Society for Technology Management

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About Us

Society for Technology Management (STEM) is a not-for-profit organization which provides facilitative environment for successful technology transfer processes and promotes best practices in technology management.

STEM provides an environment that is supportive of entrepreneurship and networks with referral links for information and other resources. It contributes in the professional development of technology management professionals in life sciences, food sciences, engineering sciences, physical sciences, etc. It also provides appropriate guidance and assistance to inventors and corporations in matters of intellectual property.

- STEM offers guidance and assistance to inventors and corporations on matters of intellectual property.
- STEM increases general awareness on intellectual management and engages in capacity-building among technology management professionals both in India and neighboring countries
- STEM operates as a catalyst in the professional development of technology managers for the commercial benefits of innovations.
- STEM allows genuinely interested Indian researchers and technology experts to network with global technology managers.
- STEM organizes annual meetings and seminars to benefit technology transfer professionals nationwide.
- STEM promotes economic growth of its constituent

President's Message

During the last quarter of the twentieth century, North America and Europe experienced an economic boom that was fuelled by accelerated investment in research, generation of intellectual assets and rapid enterprise development.

However, during the twenty first century, emerging economies such as India and China have emerged as high growth countries. They have envisaged significant investments in Science and Technology. As a result, they are primed to become key destinations for technologies to flow in. Technologies flow in where markets are in focus and these two countries will command the attention of the academia, industry and the global non-government research organizations due to significant enhancement in national income levels and due to focus on improving the quality of life.

While there is significant need for technologies to be adopted in these countries, there is very limited generation of domestic patents by domestic institutions in these countries. The surge in research investments by these countries would result in generation of intellectual assets over the decade and eventually result in building capability within these countries to out-license technologies. However, the liberalized policy of India and China to let global leaders establish research facilities in these countries would trigger numerous patent filings and out-licensing opportunities in the near and medium term.

The ASEAN region would continue to focus on investing in technology development. While Japan excels in patent filings, countries such as Thailand and Indonesia are still building their institutional mechanisms for nurturing innovation and intellectual assets creation. For countries to thrive in innovation and enterprise development, strong institutional framework to expedite the patent review process, funding platforms to encourage enterprise development and vibrant reward mechanisms for rewarding innovators within the academic framework are essential requisites. India has begun to focus on creating such mechanisms and these efforts would have long-range gains for the country.

However there are number of countries in the Asian region who do not have fundamental capacity to create and nurture innovation frameworks. They would need support and help from other countries in Asia who can provide human capacity building support, transfer technologies that can help them to address food security and basic health care needs and build institutional mechanisms that can provide sustainable developmental advantage.

Given the vibrant nature of the emerging IP fabric in Asia, this issue of the STEM Newsletter comprises of perspectives on technology transfer emerging from Asia. The special issue of this newsletter includes articles from experts on South Asia, South East Asia and Australia. Wish you wonderful reading. In closing, let me wish the technology management professionals of the country a productive professional engagement in adopting best practices in the profession and in nurturing the innovation boom that we are beginning to witness in India.

Best wishes,

Vijayaraghavan.

Technology Transfer in South Asia: India Steps Forward

Dominic Keating

Sanjit Kaur Batra

Technology-led economic growth is a time tested model for development. However, this model has not been successfully leveraged in South Asia due to lack of investment in research and development (R&D) and a low proportion of skilled human resources. Although India's economy has grown impressively over the past few years, its viability as a knowledge economy will be threatened if adequate investment, training and infrastructure are not provided for scientific R&D and technological advancement. The Indian government is seeking to leverage technology transfer as one tool to enhance scientific R&D and promote economic development. Technology transfer is a formal transfer of rights of use and commercialization of new discoveries and innovations resulting from scientific research from one individual or another entity. An effective technology transfer can result in the commercialization of a new invention or in the improvement of an existing one. The technology could be a publicly or privately developed, depending on the source of funding for the R&D.

Asia's expenditure on R&D in the year 1999-2000 was US$ 235.6 billion, which accounts for 31.2% of the total global share[1]. However South Asia's investment in R&D is quite miniscule. During the last decade i.e. from 1990 to 2000, India has been investing only about 0.7% of its Gross Domestic Product (GDP) in R&D. Even in the year 2007, India invested only 0.7% of its GDP in R&D as compared to approximately 2% by developed countries and 1.3% by China. Worse yet are the other South Asian countries. Pakistan invested less that 0.5% of its GDP in R&D while Sri Lanka invested less than 0.2 %. Nepal's investment in R&D in the years 2000-2002 was 0.67% of its total GDP[2] while Bangladesh's R&D investment in 1998-99 was only 0.02% of its total GDP[3].

Not only is the investment in R&D low in South Asia but even the proportion of skilled human resources are minimal as compared with other countries. India and Sri Lanka have only about 101 to 300 researchers per million inhabitants while Pakistan has less than 100 researchers per million inhabitants. In contrast to this, developed countries like United States and Canada have more than 2,001 researchers per million inhabitants[4]. Reiterating the importance of R&D, U.S. President Barack Obama has recently established a goal of investing 3% of U.S. GDP in R&D and scientific innovation.

Recognizing these challenges, the Indian Planning Commission set forth the eleventh five-year plan with an approach to science and technology that emphasizes "establishing globally competitive research facilities and centers of excellence; kindling an innovative spirit among scientists to translate R&D leads into scalable technologies;" and "developing new models of PPPs in higher education, particularly for research in universities and high technology areas."

Furthermore, the plan suggests a significant increase in the allocation of funding for R&D over those of the tenth five year plan. For example, it is projected that government expenditures targeted for agricultural research and education in the eleventh five-year plan will grow by 124% over actual expenditures in the previous five-year period, while government funding for scientific departments in the

1. Source: http://www.nstmis-dst.org/RnDPDF/CHAPTER%20-%20VIII.pdf
2. Source: http://dst.gov.in/admin_finance/ls_8/sq441.htm
3. Source: K.N.Islam, 2001 taken from "Proceedings and Papers presented at the National Workshops on promoting business and technology incubation for improved competitiveness of small and medium-sized industries through application of modern and efficient technologies" published by United Nations Publications, 2004
4. Source: www.uis.unesco.org

eleventh five-year plan is projected to grow by about 145% over actual expenditures in the preceding five year period. Furthermore, the eleventh five year plan proposes to bring about changes in science and technology "to create a conducive environment for R&D and ensure optimal/ efficient use of public sector R&D resources." To achieve this objective, the plan envisages creating ten national and regional technology transfer cells (TTC) to provide high-caliber, specialized and comprehensive technology transfer services. These TTCs would evaluate technology and identify its potential commercial uses, develop and execute commercialization and intellectual property protection strategies identifying appropriate potential licensees, negotiate licenses and monitor the licensing arrangements. Each TTC would service a cluster of institutions in a region while new centers of excellence would be established within existing universities, medical, agriculture and allied colleges. These proposals reflect a changing mind set of the Indian society and the government towards advancement of the sciences and technology transfer.

In developed countries, privately developed technology is more predominant while in developing countries, publicly developed technology leads the way. For example, in the United States, the government, universities and non-profit institutions fund around 34% of the research while industry funds approximately 66 %. In India, on the other hand, the public sector funding for research is 77 % of the total funding available for research[5]. However in India, government funded educational and research institutions that are involved in technology transfer and commercialization of Intellectual Property (IP) are few and far between. Furthermore, due to the lack of financial resources and incentives for innovation, Indian technological advancements are largely limited to educational or research institutes and they often do not reach the potential user.

Incentives for the innovator are not fixed, thus creating unpredictability for innovators. For example, the Foundation for Innovation and Technology Transfer (FITT), a registered society at the Indian Institute of Technology in Delhi which serves as an effective interface with the industry to foster, promote and sustain commercialization of science and technology in the Institute for mutual benefits may pay 60% as license fee to the inventor while retaining 40% for the institute. On the other hand, the National Research Development Corporation (NRDC), a government of India enterprise under the Department of Scientific and Industrial Research in the Ministry of Science and Technology may pay 50% of the licensing revenue to an individual inventor, while retaining an additional 50%. The amount of licensing revenue that NRDC may pay to a university is 60%, while the amount that it may pay to the Council of Scientific and Industrial Research laboratory is 70%. Therefore, each entity follows a different model for technology transfer and revenue sharing.

