the price is lowered and quantities increased the licensors royalty drops. But the licensor does not suffer as greater number of products are sold [Dorr Munch, 1995].

The above illustration shows just one of the considerations required to be considered during licensing agreement and highlights the importance of having a skilled person at the IP divisions of a University or research institutions.

In India it should be noted that CIPAM a professional body under the aegis of DIPP which ensures focused action on issues related to IPRs and addresses the 7 identified objectives of the policy. CIPAM assists in simplifying and streamlining of IP processes, apart from undertaking steps for furthering IPR awareness, commercialization and enforcement.

CIPAM assists in simplifying and streamlining of IP processes, apart from undertaking steps for furthering IPR awareness, commercialization and enforcement. Technology and Innovation Support Centre (TISC) program of CIPAM intends to feed innovators with access to locally based, high quality technology information and related services, helping them to exploit their innovative potential and to create, protect, and manage their intellectual property (IP) rights. TISCs provide a diverse range of services, helping inventors, researchers, and entrepreneurs unlock their innovative potential.

- Training on access to and use of patent information
- Access to patent and non-patent databases
- Support to inventors in patent filling and IP commercialization
- Create networks and contribute to exchange of experience
- Provide quality services on patent search and analysis
- Increase awareness on IP and contribute to economic growth in the country

Services provided by the Technology and Innovation Support Center could be launched at a basic level and built up according to local user needs and include advice on licensing as additional (optional) service [CIPAM, 2017-2].

3. Methodology of the Research

The methodology adapted involves study of literature, Quantitative and Qualitative analysis by getting the opinion of the experts from various categories as the field of commercialization of Patents is very wide and diverse. Quantitative analysis of the Revenue generated by universities and their respective technical field is carried out by analyzing the revenue generated from research and revenue generated from IPRs along with forward citation analysis in order to understand the importance of joint research by University and Industry. The trend for the revenue generated is analyzed for the Indian Institute of Technology and University of Tokyo. Further analysis is carried out with the number of forward citations as an indicator of technological impact and IP value. The trend for the same is analyzed for the Indian Institute of Technology and Tokyo Institute of technology. The above Universities are chosen randomly.

The Qualitative analysis focus on the activities of various supporting organizations such as INPIT, JST, UNITT, Yokohama Venture Plaza and also few successful SMEs and TLO to study its relevance to the Indian context and to the other developing countries. For this the study is mainly dependent on the expert opinion obtained through the in depth interviews from the representatives of some of the supporting organizations and SMEs and their experience in the supporting activity and running the SMEs successfully. It is necessary to understand the actions taken at various levels by different agencies and their relevancy to the Indian context and the other developing countries. The study also aimed to be narrative with the inputs from several Industries who are successful in harnessing their IP Portfolio and further study on the existing set up in India for IP utilization and the history of IP support to Industries and Universities in Japan. The questions to the experts in the field is based on the following three categories.

1. What is the most important IP support to Universities and Start-up companies from Government?

It is important to understand the role played by the Government and its supporting agencies and the valuable lessons from its implementation. Such a process started in Japan from late 1990s and there is a need to find out how this process evolved over time. In spite of the perception that the University-Industry collaboration helped the large companies there is a growing trend to start a company and interest in startups is being revived in Japan. The challenges faced by the companies and the role of Government initiatives in Japan as seen by the experts in the field is a valuable input.

2. How should University IP office or its TLO work for growing the start-up companies from the aspect of IP?

How University can engage a small company in research is a very challenging question. Incubation cells or Research Parks and their role is very vital for startups to grow. There is a need for clear understanding and awareness of benefits offered through the Universities for the small industrialists.

3. What is the most important IP skills the leaders of the university IP office/TLO/Start-up companies must have?

Persons engaged in IP divisions of a company or industry are usually expected to have sound knowledge of research as well as experience in establishing a company besides a

good knowledge of IPR, licensing activities etc. Hence it is important to understand the skills required and how frequently they are trained as finding people with multiple skills is hard to find.

The category of interviewee is categorized as experts with long experience in Policy making and supporting agencies such as METI, JST and INPIT and experts with long work experience in TLO and Venture plazas along with the Company representatives where the company has grown utilizing its Intellectual Property.

Table 2. The scheme for the interviews.

Area of Expertize	Organization	Interviewee
Govt. Agency	Tokyo Institute of Technology (TIT)	Prof. Masahiro Hashimoto (formerly METI)
	INPIT	Mr. Yuzaburo Kanezaki, Senior IP Advisor for U-I Collaboration
	JST	Mr. Yoshio Nanba, Senior Researcher
TLO / Venture Plaza	Campus Create	Mr. Kohei Yasuda, CEO
	Yokohama Venture Plaza (TIT-YVP)	Mr. Hitoshi Akimoto, Chief Incubation Manager
SME/Startup (Engineering)	ZyCube	Mr. Manabu Bonkohara, CEO
	Street Design	Mr. Kajiro Sakamoto, President
SME/Startup (Pharma / life science)	Therabiopharma	Dr. Atsushi Imaizumi, Vice President
	CellSeed	Dr. Setsuko Hashimoto, CEO

4. Results and Analysis

4.1 – Quantitative Analysis

4.1.1 Revenue generation through research and IP

The revenue generated through research and patents available for top ranking Institutes from India available at https://www.nirfindia.org/OverallRanking.html / is collected and compared with the figures obtained from the website of University of Tokyo.

Table 3. Comparison of the revenue generated through research and patents between Indian universities and the University of Tokyo

University	**Income from Research**		**Income from IP**	**Proportion (approx.)**
University of Tokyo	52,868,000,000 (fiscal 2016)		6,588,457,000 (end of 03/2017)	**12.46%**
	Sponsored research 2015-16	**Consultancy project 2015-16**		
IISC, Bangalore	5,379,344,267 (Rs.3192478039)	180,605,670 (Rs.107184000)	17,070,699.99 (Rs.10127000)	**0.31%***
IIT, Madras	3,271,101,914 (Rs.1941300000)	1,064,081,213 (Rs.631500000)	65,486,286.53 (Rs.38849000)	**2.00%***
IIT, Bombay	3,651,407,741 (Rs.2167000000)	592,111,066 (Rs.351400000)	96,419,871.55 (Rs.57200000)	**2.64%***
IIT, Kharagpur	1,732,527,780 (Rs.1028202810)	382,137,797 (Rs.226787219)	11,504,186.95 (Rs. 6824729)	**0.66%***
IIT, Delhi	1,321,439,715 (Rs.784234483)	673,286,669 (Rs.399575264)	8,875,074.96 (Rs. 5265038)	**0.67%***

* W.r.t. sponsored research only

From the above it appears that the focus from research to IP revenue generation needs more emphasis. It obviously indicates the need to focus research activities with the aim of obtaining and commercializing Patents in addition to offering research activity only as a service or sponsored research. Contribution of research results towards creation of IP at the stage when research activity started may not be the main focus with more emphasis on academics. But it certainly indicates the road ahead for other Indian Universities and the need to engage in joint research with Industries in the early stages in order to compete with the prestigious group of Indian Institute of Technology and other top end universities. Further it should be noted that the comparison here is merely to study the size and does not necessarily refer to as a performance indicator under similar situations.

4.1.2 Forward Citations as a measure of IP value and technological impact

Forward citations are considered as a measure of technological impact and having an economic value. Using the number of forward citations as a measure of technological impact of a patented invention can be motivated by direct analogy to the larger and pre-existing

bibliometric literature starting with Garfield (1955) and later Trajtenberg, Henderson, and Jaffe (1997) undertook to demonstrate the validity of this and other metrics by comparing the citation rate to university patents and corporate patents [Jaffe de Rassenfosse, 2017]. The important patents are those that are cited a lot and the number of forward citations is considered as a good predictor of importance [Jaffe de Rassenfosse, 2017].

It has been suggested in general to use the following indicators as patent quality:

(1) Ratio of granted to filed patents; (2) International scope; (3) Technological scope and (4) Citation frequency [Ernst, 2003].

A comparative study between an Indian University and a University of Japan is done to understand whether number of forward citations can demonstrate the impact of joint collaboration between an industry and a University. Also the data of revenue generated by University Patents and the number of forward citations can be a good combination of parameters to analyze the value and impact of the respective Patents.

A comparative study of the Patents obtained by Indian Institute of Technology and Tokyo Institute of Technology which is chosen randomly is undertaken. Data for forward citations is to be obtained for sufficiently longer period of time to clearly arrive at the number of citations comparable. At least 10 years of time from publication date is considered for this study. Hence the Patent applications published from 2000 to 2004 is considered. The data for both the Universities are obtained from the Espacenet advanced search page, (https://worldwide.espacenet.com/advancedSearch?locale=en_EP) where forward citation data can be obtained. The data refers to the number of citations obtained as on September 2017. The data obtained is tabulated below.

Table 4. Total applications:

	IIT					TT				
	2000	2001	2002	2003	2004	2000	2001	2002	2003	2004
Total no. of applications published	8	7	28	17	17	22	31	32	30	41
Sole application and with inventors	7	3	20	14	14	21	23	16	20	16
Joint application with others	1	4	8	3	3	1	8	16	10	25
Total no. of forward citations	7	28	19	159	28	137	84	116	299	131
Citation/appl.	0.875	4	0.678	9.35	1.64	6.22	2.70	3.6	9.96	3.19
No. of application with forward citations	**2**	**2**	**6**	**6**	**6**	**15**	**19**	**22**	**20**	**32**
Applications with FC / appl.	**0.25**	**0.28**	**0.21**	**0.35**	**0.35**	**0.68**	**0.61**	**0.69**	**0.66**	**0.78**

Table 5. For Joint application with others

	IIT					TT				
	2000	2001	2002	2003	2004	2000	2001	2002	2003	2004
No. of Joint application with others	1	4	8	3	3	1	8	16	10	25
No. of applications	0	2	2	0	2	1	3	13	6	22
%	0	50	25	0	66	100	37	**81**	**60**	**88**

Table 6 For sole / joint application with inventors:

	IIT					TT				
	2000	2001	2002	2003	2004	2000	2001	2002	2003	2004
Sole application and with inventors	7	3	20	14	14	21	23	16	20	16
No. of applications	2	0	4	6	4	14	16	9	14	10
%	28	0	20	42	28	66	69	56	70	62

The number of applications for the Indian Institute of Technology for the above period is too less to be considered as a sample and to draw meaningful conclusion. The data of Tokyo Institute of Technology showed more number of forward citations. In case of joint application with others usually companies or other research labs the number of forward citations is slightly higher with more numbers registering forward citations by 2004. Joint applications can indicate the presence of collaborative research. It can be implied that the more active an University engages in collaborative research the more valuable patents it will generate. It can be seen that even the patents without the joint applicants as companies had significant number of forward citations for Tokyo Institute of Technology implying spillover effect. Presence of a collaborative research atmosphere can be said to have a positive spillover effect on the research themes selected by other groups of the University researchers.

Further it should be noted that especially IIT-Madras and IIT-Bombay have established research parks and incubation cell as a way to achieve commercialization of Patents and made significant progress. But other than the few high end Universities and institutions rest of the Universities are yet to make progress and most of them are focusing on developing their patent portfolio with more attention on Patent filing. It is important that they recognize that the joint research with industry with long term partnership is vital for increase in the filing rate as well as future commercialization. But with SMEs the goals are usually of short term compared to Universities. SMEs may not have sufficient time and money to match their needs with that of University where the thrust is more on basic research.

Forward citation analysis can also be used to get the trends of technical fields based on IPCs that can be termed more valuable for the period under consideration. For example for the above data the relevant IPCs with number of occurrences of forward citations is shown in Table 7 for Tokyo Institute of Technology.

Table 7 Relevant IPCs with number of occurrences of forward citations

IPC	Field	No. of occurrences (no. of forward citations)
H01L	SEMICONDUCTOR DEVICES; ELECTRIC SOLID STATE DEVICES NOT OTHERWISE PROVIDED FOR	18, 146
G06F	ELECTRICAL DIGITAL DATA PROCESSING	7, 33
C23C	COATING METALLIC MATERIAL; COATING MATERIAL WITH METALLIC MATERIAL; SURFACE TREATMENT OF METALLIC MATERIAL BY DIFFUSION INTO THE SURFACE, BY CHEMICAL CONVERSION OR SUBSTITUTION; COATING BY VACUUM EVAPORATION, BY SPUTTERING, BY ION IMPLANTATION OR BY CHEMICAL VAPOUR DEPOSITION, IN GENERAL	7, 15
G21C	NUCLEAR REACTORS	6, 49
C07D	HETEROCYCLIC COMPOUNDS	5, 18
G01N	INVESTIGATING OR ANALYSING MATERIALS BY DETERMINING THEIR CHEMICAL OR PHYSICAL PROPERTIES	4, 20
C30B	METALLURGY - SINGLE-CRYSTAL-GROWTH	4, 8
F25C	REFRIGERATION OR COOLING; COMBINED HEATING AND REFRIGERATION SYSTEMS; HEAT PUMP SYSTEMS; MANUFACTURE OR STORAGE OF ICE; LIQUEFACTION SOLIDIFICATION OF GASES	4, 14
C08G	MACROMOLECULAR COMPOUNDS OBTAINED OTHERWISE THAN BY REACTIONS ONLY INVOLVING UNSATURATED CARBON-TO-CARBON BONDS	3, 30
B01D	PHYSICAL OR CHEMICAL PROCESSES OR APPARATUS IN GENERAL - SEPARATION	3, 43
G02B	OPTICAL ELEMENTS, SYSTEMS, OR APPARATUS	3, 25
C12N	MICROORGANISMS OR ENZYMES; COMPOSITIONS THEREOF (...); PROPAGATING, PRESERVING OR MAINTAINING MICROORGANISMS (...); MUTATION OR GENETIC ENGINEERING; CULTURE MEDIA	3, 34
H01M	PROCESSES OR MEANS, e.g. BATTERIES, FOR THE DIRECT CONVERSION OF CHEMICAL INTO ELECTRICAL ENERGY	3, 24

However caution should be exercised before considering these trends, for example the above figures has limitations of lesser sample size, the period and the institutes considered represents the circumstances unique to their own goals, policies and directions etc. Further it should also be noted that the comparison here is merely to study the size and trends if any and does not necessarily refer to as a performance indicator under similar situations.

4.2 – Literature Review

It is found that Collaborative research is the dominant mechanism of technology transfer in Japan and TLOs play a secondary role. 50% of all patented university inventions are

attributed to joint research and 75% of all patented university inventions actually transferred to Industry are joint research inventions on which university and company apply jointly for patents. Further MEXT data also show the dominance of large companies among co-applicants of joint Patents with major universities with Keio University having 80% in 2004 and 2005 and U Tokyo 75% in 2004 and 86% in 2005. It is also observed that in the field of life sciences joint research partners are a mixture of startups, other SMEs and large companies whereas in other fields partners are overwhelmingly large companies [Kneller, 2011].

4.2.1 Best Practices for Companies

Promising outcomes of University projects often fail to translate into tangible impacts for the companies involved due to an outcome-impact gap in University collaborations. From a business point of view research outcome is considered only of incidental importance. What matters is not outcome but impact i.e, how the new knowledge derived from a collaboration with a University can contribute to a company's performance [Pertuze et al., 2010]. Therefore the seven best practices prescribed that is said to bridge this outcome-impact gap are:

1. Define the projects strategic context as part of the selection process
2. Select boundary-spanning project managers with three key attributes of in-depth knowledge of technology needs in the fields, inclination to network across functional and organizational boundaries and the ability to make connection between research and opportunities for product applications.
3. Share with the University team the vision of how the collaboration can help the company
4. Invest in long-term relationships
5. Establish strong communication linkage with the University team
6. Build broad awareness of the project within the company
7. Support the work internally both during the contract and after, until the research can be exploited.

Information exchange between Industry and University is very important in general as it serves for practicing the above best practices for industry. The data provided by University websites can disseminate lot of useful information for the individuals as well as industry. In order to understand the efforts made in Japan for promoting collaborative research the information provided by some of the top ranking Japanese Universities and the supporting agencies in their website are studied. The data available in their website can be taken as indicative of the concrete steps taken by them.

Some of the major features available in the websites of Japanese Universities:

a. Separate link for IPR cell or division with IPR policy and administrative unit details
b. Invention disclosure and patent filing details with procedure
c. Joint research details
d. List of available patents for licensing
e. Procedures for requirement of research by companies
f. Revenue from research and Patents
g. Details of support to start ups
h. List of research topics
i. Research agreement formats and sections on COI (Conflict of interest)
j. License agreement formats and guidelines
k. Support for joint research abroad

l. Education on IPR and IP management
m. Researcher database

Further initiatives are also undertaken by many universities, for instance the University of Tokyo has established the University of Tokyo Institutes for Advanced Study (UTIAS) on January 1, 2011, as a University-wide organization to enhance the University's academic excellence and further internationalize its general research environment. Here it provides details about Grant-in-Aid for Scientific Research Project, Other competitive funds, Commissioned research, Collaborative research with private sector etc, research grants from external organizations etc. It also has Institution / statistical data having the details of number of domestic and foreign patents, income from licenses etc [The University of Tokyo, 2017]. Kyoto University has a separate link to Office of Society – Academia Collaboration for invention having details about venture support for Promoting Entrepreneurship, Consultancy to University Start-ups, Entrepreneurship Educational Program and also to support and fund the rapid development of business concepts developed by Kyoto University faculty, students, alumni or relevant persons who have significant potential synergy with the University, into viable ventures [The University of Tokyo, 2017]. Similarly Tokyo Tech established the "Office of Industry Liaison (OIL)" in January 2004 to promote the utilization of knowledge generated on campus. Its OIL website has details of programs for research like collaborative research program, Collaborative Research chair / Division Program, sponsored research program, research alliance program etc. [Office of Industry Liaison, Tokyo Institute of Technology, 2017]. Further Tokyo Tech implemented education and research system reforms throughout the Institute in April 2016. One key factor in successfully see these changes through lies in Tokyo Tech's ability to establish and strengthen frameworks that facilitate close and cooperative relationships with industry [Tokyo Institute of Technology, 2017]. All the above observations clearly show the keen interest of Japanese Universities in conducting joint research with industries and also to promote entrepreneurship.

In India some of the premier institutes like Indian Institute of Technology have made significant efforts and progress by establishing research parks with incubation cell for promoting entrepreneurship and for establishing a strong link between industry and academia. However an industry cannot know for sure whether its goal matches with the research topics of other Universities as many times companies prefer proximity of the Universities. Here information exchange between universities and also between industries becomes vital. Sometimes interaction between big corporations and small industries is also important. Hence networking of Universities plays an important role as it provides platform to match the needs of the industry with the research requirement or strength of a particular University.

4.2.2 Importance of Networking

University Network for Innovation and Technology Transfer (UNITT) established in Japan for instance serves this purpose. UNITT was established in order to promote the sound development of partnerships between academia and industry, through exchange, awareness raising, investigations and research, proposals, and other activities aimed at helping institutions of higher learning manage intellectual property and transfer technology more efficiently, maintaining a close partnership between institutions of higher learning, TLOs, and the individuals and institutions that support their activities [UNITT, 2017-1].

Its major Activities includes:

1. Proposals to help institutions of higher learning manage intellectual property and transfer technology more efficiently

2. Exchange of information, investigation, and research
3. Workshops and seminars aimed at developing human resources and disseminating information
4. Publication of an Association journal and other periodicals
5. Enhanced communication, exchange, and cooperative relations with other organizations in Japan and internationally
6. Enhancement of a national support system for intellectual property management and technology transfer at institutions of higher learning
7. Raising awareness, education, and proposals regarding intellectual property management and technology transfer at institutions of higher learning

Its full members are TLOs (Technology Licensing Offices) and Institutions of higher learning (schools / faculties involved in intellectual property. National Universities in Japan did not have legal personhood as of 2002 and hence they had to set up TLOs which are required to have legal person hood outside of their campuses at that time [Hatori, 2016]. In 2004 the National Universities turned into legal entities and hence some Universities integrated their Intellectual Property Offices (IPO) with the TLOs. Hence in Japan three types of TLO-IPO cooperation came into existence. First is an integrated form of IPO and TLO. The second one is one to one cooperation between a University and extra-campus TLO. The third one is one to many extra campus TLO and multiple Universities.