It is therefore important for India to have a standard mechanism in place to encourage the innovator to incentivize and commercialize inventions, especially those created by using public funds. To address this issue, the Ministry of Science and Technology in India has drafted legislation known as the Public Funded Research and Development (Protection, Utilization and Regulation of Intellectual Property) Bill, 2007. This Bill is modeled on the U.S. Bayh-Dole Act. It provides for the protection and utilization of intellectual property originating from public funded research, seeks to encourage innovation, promote collaboration between government, private enterprises and non-government organizations and promotes commercialization of IP generated out of government funded R&D. It also fixes remuneration for the inventors (at least 30% royalty from the licensing of the patent) and provides an incentive for the commercialization of inventions developed with public funding.

This legislation is a major step in the right direction. However, there are certain provisions which if passed in the current format might pose as a problem for the inventors. For example, the time period (within 90 days of the disclosure) to identify countries where the inventor wants to file applications for protection of IP may be insufficient. The licensing partner, rather than the inventor, may sometimes wish to choose where to seek protection. Appropriate time should be afforded. Also, it is critical for licensing partners to have certainty of title. Exceptions in the bill may limit this certainty by denying title to contractors when it is "in the public interest" or "in exceptional circumstances," without defining these exceptions. Furthermore, as the bill specifies that inventors are to receive a 30% royalty, this leaves little flexibility for the institutions involved. However, this legislation is a step in the right direction to encourage knowledge based ventures to use technology transfer as a tool to create a culture of innovation and creativity in the society.

Though R&D and technology transfer efforts in many of the South Asian countries are fragmented, uncoordinated and lack a strong institutional mechanism, there have been some success stories which have proved how technology transfer can be used to achieve national objectives and promote economic growth. An example of this is successful technology transfer of bio-gas, solar power and micro-

5. Source: National trends in Technology Transfer-Implications for National and International Policy by John H. Barton

hydro power technology in Nepal, leading to greater competition in the alternative energy sector in that country.

Technological transfer is an important tool for increasing innovation and economic growth. Although it has not been fully utilized in South Asia, the Indian Planning Commission's eleventh five year plan and the draft Indian technology transfer legislation may serve as a model for other Asian and South Asian Countries. These efforts have the potential to promote economic development and bring new products and services to the markets that may improve countless lives.

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Mr. Keating has served as a Patent Attorney in USPTO's Office of International Relations (2003-2006), the Intellectual Property Attaché at the United States Mission to the World Trade Organization in Geneva (2001-2003), an Attorney-Advisor in USPTO's Office of Legislative and International Affairs (2000-2001), a Patent Examiner at the USPTO (1997-2000) and a Trademark Examining Attorney at the USPTO (1996-1997). Mr. Keating has headed numerous U.S. Delegations to the World Trade Organization Trade Related Aspects of Intellectual Property Rights Council and to meetings of the World Intellectual Property Organization.

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Improving Technology Transfer Offices Efficiency and Effectiveness for Public Benefit

Jon Sandelin

The primary mission and purpose of Technology Transfer Office (TTO) is to add value to the public and society by facilitating the transfer of ideas, innovation, and research results from research organizations to companies (start up or established). The development and marketing of new products and services lead to job creation and economic growth, both benefiting the public. Thus it is important to constantly review and monitor legislation and policies that may inhibit the efficiency and effectiveness of the technology transfer process in your region. Later in this article I will use Japan as an example of a region where changes in legislation and policy would improve the efficiency and effectiveness of technology transfer and thereby enhance public benefit. Professional associations such as the Association of University Technology Managers (AUTM) in the U.S., Society of Technology Management (STEM) in India, and the University Technology Transfer Association, Japan (UNITT) should make it a priority to identify areas that inhibit technology transfer and provide leadership in bringing about changes.

The fundamental nature of technology transfer is for the TTO personnel to identify within a company a person who they can get interested and then enthusiastic about the value of their technology and that person would then become an internal advocate for licensing the technology. This will in most cases result in a licensing agreement. TTOs must therefore develop the resources and contacts available to them to identify potential internal advocates.

In my opinion, there are three areas that lead to success in the technology transfer area. They are:

1. A pipeline of innovation (usually research results with commercial potential) in a culture/environment that supports disclosure of inventions and with incentives that will encourage inventors to support and participate in the commercialization process.

2. An efficient, effective, and responsive process for (a) evaluating invention disclosures to determine if they should be pursued; (b) developing an Intellectual Property strategy; (c) developing a marketing strategy to find potential licensees or entrepreneurs to start companies; (d) efficient and timely negotiation of agreements; (e) effective monitoring of diligence terms of agreements and an efficient process for making amendments if needed

3. Patience – This is in the context of the Stanford University experience where cumulative royalty income from 1969 -

1980 was USD4 million, from 1981 - 1990 it was USD40 million, and 1991 - 2000 it was USD400 million, but about 98% of the USD400 million was traced to inventions disclosed in the 1970s. It is also the Stanford experience that only about 1 in 100 of inventions selected for investment (IP costs and time/energy of commercialization office people) generates significant income. Thus one must recognize short term income returns are very unlikely and there must be support to invest in a portfolio of technologies with the potential for commercialization

In my experience in reviewing technology transfer practices in various regions of the world, I have found in most cases the process for evaluating and selecting those invention disclosures to invest in is not as rigorous or thorough as it should be. At Stanford, where we do have a rigorous process, we invest in about 50% of disclosures in the Life Sciences area (an area that is licensing friendly with many companies having offices to seek out inventions for licensing) and about 30% in the Physical Sciences (where most companies are licensing unfriendly). And we end up licensing (and thus obtaining reimbursement for the investment) in about two-thirds of our investments. In my opinion, if you are not licensing at least 50% of your investments, then you may wish to review and strengthen your evaluation and selection process.

When I am evaluating invention disclosures, I consider five factors:

1. The degree of development of the invention, where the more developed it is the less risk in creating an actual product (and in some cases the invention may not be developed sufficiently where evaluation is possible, and where either further confirming research results or investments in making a working prototype may be needed);
2. The strength and breadth of intellectual property protection;
3. The inventors contacts with industry, how well known is their research by industry, and their willingness to actively participate in the licensing process;
4. Is the invention in a licensing friendly industry (Life Sciences) or in a licensing unfriendly industry (most Physical Sciences companies); and
5. If a specific product can be identified from the invention, what are the relative advantages compared to competitive products and how large is the prospective market.

I gave a presentation at a National University in Japan last November, where I pointed out four areas where change would increase the efficiency and effectiveness of TTOs in Japan. The first was a meaningful grace period, a time period when a patent can be filed after first public disclosure. There exists a six-month grace period in Japan but the rules and regulations for its use, according to Professor Robert Kneller of the University of Tokyo, have prevented universities in Japan from making use of this grace period. My suggestion is that the grace period has no restrictions, and preferably be one year (as in the U.S.)

It is good public policy for researchers to reveal important research results as quickly and as broadly as possible as this enhances the reputations of the researchers and the research organizations they represent. But it is also good public policy that if such research results can be the basis for new products or services, that patenting be possible to encourage such product development to create jobs and help the economy.

The second area is to institute a provisional patent system in Japan. This quick and inexpensive way of establishing patent priority (must convert to a regular patent application within one year) is a very useful tool to have when developing an intellectual property strategy for a given invention.

The third area is dealing with co-inventorship situations. After the 2004 change of status of Japan's National Universities, where ownership of title to IP is now almost always with the university, the growth of co-inventorship situations (where a company person is named as a co-inventor) has grown to where today in many universities over 50% of invention disclosures have such co-inventorship. And under Japanese law, both parties must agree in writing before any patent rights can be granted to a third party. Prior to 2004, ownership of IP was usually with the inventors, and they would pass such ownership to companies in exchange for research support and other benefits, with no obligation for the receiving company to develop the invention into products or services.

My suggestion is that if the company with co-ownership is willing to sign a development agreement (after a reasonable time for review, such as three months) with diligence terms and milestones to ensure timely development, then that is fine. But if not, and thus an indication they have no interest in developing the invention, then ownership rights should revert back to the research organization so they can determine if another party will take a license to develop products or services for public benefit (with possible royalty sharing with the co-inventorship company).

The final area is government or institutional guidelines for making a decision to invest in a given invention disclosure, and if not, to give ownership to the inventors in a matter of a few weeks. At the university where I gave my presentation, the guideline is two weeks. In my experience, it takes on average four to six months to make a rigorous evaluation, and sometimes can take more than a year. Under the Bayh/Dole law in the U.S., universities have two years (or 60 days prior to a patent bar date) to make a decision to take ownership. If decisions are made too quickly without a rigorous evaluation, then either a costly patent portfolio may result with a low probability of licensing many of the investments in the portfolio, and thus not obtaining reimbursement of the investment costs. Or if ownership is given to the inventors, there is a good chance that it will be passed to a company with no obligation to develop it into products or services.

In conclusion, I encourage regions of the world, especially those with technology transfer professional associations, to be proactive in identifying areas of legislation or policy that inhibit TTO efficiency and effectiveness, or where new legislation or policy would enhance efficiency and effectiveness, and promote change for public benefit.

__Jon Sandelin__ graduated from the University of Washington with a degree in Chemistry in 1962, and then served four years in the U. S. Naval submarine service. He then returned to school, obtaining an MBA from Stanford University in 1968. He returned to Stanford in 1970 as the Financial Officer and then later as the Associate Director of the Stanford Computer Center. Jon was recruited to join Stanford's Office of Technology Licensing (OTL) in 1984, where he has been responsible for licensing all forms of intellectual property, including inventions, computer software, and university trademarks. Jon has served as a consultant on the licensing of research-related inventions to other universities, non-profit research organizations, and governments, and has provided services for clients in the U.S., Europe, Asia, Africa, Arab League, and Latin America. He is the author of over 20 published articles on technology transfer through licensing and has given workshops, seminars, and presentations on this topic throughout the world. Jon served two terms as a Vice President of the Association of University Technology Managers (AUTM), where he was responsible for developing AUTM's overseas relationships, and is past president of the Association of Collegiate Licensing Administrators (ACLA). Jon converted to Emeritus status on March 1, 2003. He retains an office at the OTL, where he works on selected projects for Stanford University. However, most of his time is now devoted to helping other regions of the world better understand the process of converting ideas and innovation into products and services to create jobs and strengthen economies.

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Improving Trends in Australian University Technology Transfer Metrics

Dr. Andy Sierakowski

Introduction

This article explores some recent Australian public-sector commercialisation metrics data. In particular, both recent and historical biotechnology case-studies are discussed. The Australian scene is characterised by excellent research capabilities through its universities, institutes and government research organisations such as ANSTO, CSIRO and DSTO. Australian universities do suffer from "economies of scale" in research and infrastructure funding when compared to larger economies such as the U.S., Japan and the U.K. In spite of these factors its universities rate highly in rankings such as the Shanghai Jiao Tong with six Australian universities in the top 200 world universities. In addition, technology transfer from these universities has been noticeably improving over the first decade of this century.

Some Historical Case-Studies

Two well-known Australian public-sector research commercialisation successes which happen to be both biomedical devices are Cochlear and Resmed.

A. Cochlear

Cochlear is an Australian public-listed company that manufactures cochlear implants in its Sydney-based operations for distribution globally. The original technology was developed at the University of Melbourne where Graeme Clark had looked into the feasibility of an implanted electronic device (a cochlear implant) to provide deaf people with hearing in his PhD work in the 1960s. In the 1970s, Professor Clark set about assembling the team to turn this dream into a reality. He was able to see the importance of computer technology and a multidisciplinary approach to the problem. By 1978, the Melbourne team was able to implant their first prototype implant into a deaf person. From these early beginnings, Cochlear the company was formed.

The company has seen excellent growth in the last few decades and here are some comments from their 2008 annual report:

- The global market for partially and profoundly deaf people is approximately 280 million
- Total revenues were up to \$601.7M and profits were also up to \$167.3M
- Strong sales growth in Asia-Pacific and Europe
- The company has some 800 patents granted or in application

B. ResMed

ResMed is a leading respiratory medical device manufacturer, specializing in products for the diagnosis and treatment of sleep disordered breathing (SDB). Its manufacturing operations are in Sydney and its corporate headquarters are located in San Diego California.

When ResMed was formed in 1989, its primary purpose was to commercialize a device for treating obstructive sleep apnea. Developed in 1981 by Professor Colin Sullivan and his colleagues at the University of Sydney, nasal continuous positive airway pressure (CPAP) provided the first successful non-invasive treatment of this condition. Since 1989, ResMed has maintained its focus on SDB, which is gaining greater public and physician awareness.

Innovation has played a major role in ResMed's success. Since the company's founding in 1989, a large number of product advancements and improvements designed to increase patient comfort and encourage compliance with therapy have been developed. Feedback from patients and specialists around the world is used to produce products that meet the different market needs. At the end of June 1999, the company had a total of 186 patents issued and pending for a range of technologies.

In its 2008 annual report it again reported continued year on year growth. For example, sales were up to $835.4M USD and profits up to $133.9M USD for the year.

These are both phenomenal success stories in many ways - excellent technology with global markets leading to huge public good benefits as well as excellent financial returns. Of course there have also been many other Australian biotechnology successes over the last decade but not yet on the scale of Cochlear and ResMed.

KCA Commercialisation Metrics Survey

In 2008, Knowledge Commercialisation Australasia Inc (KCA) published its report on Commercialisation Metrics Data for the years 2005 to 2007 inclusive. The full report detailing the respondents and their data can be viewed on KCA's web-site www.kca.asn.au but it is well-worth while discussing some of the highlights from this report.

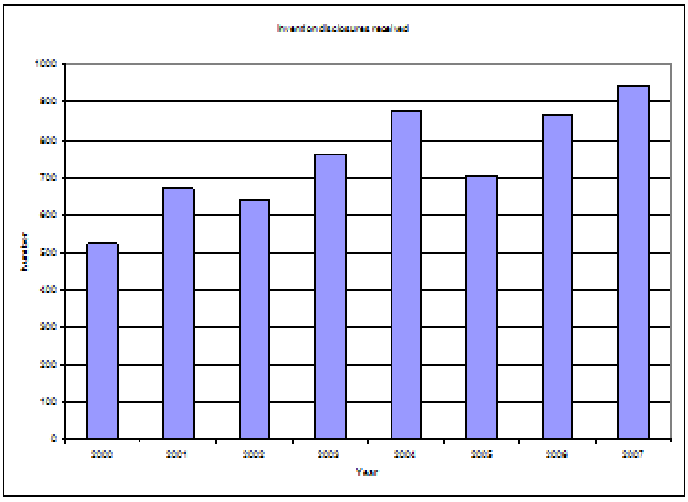

Figure 6. Invention Disclosures Received

Researchers are clearly engaging more actively with the commercialisation process, as evidenced by the growth in invention disclosures to 944 in 2007 - compound annual growth rate of eight percent over the period 2000-2007. This trend is illustrated in Figure 1. Invention disclosures are a key leading indicator for future success in terms of the engagement of researchers in the technology transfer and commercialisation process.

It is particularly encouraging to see the growth in invention disclosure and growing application of inventions in the market place "mirrored" in the number of LOAs yielding income (figure 2). These two positive trends auger together for future growth in royalty streams.

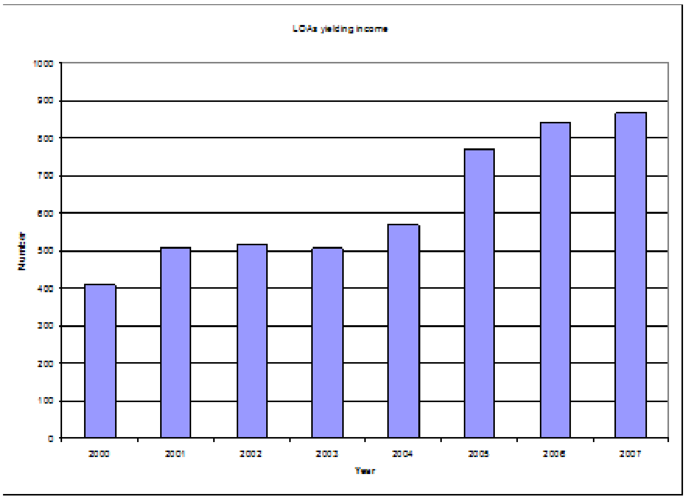

Figure 7. "Active" Licenses, Options and Assignments (LOAs)

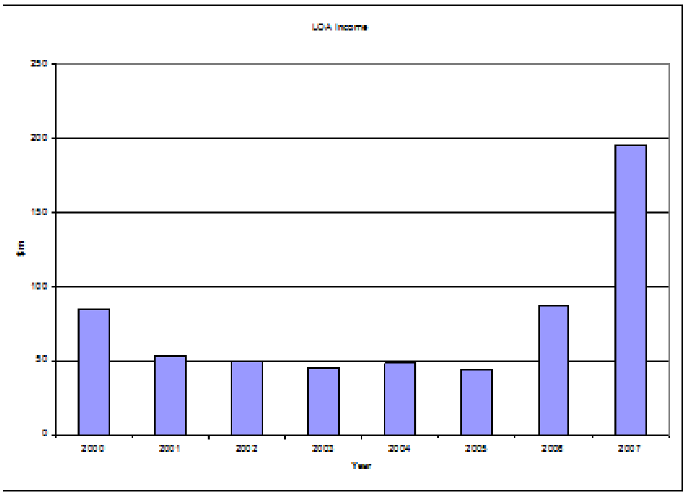

Figure 8. Income from Licenses, Options and Assignments of IP

The growing revenue trend 2005-2007 shown in figure 3 is due principally to growth in Gardasil royalties and Monash University's exit of Monash IVF which are both discussed below.