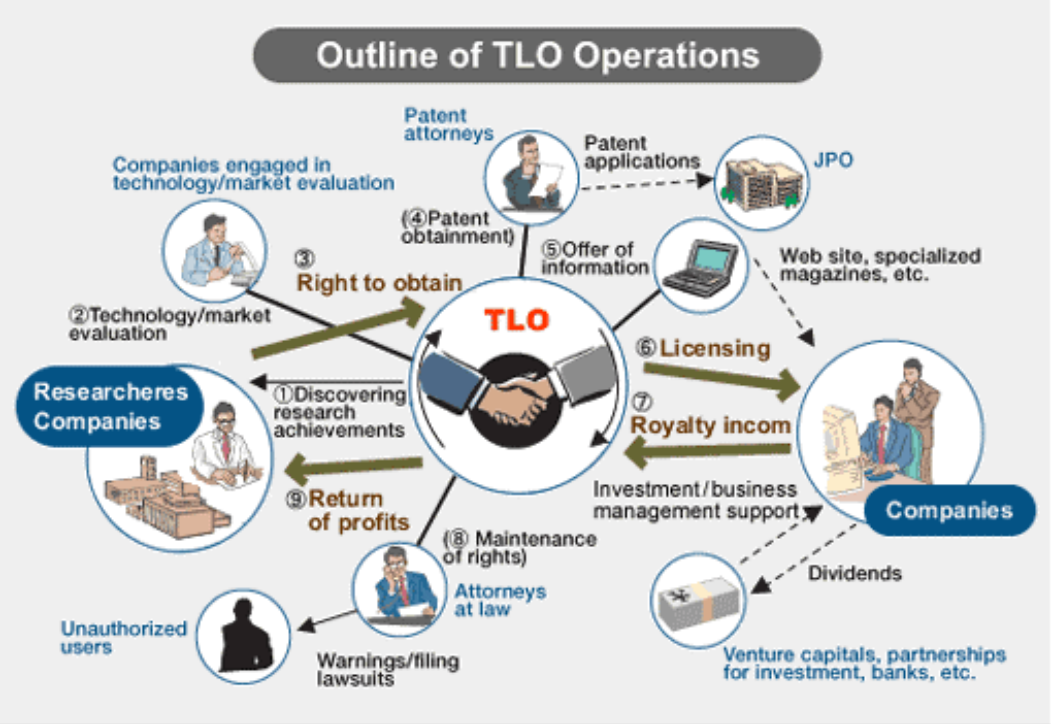


Figure 2. Outline of a TLO [UNITT, 2017-2]

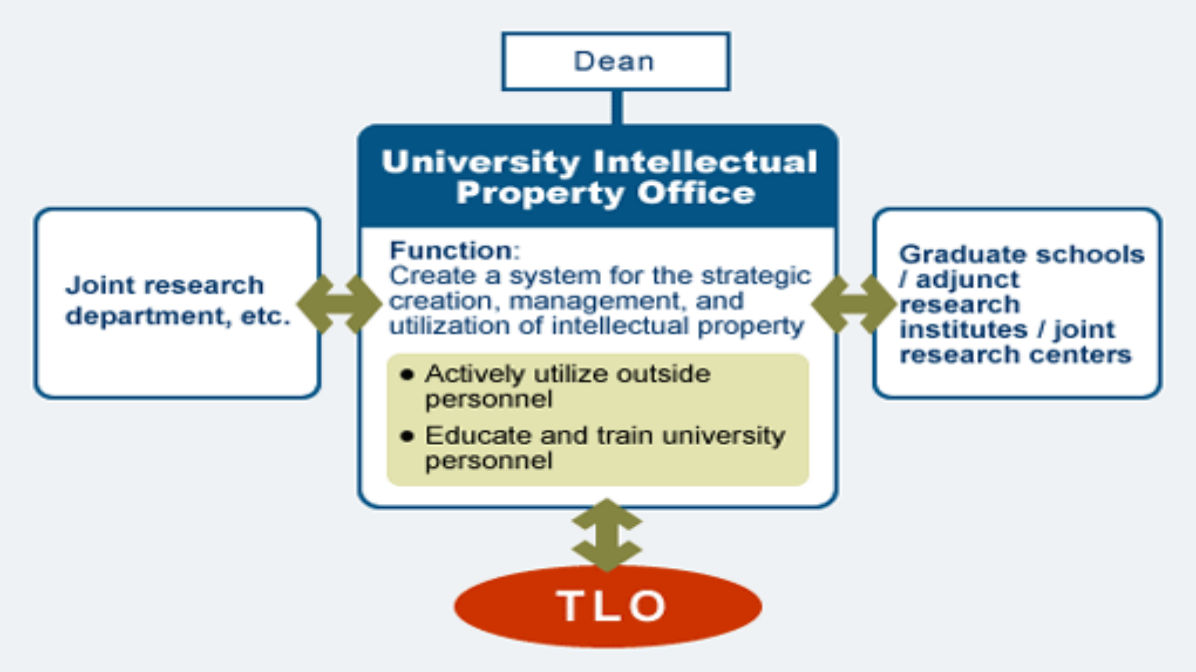


Figure 3. Interaction of university IP office with TLO
[UNITT, 2017-3]

University IP office interacts with TLOs for commercialization and with internal research teams for creation and management of IP.

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.

4.2.3 Measures by Government Agency

4.2.3.1 Measures taken by INPIT

Further in Japan National Center for Industrial Property Information and Training (INPIT) helps and assists innovation oriented small and medium sized enterprises, startups, universities, national laboratories and related consortiums. The INPIT was established as an independent administration unit and provides comprehensive information on industrial property. It has implemented a SME support program since FY 2011. IP strategy experts are currently coaching SMEs that intend to launch business especially in Asian markets. In order to support the strategic IP management of industry-academia-government R&D consortiums IP strategy experts are dispatched to the consortiums. The INPIT also helps establish networks of Universities within a strategic IP and R&D alliance in special fields. The INPIT maintains the Patent Licensing Information Database (PLID) and Research Tool Patent Database (RTPD) as IP utilization structures for SMEs and startups which can be used free of charge for all services [National Center for Industrial Property Information and Training (INPIT), 2017].

4.2.3.2 Measures taken by JST

While UNITT and INPIT provides platform for useful information exchange between the Universities and Industries, Japan Science & Technology Agency (JST) provides funding to excellent scientists which is its conventional activity. It is an advanced network-based research institute that promotes the state-of-the-art R&D projects and aims to lead the way for co-

creation of innovation for tomorrow's world together with society [JST, 2017-2]. JST formulates plans and promotes various programs based on goals established by the Government of Japan.

To promote the commercial development of advanced technology seeds created and nurtured by universities and other public research institutions, JST supports the development of human resources required for industry-academia collaboration as well as a range of technology transfer activities relating to the output from academic research, including patent acquisition and licensing. JST undertakes such support while utilizing the respective R&D potential of universities and private-sector enterprises.

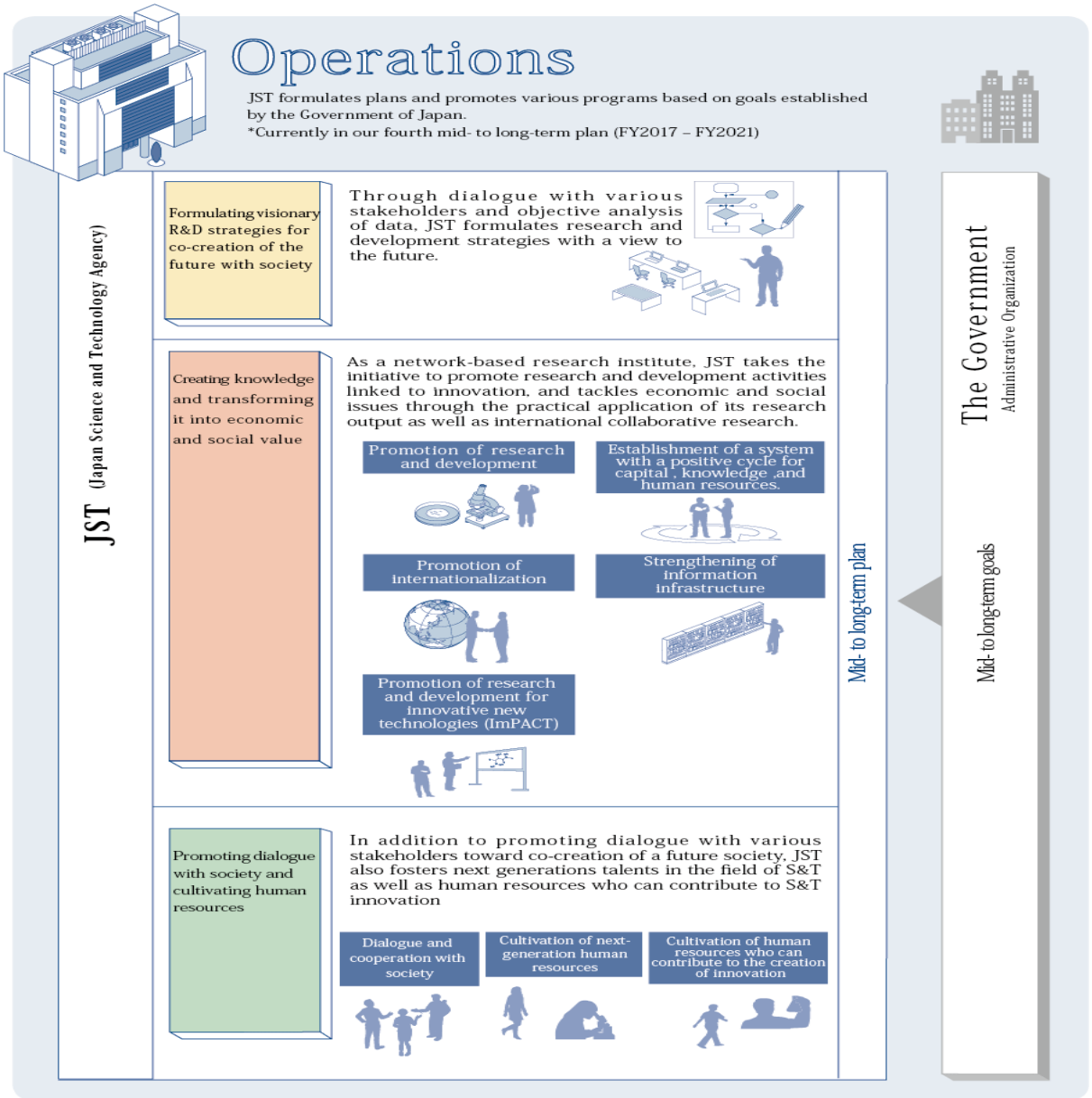


Figure 4. Operations of JST
[JST, 2017-3]

4.2.3.2.1 Providing Platform for communication

JST maintains J-STORE which is a database (principally in Japanese) open to the general public free of charge, comprising patents and unpublished patents held by universities, JST and other parties which are available for licensing to companies. JST conducts New Technology Presentation Meetings which aims to foster new links between academia and industry through technology presentations given by inventors based on their own perspective of practical applications.

JST also conducts University Technology Exhibitions for supporting the matching of research output from universities and public research institutions with industry. Further it conducts open Innovation Seminars for communicating the needs of companies to Universities. At Open Innovation Seminars, companies communicate their research-related needs to universities, including issues that require short-term solutions and issues on which companies wish to conduct collaborative research. It maintains a portal Site for Industry-Academia-Government Collaboration and Industry-Academia-Government collaboration support database having Program and project database with R&D support programs conducted by public institutions like national and regional government agencies, financial assistance programs operated by foundations and other bodies and venture capital details [JST, 2017-4].

JST further has programs for training and consultancy. Human Resource Development Program for People Involved in Technology Transfer provides training program to develop the abilities of people involved in technology transfer programs at universities and TLOs and to build a network of human resources. General Consulting Service for Technology Transfer aims for a free-of-charge one-stop consulting service [CIPAM, 2017-1].

4.2.3.2.2 Research funding programs

JST further has various Competitive Funding Programs. One such program is Adaptable and Seamless Technology Transfer Program through Target-driven R&D (A-STEP). It aims for Promoting technology transfer from academia to industry so that the research outputs of universities and public research institutions, which could create significant economic impacts, can be efficiently put into practical application. This program supports collaborative industry–academia research and development (R&D) based on the results of high-quality basic research (research output, intellectual property, etc.) to ensure that the benefits of such research are passed on to Japanese society [CIPAM, 2017-2].

Depending on the R&D phase and the objectives of each particular project, A-STEP determines the optimal R&D funding and R&D period to enable the seamless pursuit of medium- to long-term R&D. Through this approach, the program aims to bridge the gaps between academic research results and industrial needs to realize highly effective and efficient innovation. It has two support types. One is the “Strategic theme-focused type” and the other is the “Industrial needs response type.”

The mission of the “Strategic theme-focused type” is to return outstanding achievements of JST’s basic research programs to society and to create the foundations of new industries. The “Industry needs response type” aims to bolster Japanese industrial competitiveness by contributing to the solution of technical issues common in industry.

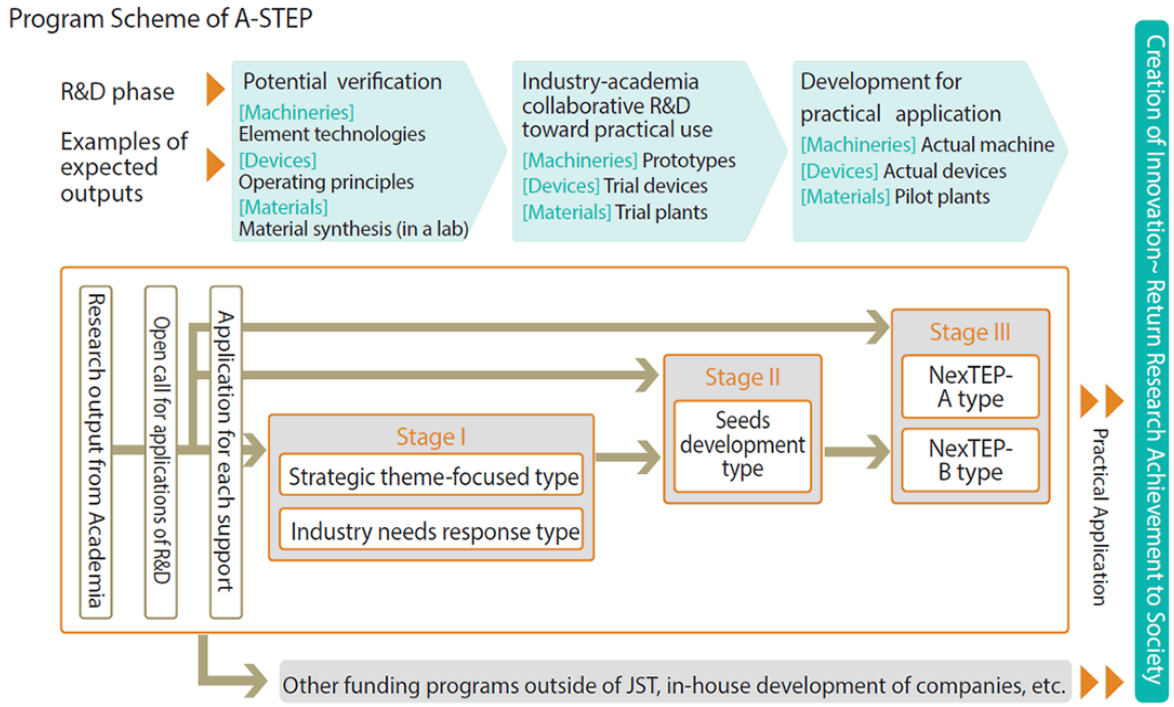


Figure 5 Program scheme of A-STEP
[JST, 2017-5]

This Program requires that applicants from academia should hold the position of full time researchers at universities or public research institutions in Japan. Applicants from industry also should hold a full time position at companies with Japanese corporate status [JST, 2017-5].

Further JST works to accelerate innovation driven by close collaboration between industry, academia and government, and facilitated by a platform for dialogue between all three sectors. JST also aims to foster the creation of new industries and assist industries' efforts to strengthen their competitiveness. To achieve these goals, JST specifically focuses on strengthening basic research and R&D infrastructure through dialogue between industry and academia, as well as by implementing large-scale R&D projects through industry–academia consortia.

Its S-innovation program aims for bringing together academic researchers and private enterprise to generate innovation, based on attractive R&D themes [JST, 2017-6]. Its Development of Advanced Measurement and Analysis Systems aims for development of technology and systems for advanced measurement and analysis that will bolster the infrastructure for creative and original R&D [JST, 2017-7]. Its Collaborative Research Based on Industrial Demand aims at promoting basic research that will contribute to solutions to technical themes shared across the industrial sector [JST, 2017-8].

In addition to the above programs it has Center of Innovation (COI) Program. The Center of Innovation (COI) program is one of the main funding programs under the Center of Innovation Science and Technology based Radical Innovation and Entrepreneurship Program (COI STREAM) which was launched in 2013 by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) [JST, 2017-10].

Table 8 A-STEP Support Content [JST, 2017-5]

	Stage Ⅰ		Stage Ⅱ	Stage Ⅲ	
Support Type	Industrial needs response type	Strategic theme-focused type	Seeds development type	NexTEP -B type	NexTEP -A type
Objectives	Bolster Japanese industrial competitiveness by contributing to the solution of technical issues common in industry	Return outstanding achievements of JST's basic research programs to society and create the foundations of new industries	Lower the technical risks of research outcomes of academia and establish core competency of private companies by utilizing academia's technology seeds	Support private companies who carry out high-risk development which uses research achievements of academia. (NexTEP-B is available only for small and medium-sized enterprises whose capital is 1 billion yen or less.)	
R&D Fields	Specific R&D themes*1		Broad area*2		
Applicants' Affiliation*3	Academia	Academia and Industry	Academia and Industry	Industry	
IP	Not required		Required		

	Stage Ⅰ		Stage Ⅱ	Stage Ⅲ	
Support Type	Industrial needs response type		Seeds development type	NexTEP-B type	NexTEP-A type
R&D Expenses (supplied by JST)	up to \ 25 million per year	up to \ 50 million per year	\ 20 million ~500 million per R&D period	Up to \ 300 million per R&D period	Up to \ 1.5 billion per R&D period
	Grant		Matching funds	Matching funds plus payment of royalties	Quasi-loan plus payment of royalties
R&D Period	2～5 years	Up to 6 years	2～6 years	up to 5 years	Up to 10 years

For COI STREAM, MEXT (i) sets visions by using a back casting method with the aim of realizing a desirable society and way of life, (ii) identifies R&D challenges along the visions, (iii) breaks out the frameworks of traditional research fields and existing organizations, and (iv)provides intensive support for industry-academia collaboration from basic research to practical application. COI STREAM intends not only to realize radical innovation which is difficult to be accomplished by industry or academia alone, but also to establish innovation platforms in Japan [JST, 2017-10].

The above types of funding programs appear to cater to various types industries or industries based on different type of classifications. Further as per the message from the president JST will start the "Mirai Program (provisional name)" – one of the main features in 2017 – to concrete JST's roles. This new implement will develop two types of projects in parallel: 1) large scale units for which JST sets themes in cooperation with the Ministry of Education, Culture, Sports, Science and Technology (MEXT), and 2) small scale units for which JST initiates the theme searches and the studies of impact on society. JST takes direct responsibility of the management for both research projects, which makes them different from the existing projects of JST. JST will take on the challenge of high-risk high-impact R&D through this [JST, 2017-1].