Commentary on the Biotech Sector and More Recent Case Studies

The 2007 Research Australia report Beyond Discovery 2007 has some interesting data on the original sources of biotechnology research feeding into creating new companies. The report makes some comparisons with its own 2004 report. It might be useful to draw some cautious conclusions on these data given that different biotechnology companies responded to the surveys. In 2004, for example, universities accounted for 66% of the source of the discoveries attributed to the biotechnology companies. This had changed to 35% in the 2007 sample but this was with a different survey group. Clearly, universities' research is the technology feed in establishing such companies. In addition, the funding sources for such research and company formation are largely from the NHMRC and the universities themselves. Angel investors and venture capitalists are small players (about 11-12%) in funding research leading to company formation.

An example of NHMRC and university funding leading to an outstanding success has been the Gardasil story at the University of Queensland. The original research work was done in the 1980's by Professor Ian Fraser and his group. The patented technology was licensed in the early 90's by Uniquest, the university's commercial arm, to CSL who on-licensed to Merck. In 2008, Merck's world-wide sales of Gardasil were around AUD $2.3 billion which attracted pleasing royalties for both CSL and Uniquest.

A different type of success, this time as a cash exit, was the sale of shares by Monash University in one of its holdings. Monash University's 2006 annual report showed that its in-vivo fertilisation (IVF) operation known as Monash IVF had recorded revenue of almost $35 million, and profit of $7.4 million. According to its website, Monash IVF controls seven clinics in Victoria, another eight nationally and has affiliates in Sri Lanka, New Zealand and China. It is Australia's biggest IVF network. However, in 2007, Monash University sold its 53% share of this renowned group to ABN Amro Capital, a private equity offshoot of the global investment bank for over $100 million.

The Current Australian Scene 2008 & 2009

The recent technology landscape as far as government support has been one of "mixed blessings". In the 2008 budget the current federal government dropped the Commercial Ready Scheme which supported start-up companies with matching funds. The loss of this program which offered $700M over 4 years is sorely missed. On top of this the current global financial crisis has seen early stage funding essentially evaporate. More recently, in the May 2009 budget, the government announced the setting up of a "Commonwealth Commercialisation Institute" to support both the private and public sectors. The funding allocated is $196M over 4 years. At this stage it is unclear on the details and the charter of this "institute". However, the university sector hopes that the money will be spent in much needed and targeted programs supporting the established technology transfer and commercialisation infrastructures already in place not building new layers of bureaucracy. KCA comes to engage and support the government in this process.

In summary, the Australian university technology transfer scene is showing some very positive trends that auger well for the future in spite of the current challenges in financial markets.

__Dr. Andy Sierakowski__ completed his BSc and PhD at The University of Western Australia and carried out Post-Doctoral work in the UK and Switzerland. In 1980, he joined Kodak Australia in Melbourne as a Group Leader R&D. He has considerable experience in commercialising his and co-workers inventions, including intellectual property that has been either patented or kept as trade secrets. He has co-ordinated large technology transfer and commercialisation projects for Kodak on a worldwide basis and has extensive knowledge of product development processes.

Dr Sierakowski gained wide experience with Kodak working in manufacturing, technical marketing, and quality assurance in Australia, France, Asia and the US.

From 1992 to 1997, he was Business Unit Manager of Kodak Professional with responsibility for Australia and New Zealand with a sales turnover in excess of $100 million. He has experience in setting up joint venture companies and acted as Executive Director of such companies. In 1998, Dr Sierakowski returned to Perth as General Manager of Joyce Rural, an agrichemical company and a subsidiary of Joyce Corporation. This role encompassed R&D, sales and marketing, manufacturing, logistics and distribution functions. In January 2001, he joined The University of Western Australia and heads up the Office of Industry and Innovation. He is also on the Board of two UWA spin-off companies.

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Technology Transfer Considerations for Stem Cell Technologies

Melissa Harwood

Andrew Serafini

Recent trends in patent application filings suggest that stem cell technology transfer is a globally relevant issue. Moreover, Asian countries are playing an increasingly important role in stem cell innovations and patenting. In fact, outside of Patent Cooperation Treaty (PCT), United States Patent and Trademark Office (USPTO), and

European Patent Office (EPO) patent applications, the most active countries for stem cell filings were Australia, Canada, Japan, Germany, China, the United Kingdom, and Israel, with approximately 10% of filings occurring in Asia[1]. Adequate technology transfer mechanisms are particularly important for stem cell technologies because of the large numbers of stem cell patents and the global reach of stem cell research and development.

Stem cell research and development is characterized by unique technology transfer considerations. First, the patent landscape is characterized by large numbers of patents, and in particular, the presence of dominant and fundamental stem cell technology patents[2]. Given the nature of the patent landscape, due diligence is an essential element of stem cell technology transfer. Due diligence, generally addresses factors having significant impact on technology transfer, including patentability, freedom to operate, and third-party obligations.

Patents give patentees the right to exclude others from making, using, or selling a particular claimed invention. A patent does not, however, guarantee the right to practice one's own invention. Although one might expect clear boundaries between patented inventions, the reality is that patent scope frequently overlaps to some extent. Overlapping patent scopes and interdependence tend to be very common in the stem cell field[3]. In these zones of overlap, no party has freedom to operate, absent some agreement to the contrary. Unless licensing is effectively implemented, these technologies will be underutilized and innovation may be stifled.

A condition known as the tragedy of the anti-commons arises when too many parties have the right to exclude others from using a particular resource[4]. In the case of patents, this scenario is known as the patent thicket[5]. The patent thicket occurs in highly crowded fields or fields having dominant or fundamental patents. In order to have freedom to operate in a highly crowded patent landscape, it may be necessary to license numerous patents, thereby driving transaction costs upwards. Dominant or fundamental patents have a particularly dramatic impact in the patent thicket. To the extent the blocking patents are dominant or fundamental, progress in that area is unlikely without licensing, and bottlenecks in research and development can arise. Dominant patents can also drive transaction costs upwards. When transaction costs reach a threshold level, it becomes uneconomical to utilize that resource and the incentives for innovation diminish.

The impact of dominant patents and the patent thicket are evident in the stem cell research and development field[6]. In this field, a small number of dominant patents cover fundamental technologies and ultimately lead to innovative bottlenecks. Without access to those technologies, innovation may be seriously limited. Technologies that are most likely to create bottlenecks in the field include stem cell lines and preparations and stem cell culture methods and growth factors[7]. Stem cell research and development depends on access to these fundamental technologies, and therefore, patent licensing and material transfer agreements (MTAs) are widespread.

Because there are a large number of stem cell patents and in particular, the dominance of some of those patents, due diligence is crucial in stem cell technology transfer. Due diligence generally addresses three fundamental considerations, including: patentability, freedom to operate, and the existence of MTAs or other third-party obligations. Due diligence enables parties to identify the value of technologies in view of their potential impact in the market and the degree to which other patents or contractual agreements hinder their patentability or practice. Assessing the patent landscape and any rights or obligations within it will be crucial to avoid infringement and potential litigation. A central goal of due diligence is the identification of patents which must be licensed prior to any infringing activities.

Patentability determinations are generally one aspect of due diligence and focus primarily on whether a particular invention is novel. Novelty depends on whether the invention was previously patented or publicly known. Several factors impact novelty and the standards for novelty vary somewhat from country to country. In general, however, when an invention is patented or publicly known, it ceases to be novel (with the exception of grace periods in certain countries, such as the U.S.). Therefore, the existence of other patents, public disclosures, such as

1. Bergman, K. & Graff, G.D. *Nat. Biotechnol*. 25, 419, 420 (2007)
2. *Id*. at 421
3. *Id*. at 422
4. Heller, M.A. *The Tragedy of the Anticommons*, 111 Harv. L. Rev. 621 (1998); Heller, M.A. & Eisenberg, R.S. Science 280, 698-701 (1998)
5. Bergman, K. *Nat. Biotechnol*. 25 at 419
6. Bergman, K. Nat. Biotechnol. 25 at 422
7. Eisenberg, R.S. & Rai, A.K. in *Handbook of Stem Cells* (eds. Lanza, R. et al.) (Elsevier Academic, Burlington, Massachusetts, USA, 2004); O'Connor, S.M. *New Engl. Law Rev.* 39, 665-714 (2005); Giebel, L.B. *Nat. Biotechnol*. 23, 798-800 (2005); Rao, M. et al. J. Alzheimers Dis. 8, 75-80 (2005); Ebersole, T.J. et al. *Stem cells - patent pools to the rescue?* (Sterne, Kessler, Goldstein, & Fox P.L.L.C., Washington, DC, 2005); Rohrbaugh, M.L. in *Regenerative Medicine* 2006; (National Institutes of Health, Washington, DC, 2006)

publications, sales, and public use will destroy novelty when they occur before a patent application is filed (or, in the U.S., more than one year before the application is filed).

Other aspects considered in a patentability analysis include: the degree of novelty, the scope of the invention, and the characteristics of the patent landscape. Because of their interdependence, each of these factors should be considered together. For example, an invention that is narrowly claimed and has a high degree of novelty may be patentable in view of a crowded patent landscape and a broadly claimed invention with a low degree of novelty may be unpatentable in view of a sparsely crowded patent landscape.

Freedom to operate is generally defined as the ability to make, use, and sell a product or method without infringing the intellectual property rights of others. Generally, freedom to operate is determined for a specific product or "perceived" product. Where no particular product is known or perceived, however, a patent landscape analysis is more appropriate. In a patent landscape analysis, particular areas that may pose potential freedom-to-operate issues are identified. By contrast to patentability analyses, which focus on disclosures as a whole, freedom-to-operate and patent landscape analyses consider only the scope of patent claims. In the event a particular product or process falls within the scope of another's patent, however, a license from the patentee may secure freedom to operate. Patent licenses generate third party obligations, which are also relevant in due diligence analyses.

Patent licenses and MTAs are two important classes of third-party obligations considered in due diligence analyses. The value of a particular technology depends upon the terms of those agreements, and certain restrictions may render a particular technology valueless to an innovator. For instance, grant-back provisions, which require licensees to assign their rights in improvement patents back to licensors, may diminish the value of innovations for licensees and increase their value for licensors. Diminished innovation can result when patentees negotiate overly restrictive licenses, including certain types of grant back provisions. Because certain stem cell patents are dominant, those patents must in many cases be licensed by researchers. Bottlenecks are especially likely when a large percentage of practitioners must license a particular patent or group of patents in order to secure freedom to operate.

Technology transfer of stem cell innovations differs from other fields because of widespread and extensive regulatory limitations on stem cell research. Because the regulatory environment is likely to become progressively more permissive, however, stem cell portfolios may become increasingly valuable over time. For this reason, strategic delays in technology transfer of stem cell technologies may become more favorable and common.

There are several challenges to stem cell technology transfer due to the global extent of stem cell research, development, and patenting. The nature of the stem cell patent landscape makes due diligence and innovative technology transfer strategies necessary for optimal dissemination of stem cell technologies. Some have proposed the use of compulsory licenses or bundled licenses to improve access to fundamental stem cell technologies as a means for enhancing technology transfer[8]. The impact of these proposals would likely be significant and controversial; however, a discussion of those effects is outside of the scope of this article.

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8. Id. at 424

Technology Commercialization by Academic Institutions of Far East Countries: A Review

M. V. Ramani[1]

Introduction

The Bayh-Dole Act[2] of the United States (1980) is widely recognized as a major amendment in federal policy towards utilization of the results of academic research. American universities that contribute to the growth of U.S industry by serving as a source of knowledge can now own patents that arise from federally funded research[3]. This has promoted the transfer of academic innovations to industry through licensing and new venture formation.

This paper attempts to review and understand how effectively the Far East countries have adopted the principles of the Bayh-Dole Act or have implemented programs which promote relationships between universities and companies in the commercialization of scientific and technological innovation. The Far East is a term often used by people in the Western world to refer to the countries of East Asia.The Far East Countries are China, Indonesia, Japan, Korea, Malaysia, Singapore, Taiwan, Thailand and Vietnam[4]. The mechanisms available for commercializing innovative technologies developed by the academic institutions of these countries are reviewed.

China

As early as 1985, just five years after Bayh-Dole was passed in the United States, provisional regulations issued by the State Council on Technology Transfer gave Chinese universities the right to manage and use the inventions of university researchers, even though ownership formally remained with the State. The amended Science and Technology Law that became effective on July 1, 2008, allows scientists or their institutions to own patents on inventions, computer software copyrights, layout design of integrated circuits, and new varieties of plants developed from publicly funded research projects[5].

Academic technology is transferred primarily through patents and licenses, publications and conferences, collaborations between universities and companies, and university start-ups. Patenting and licensing are new types of commercial activities for Chinese universities. The Chinese government has delineated eight high-tech areas: information technology, biotechnology, space, lasers, automation, new materials, new energy and ocean technology. The universities are encouraged to work on these areas. Chinese government has encouraged university professors to form and run their own companies. Even in public universities, a professor can own shares, act as CEO or chair of the board and run a company using her/his own lab technology. In 1999, the government granted building permission for the first university-associated science park. Since then, fifty have been constructed. Six companies controlled by the Chinese Agricultural University are now listed in the stock-market, three in Hong Kong and three on mainland China[6].

Indonesia

The National Systems for Research, Development, and Application of Technology Law (2000), stipulates that universities in Indonesia should establish units for IP management and use the income derived from the exploitation of intellectual property. There are over 90 IP management units at institutes and universities throughout Indonesia. Kekayaan Intellectual dan Alich Teknologi (KIAT), established in 1999, Indonesian Institute of Science (LIPI), University of Indonesia, Bandung Institute of Technology, and Bogor Agricultural University (IPB) handle the technology transfer. Technology transfer refers to the transfer of academic technology to the community for its development[7].

The mission of higher educational institutions in Indonesia is to create knowledge through the three pillars namely education, research, and community development. There is a strong inter-link among the three pillars. Education

1. The author acknowledges Prof.Karen Hersey, Professor of Law, Franklin Pierce Law Center, for her valuable guidance and support through out the preparation of this manuscript.

2. 35 U.S.C. 200-212 (1980).
3. Bhaven N. Sampat et al., Changes in university patent quality after the Bayh-Dole act: a re-examination, http://www.card.iastate.edu/research/stp/papers/Sampat-Mowery-Ziedonis.pdf (last visited May 4, 2009).
4. Countries in the Far East/ Pacific Rim, http://www.2020gene.com/countries_in_the_far_east.htm (last visited May 4, 2009).
5. Wei Hong, Technology Transfer of Chinese Universities: Forms and Implications, http://www.allacademic.com/meta/p_mla_apa_research_citation/0/2/1/5/5/p21558_index.html (last visited May 4, 2009).
6. Zhanglian Chen, Innovation: The Chinese Experience http://nabc.cals.cornell.edu/pubs/nabc_18/NABC18_Chen2.pdf (last visited May 4, 2009).
7. Satryo Soemantri Brodjonegoro, University-Industry Technology Transfer, www.stepan.org/techtransfer/Indonesia%20-%20SSBrodjonegoro.ppt (last visited May 4, 2009).

provides students with the latest and updated knowledge so that they become the cadre for knowledge development. The research further facilitates the application of the newly developed knowledge and contributes to the scientific community in terms of quality publications and contributes for nation's prosperity, e.g. through patents, royalties, intellectual properties. Community development increases the relevance of education and research with the need of the stakeholder and contributes directly to the development of small & medium enterprise through technology supervision. There are various research awards related to promote technology transfer such as Research Award for Junior Staff, Basic Research Award, Collaborative Research Award, Competitive Research Award, Research Award for Graduate Program, University-Industry Strategic Research Award[8].