4.2.4 Benefits to Industry in Japan

With the reforms of University-Industry cooperation framework beginning from the late 1990s through the TLO Act in 1998 and the Bayh-Dole Act in 1999 there is a steady expansion of joint research between companies and the Universities. This expansion is evident in increases in funding from companies, number of University and industry researchers in collaborations and transfer of University Intellectual Property to industry usually by joint Patent applications. This expansion probably has provided substantial benefits to the partner companies and resulted in the development and commercialization of some University discoveries to the benefit of the society. However at least in the case of major Japanese Universities, large and established companies have benefitted the most. Access to University discoveries of small companies and in particular new entrepreneurial high technology companies has been limited. This may be due to large companies being more suited than new companies to develop some University discoveries and also due to system of University IP management that enables large companies to preempt University discoveries and limiting the opportunities to the new technology based companies to grow. Preemption refers to the joint research partner receiving exclusive control over the discoveries within the scope of the joint research project. Japanese government research projects may themselves facilitate preemption, because many large government projects tend to address applied research questions and some consortium projects are aimed at increasing the international competitiveness of large companies [Kneller Shudo, 2008].

According to R. Kneller, in Japan new companies play a small role in innovation. Outside of about 50 companies in the life sciences and a few in software, the number of new companies that are developing globally innovative technologies and that have significant prospects of growth is small. This applies to both startup and spin off companies. R. Kneller says the reasons for this difference are complex and mentions the following as likely leading causes [Kneller, 2011].

1. The continued prevalence of lifetime employment and low worker mobility in high technology manufacturing industries.
2. The continuing tendency for autarkic innovation in Japanese manufacturing companies
3. Demographics of japan with population is aging and low immigration rate.

4. System of University-Industry collaboration characterized by preemption by large companies of University IP and the energies of academic researchers [Kneller Shudo, 2008].

Other serious problems mentioned are shortage of skilled managers for ventures, immaturity of capital markets and difficulties in raising capital and hence much of Japan's best human and financial resources are locked up in large organizations, leaving limited opportunities for new high technology companies to grow. R. Kneller recommends that the ability of the sponsoring companies to restrict the publication by University researchers should be limited of course with the confidential information of companies should not be published, Japanese law requiring co-owners must agree to any transfer should be irrevocably overridden in all joint research contracts with negotiation of rights on a case by case basis and by improving IP management by University IP management offices so that in the long run University and academic researchers should benefit by receiving a more equitable share of returns from their inventions, by ensuring greater rewards for ground breaking discoveries and by encouraging entrepreneurship [Kneller Shudo, 2008].

4.2.5 Focus on Startups

JST has a specific program for Startups called the Program for creating Start-ups from Advanced Research and Technology (START Program). START Program is aiming at developing business/intellectual property (IP) strategies for technology seeds in universities that are risky but have great potential and commercializing them, by combining public funding and private sector commercialization knowhow even before start-ups are established. They aim to commercialize with high risk but high potential technologies while looking at markets and exits. It aims to connect project promoters and researchers such as universities and supports R&D and business development. It is composed of "Project promoter support type" to support activities of project promoters and "project support type" to support projects at universities and others.52

The flow to business start has following steps.

1. Submission of first application by a researcher such as a University to their preferable project promoter units through JST.
2. Project promoter identify the promising seeds according to their own commercialization policy.
3. Further examination of promising seeds by project promoters and submission of further materials by University R&D agency researchers.
4. Further examination if it is found that the proposed projects have potential for commercialization, researchers further consider the project development with support of the project promoters for preparing the second application document.
5. Submission of second application by researchers at universities and colleges with the project promoter within the time limit.

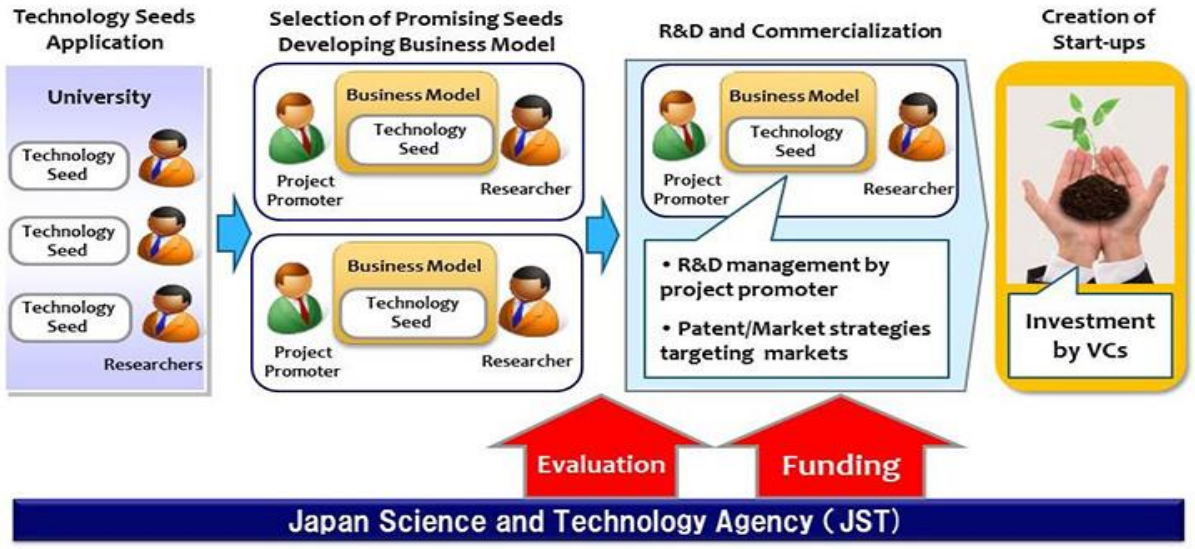


Figure 6. The process to Start-ups

6. Conducting project screening by JST based on the secondary application documents to decide whether or not to support.
7. After the projects have been selected, the costs for R&D and commercialization support are funded, and the projects are carried out under the management of the project promoters.

In principle, the START Program aims to establish academic start-ups in three years. The extension of support period is basically not allowed. However, according to subsequent screenings, if necessary, support may in some cases be extended to up to five years until proof of concept (POC) [JST, 2017-11].

4.2.6 IP strategy Program in Japan – 2016

Looking back at the efforts taken by JST and INPIT it is clear that the improvement in IP management at University is being done together with funding by JST and dispatch of IP advisors by INPIT with the aim to benefit big corporations and SMEs. The Intellectual Property Strategic Program 2015 (approved in June 2016 by the Intellectual Property Strategy Headquarters) puts particular emphasis on Usage with regard to the IP-related creation, protection and usage cycle and also "knowledge" takes on the form of IP which serves as a focal point for industry-academia collaboration and collaboration across different industries. The Program recognizes it is crucial that industry-academia and inter-industry collaboration which is inclusive of SMEs in major urban areas as well as in regional areas be promoted. It aims for promoting awareness of IP management amongst SMEs and that SMEs be supported in tackling IP-driven challenges, including developing global markets. It also aims to support SMEs access to courts for handling IP disputes [Cabinet Public Relations Office, Cabinet Secretariat, 2016].

The Intellectual Property Strategic Program 2016 spells out that Industry-academia and inter-industry collaboration relies heavily upon key human resources to facilitate bridge-building and commercialization-support. The people needed for these roles will include experienced business professionals, both retired and active, who must be able to work with not only those in universities and large corporations but also regional SME supporters to perform

marketing, matching and production while utilizing IP. The Intellectual Property Strategic Program 2016 emphasized the importance of securing and cultivating these sorts of human resources, as well as fostering networks amongst them, and various ministries and agencies are currently putting in place bridge-builders and commercialization support personnel who are working together in line with policy objectives. In order for the efforts of these human resources to succeed in realizing innovation creation, a variety of measures need to be actively pursued from a long-term perspective. With regard to industry-academia collaboration, the majority of such collaborations thus far have been on the individual level of academics working with company researchers; however, as interest and expectations for robust industry-academia collaboration geared towards innovation creation grows within the business world, it is important that universities step up their involvement on an organizational level in such collaborations [Cabinet Public Relations Office, Cabinet Secretariat, 2016]. Such an effort is worth noting from the point of view of Indian context.

The Intellectual Property Strategic Program 2016 mentions about the following initiatives are being promoted by relevant ministries and agencies with respect to University – Industry collaboration [Cabinet Public Relations Office, Cabinet Secretariat, 2016] among others.

a. Enhancing the Functionality of Industry-Academia/Inter-Industry Collaboration by
   i. Promotion of Joint Research via an Industry-Academia Co-creation Platform
   ii. Local Innovation Ecosystem Creation Program
   iii. Stronger Support for Venture Business Creation
   iv. Develop Capacity for Bridge-building and Commercialization Support
   v. Bridge-building and Commercialization Support Personnel Collaboration
   vi. Strengthening IP Strategy within a "Knowledge Aggregation and Utilization Platform"
b. Strengthening University IP Strategies by
   i. Strengthening University IP Management
   ii. Popularization of Comprehensive IP Management
   iii. Promotion of Activity Improvement via Functional Assessments of Industry-Academia Collaboration
   iv. Strengthening Industry-Academia Collaboration Capability by Strengthening the Internal Assessment Capability of Universities
   v. Promotion of Intellectual Property Utilization in Universities
   vi. Handling of Joint Research Results
   vii. Development of Proof of Concept Support Measures
   viii. Strengthening of IP and Standardization Strategies for Public Research Institutions
   ix. Strengthening of IP Strategy at Agriculture, Forestry and Fisheries-related National Research and Development Agencies

The "Intellectual Property Strategic Program 2016" sorted SMEs into two types, according to their size and the nature of their business model. The first type of SME is the "Intellectual Property Use Challenger Type," which consciously seeks to acquire rights for the IP it possesses, and then boldly uses these in the independent development, production and expansion, including overseas expansion, of its own products; while the second type is the "Intellectual Property Use Developing Type," which does not possess IP for which rights can be acquired, has little awareness of IP, has fixed products, sales channels and customers, and is often in the position of being a subcontractor [Cabinet Public Relations Office, Cabinet Secretariat, 2016].

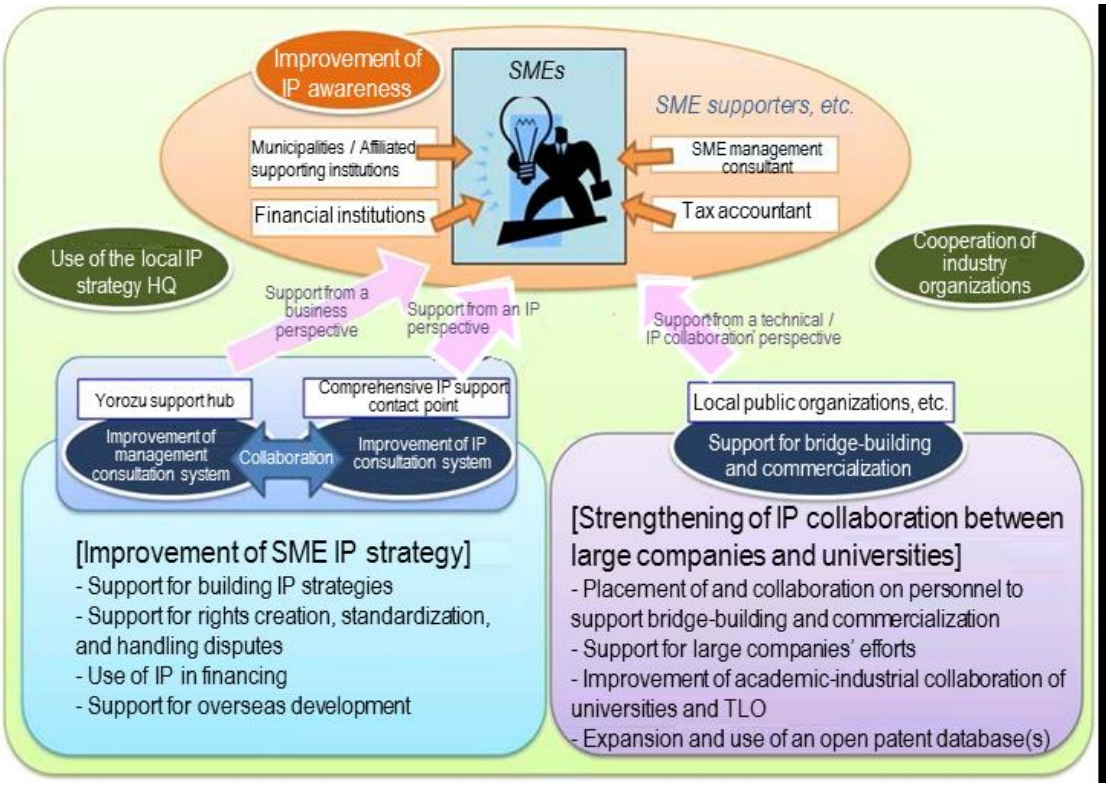


Figure 7. Intellectual Property Strategic Program 2016

In the case of intellectual property use challenger-type SMEs strengthening of consultation and support from the perspective of both IP and business, and to promote the utilization of IP in financing is emphasized. In the case of intellectual property use developing-type SMEs, an emphasis was placed on raising awareness of IP and the opportunities for new business growth it presents. Local Intellectual Property Utilization Promotion Program envisaged by the Intellectual Property Strategic Program 2016 is shown in Figure 7.

The Intellectual Property Strategic Program 2016 mentions about the following initiatives are being promoted by relevant ministries and agencies with respect to promoting IP among SMEs among others.

1. Strategic Dissemination Aimed at Intellectual Property Use Developing SMEs by
   a. use of Comprehensive Intellectual Property Support Counters to raise awareness
   b. install additional personnel capable of handling IP-related consultations to better identify latent IP-related needs
   c. Promote the cultivation of personnel capable of handling IP support activities.

2. Strengthening of Domestic Support for Intellectual Property Use Challenger Type SMEs by
   a. Strengthening of Consultation Capabilities Related to Intellectual Property Utilization in Business
   b. Promotion of Pioneering and Ambitious Local IP Activities
   c. Strengthening Support for Local SME Intellectual Property Activities by making use of Comprehensive Intellectual Property Support Counters.
   d. Promotion of Intellectual Property Management by SME

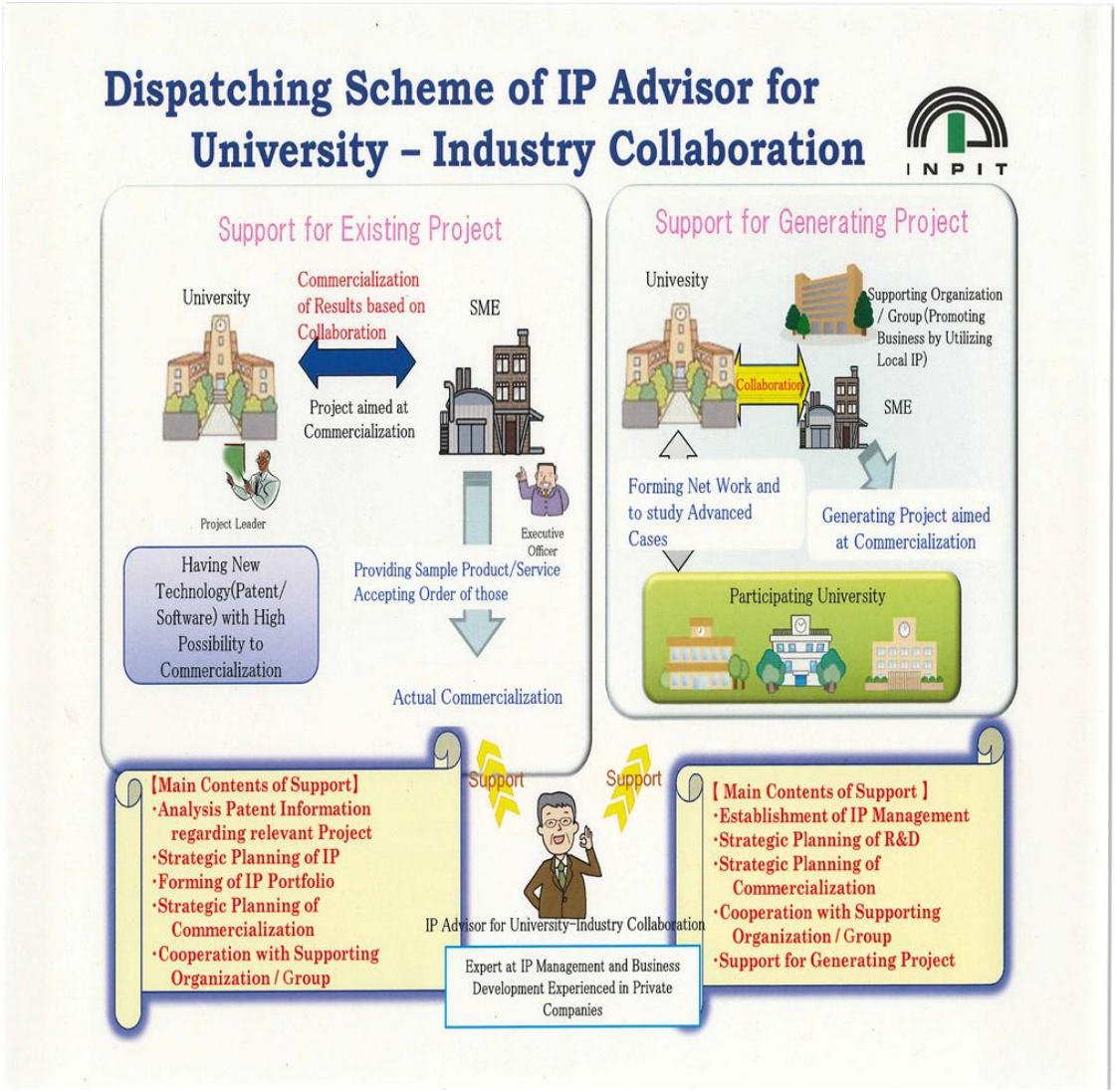


Figure 8 Dispatching scheme of IP advisor for university – industry collaboration [4]

3. Strengthening of Support for Overseas Expansion [Cabinet Public Relations Office, Cabinet Secretariat, 2016]

Further it is also quite interesting to note that INPIT has also categorized the projects into two similar types while dispatching IP advisors for University-Industry Collaboration. One is support for existing project similar to Intellectual Property Use Challenger Type SMEs and the other is support for generating project similar to Intellectual Property Use Developing SMEs [4].

4.2.7 Skill set required for IP personnel working in University and Industry

All the experts interviewed put great emphasis on the skill set required for the persons working in IP departments and continuous training. The skill sets required for IP personnel at different places and stages are different. The requirement can be broadly classified as IP experts at University and IP experts for Industry. The skill sets at University can be broadly that relating to IP filings, collaboration for research etc. whereas the skill sets at Industry can be broadly relating to business plan, financing, negotiation skills etc. There may be overlaps. Industry can

be further classified as large, small, medium and also as successful and not so successful etc. The requirement of skill sets can be varying in all these instances. Startups are also under the category of IT related and non-IT related such as automobile, chemistry, Life science, Engineering etc. Most of the IT related startups are without Patents and based on business ideas where entrepreneurial development skills are very important whereas most of the non-IT startups grow with Patents and also need initial assistance in financing, infrastructure development etc. For startups in the field of life sciences the skill requirement relates to conducting joint research with University and development of IP etc. In Universities the skill requirement varies widely as there are many stakeholders like inventors who can be professors, researchers and students, University administration, company involving in joint research or a potential licensee, Patent Attorney, venture capitalists, funding agencies like JST, NEDO and Ministry. The IP related functional areas of University can relate to

1. Application and Licensing
   a. Understanding of invention
   b. Marketing
   c. Negotiation
   d. Contract
2. Coordination for joint research
3. Support for startups.

Requirement of IP knowledge is high for application and licensing whereas for coordinating joint research combined knowledge of both IP and research experience is necessary. As many of the startups are not related to IP, entrepreneurship skill and encouraging the inventor to start a company is the major requirement along with sufficient basic IP knowledge.