Japan

Japan enacted a new law on April 1, 2004 and was referred to as Japanese Bayh-Dole law as it contains many of the U.S. Bayh-Dole provisions. This law provided funding for approved Technology Licensing Offices (TLO). The Japanese Bayh-Dole law clarifies the ownership rights for university inventions. The universities are exempted from the income taxes on the royalties received and thus allowed for an efficient and effective technology transfer process.

The other laws promoting technology transfer by Japan's universities are

1. Law on Special Measures for Industrial Revitalization (1999). This law reduced patent fees for approved TLOs by 50%. There was also the establishment of the Small and Medium-Size Business Innovation Research System, which is referred to as the Japanese SBIR system.
2. Law to Strengthen Industrial Technology (2000). This law permitted paid consulting for professors under certain conditions and permitted them to also hold management positions in companies when commercializing their inventions. It also allowed approved TLOs to use National University facilities free of charge.
3. Revisions to existing laws that would allow university-based venture companies to use National University facilities and encouraged the start-up activities of approved TLOs (2002).
4. Basic Law on Intellectual Property to change the legal status of the National Universities (2003).

Japan Association for University Intellectual Property and Technology Management (JAUIPTM) actively presents the needs of Japanese universities to government policy makers. It has been suggested that JAUIPTM, would benefit by having significant representation from both industry and the service providers to the technology transfer profession[9].

Korea

Korean 'Research and Development Promotion Act', 1972 has enabled contractors including Government sponsored Research Institutes (GRI), universities, and private firms to hold title to inventions developed while they are pursuing government-sponsored R&D. Around 1000 spin-offs have been established by universities and other public research organizations in the country out of which 730 are in operation. Some firms have also made Initial Public Offerings. Since 2005, five joint ventures have been established by universities and private businesses in the Daeduk special R&D zone. Although the joint ventures have more support from Public research organizations and the government, they still face various difficulties involved in technology commercialization such as insufficient financing, lack of manpower, and financial risk[10].

Public research organizations plan to establish technology holding companies in order to maximize financial returns from technology commercialization based on their R&D results. The holding companies can manage the technology commercialization of the parent public research organization's research efficiently by controlling corresponding subsidiaries[11]. Representing not-for-profit organizations, the Korea Association of University Technology Managers (KAUTM), established in 2002, has been expanding its activities with fifty seven participating universities. The Intellectual Property Man and Society (IPMS) forum has been operating since 2001 for the purpose of networking, information exchange, and coordinating organizations in the field of intellectual property[12].

8. Zain Adnan and Brett McGuire, Indonesia Progress in IP protection - but much still to be done, http://www.buildingipvalue.com/08_AP/207 (last visited May 4, 2009).

9. Jon Sandelin, Japan's Industry-Academic-Government Collaboration and Technology Transfer Practices: A Comparison with United States Practices, http://sangakukan.jp/journal/main/200503/003-08/003-08_e.pdf (last visited May 4, 2009).

10. Hwa-Cho Yi, Strategies for improving technology commercialization in the Korean Public R&D sector Korean experience in fostering university-industry partnerships, http://www.wipo.int/uipc/en/partnership/ (last visited May 4, 2009).

11. World Intellectual Property Organization, Intellectual property and effective university-industry partnerships -The Experience of China, India, Japan, Philippines, The Republic of Korea, Singapore and Thailand, http://www.wipo.int/freepublications/en/intproperty/928/wipo_pub_928.pdf (last visited May 4, 2009).

12. Hwa-Cho Yi, Strategies for improving technology commercialization in the Korean Public R&D sector Korean experience in fostering university-industry partnerships, http://www.wipo.int/uipc/en/partnership/ (last visited May 4, 2009).

Malaysia

Under the Patent Act of 1983, employers, including publicly funded research institutions, are the rightful owners of intellectual property created by employees in the course of employment. In 2004, based on a review conducted by Malaysia's Ministry of Science, Technology, and Innovation, the government indicated that unlike Bayh Dole Act, it would pursue a policy of three-way IP rights comprising the government, research institute, and inventor who would jointly own research results.

The Malaysian government realized that stronger university-industry collaboration enhances technology transfer and talent pool development. The government is encouraging the universities to take an active part in entrepreneurial activities besides teaching and research. It is expected that the universities will effectively commercialize their inventions through spin-offs, technology and patent licensing. However, universities are expected to work with the industries without compromising their primary responsibilities of teaching, research, open dissemination of information and serving the public. Government included policies for special tax exemptions for expanding industrial support of R&D, expanded permissions for collaboration with foreign R&D supporting institutions, and the development of a strong research infrastructure.

The focus areas of technology transfer are biotechnology and biomedicine. The Intensification of Research in Priority Areas (IRPA) program established by the government enables the technology transfer.

However, there are some constraints on university-industry collaboration. Dominance of foreign investments in the critical sectors of manufacturing, lack of really effective R&D funding in industry, the lack of highly capable scientists who can lead in terms of knowledge frontiers, the lack of innovative entrepreneurship and the focus of universities are few important constraints. Companies find it difficult to motivate academics to work on problems specifically pertinent to industries. It is also difficult and time consuming to extract the details from the large amounts of know-how in the universities. Companies cannot directly utilize the scientific knowledge of universities without investing additional R&D but often face a short term focus making it difficult to deal with academia.

Singapore

National University of Singapore (NUS) and Nanyang Technological University (NTU) of Singapore significantly contribute to the nation's technological development. According to NUS, all rights to inventions developed by a staff member as part of his duties or contract of employment, or through the course of his participation in a research project funded through or by NUS belong to NUS.

NUS and NTU have dedicated technology transfer offices known as the Industry and Technology Relations Office (INTRO) and the Innovation and Technology Transfer Office (ITTO) respectively. NUS and NTU have mature and well-structured sets of guidelines relating to collaboration with industry. While technology transfer through licensing is the most direct approach, NUS employs a variety of approaches to publicize the availability of technologies that they have at hand. It sends technologies selectively to companies for evaluation and places these on its "technology offer database" on the internet. Interested companies are given opportunities to evaluate the technologies. If they are interested in exploiting the technology, they can submit a business plan for negotiation with INTRO. Companies often seek exclusive licensing, but NUS grants such exclusive licensing judiciously and only when companies are able to be specific on the field of use and geographical application of the technology. INTRO also conducts licensing negotiations on behalf of NUS[13].

Taiwan

Taiwan enacted the Science and Technology Basic Law (STBL) in 1999 similar to Bayh Dole Act. STBL also clarified that ownership of intellectual property rights (IPR) that are generated from government funding research would reside in academia. It was expected that granting IPR ownership to universities would accelerate the commercialization of new technologies and promote national or regional, economic and innovative activities.

Furthermore, the National Science Council (NSC) is the leading academic funding organization in charge of promoting industry-academia collaboration in Taiwan. In order to encourage academia to become involved in patenting activities, the NSC implemented the Principles of Management and Promotion of Academia R&D Results in 2002. There were nearly 10 technology transfer/licensing offices established in public research institutes by 2003. The government committed to reimburse 50 percent of the patenting expenditures, including patent application and maintenance fees.

The Intellectual Property Offices (IPOs), the Technology Transfer Offices (TTOs), incubator centers, or their equivalents have become widely established for the purpose of technology protection, transfer and commercialization.

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13. S. K. Chou, Development of university - industry partnerships for the promotion of innovation and transfer of technology, http://www.wipo.int/uipc/en/partnership/ (last visited May 4, 2009).

Industry-academia research collaborations have innate difficulties in transferring and commercializing academic technology/knowledge. However, university policy to encourage the establishment of venture funds and spin-offs demonstrates a commitment towards a more entrepreneurial orientation. Academic entrepreneurs play the role of champions who become involved from the beginning to the end of the commercialization process. The major links between industry and academia remain short-term, informal, personal and contract-based collaboration rather than long-term, formal, organizational and joint capability development.

The public universities in Taiwan have more research endowments and government funds. However, the bureaucratic culture and rigid organizational structure of public institutions hinder technology transfer from universities to industry. Taiwan is inventing its own model to echo the trend of industrializing academic knowledge. However, still in the initial stage of developing academic entrepreneurship, the Taiwanese academic-owned spin-offs are few. Rather than establishing new firms to exploit university-generated intellectual property, Taiwanese universities help industrial partners to create new ventures mainly through incubator centers on campus. In assisting start-ups to develop the firm's technology competence, the Taiwanese incubator centers offer firms the opportunity to get involved in academic research facilities, faculty consultation, and research network build-ups[14].

Thailand

There are diverse mechanisms to transfer technology from universities to companies in Thailand. However, these mechanisms are not yet formalized. Some universities have technology transfer offices, intellectual property licensing offices, university-industry collaboration units. The important technology transfer mechanism is establishing a science and technology park. The parks form a bridge between the supply from universities and the demand from industries using the know-how or intellectual property developed at the university as the means.

The key factor for successful technology transfer is co-operation among government, university and industry. Most of the university research grants are from the national budget. Few universities have research grants from private sectors. However, there is not adequate support from the government. It is believed by the government that it was unfair to spend taxes paid by people to help some companies[15].

The firms in Thailand are mostly small and medium enterprises and need only low technology. Companies prefer to import overseas technology, instead of transferring technology from local universities, as it was found to be simple, involves no risk and will meet their timelines.

Vietnam

There are few mechanisms in Vietnam to clarify and ensure the rights of ownership over technology created at universities and research institutes. However, leading research institutions in the life sciences are beginning to orient toward intellectual property as a tool for technology transfer.

In Vietnam University, industry technology transfer is very limited because of various issues both from the university and from the industrial side. The issues with university are due to small investment in university R&D activities. R&D activities and results do not meet practical needs of industry and there is lack of trust from the industry. The universities lack technology transfer offices and have limited understanding about the technology transfer process and intellectual property issues. Companies are not pro-actively seeking technological innovation from the universities in Vietnam. Firms have limited financial and human resources to invest in innovation and are unaware about the technology transfer process and intellectual property issues.

Among other issues, there are few academia-industry joint research projects. The patent system including patenting procedures, cost for filing IPR applications both domestic and international are not fully developed. The availability of patent specialists, technology transfer specialists, and patent licensing advisors is very limited. There are no well defined systems available for licensing of patents and other IPR to private sector. There are political, institutional and other potential barriers to creating TTOs in country's leading technical universities[16].

Conclusions

National policies and governmental guidelines have encouraged universities in Japan, China and Singapore to transfer and commercialize knowledge on their own. The

14. Hua, Mingshu , Industrializing academic knowledge in Taiwan: the attitudes of Taiwan's universities toward..., http://findarticles.com/p/articles/mi_6714/is_/ai_n29192415(last visited May 4, 2009).

15. Nithad Krisnachinda, Thailand's experience in fostering university-industry partnerships, http://www.wipo.int/uipc/en/partnership/ (last visited May 4, 2009).

16. Nguyen T. Phuong Mai, University-Industry Technology Transfer, www.stepan.org/techtransfer/Country%20presentation-Vietnam-Phu ongMai.ppt (last visited May 4, 2009).

intellectual property infrastructure buildup, patenting and licensing activities at the universities of these nations have flourished.

Korea, Taiwan and Malaysia have implemented legislation that is similar to the Bayh-Dole Act and have well defined policies for intellectual property ownership. However, they are yet to fully succeed in technology commercialization. The major barriers to technology commercialization in these countries are conflicting organizational objectives and lack of awareness of commercial potential. To encourage transfer and commercialization of university knowledge, governments and university leaders need to provide more incentives and support for academic entrepreneurs. More long-term and joint capability development of university-industry partnerships would be beneficial for Korea, Taiwan and Malaysia.

Thailand, Vietnam and Indonesia need governmental support for academic-industry research projects. Government can establish technology transfer offices in university, provide models of ownership and frame of benefit sharing mechanism for university and other public research organizations. Possible mechanisms for technology transfer of research may be consultancy service, outright sale of technology, licensing of technology, joint-venture and start-up ventures. Stimulating collaborations between universities and industry, transfer and commercialisation of university-born inventions would be the key steps for the economic development of these countries.

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Technological Growth in the Emerging Markets: Lessons from the Case of India

Dr. Vipin Gupta

What's the standard prescription on the drivers of technological growth of an emerging economy? The recipe for success, it seems, involves the importing of foreign technology, reengineering and adapting it, and incrementally changing and applying it.

Success stories of several nations suggest the viability of this prescription. In Japan, South Korea and China, the governments encouraged large domestic firms to import electronics technology from various multinational corporations (MNCs), then incrementally assimilate it, and develop capacity to perform complex innovations.

We identify several counter hypotheses suggesting limitations of this model.

First, socio-technical systems hypothesis predicts that the technologies are linked to the social institutions. Research has demonstrated difficulties in transferring mass production technology from the US to Europe, and lean production technology from Japan to US and Europe. The so-called advanced technologies from overseas cultures did not succeed until local solutions that selectively built on the know-how emerged.

Secondly, absorptive capacity hypothesis predicts that without a strong related prior technological base, it may not be even feasible for the private sector to absorb and assimilate foreign technology, and if the government coerces this through subsidies, then the absorption initiatives would occur but at a very high cost.

Third, property rights hypothesis predicts that the MNCs have constrained incentives to nurture foreign capacity building, because their property rights in foreign nations - particularly those who are keen to learn from their know-how and develop local base - are incomplete. MNCs are concerned with the intellectual property rights piracy in the emerging markets, and withhold transfer of their key technologies.

So, what might be an alternative model for the emerging markets? Let's look at the story of India, and the role different technological drivers played over the course of the history.

We identify 1951-80 as Phase I of development. During the 1950s, massive public sector funds were invested in the basic and heavy sector. The private sector investment was under licensing controls, supported through concession finance. Several domains were reserved for the small scale sector. Foreign aid and technology was mobilized for basic industries, agriculture, and technical education.

To reengineer this know-how internally, a network of publicly funded R&D labs was created, along with technology and engineering colleges. These efforts yielded mixed results - the nation became 90% self sufficient in capital goods by late 1970s, but there were substantial consumer goods supply constraints, along with economic stagnation, inflation, educated unemployment, and growing poverty, despite the *garibi hatao* or eradicate poverty campaign. Also, the cost of capital goods was high, e.g. the computers had limited applications, and were costlier than better foreign options.

This Phase I suggests that the public sector controls may be excessively oriented towards basic infrastructure and capital goods industries. They may take an expedient approach to fulfill social goals, which may be cost-escalating and dysfunctional.

Phase II is the period between 1981 and 1995. The government introduced liberal policies for electronics, including computers, telecom, and software. In the 1980s, public sector railroads and banks were computerized, and the work was assigned to private professionals to help enhance their capabilities, resources, & confidence.

A focus was put on Bangalore as an IT regional cluster. Bangalore had several large public sector electronics, telecom and aeronautics firms, several government R&D labs, and several technical colleges. A body shopping link in Bangalore was facilitated, for instance, between GE and Infosys. This had a positive demonstration effect on many US MNCs, who set up software development centers in Bangalore.

At the time, smaller firms began importing and assembling Korean and Taiwanese computer kits. Many larger firms, unable to compete on cost, moved to software, by hiring away from the firms who had participated in the public sector computerization, and began focusing on the MNC clients. The firms began doing low-end work onsite in the US, but as their alliances strengthened, shifted higher end work offshore to India. The offshore work focused on the maintenance of various legacy systems, by leveraging on the skills in India of working with several foreign platforms. The onsite work was largely body shopping, with low skill programming and short term client relations.

The Phase II suggests that the rise of professional controls may need incubational institutional support in developing capabilities, resources, and confidence. The professional controls can be very effective in making a business case to the MNCs, and in building relationships that allow value added work to be done in the emerging markets.

Phase III is the period between 1996 and 2005. After the mid-1990s, numerous MNCs entered seeking to compete with local family businesses and professional firms, often offering attractive consumer credit, and hiring away experienced local employees at high compensation. Many Japanese firms that sought to use older technology quickly failed. Korean firms, who adapted Indian methods, and offered their latest technology products, were successful. As the foreign competition intensified, the private sector firms showed amazing capacity to produce quality goods and services at ridiculously low prices: $20 air flights, 2 cents-a-minute cell-phone service, $2,200 cars, and low-cost medical procedures and medicines. This capacity allowed many Indian firms to become successful MNCs, and some pushed ahead by acquiring even the premium-end assets.