The major skill sets necessary are:

1. Knowledge in IP filings - general
2. Licensing knowledge – during commercialization and joint research agreements
3. Communication and coordination skill – especially during joint research, establishing stat-ups and licensing the existing technology to large companies.
4. Business model planning and business skills – at incubation centers
5. Negotiation skills – licensing and joint research agreements
6. Market research – to find interested companies for licensing and identifying cutting edge technologies
7. Ability to see the market 5 to 10 years ahead.
8. Experience in industry as well as research field.

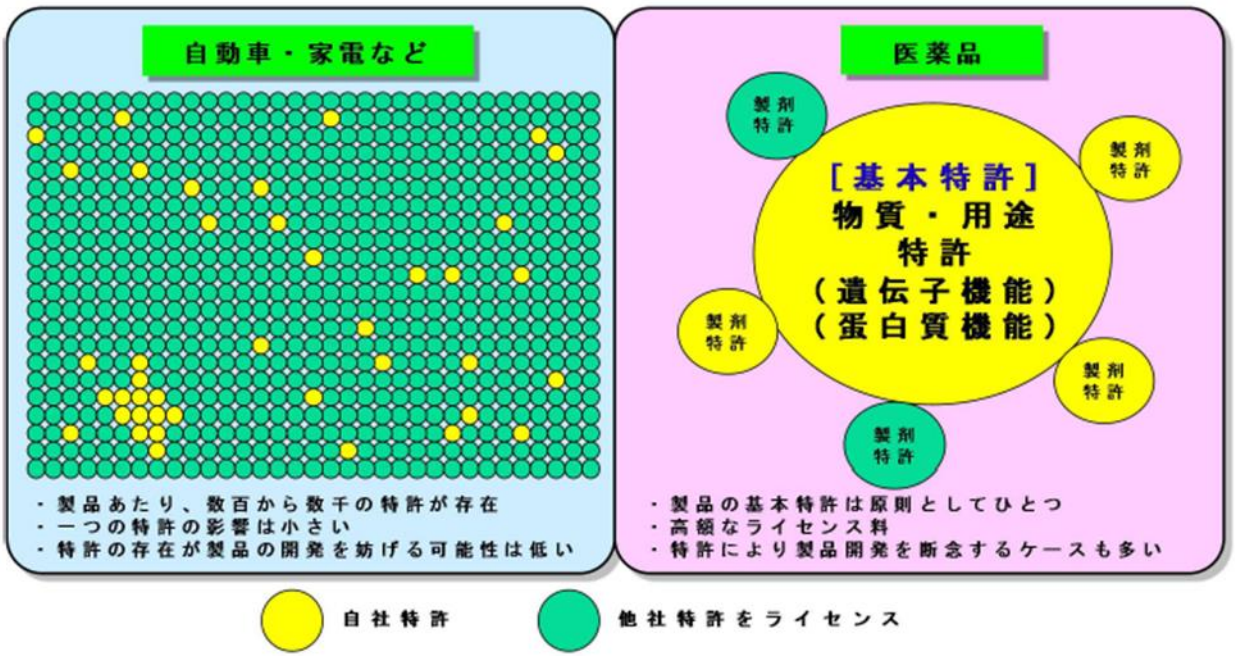
It is also emphasized that the companies in the field of Engineering need to have a bunch of Patents strategically while for the companies in the field of pharmaceuticals and life sciences one good or valuable is needed. Hence the skill sets for the former is more focused on IP related filings, search, infringement analysis etc. for the latter the skill set requirement is focused more on research ability, obtaining regulatory approvals, clinical trials etc.

Table 9. Skill set required for IP personnel working in University and Industry

Areas	Skill sets (Not necessarily in the same order of priority)
University IP division (newly established)	IP filings
University IP division (with sufficient IP portfolio)	IP filings, market research, communication and coordination skills, licensing.
University IP division (with sufficient IP portfolio and support for start-ups)	IP filings, market research, communication and coordination skills, licensing and business establishment, Ability to foresee.
University IP division (with sufficient IP portfolio and establishing research facilities)	All the above and negotiation skills having an IP expert with prior experience in industry and ability to foresee the market 5 to 10 years ahead, information sharing.
Company IP division (newly established)	IP filings, IP search, Ability to foresee
Company IP division (with sufficient IP portfolio)	IP filings, IP search, market research, communication and coordination skills, licensing, infringement analysis, information sharing, Ability to foresee
Start-ups with IP portfolios	IP filings, IP search, market research, communication and coordination skills, licensing, infringement analysis, Ability to foresee.

4.2.8. Gap funding for SMEs / Startups

But the challenge to startups even with a good patent is funding. Hence they depend largely on gap funding to survive the valley of death. The “valley of death” is a common term in the startup world, referring to the difficulty of covering the negative cash flow in the early stages of a startup, before their new product or service is bringing in revenue from real customers [Zwilling, 2013].55 According to a Gompers and Lerner study the challenge is very real, with 90% of new ventures that don't attract investors failing within the first three years. Mr. Kohei Yasuda of Campus Create Co., Ltd. during his interview has put more emphasis on startups getting the gap funding in time. The problem is that professional investors (Angels and Venture Capital) want a proven business model before they invest, ready to scale, rather than the more risky research and development efforts [LERNER, 2002].



Huge number of patents per product
The effect of one patent is relatively small

In general, Only 1 patent is essentially important
Expensive licensing fee. The existence of killer Patent will be the huge damage for commercialization.

Figure 9 Comparison of the status of IP in the different technology/business field [3]

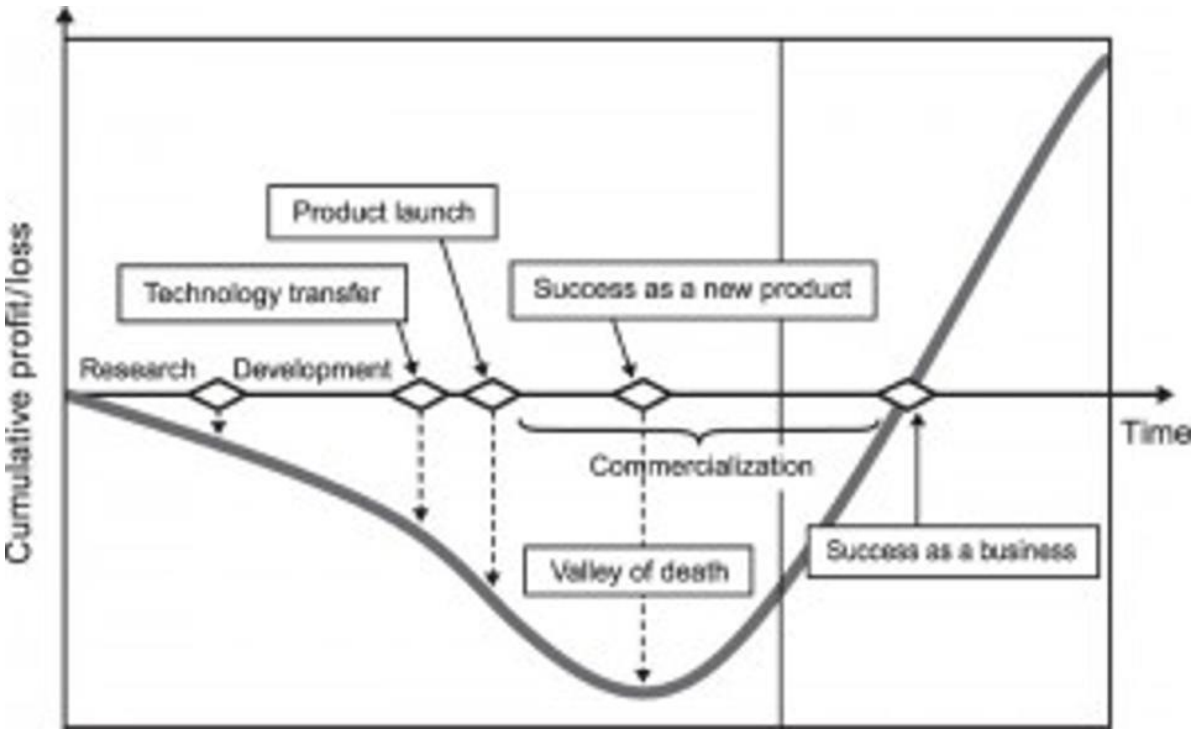


Figure 10. Valley of death in R&D *[Zwilling, 2013]*

According to Mr. Martin Zwilling [Zwilling, 2013], the following suggestions which are worth repeating will help to survive the valley of death:

1. Accumulate some resources before you start.
2. Keep your day job until revenue starts to flow.
3. Solicit funds from friends and family.
4. Use crowd funding.
5. Apply for contests and business grants.
6. Get a loan or line-of-credit.
7. Join a startup incubator.
8. Barter your services for their services.
9. Joint venture with distributor or beneficiary.
10. Commit to a major customer.

Hence it is imperative that the persons involved in startup companies based on a valuable Patent should have a sound knowledge not only on IPR issues but also on entrepreneurship skills along with a fair knowledge on the issues that can come up at a later stage either on IP front like infringement and litigations and fund requirements and business related issues.

4.3. Qualitative Analysis - Interview Summary

4.3.1. Interviews of experts with experience in Government Agencies

Interviews conducted with Prof. Masahiro Hashimoto of Tokyo Institute of Technology with vast experience in the functions of METI and formation of UNITT, Mr.Kanezaki of INPIT and Mr.Nanba of JST reveals that the following measures from the Government are very important.

1. Ensure dedicated IP persons in University especially the so called late comers.
2. Providing funds based on certain criteria like the extent of IP portfolio, research activities etc. and / or Help of venture capitalists within the University.
3. Support service for IP in the global development
4. Forming consortium of University-Industry & dispatch IP producer / expert and Support for licensing activities, consulting service etc.
5. Provide platform for University and Industry interaction viz. New technology presentation meetings, University Technology exhibitions, Open innovation seminars, provide databases like J-Store, PLID, Portal for industry-academia-government collaboration etc.
6. Schemes for funding joint research (similar to A-Step, S-innovation etc.)

They are of the view that the University should initiate the following actions to foster IP and its commercialization.

1. Form networks similar to UNITT
2. Meetings and conferences to interact with industries
3. Provide funds and help of venture capitalists for Startups.(programs similar to START of JST)
4. Identify projects for University-industry consortiums
5. Formation of Research parks with Government support wherever feasible.

Important IP skills necessary for the leaders in the field are:

1. Business establishment, licensing etc.
2. IP filings
3. Communication and Coordination
4. Ability to see markets 5 to 10 years ahead.

The most important suggestions that needed immediate attention as per their opinion are related to providing a platform for University – Industry collaboration, dedicated and experiences persons in IP divisions with business related skills and formation of networks for information and knowledge flow.

4.3.2 - Interviews of experts with experience in TLO / Venture Plaza

In the interviews conducted with Mr.Kohei Yasuda, President / CEO, Campus Create Co., Ltd. and Mr.Akimoto, Chief Incubation Manager, Yokohama Venture Plaza, they mention about the following measures needed from the Government.

1. Dispatch experts in IP and entrepreneurship development and assistance during appeal and infringement trials.
2. Assistance in foreign filing, PCT filing and also reduction in the filing fees and faster processing
3. Gap funding to survive the valley of death for Startups.

Actions needed from the University according to them relates to providing sufficient budget for the IP divisions and conducting seminars and lectures for information sharing and skill upgradation. Also the importance of gap funding to startups is considered vital. They stressed on the importance of communication skills and understanding of the nature of business and entrepreneurship skills for the people from academia.

The most important suggestions from them is the necessity of gap funding to startups and understanding the nature and mind set of the business managers from academia and assistance to startups during the appeal and trial stages.

4.3.3 - Interviews of experts from SME/Startups

Interviews are conducted with Mr.Manabu Bonkohara, Chairman & CEO, ZyCube, Mr.Kajiro Sakamoto, President, Street Design Corporation, Professor Atsushi Imaizumi at Therabiopharma Inc. and Professor Setsuko Hashimoto, President and CEO, CellSeed and they discussed about the measures necessary from the Government. They stressed on the importance of Financial or budgetary support from the Government. They expect more support regarding consultation on marketing and related information. Information flow on regular basis is very vital for the SMEs to continue in business. They also look for research schemes which are of a shorter duration up to 3 years and in the field of pharma and life sciences tie up with University professors with long term relationship is emphasized.

They expect more interaction and information exchange with the Universities especially with regard to technologies which can be integrated to find out what kind of business it can generate. They also expect more understanding of the business aspects from the academia.

The skill sets they expect from the IP personnel is that they should have the ability to foresee the future technical development and build new schemes with the vast information available and converting them to business. IP personnel should have the foresight to see the technology ahead and decide on the Patent filing. A good knowledge on patent filing and procedures is required along with the ability to communicate with other industry people and academia.

Support for foreign filing and PCT applications are considered very vital for startups. In Japan the additional costs involved in translation adds further burden to the pockets of the small firms. Such a support is considered very crucial at least during the stage when the startup company has not yet grown to make profits and struggling for funds. Availability of venture capitalists within the university can be a big boon for them. Further companies in the field of pharmaceuticals or life sciences expect from the Government for the provision of longer Patent term extension as they believe that more time is spent on clinical trials and in obtaining other regulatory approvals from the Government.

Table 10. Comments from the experts (Govt. Agency)

Interviewee	IP support to Universities and start-ups from Government	Functions of University IP offices to grow start-ups	IP skill required for University IP officers
Prof. Masahiro Hashimoto (Tokyo Tech)	*1. Ensure dedicated IP persons in University* *2. Provide training in IP procedure & licensing* *3. Help of venture capitalists within the University* *4. Providing funds based on certain criteria.*	*1. Form networks similar to UNITT* *2. Meetings and conferences to interact with industries* *3. Help of venture capitalists within the University* *4. Advise from overseas experts*	*1. IP filings* *2. Licensing* *3. Communication skill* *4. Experience in industry and business establishment*
Mr. Kanezaki (INPIT)	*1. Provide IP strategy experts to University(late comers); experience in IP div of companies* *2. Patent Licensing database* *3. One-stop support service in each major areas* *4. Consulting and support service for trade secret management & know-how* *5. Support service for IP in the global development* *6. Forming consortium of University-industry & dispatch IP producer*	*1. Identify projects for University-industry consortiums* *2. Formation of Research parks with Government support* *3. Have full-fledged IP strategy experts*	*1. Business model planning* *2. Coordination skill* *3. Market research* *4. Information sharing between most advanced researchers (science) and researchers on the technology side.*
Mr. Yoshio Nanba (JST)	*1. Support for licensing activities* *2. Patents available for licensing with Universities (J-store)* *3. New technology presentation meetings (inventors)* *4. University Technology exhibitions* *5. Open innovation seminars (communicating industry needs)* *6. Portal for industry-academia-government collaboration* *7. General consulting service for technology transfer* *8. Schemes for funding joint research (similar to A-Step, S-innovation etc.)*	*1. University initiated new industry program (similar to START of JST) with government support.* *2. Research parks – semi government agency*	*1. Ability to foresee the markets 5 to 10 years ahead.* *2. Prior experience in industry* *3. Business skills* *4. IP filings*

Table 11. Comments from the experts (TLO / Venture plaza)

Interviewee	IP support to Universities and start-ups from Government	Functions of University IP offices to grow start-ups	IP skill required for University IP officers
Mr.Kohei Yasuda, President / CEO, Campus Create Co., Ltd.	1. *Dispatch experts in IP and entrepreneurship development* 2. *Reduction in the filing fees and faster processing* 3. *Assistance in foreign filing and PCT filing.* 4. *Research schemes for SMEs.* 5. *Gap funding to survive the valley of death for Startups.*	1. *Seminars and lectures on entrepreneurship skills* 2. *Portal site of Industry-academia-Government collaboration*	1. *Understand the nature of the business and mind set of the managers of startups.* 2. *Skills required in finding the other party* 3. *Communication and coordination*
Mr.Akimoto, Chief Incubation Manager, Yokohama Venture Plaza	1. *Services reg. search* 2. *Consultancy during infringement trials or appeals*	1. *Sufficient budget for University R&D divisions*	1. *Utilize the IP in conjunction with the business operations* 2. *Business establishment and business cycles*

Table 12 Comments from the experts (SMEs/Startups)

Interviewee	IP support to Universities and start-ups from Government	Functions of University IP offices to grow start-ups	IP skill required for University IP officers
Mr.Manabu Bonkohara, Chairman & CEO, ZyCube	*1. Financial or budgetary support,* *2. Research schemes of shorter duration*	*Communication and information exchange with Universities*	*1. Ability to foresee the future technical development,* *2. Ability to build new schemes with the information available and convert them to business.*
Mr.Kajiro Sakamoto, President, Street Design Corporation	*1. Consultation support on marketing,* *2. Research scheme of a duration of up to 3 years.*	*Coordinate with industries for integrating the vast available technologies.*	*1. Foresight to see the technology ahead and identify the kind of business it generates,* *2. Patent filing,* *3. Ability to integrate technologies for business creation*
Prof. Atsushi Imaizumi, Visiting Professor, Tokyo University of Pharmacy & life sciences (Therabiopharma)	*1. Assistance in foreign filing* *2. Support of venture capitalists within university*	*1. Support of venture capitalists within university* *2. Joint research with long term relationship*	*1. Ability to foresee the market quickly*
Prof. Setsuko Hashimoto, President & CEO, CellSeed.	*1.Patent term extension* *2. Assistance of an IP expert*	*1. Availability of an IP expert* *2. Understand the business needs of small companies*	*1. Business related skills along with IP related skills.*

5. Implications and Recommendations

It can be seen that in India as per the National IPR Policy 2016 (hereafter IPR Policy), Cell for IPR Promotion and Management (CIPAM) is entrusted with many activities and many of the activities similar to that are initiated in Japan. The following are the activities that can be reasonably said to be the activities that are in line with the said IPR policy.

I - Activity of providing a platform for IPR owners and users of IPRs by acting as a facilitator for creators and innovators to be connected with potential users, buyers and funding agencies; (5.1.1 of the IPR Policy)

Providing a platform for creators and innovators is considered in Japan as very important. Japan Science & Technology Agency (JST) is aiming to achieve it in two different ways by providing

a. Opportunity to meet in person and discuss
b. Access through website

To provide opportunity to discuss in person JST conducts

1. New Technology Presentation Meetings where individual inventors provides presentation of their technology
2. University Technology Exhibitions where Universities exhibit their technologies to find prospective industries who are interested in obtaining license and
3. Open Innovation Seminars where Industry communicates its needs to the Academia.

JST also maintains Portal Site for Industry-Academia-Government Collaboration and also the database J-Store where the Patents held by Universities available for licensing are displayed. Experts interviewed have expressed that this is an important step which shall be started as soon as possible and should be done continuously.

It is also important and useful to categorize the Universities as the one requiring support for the existing projects and the one requiring support for generating the projects. It can be a quite challenging task to identify the various Universities in India with a vast diversity for supporting them at various levels by above categorization. However such a step may be necessary as the type of support necessary for different universities may be different at different times. The IP strategy program 2016 in Japan recognizes this aspect and classified the universities as IP use challenger type and IP use developing type.

II - Establish links among different organizations for exchange of information and ideas as also to develop promotional/ educational products and services; (5.1.3 of IPR Policy)

UNITT established in Japan serves to establish this link among different organizations. This is also considered by the experts interviewed as the most important step and should be established at the earliest. Particularly Prof. Masahiro Hashimoto of Tokyo Tech emphasized that even in Japan this step would have been taken much earlier and added that few reputed Universities in India can start forming a group and can expand further. Once established such a group can conduct frequent technology presentation meetings, open innovation seminars etc. parallelly along with other agencies to connect users and buyers of IPR.

It is also known that seldom do experienced venture capital firms wait for investment opportunities to approach them. Successful firms have a focused investment strategy and actively develop opportunities or targets. For the investor who appreciates the value creation patents offer, there are ready channels and tools to resource opportunities such as Licensing Executives Society (LES), the Association of University Technology Managers (AUTM) and the Commercial Development and Marketing Association (CDMA) [Malackowski Wakefield, 2008]. UNITT of Japan is established in similar lines of AUTM of United States. Networking of Universities can not only benefit the Universities and industries but also beneficial to venture capital firms.

III - Study and facilitate implementation of best practices for promotion and commercialization of IP within the country and outside; (5.1.5 of IPR Policy)

Japan has utilized the services of experts from both inside and outside the country as IP advisors for providing guidance on IP to University, Industry and other consortiums and also to educate the persons working in TLOs. It is evident that available expertize should be made use of as and when necessary. Japan Science & Technology Agency (JST) regularly conducts Human Resource Development Program for People Involved in Technology Transfer at universities and TLOs.

IV - Promote licensing and technology transfer for IPRs; devising suitable contractual and licensing guidelines to enable commercialization of IPRs; promote patent pooling and cross licensing to create IPR based products and services. (5.2 of IPR Policy)

Japan Science & Technology Agency (JST) acts as an intermediary between new-technology researchers or patent holders and companies applying to acquire a technology license. JST provides services to coordinate the smooth progress of such applications. It has a Holding and Licensing Department which can be contacted by the interested parties to discuss the steps toward acquiring a technology license. It also conducts training sessions for upgrading the skills of IP personnel of companies.

V - Provide support for MSMEs, Individual Inventors and Innovators from the informal sectors with enablers like facilitation centers for single window services to help them commercialize their IPRs. (5.3 of IPR Policy)

In Japan IP total support centers are setup across the country as a one-stop service to help solve IP-related problems faced by SMEs during each step from conception to commercialization in collaboration with IP specialists [Yoshida, 2016]. The START Program of JST aims to establish academic start-ups in three years. Similar programs of shorter duration is very important as SMEs are interested to establish their business as early as possible and to make profits for sustaining in the long run.

VI- Incentivize Indian inventors, MSMEs and start-ups to acquire and commercialize IPRs in other countries also. (5.4 of IPR Policy)

In Japan, JST provides universities with expense loan support, including attorney payment, for filing PCT applications. To have its

Patented invention selected for this support, the university needs to ensure the likelihood of licensing the invention, such as by concluding a licensing agreement with a company. If it

obtains a licensing income, the university will then repay the loan with that income in half installments. JST provides comprehensive support for PCT applications and transfers to designated countries, including assistance with expenses and expert opinions from JST intellectual property specialists [Hatori, 2016].

VII - Promote collaborative IP generation and commercialization efforts between R&D institutions, Industry, Academia and Funding Agencies. (5.7 of IPR Policy)

JST provides Industry-Academia Collaborative R&D Program to accelerate innovation driven by close collaboration between industry, academia and government, and facilitated by a platform for dialogue between all three sectors. It has programs like Strategic Promotion of Innovative Research and Development (S-innovation), Development of Advanced Measurement and Analysis Systems and Collaborative Research Based on Industrial Demand [JST, 2017-9].

5.1 – Priority Actions

All the major activities similar to that envisaged in the Indian National IPR policy 2016 especially with respect to commercialization are found implemented in Japan and from the experts opinion obtained through interviews it can be fairly concluded that the following are the priority actions that is required in the early stages.

1. Networking among Universities and Industries
2. Providing platform for dialogue between University and Industry viz. Technology presentation meetings, conference, seminars
3. Ensure dedicated / full-fledged IP persons in University having a sound business knowledge and ability to foresee the market and future technology ahead.
4. Ensure gap funding for startups preferably by having venture capitalists within the University.

Parallel with the above and subsequently the following are also need to be implemented.

1. Getting the help from the experts in the field within and outside the country
2. Providing one-stop service to SMEs at regional levels and during this phase

a. Help them to acquire IPs and commercialize inside and outside the country (VI)
b. Help them devise suitable contractual and licensing guidelines, patent pooling etc. (IV)

Further there should be a continuous encouragement for collaborative research as it is seen that joint applications of University and Industry is more likely to have many forward citation documents indicating value and technological importance. Various programs of JST are indicative of the kind of support that can be provided for joint research. As time required from Joint research to Patent filing and subsequent commercialization is likely to take sufficient time and it is also important for University and Industry to enter into a long-term relationship in order to expect a break through innovation, it is necessary to start programs that encourage joint research at the earliest. Indian National IPR policy 2016 envisages various actions and the lessons from the scenario of Japan and the experts opinion clearly demonstrates that among them Networking of Universities and Industries, dedicated / full-fledged IP persons and providing a platform for dialogue between users and buyers of IP requires greater attention in the beginning phase for accelerating the acquiring of IP as well as commercialization of IP in the long run. This seems to be applicable not only for the Indian context but also for other countries aiming to harness the fruits of IP.

5.2 – Information through websites

While Government support is a prerequisite the successful outcome of these schemes largely depends on the extent of participations from the Universities. From the study and the in depth interviews it is observed as mentioned above that forming a network is an important step but utilizing the network to share vital information is equally important. The information provided by the websites of various Universities of Japan and also some Universities in India like IIT-Bombay, IIT-Madras, Indian Institute of Science Bangalore etc. shows the content that can be shared for effective utilization. Some of the suggestions based on the above information from these Universities to include in their websites are:

1. Providing Research news and highlights
2. Providing list of database of researchers and research topics
3. Providing a web page inviting for research and development projects from industry and other organizations
4. Providing a list available technologies available for licensing
5. Providing a list of number of invention disclosures, Patent applications filed and granted
6. Providing details of revenues obtained from research, consultancy and Patents
7. Providing details of venture support or incubation cell and list of incubated companies
8. Providing details and support for International joint research programs
9. Providing formats and procedure for licensing agreements, collaborative research, sponsored research etc.
10. Exploring the possibility of establishing a research park
11. Providing list of University wide publications

While the above list are not exhaustive nevertheless it provides a broad outline for those Universities which are at the beginning stage of developing their IP portfolios aiming for profitable commercialization.

Further this study also recommends to have a provision in the Indian search website inPASS for obtaining forward and backward citations as it will be useful in the long run for anyone interested in the analysis of forward citations or similar studies.

5.3 Limitations and Further studies

IP environment in Japan and India may be different and what is suitable in one environment may not be suitable in the other in spite of many similarities. There is a geographical proximity of Universities and Industries in Japan while in India the distance may be much far. This research is not focused on policy issues as India has a National IPR Policy 2016 and the implementation of the lessons from this study is to be within the ambit of the National IPR Policy 2016. More importantly the conclusions in this study is based on the personal opinions of the interviewees which may not necessarily reflect the view points of the organizations they represent nor it is expected to be ideal for Indian context. The issue of University-Industry collaboration is complex and diverse in nature with many players involved at different levels requiring to take timely decisions for its success. Hence caution and due diligence is required before considering any of the recommendations.

It is recommended that various programs similar to the A-Step, S-innovation etc. of JST may be implemented for the benefit of University-Industry Collaboration in India to cater to the different size and environment of industries and Universities, but the exact nature of the

scheme may have to be determined considering the situation in the actual Indian context. Further research and study in this area may be required to determine the different kind of support, the extent of grant to be provided etc. that is necessary for the optimal benefit of Universities and Industries in India. Further the schemes offered by the JST other than the scheme of START for joint research between University and Industry appears to be suitable mainly for large companies as the scheme duration in some of the schemes is as long as 10 years. It is not clear whether such a scheme is suitable for small and medium sized firms. There was a suggestion that these schemes are in stages and small firms can contribute to the research at a particular stage. Further study may be required to assess what type of research schemes are suitable for SMEs or startups considering the relatively lesser resource and time available to them.

Further the extent of assistance required by different Universities may be different as the progress of IP divisions are at various stages in various Universities. In this regard it can be noted that the IP strategy program 2016 in Japan recognizes this aspect and classified the universities as IP use challenger type and IP use developing type. In India with wide geographical distribution of Universities with varying progress in IPR aspects, Universities may have to be classified into various categories. A separate in depth study may be required to assess the assistance required by them and to categorize accordingly. Even though it is recommended that Universities should have their own IP experts, some Universities may need assistance from the Government in the initial stages which needs to be studied further. Also in view of the above complexities it can be noted that the study on comparison of values like number of patents, income generated etc. are intended to understand the size and does not necessarily refers to as performance indicator under similar circumstances.

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Notes:

1. Information from the interview with Prof. Masahiro Hashimoto of Tokyo Institute of Technology, ref. Appendix I

2. Information from the meeting with one of the Advisors, Prof. Mitsuhiko Oi of Tokyo Institute of Technology

3. Figure from one of the Advisors, Prof Makiko Takahashi of Kanazawa Institute of Technology

4. Figure from one of the interviewees, Mr. Yuzaburo Kanazaki of INPIT, ref. Appendix II

Appendixes

Appendix I: Minutes of the Interview with Mr.Hashimoto Masahiro, Ph.D, Director of Department, Professor

Date and Time: 18/10/2017, 4.00-5.00PM

Location: Department of Innovation Science, School of Environment and Society, Tokyo Institute of Technology, CIC 903, Shibaura 3-3-6, Minato-Ku, Tokyo 108-0023.

Attendees:

1. Prof. Hashimoto Masahiro, Ph.D, Director of Department, Professor, Department of Innovation Science, School of Environment and Society, Tokyo Institute of Technology - Interviewee
2. C.N.Shashidhara – Interviewer
3. Dr.Yorimasa Suwa – Senior Researcher APIC-JIPII

Prof. Hashimoto Masahiro gave a brief presentation about the National Innovation policy in Japan and IPR strategy in digital era. He explained that in Japan since the 1990s, while Japan economy slowed down, during a remarkable activation of the industries through the development of industry-academia-government collaboration in the United States, the structural reformative technology policies were emerging, such as support measures for industry-academia-government collaboration and deregulation reform policy. The relevant laws are:

1995: Basic Law on Science and Technology (1996 first basic plan)
1997: Act on the term of office of the faculty of the University
1998: Act on technology transfer from Universities (TLO Act)
1999: Law on special measures for Industrial Revitalization (Japanese version of Bayh-Dole Act)
2000: Industrial Technology Enhancement Act
Further restructuring of Government ministries and agencies took place since 2001.
2001: Re-organization of government ministries, second science and technology basic plan
2002: School education Act amendment
2003: Permanent research and development tax of promoting R&D
Independent administrative institution of research and development corporations: NEDO (New Energy Development Organization), JSPS (The Japan Society for the Promotion of Science), the JST (Japan Science & Technology Agency).
2004: Incorporation of National Universities
2006: New Economic Growth strategy and third Science and technology basic plan established
2007: Innovation 25 report

Further Prof. Hashimoto explained the Innovation policy of US where laws relating technology transfer were enacted from 1980s.

Stevenson-Wydler Act - which required federal laboratories to actively participate in and budget for technology transfer activities.

Bayh–Dole Act - dealing with IPR arising from federal government-funded research and permits transfer of ownership of inventions from Universities.
SBIR Act - intended to help certain small businesses conduct research and development.
National Cooperative Research Act – for promoting research joint ventures
SEMATECH - research and development to advance chip manufacturing (Semiconductor Manufacturing Technology)
Federal Technology Transfer Act - technology transfer from federal government agencies to the commercial sector.

Prof. Hashimoto explained that during 1950s and 1960s the National Innovation System of both Japan and US focused on organization perspective. In the 1970s Japan enforced technological capabilities by conducting national R&D projects, which later led to competitiveness. This shift in Japan had an impact on the National Innovation System in the U.S. and the U.S. also shifted its focus from defense to the technological capability of industry, especially high-tech industries. However it was accompanied by strengthened collaboration promotion and IP protection. Japan also adopted this fundamental perspective for its National Innovation System, but there is a time lag.
The points for Innovation and IPR strategy in the 21st century digital era are:

- Tools for digitized and networked society
- Ready for IOT (Internet of things)
- Open and close strategy: Business architecture
- Global business eco-system
- Total strategy including business, R&D and IPR

Questions and Answers

I. What is the most important IP support to Universities and Start-up companies from Government?

METI was actively engaged in enacting laws such as TLO promotion law, Law of small and business innovation research system etc., approval of TLOs, providing grants to TLOs, surety for TLO debts etc. Can you please elaborate on the criteria on approving TLOs? In your view point can this method be applied for University IPR offices in India?

Answer: The IP division of a University should have sufficient number of IPRs and inventions under consideration. It is important to have a consultant who can guide the University professors in the right direction. They should have dedicated experts in the field of IPR who are well versed in patent filing procedure and licensing activities. Providing funds and help to University IP divisions can be assessed on case by case basis depending on the various activities undertaken by them in matters related to IPR.

2. Looking back, in your opinion what other measures you wish would have been taken by METI or MEXT or JPO and Universities in Japan in 1990s or after 2000s for improving the functions of University IP offices or TLOs and commercialization of Patents in general. What suggestion you have for India in this regard?

It is very important to establish networking in the early stages itself. In Japan University Network for Innovation and Technology Transfer (UNITT) was established in 2004 for enhancing communication, exchange, and cooperative relations with other organizations

in Japan. There are many reputed Universities in India and they can take a lead in forming a network sooner as communication and information exchange is very important factor. University IP divisions should have experts fully dedicated to IP filings and with good communication skill to interact with the industries for joint research as well as commercialization of Patents. This has to be considered as top priority. Those working in IP divisions should have a sound knowledge on licensing activities and regular training to them on licensing with practical knowledge is to be provided.

Interactions with the Industry is to be increased in the early stages and to be maintained continuously for understanding the mutual requirement.

3. In India there is 50% fee reduction for SMEs and a startup can request for expedited examination. Also a scheme for assistance through a facilitator is available for startups. What other role or initiative can you suggest for Patent Office in order to encourage commercialization of Patents?

In Japan continuous encouragement was given to Startups and few Universities like University of Tokyo succeeded in developing startups whereas many could not succeed in that direction. A support platform for startups is required within the University IP divisions or TLOs to continuously guide them to start a company. Experts in entrepreneurship is required within the University and they should have skills in research as well as knowledge in business establishment. Adequate training to develop such experts is necessary.

4. Can Government support networking of Universities and industries in India in the long run due to vast area and cultural diversity or is it better to have an establishment like UNITT established by University and Industry?

As mentioned above there are many reputed Universities in India and two or three can take initiative to form a network which can be expanded. They should arrange to meet regularly through conferences or seminars for exchanging information and to establish continuous communication with Industries. Networking should include many Universities and Industries to promote and utilize IPRs.

II - How should University IP office or its TLO work for growing the start-up companies from the aspect of IP?

1. In your opinion how frequently the meetings or conferences between Industry and academia is required to be held especially with a view to benefitting Universities that have just set up an IPR division.

Networking is very important to establish connections. In India such meetings can be arranged at different locations like Mumbai, Delhi, Kolkata, Chennai etc. frequently so that many institutions, universities and different industries are covered. It is required to be conducted as frequently as possible to keep the information flow continuously.

2. How Universities can support a startup or spin off company as seed funding provided by Universities may not be encouraging to start a venture? Or how long does it normally take for Universities to start getting revenues from IP which can be used for funding a spin off company? Or in other words how long does the Government support in providing funds to TLOs for University spin off companies / commercialization? I understand that in Japan the

support to TLOs is provided for around 10 years considering it to be sufficiently long period. Can you please elaborate this scenario and give your valuable suggestions.

It is better to have a plan of 5 years to support University IP divisions with continuous monitoring of progress and review after 5 years for extending the plan if required.

III - What is the most important IP skills the leaders of the university IP office/TLO/Start-up companies must have?

1. Many of the Institutions in India may not have an active R&D. Can you suggest a method for them to identify and pursue research in a technical field which can generate valuable Patents?

Universities should assess their core research strength and pursue research in that area. It depends on the researchers and faculty and their area of expertise. They need to take suggestions from the experts in the relevant field of technology both inside and outside the country. For example India has expertise in IT and the Universities having tie up with IT companies can encourage research and startups in the field of e-commerce. Joint research with the Industries and consultations with them is very vital to properly identify the research area.

2. What is the required skill sets for persons engaged in TLOs and commercialization of Patents in general?

They should have knowledge of IPR with prior exposure to research as well as experience in industries and business establishment. In addition to that a sound legal knowledge is a prerequisite for persons engaged in commercialization of IPRs along with the knowledge of licensing activities. Prior experience of working with other IP divisions of a company or university will be advantageous.

3. What is the qualification and experience required for the IPR experts sent by JPO / METI for advising the TLOs or SMEs?
Answer: For advising the TLOs many times experts from the foreign countries with experience in TLO operations are sent for advising the TLOs.

Additional question:
What is the reason for increase or decrease in University rankings in respect of commercialization of Patents?

Many times University has to give more attention on education and there may not be enough staff and faculty available for activities relating to IPR. Also the fruits of research takes time to produce the required benefits. In the meantime there can be variations in the University rankings. University-Industry collaboration should be aimed for a long-term relationship and breakthrough innovations cannot be expected immediately as it takes time to understand the mutual requirements and to align the university research with the industries development strategy which is in terms of tangible product or process.

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Appendix II: Minutes of the Interview with Mr.Yuzaburo Kanezaki, Senior Intellectual Property Advisor for University-Industry Collaboration

Date and Time: 24/10/2017, 3.00-4.30PM
Location: Asia Pacific Industrial Property Center, 3-4-2 kasumigaseki, Chiyoda-ku, Tokyo 100-0013

Attendees:
1. Mr.Yuzaburo Kanezaki, Senior Intellectual Property Advisor for University-Industry Collaboration, National Center for Industrial Property Information and Training
2. Ms. Yumi Uchida – Department of Human Resources Development & Utilization, National Center for Industrial Property Information and Training
3. C.N.Shashidhara – Interviewer
4. Dr.Yorimasa Suwa – Senior Researcher APIC-JIPII
5. Ms. Haruko Nishikawa - Interpreter

Mr.Yuzaburo Kanezaki explained briefly about the functioning of National Center for Industrial Property Information and Training (INPIT) especially in respect of the role and functions of IP strategy experts. Mr.kanezaki introduced himself as working in a company earlier in legal department, negotiating with companies in India, Germany and Soviet Union. It was a time when Universities and companies in Japan started establishing IP divisions. Typically it consisted of legal staff, Engineers and IP experts. He was working in an IP department of a University. At that time in Japan the large scale electronic companies had advanced IP department. Usually the directors who worked in these large companies started establishing the IP department in the Universities. At that time two public entities were responsible for establishing the IP departments in Universities which are MEXT and JPO. MEXT provided the much needed budgetary support for establishing the IP department in mostly the imperial Universities. JPO was providing the support to SMEs by hiring of the directors with expertise in the IP department of large companies. Mr. kanezaki is thus involved in establishing the IP department in Universities. Initially the IP advisors are hired for a period of 3 years and the number of such advisors are around 15. The major role of such advisors are to establish the IP systems such as rules and regulations of the IP department, organizational structures and organizing the programmes. This enabled the Universities which were filing a couple of Patent applications earlier to file applications in the range of 50 to 60 per year. Such a supporting project lasted for 9 years. Subsequent stage is called the second stage. In the second stage with those universities having sufficient IP portfolio were encouraged to form a network where IP experts are dispatched to assist them. In the first stage around 60 Universities are covered and in the second stage it was intended to cover 150 Universities in 5 years. Two years ago we got into the third stage. The purpose of the third stage is to support the projects aiming at commercialization. The Patents applied and obtained at the first and second stages are aimed for commercialization. However we planned for three stages, it was not proceeding as expected. The term of the directors is for 3 years and the first stage lasted for 9 years and hence the IP advisors sent by JPO who were directors of a large company were usually different in the first stage. The aim of the project is to ultimately make the University IP department work independently. Also at comprehensive IP support centers established at various prefectures INPIT was dispatching IP experts to help SMEs which was basically consultative in nature where SMEs will come to the center asking for consultation. What is being done now is support Universities eventually supporting SMEs through them. So the initial target was Universities.

Questions and Answers

I. What is the most important IP support to Universities and Start-up companies from Government?

1. I understand that INPIT dispatched IP strategy experts to consortiums to help SMEs? How frequently their services are utilized? Is there any case study of successful SMEs.

As mentioned above IP advisors are dispatched to the Universities to help them establish IP departments and help establish its functioning. Usually they are previously in the position of directors in the IP department of large companies with experience in handling IP related matters. Help from the INPIT was provided in 3 stages. In the first stage assistance was provided to around 15 Universities for about 9 years and the IP advisors are dispatched for a term of 3 years each. In this stage Universities are helped to develop their IP portfolio with some Universities filing 50 to 60 applications per year. In the second stage spanning 5 years network with 5 to 6 Universities with sufficient IP portfolio are formed and the number of Universities aimed was increased to around 150. The third stage which started around 2 years ago is aiming at commercialization of IPRs.

IP strategy experts dispatched by INPIT to comprehensive IP support centers established at various prefectures for assistance to SMEs mainly are doing a consultative type work to help the SMEs for the specific requirements of them. Ten IP strategy experts have been dispatched to eleven medium or small size Universities (One person has been working for two Universities). INPIT support 2-3 industry-academia cooperative projects, in which a partner company for each university has already been identified and the support is continued for three years. The goal is that the prototype of the product reaches the level, in that it can be evaluated by the customers. There are many successful cases of SMEs like the developing of a fume examination device by the Professor of Yamanashi University, SME in Nagano prefecture. They are supplying it to large corporations. For detection of a scratch on the film, the Professor of Yamanashi University came up with a new technology. There is a case of manufacturing a device which is a mouth piece used in the anesthesia system to prevent tongue biting by the patients. IP advisors helped in obtaining IP, consultation and negotiating between the University and SMEs etc. There is another case relating to light emitting device of a semiconductor by Prof. Miyaki of Meo University. There were also instance of joint research between University and SMEs.

2. What is the difference between the Patent Licensing Information Database (PLID) & Research Tool Patent Database (RTPD) maintained by INPIT and how do you expect SMEs and Inventors to make use of it.

PLID refers to Patent database by which licensable patents of companies, universities etc. can be searched collectively. These organizations registered patents which they themselves would not use and permit their use for other parties. The large companies having many Patents but some of them not being utilized are part of this database so that SMEs who want to make use of it can approach them and contribute to the society. This will be beneficial to SMEs as they can use the patents without actually making investment and spending time for research and development themselves. In actual utilization the SME and the large company having the Patent should negotiate between themselves.

RTPD is the database, by which research tool patents owned by universities and/or companies and licensable to other parties can be searched collectively and refers to the method for conducting research or research tools when Universities and research

institutions are conducting joint research and they acquire patent for it. The patentees registers them for the purpose of preventing the infringement in the field of the research in advance. The purpose of RTPD is to disclose the information regarding the research tools which are used exclusively by Universities posted in the INPIT website for information so that the third party can know that this particular tools patented by a University or institution so that they can avoid the infringement or they can negotiate with the owner of the Patent. This is to smoothen the research activities in various institutions. "Research tool patents" is Japanese Patents regarding the products or methods used as tools for the research in the life science field. If SMEs identifies the patents fitted for their use, they negotiates with the patentees of above patents for licensing, makes an agreement and then utilize them.

3. Can Government support networking of Universities and industries like INPIT or is it better to have an establishment like UNITT for India in the long run due to vast area and cultural diversity??

INPIT supports mainly the industry-academia collaboration projects in which small or medium size universities and their partner companies aim the industrialization on the basis of JPO policy. In Japan, MEXT supports the industry-academia collaboration projects / consortiums mainly for the large size universities other than JPO. UNITT is a body established by TLOs for sharing the information, attempts to improve the skills for the promotion of industry-academia collaboration projects. Since the information exchange between Universities about their operation of IP departments and the issues related thereto are exchanged, such a network should be formed by Universities. In Japan subsequent to University incorporation Act in 2004 the National Universities became more independent in dealing with the inventions and its commercialization. Such a networking is helpful to Universities to share information with each other. There is a need to construct the best operating system by taking the historical, cultural and geographical backgrounds into account.

4. Looking back, in your opinion what other measures you wish would have been taken by INPIT in mid-2000s for improving the functions of University IP offices or TLOs / SMEs and commercialization of Patents in general. What suggestion you have for India in this regard?

Up to now, the IP management system and the promotion system for industry academia collaboration in Japanese University IP offices or TLO/SMEs have been supported by the IP strategy experts who had been trained in the large companies and when they left it was difficult to manage. Universities should develop and train IP persons by themselves in the earlier stage and should have full-fledged IP persons who continue to stay in University. Training in IP related matters should be provided and arranged by respective Universities with in-house training centers. I think that these organizations must have trained IP strategy experts from a little more early stages by themselves. In the training for IP strategy experts, the training courses for the skill of business model planning, the skill for the coordination among the stake holders relating to industry academia collaboration and the skill for market research must have been added.

5. What other support does INPIT is planning to support SMEs?

There are 47 comprehensive IP support centers to provide a one-stop service to SMEs. They also provide consultation services including trade secret management, know-how,

support service for overseas business expansion and IP management. Also IP producers are dispatched to the project which is funded / subsidized by the Government.

6. How does network formation for providing support for generating project happens?? How does it differ from support for existing project? Is the networking restricted to Universities or industries are part of it?

We invite public participation of the universities for supporting regularly and after examination, decide the universities to be supported. Project aimed at industrialization should be listed in an application form. University makes a request for dispatch of IP advisors and along with the request they will be sending the details of the undergoing projects, plans for commercialization and also two or three high prioritized project. The advisor will support mainly for these high prioritized project. It is only the networking of Universities. Some Universities have the most advanced projects and the other Universities in the network try to learn from the advanced project. We identify the universities targeted for support, but not the companies. About the partner company of the project aiming at the industrialization that a university targeted for support pushes forward, we support it in addition to the university concerned.

II. How should University IP office or its TLO work for growing the start-up companies from the aspect of IP?

1. What is the setup of Industry-Academia-Government R&D consortium? I understand that there is about 30 consortiums. Is it region based. How they are communicating with each other to understand the mutual requirements?

This is about the dispatch of the advisors. It is based on the technical field that the consortiums are formed. Union or consortium are formed in order to be eligible for the various financial assistance / subsidy provided by MEXT, Cabinet office or NEDO. INPIT dispatch an IP producer to the research and development project (project for development and practical use of the advanced technologies). It is necessary to form consortiums composed of university, company and/or research institute, where public funds were cast into propel and support these projects. Consortium formation is required to receive these funds which need the requirement like exchange of MOUs, responsibility sharing and so on.

2. What are the areas in which SMEs can pursue research with Universities as their goal is short term result oriented unlike Universities pursuing basic research many times with long term plans. How they can synchronize their needs?

From the point of view of the Universities, the professors and researchers intend to put theme of their research into the society. Most of them are isolated independent patent far from commercialization. When the chances of commercialization is less the company is not inclined to proceed with the same. On the other hand from the view point of the company, particularly SMEs, they intend to look for improvements that can be implemented immediately. However such improvements cannot be the main research topic for the University Professors. There cannot be a straightforward answer, but there are cases like health care such as medical devices where it can be a theme for University professors. Researchers in the Universities have strong intention to put the cutting edge technology into the society. So it is necessary for Universities to keep the dialogue process

with SMEs continuously and understand each other's requirement bridge the gap. It's a continuous process.

3. In India, Indian Institute of Technology at Bombay, Madras etc. have established Research Parks with incubation cells for encouraging entrepreneurship. What is the scenario in Japan? Does it encourage SMEs? What is your opinion on functioning of Research Parks? Can one Research Park cater to multiple Universities??

Research Parks itself is useful in terms of financing for startups because to reach up to building prototype and developing it is better to fund together with Research Park. There are several different forms of ownership. It may be a University or local Government or private fund and a financial body needs to be established. Research Parks can be established from the funds and help provided by the Government but the ownership issues are to be clearly addressed. Research parks can be a great meeting point for University researchers and Industry.

III. What is the most important IP skills the leaders of the university IP office/TLO/Start-up companies must have?

1. What is the skill sets required for IP strategy experts / advisors and persons engaged in TLOs and commercialization of Patents in general? How frequently they are trained.

It is better if they are having prior exposure to IP activities in an industry. They should have a good business knowledge or business model planning. Co-ordination and communication skill to interact with researchers and industrialists and other stake holders is very important. They should be capable of understanding market needs and also experience in conducting market research. We are conducting training to enhance those skills by inviting the specialists in those fields. These trainings are held five times a year.

2. Many of the Institutions in India may not have an active R&D. Can you suggest a method for them to identify and pursue research in a technical field which can generate valuable Patents? Or in other words how they can get the trends of the leading edge technologies to maximize the possibility of commercializing Patents?

Undoubtedly the research that takes place in Universities has a huge potential for the future. However those people engaged in the cutting edge Science scarcely think about the commercialization. On the other hand the Engineers who is working in the companies have high level skills concerning the improvements and modifications needed immediately. It is important to match the skills of the researchers in the Universities and the Engineers of the Company in terms of time line and the occasion. They should think about core research as well as about its commercialization. Frequent meeting and discussion with industry people is necessary. Government should provide through conferences and seminars a platform for continuous dialogue. Currently the National Government also announced the intention to encourage large scale companies and large Universities to have the comprehensive agreement to keep the multilateral dialogue and exchange and I think it is a great direction for their collaboration.

Additional Questions:

1. Do you have a program for professors and researchers?

JPO was dispatching the experts to provide training on IPR and to assist the professors to help them deal with IP issues. JPO compose text books for University professors so that they can use it when they teach IP to their own students or faculty. Sometimes the JPO sends their own Examiners to various Universities to assist the Professors.

2. What is the downside to startups?

Universities have to manage the funding by themselves after becoming independent from the Government. So they planned to enhance their research capability and planned for more joint projects and licensing to manage the funding. Universities also realized that licensing alone is not enough to societies benefit and improvement of local industry and economy is vital. More startups are required for more job creation and startups are better placed for small innovations or improvements which can add more value to the products.

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Appendix III: Minutes of the Interview with Mr.Yoshio Nanba, JST

Date and Time: 25/10/2017, 3.00-4.30PM
Location: Japan Science and Technology Agency (JST), Tokyo Head Quarters
7, Gobancho, Chiyoda-ku, Tokyo - 1020076

Attendees:
1. Mr. Yoshio Nanba – Senior Researcher, Industry-Academia Collaboration Promotion Group, Department of Industry-Academic Development, JST
2. C.N.Shashidhara – Interviewer
3. Dr.Yorimasa Suwa – Senior Researcher APIC-JIPII
4. Ms. Madren Reiko - Interpreter

Mr. Yoshio Nanba explained briefly about the functioning of Japan Science and Technology Agency.

Questions and Answers

I. What is the most important IP support to Universities and Start-up companies from Government?

1. Can you please elaborate on JSTs offering support for licensing to companies, and provide case studies if any on the details of licensing activities?

JST was earlier offering support for licensing activities with the help of licensing coordinators / specialists in the field. Over a period of time the TLOs of most of the Universities started employing licensing coordinators in-house and hence the extent of support decreased slowly. When it comes to licensing agreement one of the most important thing to consider is the amount of licensing fees. In the past the commissioner of JPO gave mandate in terms of percentage of licensing fees and for excellent technology it was 5%, very good 4% and so on. Since we are semi-governmental organization we followed that example. Even though that system is abolished by JPO we still follow the same. There are many cases which are successful. Invention of LED, blue light emitting device by Prof. Akazaki of Nagoya University which was commercialized through Toyota and JST received license fee of aprx. 5.6 billion Japanese Yen and IGC by Prof. Hideo Hosono of Tokyo Institute of Technology which stands for indium gallium oxide are big samples of cases handled by JST.

2. How frequently the J-store maintained by JST is being utilized? Is there any case study of successful utilization of J-Store?

J-store has approx. 17,500 technologies available for licensing as on date and used by the interested persons frequently. These 17500 include patents held by JST and Universities where these universities has requested JST for collaboration. It is accessed by more than 100000 times in a year. Regarding its utilization there is no information as the companies do not inform their utilization of J-store and its subsequent progress.

3. Which program is more effective in your opinion to connect industry and academia? New Technology Presentation Meetings or University Technology Exhibitions? How frequently

such programs are to be conducted, considering that many Universities in India have just started developing their Patent portfolios??

The program of New Technology Presentation Meetings was started in 2006 where inventors provide explanation of the invention on one by one basis so that they can find out the industries which are interested in commercializing the same. It is usually held twice in a week on Tuesdays and Thursdays and 82 times in previous year. University Technology Exhibitions are held to help Universities getting together at one venue and exhibiting their technologies to find out prospective licensees. Once in a year an exhibition of a large scale is held which is called "Innovation Japan" and other than that lots of small scale individual exhibitions are held in between. It is useful and to be held as frequently as possible but they are cost intensive. Hence by considering the budget available these programs are to be held so as to cover maximum number of Universities and the stake holders. It is difficult for one University to have such a big exhibition on their own and hence we step in to conduct such meetings for benefit of many Universities.

With India being a big country these types of programs can be held at all the major cities with the established Universities playing a central role and other Universities proximal to the cities are covered and benefitted. Care should be taken by the patent applicants to ensure that their technologies are not disclosed before the publication which is usually after 18 months from the application. In these meetings it is better to showcase one good patent rather than too many patents as commercialization of one good patent is more beneficial and is better to spend much time on it.

4. How is the response to the portal site for information related to industry-academia-Government collaboration and General Consulting Service for Technology Transfer? How many people made use of it?

JST provides a wide range of information relating to industry-Academia-Government collaboration for all interested parties to meet their information needs. It publishes monthly online journal for Industry-Academia-Government Collaboration for providing opportunities to discuss Industry-Academia-Government Collaboration domain and to spread its result throughout Japan. It provides basic details such as title of the article, author and affiliation. General Consulting Service for Technology Transfer is aimed as a one stop service and the broad range of questions on general information on JST programs and other public-sector programs, referrals to potential partners and collaborating organizations, technology content and progress status, and licensing are answered or routed to the most appropriate persons. As of now no statistics are available on the exact number of people made use of these services.

5. Looking back, in your opinion what other measures you wish would have been taken by JST in Mid-2000 for improving the functions of University IP offices or TLOs and commercialization of Patents in general. What suggestion you have for India in this regard.

It is difficult to guess clearly, but TLOs or IP departments at Universities having a specialist with good knowledge of IPR, business development, licensing activities etc. in the beginning will be of tremendous advantage. The people engaged in such activities should have a good communication and co-ordination skills as it is always better for University to approach SMEs rather than SMEs approaching University as they will not usually have enough knowledge about the research activities of Universities and hesitate to approach them.

II. How should University IP office or its TLO work for growing the start-up companies from the aspect of IP?

1. What are the areas in which SMEs can pursue research with Universities as their goal is short term result oriented unlike Universities pursuing basic research many times with long term plans. How they can synchronize their needs?

As mentioned above it is better for Universities to approach the SMEs and meeting at technology exhibitions are important. They should make use of the meeting opportunities to discuss the mutual requirement. JST has a program "University-initiated new industry creation program" (START) which connects business promoters and researchers such as universities and supports R&D and business development. It is composed of "business promoter support type" to support activities of business promoters and "project support type" to support projects at universities and others.

2. In India, Indian Institute of Technology at Bombay and Madras etc. have established Research Parks with incubation cells for encouraging entrepreneurship. What is the scenario in Japan? Does it encourage SMEs? What is your opinion on functioning of Research Parks? Can one Research Park cater to multiple Universities??

It is very useful and in Japan there are 32 Incubation plaza established at different locations by regional comprehensive support centers established by METI. More than 550 companies are registered. Where the Universities and institutions could not afford to establish Research parks, a semi Government agency can establish an incubation plaza for the help of Universities and institutions of the nearby regions. It can also provide support for research and development before a startup company can be formed.

III. What is the most important IP skills the leaders of the university IP office/TLO/Start-up companies must have?

1. Many of the Institutions in India may not have an active R&D. Can you suggest a method for them to identify and pursue research in a technical field which can generate valuable Patents? Or in other words how they can get the trends of the leading edge technologies to maximize the possibility of commercializing Patents?

In Japan Strategic targets of the National Government forms the basis for choosing the technical field for research by JST. It needs to focus on the technological fields stipulated by the National Government. The objectives are stipulated by the National Government broadly. For identifying the trends of cutting edge technologies to maximize the possibility of Patent commercialization there is a need to strike a balance between the market and corporate needs, but the most important objective is to pursue the wellbeing of the public. We support researchers who are proactive and forward looking with focus on the market 5 to 10 years ahead. The Basic research by the Universities should be based on the trends of the leading edge technologies which can be assessed by understanding the corporate needs and looking ahead 5 or 10 years ahead to understand the public needs. Market analysis available are to be made use of and they should strive for connecting with the industries to understand their needs. It is important to have a support system for their development and subsidy from the Government will help them to sustain.

2. What is the skill sets required for IP strategy experts / advisors / specialists? How frequently they are trained. What is the required skill sets required for persons engaged in TLOs and commercialization of Patents in general? How many programs are conducted under human resource development program to develop people involved in Technology transfer? What are the subjects taught and the background of faculties (like experience in industry, business development, accounting etc.)

It is always beneficial if the person has prior working knowledge working with IP divisions of a company so that they can bridge the research output with industry requirements and also bring with them the necessary contacts and information. Along with the business skills they should have keen interest on research activities. Practical experience in licensing activities and negotiation skills are very advantageous. Knowledge of industries and ability to foresee the markets 5 to 10 years ahead is one of the important skill required. Experience in Patent filings and developing Patent portfolio will be very useful if they are assisting a University which just started an IP division.

3. How frequently is the training program to develop the abilities of people involved in technology transfer programs at universities is conducted? What is the duration? Is the expenses borne by Universities or JST?

Normally the training sessions are for two days with a batch size of around 40 people conducted frequently. The expenses are borne by the JST.

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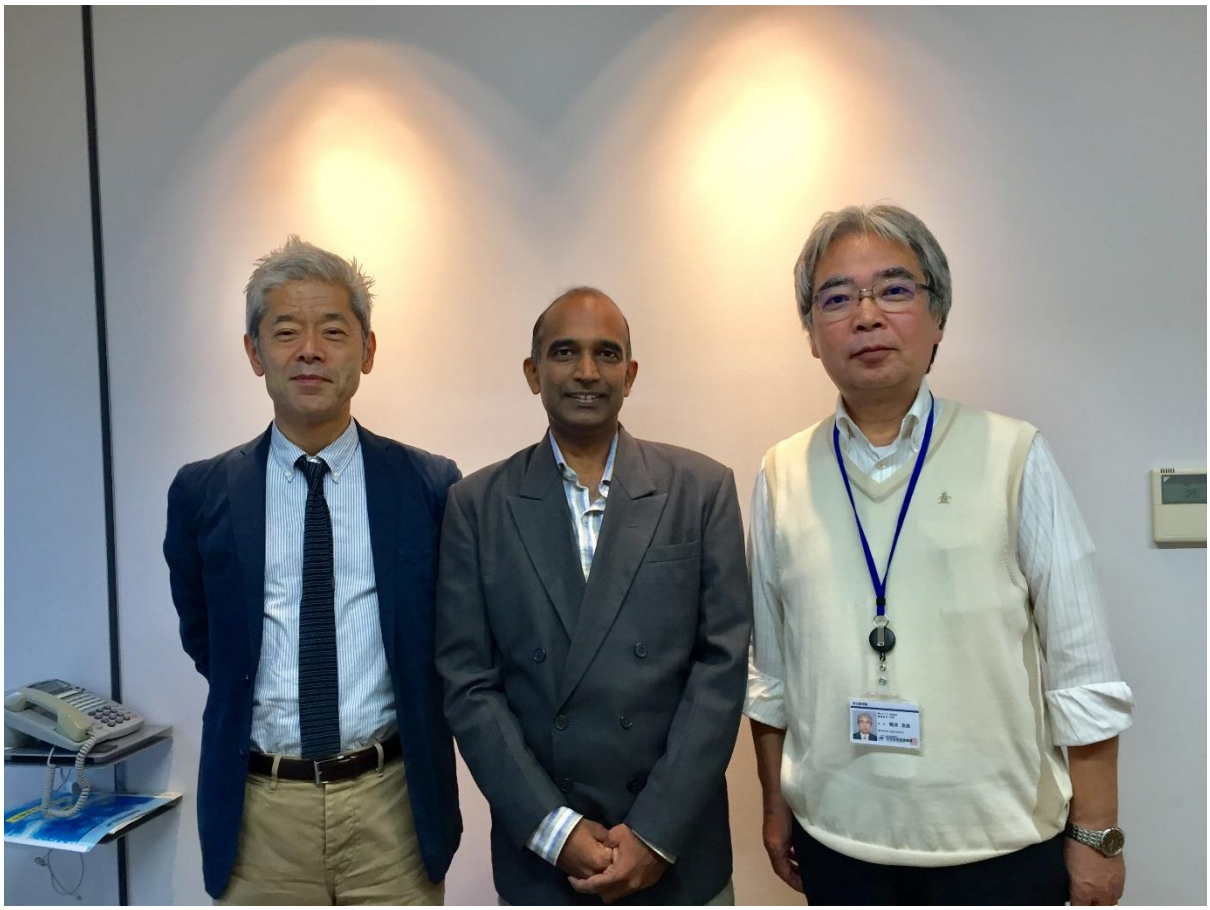

Appendix IV: Minutes of the Interview with Mr.Kohei Yasuda, President / CEO, Campus Create Co., Ltd. Technology Licensing Organization (TLO)

Date and Time: 27/11/2017, 10.00-11.30AM
Location: Campus Create Co., Ltd., 1-5-1 Chofugaoka Chofu City, Tokyo 182-8585 JAPAN, UEC, Tokyo.

Attendees:
1. Mr.Kohei Yasuda, President / CEO, Campus Create Co., Ltd.
2. C.N.Shashidhara – Interviewer
3. Dr.Yorimasa Suwa – Senior Researcher APIC-JIPII
4. Ms. Yoko Okazaki – Interpreter

Questions and Answers

Basic questions to Campus Create

1. What are the other products you offer to companies other than technology licensing? Can University IP divisions expand their work similarly to become self-sustaining?

We have activities to help the clients in guiding them on how to establish or start a company and how to co-operate with other companies or venture supports in order to start a company. We are doing this for the past 18 years and providing help for conducting joint research between the University and Industry and we have been working to bridge those two parties and has about 600 cases of partnerships. We have more than 100 Universities with which we had some kind of cooperation in the past and we also focus on interactions between company to company for understanding about the available technologies and partnerships. We can find companies that are tailored to suit for a particular type of venture businesses. For TLOs in Japan to adapt such services may not be possible as basically their function lies in Technology Transfer. However TLOs in US can extend these type of services.

2. How do you asses the importance of Patents??

We believe the Patents are important and assessing the importance of a Patent is quite a difficult task. It is important for researchers to aim for obtaining Patents for their research work, but the process has several stages like research, getting a patent and commercialization. We should evaluate it in a comprehensive way and find how much profit that they were able to make. From the statistical view point it is still difficult. There are not so many cases where the Patents are assigned to industry to make the profit in the past. It can be based on whether the patent is licensed or not and the profit figure for each patent which can be at different stages.

3. In your opinion is there higher chances of "Patents arising from joint research or collaborative research" being able to get more commercial benefits.

It depends on the nature of Patents. Large corporations may have many patents which are defensive in nature. There are also Patents aimed for generation of profits. But in Universities the scholars and researchers are sometimes interested more in publishing academic papers and getting more important materials for teaching and other academic

interests. In those cases when the commercialization is not of primary importance probably because it takes more time, the chances of these patents being licensed is less likely.

4. What made you take the leap into entrepreneurship from Academia? What were the biggest initial hurdles to building your business and how did you overcome them? What kind of support from University you expect for the upcoming startup firms to overcome these hurdles?

In and around 1999 when METI started encouraging TLOs and for starting venture companies, goal was set to achieve 1000 companies. Starting a company for an academician depends on the nature and personality of the person and interest in business. For scholars with different mindset this can be quite difficult. While some have succeeded while others are not. They should be motivated to start a company and find customers which requires different mindset. Our company was the first one to have tripartite contract between University, Industry and TLO. This was initially opposed by those who thought from the angle of mere administration. However this was encouraged by the researchers as they can focus on the technical work leaving the administrative works to a TLO. Over a period of time this scheme has become successful. To support the upcoming startup firms Universities should provide a place or venue within the University where they can interact with TLOs or other experts in entrepreneurship development.

I - What is the most important IP support to Universities and Start-up companies from Government?

Government should dispatch experts in IP and entrepreneurship development so that the required guidance is readily available to the upcoming startups. Reduction in the filing fees and faster processing is also important. Assistance in foreign filing and PCT filing is necessary. This support was provided by JST, but over a period of time this is reduced. Another area where SMEs need assistance with IP experts sent to assist SMEs is in infringement analysis when there products are said to infringe others right or vice versa, especially when they are involved in litigation or other legal proceedings. Also when the patent is obtained the owner thinks it is safe, but the technology is disclosed and the competitors try to obtain peripheral patents around it. This makes difficult for the innovators to work on their business. This is true for SMEs as well as Universities. Help from an IP expert is vital in those cases.

1. Your website mentions that 85% of beneficiaries of Technology Transfer are SMEs. Is it by number or by revenue? How many of these SMEs are involved from research stage and how many are involved in transfer of existing un-utilized Patents?

In Japan there are somewhere between 9 to 10 million SMEs. While almost half of them are conducting their own established business independently, but however the remaining are under the umbrella of the large corporations. While they may not be a subsidiary of the large company, to a large extent they receive orders from the large companies and depend on them. Whenever there are big projects in infrastructures such as that in Railways, communication or power generation systems for example, these large corporations receive order from the Government which in turn are cascading down to the small companies experienced in such works. Hence whenever Industry-Academia relations are fostered the benefits are usually cascaded down to SMEs. Hence research programs with Universities generally involves large corporations, but because of the structure of the industries so

formed sometimes SMEs also gets so involved. Exact figures are not available. But the number of SMEs involved in research are not so many.

2. JST has many schemes like A-STEP, S-innovation etc. for encouraging joint research between academia and industry. Which program in your opinion is most suitable for SMEs or Startups to pursue joint research?

JST has certain pre-requisite requirements like the research has to be related to the IP matters of the University researchers. To apply for these schemes the research themes to be selected by the companies has to be the areas chosen or relevant to the themes of JST. Otherwise they are not eligible to apply at all. Most important factor here is that the technical matter or theme should match.

3. Is it feasible for SMEs to participate in research schemes like A-STEP etc. which can last for 10 years? What other alternate measures do you expect for small firms?

As mentioned above the research area should be related. Sometimes they may be already working on a project and able to receive some funds. There are some small scale funds such that if the researcher can work with that program, then the JST will provide 1.7 million Yen or 2 million Yen to the maximum. To apply for research for a duration of 10 years is not feasible as the managers in SMEs are to carry out research concurrently with other priority business related work. There are schemes of one year length. The research themes like A-STEP have different stages and SMEs can participate in stages appropriate to them.

4. Do you make use of J-store of JST and PLID (Patent Licensing Information Database) of INPIT? Any comments on these services??

We do use these services. R&D departments of large companies do make use of them, but only a very few medium sized companies use it. Some companies have research departments and most of them are large companies. When it comes to SMEs only the few medium ones have research departments. People in SMEs have concurrent work in other projects. Utilization of database is needed for research and we do use other paid library databases as part of consultation services to large companies and earning 20-30 million Yen / year from consulting service.

II. How should University IP office or its TLO work for growing the start-up companies from the aspect of IP?

1. How many SMEs are involved in joint research with Universities? What are the major issues in Joint research of SMEs and Universities?

We do not have the figures, but as mentioned above the managers in SMEs have to do concurrent job of project management and research which is quite difficult. Their primary aim is to get the order from the market. Hence large share of the joint research is with the big companies. The major issues in joint research remains the nature of the SMEs and understanding of each other's requirement with University focus on academics and Industry focus on immediate business aspects.

2. Is your venture support activity starts from University IPs or in general without IPs? Do you believe whether University IP can create more startups?

Most of the venture support activity is without IP. Depending on the area and quality of SMEs some venture activity is based on IP. Again it depends on whether the IP is capable of creating more revenue or not.

3. What support you expect from the Government and Universities to encourage startups and do you have any suggestions for Government or Academia in India to encourage startups?

Seminars and lectures to the students on entrepreneurship skills is more important. Nowadays there are requests from large companies for venture businesses and it needs to be explored to encourage the potential students or candidates who are interested in starting a company. However there are not many success stories. Government funding to them is very important as in the beginning the SMEs go through difficulty in raising funds and there will be a time lag before the products can enter into market. Support is required to get the gap funding to survive the valley of death. This funding should not be too large to make them complacent but also should be just enough to survive during the initial phase to make them self-sufficient later.

III. What is the most important IP skills the leaders of the university IP office/TLO/Start-up companies must have?

1. What is the skill sets required for IP strategy experts / advisors?

They should understand the nature of the business and mind set of the managers and owners of startups. Managers and owners should also have interest and the mind set to know about IP. They should focus on improvements and obtaining patents along with their routine work of project or business related tasks.

2. What is the skill sets required for persons engaged in TLOs and commercialization of Patents in general? How frequently they need to be trained.

Continuous on the job training is an important factor. Skills required in finding the other party is very important. Communication and coordination in finding the right party interested in licensing and commercializing is very much necessary without which the bridging of the IP owners and users is very difficult. We have open innovation portal site for coordination of Industry-academia-Government collaboration. It invites company people for coordination and understanding their needs to support them.

3. Many of the Institutions in India may not have an active R&D. Can you suggest a method for them to identify and pursue research in a technical field which can generate valuable Patents? Or in other words how they can get the trends of the leading edge technologies or the area they should enter to maximize the possibility of commercializing Patents?

Understanding the needs of the industry is vital to pursue research. Inviting company people to discuss and understand the needs and having a portal site for sharing the information will be helpful. Information collected in seminars and conferences are to be utilized.

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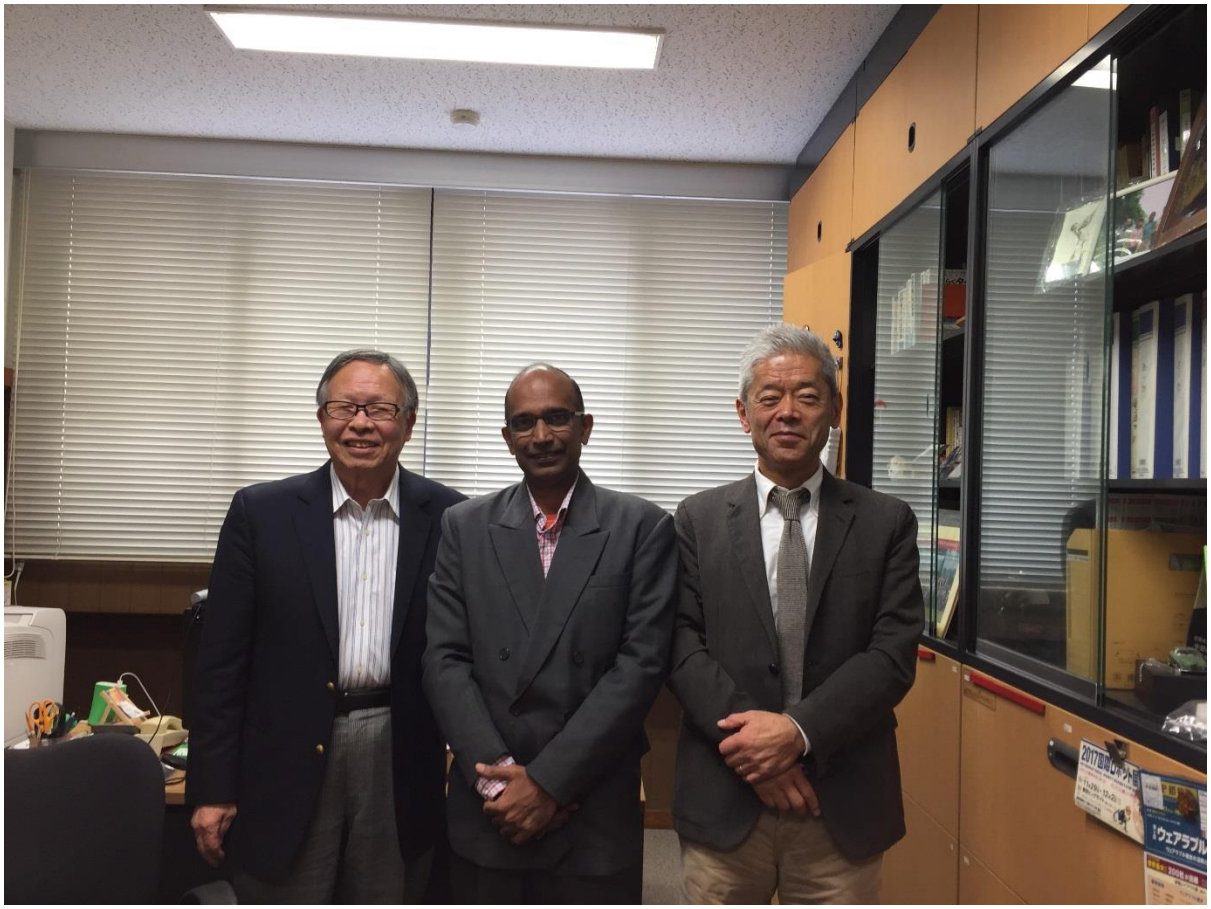

1. Appendix V: Minutes of the Interview with Mr.Akimoto of Yokohama Venture Plaza, Tokyo Institute of Technology

Date and Time: 30/11/2017, 2.30-4.00 PM
Location: Yokohama Venture Plaza (YVP), 4259-3, Nagatsuda-cho, Midori-ku, Yokohama, 226-8510

Attendees:
2. Mr.Akimoto, Chief Incubation Manager, Yokohama Venture Plaza, Tokyo Institute of Technology
3. C.N.Shashidhara – Interviewer
4. Dr.Yorimasa Suwa – Senior Researcher APIC-JIPII
5. Ms. Madren Reiko - Interpreter

Mr. Akimoto explained briefly the functions and support provided by the YVP for the startup companies. He emphasized that the support is given by the managers to the companies regarding various tips and advices until a solid business foundation is established or company is able to make profits. It provides basically a place and knowhow for the startup companies and also existing companies. The support includes many aspects regarding funding, business establishment, matching and IPR related help. With respect to IPR help is extended not just for filing but prior to filing phase by conducting search and also assisting them during the appeal or litigation phases. They also conduct many IP seminars. It is found that SMEs are concentrating on filings and not much on commercialization. Venture plaza provides support by focusing on commercialization of Patents from the phase prior of prior to filing.

Questions and Answers

Research Questions I: What is the most important IP support to Universities and Start-up companies from Government?

1. How important is Intellectual Property to the incubation plazas? How SMEs / Start-ups are encouraged to develop their own Intellectual Property?

Most of the companies have R&D and for their activities it is considered very important. Intellectual Property is considered as very important to the incubation plaza. Research and Development and innovation activities are supported. Support is also mainly provided for business and development. They are assisted in matching their needs with other parties who are interested in their business, information on subsidies, obtaining licenses etc.

2. Is the Patent Licensing Information Database (PLID) maintained by INPIT and J-Store of JST are utilized by YVP?

YVP usually makes use of other databases of private sector.

3. What is your advice to the startups of YVP on developing IP portfolio? How best do you think can they make use of the open innovation seminars such as that organized by JST?

YVP helps the SMEs during filing of Patents by conducting search to ensure the requirements of patentability like novelty, inventive step, information about competitors etc. and also to ensure that they are not infringing on others patents. Companies under YVP do attend various seminars organized for information exchange and business development.

4. What are the hurdles in developing innovation and IPR in start-ups? What is your expectation of Start-up companies in this regard? Does the consultancy service provided by "SME support Japan" includes consultancy on IPR development and utilization?

The major hurdles are lack of resources like people, building prototype and funding. Our support includes for IP filing as well as for business development. Generally some SMEs in the Plaza are not able to afford the services of a Patent attorney and the venture plaza helps them providing the appropriate services.

5. How does the online matching support works in YVP? Does it help in promoting IP?

It is a database service J-Goodtech which is a matching site for connecting the SMEs. The companies have to apply and go through the process of registration and the matching is done among the registered companies. It is mainly aimed for business growth like connecting buyers and sellers.

6. What are the IP issues in overseas business development and how does it affect SMEs?

Presently we provide consultancy services for them mainly for foreign filings and PCT filings and the subsidies for which they are eligible. PCT filings are usually by large companies and small firms generally not able to afford the cost involved.

Research Questions II: How should University IP office or its TLO work for growing the start-up companies from the aspect of IP?

7. How important do you think is the partnership of Universities with SMEs / start-ups? How do you expect Universities to partner with existing SMEs?

Most of the partnerships of University is with large companies. The business of the most of the small firms is through obtaining contracts from the large companies. The era of mass production is over. Companies need to be aware of new technological developments arising from University R&D divisions. For this there should be sufficient budget for University R&D divisions.

8. How long do you think a start-up company or an SME can engage in research activity considering limited resources and time available for SMEs?

Small firms may involve in research related activities of say one year duration. But lot depends on the support they get in the form of various subsidies.

9. How do you see incubation plazas with IPRs and without IPRs?

Assessment of the companies is done by the city of Yokohama where several factors such as awareness of IPR by management, staff, efforts on innovation etc. are considered.

IPR is a major factor in these assessments. IPR is very vital component for the companies in Yokohama incubation plaza.

Research Questions III - What is the most important IP skills the leaders of the university IP office/TLO/Start-up companies must have?

10. Can Patents will be the most influential factor in future? If so, what are the important IP skills an entrepreneur should have in your opinion?

The major skill an entrepreneur should have is to utilize the IP in conjunction with the business operations. Not every entrepreneur is equipped with that skill. Knowledge of filing, development of IP into the business for the benefit of the society is required and that is where our services are available to support them.

11. What are the skills required for the experts in IP to promote the commercialization of Patents by SMEs?

Most of the companies are focusing too much on filing and not good in commercialization. They look for assistance from the experts in this regard. Important skill for the IP experts is the ability to communicate with the top management of the companies effectively and ability to commercialize the Patents.

12. What upgradation of skills do you think is necessary for academicians and the company Engineers in order to carry out joint research? What kind of training is necessary for them? For example: Basic knowledge of licensing to academicians, importance of IP to start-up companies etc.

Most of the times the University demands unreasonably high royalty rates as they do not understand the business cycle of a company. They should be aware of the difficulty in raising funds and the time required for the companies to make reasonable profits after the company is started. This is necessary for the people from the industry also who have just ventured into new business. Hence they should be trained in the field of business establishment and business cycles which can help for better collaboration between Industry and academia. Negotiation during license agreements based on the business knowledge is another skill which is vital.

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Appendix VI: Minutes of the Interview with Mr.Manabu Bonkohara, Chairman & CEO, ZyCube.

Date and Time: 07/12/2017, 1.00-2.00 PM
Location: Yokohama Venture Plaza (YVP), 4259-3, Nagatsuda-cho, Midori-ku, Yokohama, 226-8510

Attendees:
1. Mr.Manabu Bonkohara, Chairman & CEO, ZyCube
2. C.N.Shashidhara – Interviewer
3. Ms. Madren Reiko – Interpreter
4. Ms. Tomoko Uno .

Basic questions to ZyCube

1. What in your opinion are the biggest initial hurdles to building your business, develop IPR and how did you overcome them? What kind of support from University you expect for the upcoming startup firms to overcome these hurdles?

Getting a proper direction in the field is a challenge. In this regard the semiconductor industry had a database of IP and the JPO database is found to be very useful. We were conducting searches in advance and then decide whether to file for Patent or not based on the strategic search results. We were able to get directions in which to proceed by conducting the search in advance. University patents usually are of basic technology and a bit difficult to commercialize. We started the company 15 years ago with six of us with expertise in the field of semiconductor industry from scratch on our own. It is important that the company needs to make profits early in order to survive and so it is better to venture into new business with full preparation and the help from the Government and Universities is very much necessary both in terms of technological inputs and funding or budgetary help.

2. Looking back, what other measures you wish would have been taken by you when you started the company?

The market for semiconductor industry is declining and hence ability to adapt and flexibility for changes is very important. Venture companies in this field are generally weak and vulnerable and many are out of business. Getting support from the Government is very important.

3. What in your opinion is the trend of patent filings in the area of 3D stacking technology of LSI in future? Is there any Patent infringement issues that you have faced?

With players like IBM & Intel in the 1960s and later in 1980s many companies are including Toshiba are utilizing these semiconductor technologies. But with the markets declining sometimes some companies do not disclose their technology and it affects the small companies in the related area.

I - What is the most important IP support to Universities and Start-up companies from Government?

1. How important is Intellectual Property in your business? What are the hurdles in developing innovation and IPR in start-ups? What support you expect to get from Government or Universities in developing IP portfolio? Can you explain and share your experiences in developing IP portfolio.

Intellectual property is very important and the main hurdle is the lack of help in the form of financial or budgetary support and human resources. Collaboration with different sectors is important. Patent filing costs are a concern even though there is a subsidy which is insufficient. There is a need for long term strategy from the Government to help the startups.

2. Do you participate in open innovation seminars conducted by JST for communicating your needs to the Academia? What is your views and suggestions for fostering industry-academia collaboration? Also do you utilize the Patent Licensing Information Database (PLID) maintained by INPIT and J-Store of JST.

Academia in the field of semiconductors is very active and we participate in discussions with the academia. J-store provides the summary in a useful way and helps to make decision easily. It is very hand and convenient to extract data.

3. JST has many schemes like A-STEP, S-innovation etc. for encouraging joint research between academia and industry. Which program in your opinion is most suitable for SMEs or Startups to pursue joint research?

These schemes are good with many big companies having a long term collaboration with the University. SMEs need Government support financially and research schemes suitable for shorter duration is required as the companies need to make use of the technology and earn profits.

II – How should University IP office or its TLO work for growing the start-up companies from the aspect of IP?

1. How important do you think is the partnership with University and Academic institutions? You are having partnerships with many Universities. Can you share your valuable experience with them?

Many companies have in-house IP department as companies cannot continue in the long run with their own technology. They need to look for other available technologies and enter into cross licensing agreement. This is especially necessary in the field of electronics. Hence University – Industry collaboration is very important. Without exposure to other technologies the value of the engineers in the field is decreasing and there is a lack of strategy by the industry as a whole.

2. How long do you think a startup company or an SME can engage in research activity considering limited resources and time available?

It is difficult for many companies to spend resources on research for long and they need support from the Government by way of subsidy or other financial support to encourage research with University.

3. What support you expect from the Government and Universities to encourage startups and do you have any suggestions for Government or Academia in India to encourage startups and IPR?

It is important to have good communication and information exchange with Government and academia. There is a requirement for the ability to foresee the technology development and how it can be utilized in future. Information exchange and conveying it to industry to guide them through the process by mixing various information for the benefit of industry as a whole is required.

III. What is the most important IP skills the leaders of the university IP office/TLO/Start-up companies must have?

1. Can Patents will be the most influential factor in future? If so, what are the important IP skills an entrepreneur should have in your opinion? What IP skills do you expect from the IP experts dispatched by the Government to help startups?

It is important to have IP skills with the ability to foresee the future technical development. Ability to build the new scheme with the information available from various sources and converting them to business is vital.

2. What change do you think is necessary from academicians and the company Engineers in order to carry out joint research or collaborative research? What kind of training is necessary for them? For eg: Basic knowledge of licensing to academicians.

Exchange of information between Industry and academia is of utmost importance. We have a situation where some of the experts not in the field or retired with vast knowledge which is not utilized. Training schemes are to be developed so that the expert knowledge can be shared by them to the younger generation.

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Appendix VII: Minutes of the Interview with Mr.Kajiro Sakamoto, President, Street Design Corporation.

Date and Time: 07/12/2017, 2.00-3.00 PM
Location: Yokohama Venture Plaza (YVP), 4259-3, Nagatsuda-cho, Midori-ku, Yokohama, 226-8510

Attendees:
1. Mr.Kajiro Sakamoto, President, Street Design Corporation.
2. C.N.Shashidhara – Interviewer
3. Ms. Madren Reiko – Interpreter
4. Ms. Tomoko Uno .

Basic questions to Street Design Corporation

1. What in your opinion are the biggest initial hurdles to building your business, develop IPR and how did you overcome them? What kind of support from University you expect for the upcoming startup firms to overcome these hurdles?

We have about 20 to 30 patent applications pending and around 7 to 8 granted patents. The biggest challenges are evaluating the technology prior to filing, expressing the technology clearly while drafting the specification and the fees for Patent filing. Industrial Technology Council, Tokyo Institute of Technology have provided lot of expertize in this regard and the subsidy provided by various national schemes for patent filing is useful. Also it is usually it is difficult for SMEs to collaborate with University. Support or some kind of schemes are required prior to start for the startup companies.

2. Looking back, what other measures you wish would have been taken by you when you started the company?

It is important that instead of focusing on own technology one has to explore more and think in terms of profit generation. One should start a company after equipping with everything.

3. What in your opinion is the trend of patent filings in the area of civil engineering? Is there any Patent infringement issues that you have faced?

We have certain issues like other parties infringing our rights and also the overseas partners in joint research filing patents in their own countries for our technology.

I - What is the most important IP support to Universities and Start-up companies from Government?

1. How important is Intellectual Property in your business? What are the hurdles in developing innovation and IPR in start-ups? What support you expect to get from Government or Universities in developing IP portfolio? Can you explain and share your experiences in developing IP portfolio.

Patent rights are very important when dealing with large corporations. It can be used strategically during negotiations. Patents can be a powerful weapon and last fortress for small companies. Further Government support is needed for consultation on market and lack of information on marketing hinders the progress of SMEs. University provide useful advice and consultancy but tend to focus on their own technology. They need to share information and advice on peripheral technologies which can be useful for SMEs. Support and help is required from Government especially for foreign filings which are expensive.

2. Do you participate in open innovation seminars conducted by JST for communicating your needs to the Academia? What is your views and suggestions for fostering industry-academia collaboration? Also do you utilize the Patent Licensing Information Database (PLID) maintained by INPIT and J-Store of JST.

We do participate in these seminars. J-store is very useful, but Universities focus on basic technologies while venture companies has to integrate them into their products.

3. JST has many schemes like A-STEP, S-innovation etc. for encouraging joint research between academia and industry. Which program in your opinion is most suitable for SMEs or Startups to pursue joint research?

We are exposed to these kind of programs by JST and NEDO. A-STEP is a lengthy one but useful. For SMEs research for a duration of up to 3 years is ideal but above that period may be difficult.

II – How should University IP office or its TLO work for growing the start-up companies from the aspect of IP?

1. How important do you think is the partnership with University and Academic institutions? You are having partnerships with many Universities. Can you share your valuable experience with them?

Partnership with Universities is very important. But they focus on academics and basic technology and SMEs has to think from the direction of earning profits. Sometimes the licensing share demanded by them is difficult to accept and lot of managerial skills are required to balance out each requirement.

2. How long do you think a startup company or an SME can engage in research activity considering limited resources and time available?

Many big companies have their own lab but may not make full utilization. As small companies have less resource and time they can work together with big companies and expand their venture business.

3. What support you expect from the Government and Universities to encourage startups and do you have any suggestions for Government or Academia in India to encourage startups and IPR?

In Japan lot of excellent technology are available. Support is required to foster human resources to integrate these technologies. Capacity of people to exploit and coordinate for integrating the available technologies is to be expanded.

III. What is the most important IP skills the leaders of the university IP office/TLO/Start-up companies must have?

1. Can Patents will be the most influential factor in future? If so, what are the important IP skills an entrepreneur should have in your opinion? What IP skills do you expect from the IP experts dispatched by the Government to help startups?

For SMEs patent can be the last fortress in business negotiations and it may be necessary to have multiple patents in a particular technology. IP experts should have the foresight to see the technology ahead and identify the kind of business it generates. IP experts should be good at assessing the patentability criteria such as novelty, inventive step etc. and have good filing knowledge. They should also be good in assessing the usefulness of Patents to find out what to be filed and what not to be filed.

2. What change do you think is necessary from academicians and the company Engineers in order to carry out joint research or collaborative research? What kind of training is necessary for them? For eg: Basic knowledge of licensing to academicians.

It is important to have a good team of people. People from different area with different expertize but same goal is required for good team effort. The knowledge on patents and licensing is extremely important as patents can be powerful weapons for a company. Ability to foresee the market and integrate the technologies for business creation is an important asset.

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Appendix VIII: Minutes of the Interview with Dr. Atsushi Imaizumi, Visiting Professor, Tokyo University of Pharmacy and Life Sciences

Date and Time: 12/12/2017, 10.00-11.00 AM
Location: Therabiopharma Inc. East Tower, 604 KSP Innovation Center, 3-2-1 Sakato Takatsu-ku, Kawasaki City, Kanagawa Prefecture, Japan – 213-0012

Attendees:
1. Dr. Atsushi Imaizumi, Visiting Professor, Tokyo University of Pharmacy and Life Sciences
2. C.N.Shashidhara – Interviewer
3. Dr. Yorimasa Suwa – Senior Researcher APIC-JIPII
4. Ms. Haruko Nishikawa - Interpreter

Basic questions to TherabioPharma

1. How was the company TherabioPharma started?

It started as a venture company from Kyoto University. The company is in the business of manufacturing functional food and pharmaceutical products. The Curcumin which is produced by them through the patented method is said to be 30 times more absorbable and is a product of joint research with Kyoto University. Both the company and the University are joint applicants even though the company has the right to manufacture. Curcumin is known to have anti-cancer action and used in the treatment of pancreatic cancer and also in respiratory and cardiac related diseases. Curcumin has a problem of low absorption and being unstable and the company has developed water soluble type as it is considered that injecting is more effective than taking it orally.

2. How many patents were available when it started? How important is Intellectual Property in your business? Do you have Patents that you consider valuable?

We have one Patent and in the field of pharmaceuticals one good patent is needed to start a company. Having one material patent which is a breakthrough one is extremely important. Patent is indispensable to start a company.

3. What support you expect to get from Government or Universities in this regard?

We have filed PCT and overseas applications and paid the fees by ourselves. Startup companies may require assistance in this regard.

4. Would you explain and share your experiences in developing IP portfolio?

While developing IP portfolio people usually consider the number of applications made and the number of patents granted. More importance is given to the granted patents. But it is important to place more value on the patents that are commercialized. Granted patents are to be effectively utilized.

5. What made you take the leap into entrepreneurship from the big company?

Students in Japan have the tendency to join big companies rather than start a company. It is important to provide training to encourage entrepreneurship to students and also to professors along with good knowledge on IPR.

6. What were the biggest initial hurdles to building your business and how did you overcome them? What kind of support from University you expect for the upcoming startup firms to overcome these hurdles?

In the field of Pharmaceuticals having a good patent is important to start a company and usually obstacles are not expected, but time will be required for conducting clinical trials and to follow the regulations in the field of drugs and pharmaceuticals. Having venture capitalists within the University is very important. Kyoto University started the support of venture capital with 16 million Yen around 5 year ago and it is a good encouragement for the startup companies.

7. Looking back, what other measures you wish would have been taken by you when you started the company?

In the field of Pharmaceuticals I do not see anything which I could have done earlier. If more funds were available in the beginning the process would have been much quicker. Funding through venture capitalists and angel investors like that available in U.S. will be helpful.

8. Do you have experience in litigation for an alleged Infringement of a Patent? How do you think the startup companies are equipped to handle infringement issues?

In the field of Pharmaceuticals infringement issues are rare as the products are launched after clinical trials and getting necessary approvals which takes long time. The possibility of facing it also may come much later.

Further in large companies with the necessity to launch products one after another people in R&D and IPR divisions should have the ability to foresee the market quickly and to collaborate with University R&D divisions for joint research with long term relationship. It is important to have the skill of both speed in recognizing the opportunity and to have consistent R&D efforts with academia.

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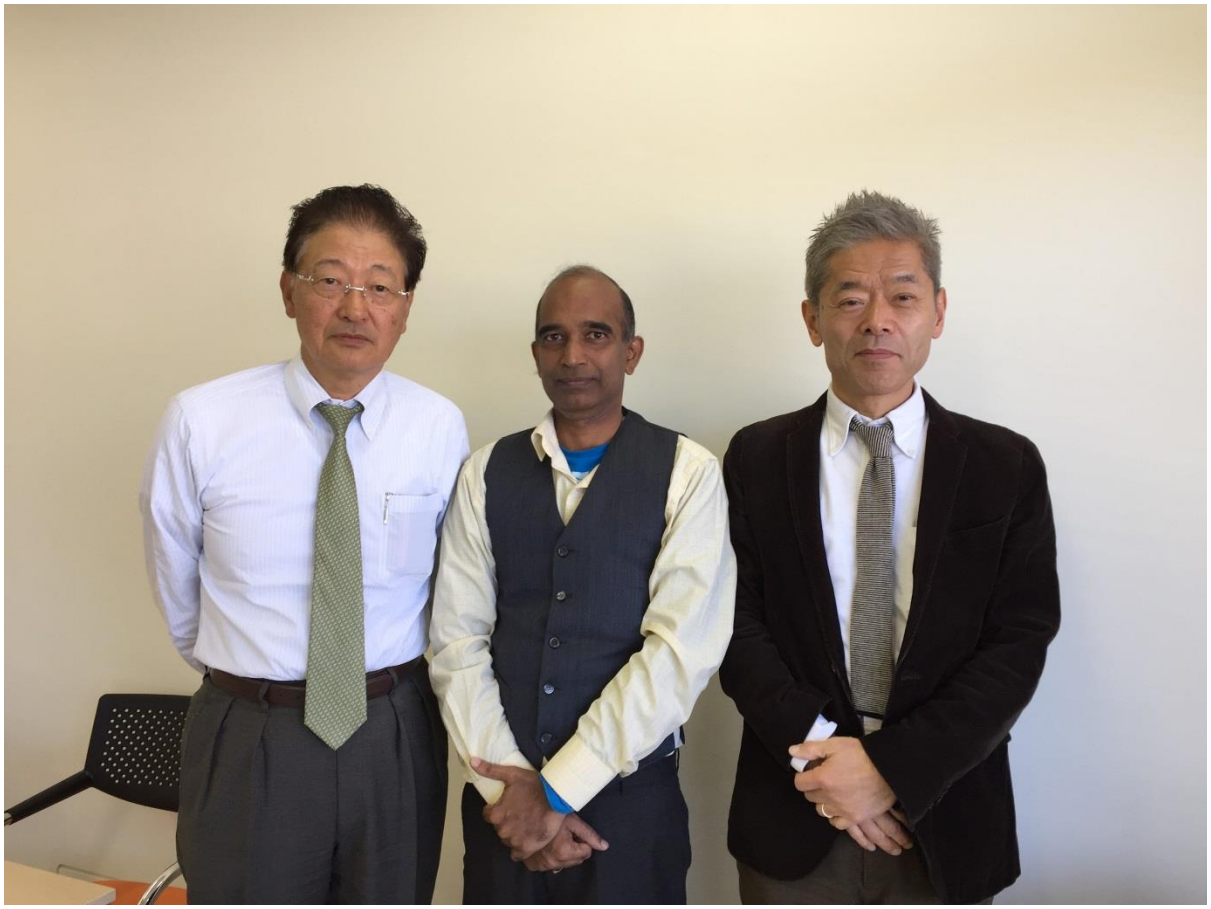

Appendix IX: Minutes of the Interview with Professor Setsuko Hashimoto, President & CEO, CellSeed.

Date and Time: 13/12/2017, 3.30-4.30 PM
Location: CellSeed Inc. Telecom Center-Bldg. 15F, 2-5-10, Aomi Koto-ku, Tokyo – 135-0064

Attendees:
1. Dr. Setsuko Hashimoto, President & CEO, CellSeed
2. C.N.Shashidhara – Interviewer
3. Dr.Yorimasa Suwa – Senior Researcher APIC-JIPII

Questions and Answers

1. How important is Intellectual Property in your business?

Intellectual Property is considered very important as starting a company especially in the field of life science depends on having a good and valuable Patent. We are partnering with academia and particularly with the research work of Prof. Okano. Whenever we find that there is a Patent which we find has market potential we discuss and negotiate with University to get the Patent and commercialize it.

2. Do you have Patents that you consider valuable? Do you have mechanism to value your Patent?

We have Patents in the field of cell sheet regeneration.

3. Would you explain and share your experiences in developing IP portfolio?

We started with less number of Patents and in the beginning enthusiastic to acquire more patents. But overtime we understood the field and started looking for valuable patents and we know the direction based on our experience.

4. What support you expect to get from Government or Universities in this regard?

In the field of life sciences as clinical development takes longer time, extension of patent term is very helpful. Many countries provide an extension of up to 5 years which we feel is insufficient.

5. What made you take the leap into entrepreneurship?

It is rare that a scientist venturing into business. With long experience in Pharma industries and later taking position as Senior Investment adviser in life science at the embassy of Sweden, I took the decision to be an entrepreneur.

6. What kind of support from University you expect for the upcoming startup firms?

Startup firms usually will not have sufficient knowledge on IP related matters. Availability of an expert in IPR o guide them will be very useful. Expert available in University should be able to guide them in IP as well as business establishment matters also.

7. Looking back, what other measures you wish would have been taken by you say few years back?

Having a good team early on is very useful. Human resource in the field of life sciences is in shortage and hence building a good team will be more advantageous.

8. What are the issues in enforcing patents in the field of cell sheet regeneration or life science in general?

We do not have much competitors in this field and also in the field of life sciences with more time spent on clinical trials and complying with other regulations the question of enforcement may come much later.

9. Do you have experience in litigation for an alleged Infringement of a Patent? How do you think the startup companies are equipped to handle infringement issues?

No. Small companies may need the help of expert advice and consult them. Government or Universities may have to provide for such assistance to small companies.

10. What in your opinion is the trend of patent filings in the area of Cell sheet regeneration in future?

The technology of cell sheet regeneration targets diseases that are hard to treat by conventional medical care. More breakthrough are expected in this area in the coming years and some of the conventional medicines are likely to be replaced by the cell sheet regeneration technology.

11. What are the patent related issues that you are facing or likely to face on the patent related issues in the area of Cell sheet regeneration and its application in the medical field.

We do not see much in this particular field of life sciences.

12. What are the major issues in commercialization of Patents and research collaboration with Universities and R&D institutions?

The expectation from the University usually tends to be high. They expect similar situation with large and small companies. Small companies cannot make upfront payments like large companies and it is difficult to convince the people form academia in general. They need to be aware of the business processes especially of the smaller companies.

13. What is the most important IP support to and Start-up companies from Government?

Providing financial support in the establishment phase is important as many companies could not pass through that stage. Support of an IP expert and availability of human resources are other important aspects.

14. How should University IP office or its TLO work for growing the start-up companies from the aspect of IP?

The mind set of academia and business are sometimes conflicting and the view point of both are to be understood which will help in establishing contracts with small companies and help them overcome the initial hurdles of business establishment.

15. What is the most important IP skills the leaders of the university IP office/TLO/Start-up companies must have?

The IP experts should have multiple skill sets especially when assisting a small companies. Knowledge of licensing, framing an IP policy and communicating the business aspects to scientist are all of vital importance.

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