Phase III suggests that the learning of the local techniques were critical for the successful tech based competition of the MNCs. The creative deepening of the local technical know-how enabled the local firms to withstand that competition.

We can identify the Post 2005 period as Phase IV. We are seeing a sharpened focus on the bottom of the pyramid and the grassroots. Intensified efforts are on, supported by several Non-Government Organizations (NGOs), public sector institutions, and the community cooperatives, to scout and encourage the grassroots knowledge. The efforts are on connect the grassroots innovators with the local, national, and global markets, with the involvement of various family businesses, other private professional firms, and the MNCs. Many MNCs are also recognizing the benefits of collaborating with the Indian firms to penetrate the rural market. 60% of India's population lives in 650,000 villages, which are clustered into 600 districts. They are also recognizing the benefits of including other invisible groups, notably the women. Many American MNCs, in particular, have instituted diversity heads and policies in India, with aggressive goals.

In summary, the Indian development model began by emphasizing the role of foreign technology and public sector organizations for the basic and heavy industry sector, presence of a few large family business groups in select niches of capital and consumer goods, and a number of small scale enterprises in several reserved areas. The model was supported with subsidized public finances. Inefficiencies, escalating costs, restricted outputs, limited variety, and gaps in technologies, limited the efficacy of the model.

The model then shifted to enabling the family business groups and professional enterprises to serve the foreign multinationals, and refocusing the small enterprises on new products based on imported and domestic inputs. Through this exchange, the capabilities of the Indian firms strengthened in areas that were comparatively weak for the foreign firms. But a macro-economic crisis ensued, because the rupee denominated public finances could not support the demand for dollar denominated import fund needs.

Next, on the basis of the strengthened private sector, the international finances and MNC investments were attracted. This allowed the private sector to further strengthen its global competitiveness, and to broaden the domain of areas to compete.

Inclusion of the groups, previously excluded from the national and global market, is the new mantra. These groups have human capital, purchasing power, as well as unexplored technological endowments. In a recent article, the Wall Street Journal (Wonacott, 2009), noted how India has defied global slump, powered by growth in poor rural states, "Growth has slowed in the new India of technology outsourcing, property development and securities trade. But old India -- the rural sector that is home to 700 million of the country's billion-plus people -- shows signs it can pick up the slack. The rural awakening helps explain why India continues to grow."

To conclude, the public controls have shifted their role from being the nation's primary financier and generator of knowledge and technology, to a secondary supporter of innovations by well managed private sector enterprises, and now to a tertiary governance and organization of the distributed knowledge in diverse communities.

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Valuing Intangibles in a Complex, Competitive World

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In an increasingly flat world defined by globalization and fast technology driven markets, most of the talk across seminars, conferences, workshops and some boardrooms today revolves around creating value out of intangibles. Intangibles, especially Intellectual Property (IP), are recognized as one of the most valuable asset of an enterprise. A well-identified, managed IP in an enterprise can help it in attracting new investment, in new research and product development, in hiring the best and brilliant minds, and in expanding across geographies, while surpassing competition.

Success is no longer just dependent on ownership and management of tangible assets.

If one were to look at the recent events in the banking system of developed economies, a key reason for the banking system to be so close to a complete meltdown could be attributed to the poor understanding amongst key stakeholders of the complex financial instruments. In a similar vein, intangibles running an entire global market would require identifying, understanding, managing, nurturing and leveraging such intangible assets before it is too late.

When we take an historical view, over the past three decades many enterprises have attained leadership position through effective IP management. During this period, intangibles have started occupying a higher proportion of many corporate balance sheets than ever before. In this context, it becomes extremely important to identify ways to exploit the IP, assess the risks and rewards associated with it, and decide the best strategy to manage it. To determine these, the holder needs to assess the current and the potential value of the IP under each scenario.

If one were to look at India, over the past decade, India has been on the forefront of putting IP frameworks in place, with a number of inspiring legislations in place to protect and promote IP management. The increase in awareness of IP amongst scientists and enterprises is also seen in the increased filings for patents and trademarks at the Indian Patent Office (IPO). By 2010, filings for patents are expected to touch 100,000 per year, while trademark filings would increase to about 150,000 per year.. As India moves towards a knowledge and increasingly IP-based economy and is emerging as a globally sought-after IP destination, this article aims to be a primer that touches upon some of the new and traditional concepts associated with valuing the intangibles.

Measuring, protecting and maximizing the value of IP is of paramount importance for companies of all sizes and across most industries. Valuation is of high significance as it helps in valuing IP in the in-licensing/out-licensing processes, sale of IP and alliance/JV decisions, for employee inventor compensation related to technology transfer and for patent pooling.

Before valuing IP, the valuer has to gain an understanding of the purpose and context of valuation. The value of an IP depends on the expected future cash flows derived from use or exploitation of the IP. Today there are nearly 50 methods of valuation of IP. But there is no standard approach followed. One size fits all approach does not work in case of valuation of IP as it is unique by nature. Conducting an IP valuation that makes sense to more than a few experts is a Herculean challenge. It is a matter of high subjectivity involving various assumptions, perceptions and judgment, making it complex and difficult to get consensus on the best method of valuation applicable.

As rightly quoted by Aristotle "It is a sign of an educated mind not to expect more certainty from a subject than it can possibly provide", we cannot arrive at value with certainty but valuation requires an intermediate perspective between ignorance and certainty and requires skill, experience and judgment. It is time and context based. The best that can be said about current methods of IP valuation is that they are better than nothing. But how much is a question of substantial disagreement.

There are many proprietary and specialized approaches to IP valuation. These range from subtraction theory of value, to a profit-split approach, to VALMATRIX® and Brand Value Equation (BVETM) proprietary methodologies.

Some of the key traditional approaches to valuation include the following.

Cost Approach

Two different styles are often applied in valuing IP on cost basis.

1. Historical Cost basis
2. Replacement or Reproduction Cost basis

In the first style, the asset is valued based on the cost incurred in developing the IP. The second style considers current prices to calculate the costs of replicating the asset today. One point of caution is that we should not forget to include the opportunity cost of delayed market entry in calculating the cost.

This method does not reflect any potential earnings out of the IP and hence is not highly appreciated in many cases and is least applicable when the asset is old or hard to recreate Its correlation to the utility or the market value is least.

However, this may be the only data found or suitable to the context in some cases. In any event, this approach often (but not always) provides the floor price or minimum value. One example of such an application is to make decisions of licensing out during one of the stages of clinical trials.

Market Approach

Under this approach, IP is valued by comparing recent sales or transactions involving similar assets in similar markets. Such an approach would require an active market, sufficient number of similar exchanges/transaction and publicly available price information. Some of the common sources for such market data include Royalty source, Royalty stat, Knowledge express.

Apart from the major problem being finding of a comparable asset, it also ignores the deal leverage. However, in practice, when the data is available, the market approach is practical, logical and applicable to all types of intangible assets. Also, when reliable data is available, market approach is considered the most direct and systematic approach to value.

Income Approach

This approach is based on determination of future income streams expected from the asset under valuation. This is one of the widely used approaches as the information necessary to determine value using this approach is usually relatively accurate and often readily available. The parameters required in this approach include future income stream, duration of the income stream and risks associated with generation of the income stream. As per this approach, an asset will be worth the present value of future economic benefits that will accrue to its owner. Future income attributable to the IP is projected for an estimated duration of the income stream taking into consideration the risk associated with generating the projected income stream.

The main advantage of this method is that a sensitivity check can be done on the assumed parameters that go into valuation of the property.

There are four variations to income approach:

Price Premium Method

Price premium method measures excess over guideline company earnings of companies that do not possess the IP being valued.

Production Savings Method

The method gives importance to the contribution of IP to inputs which result in cost savings for the entity possessing IP.

Relief from Royalty

This is a commonly used method when the revenues attributable to the IP over its economic life can be separated from other sources of revenue. Royalty rate of a comparable asset is considered and this rate is applied to the projected revenues attributable to the IP. An appropriate tax charge is then applied and the resultant cash flows are discounted to the present value to realize the ultimate value of the IP.

Residual Method

When the earnings attributable to the IP cannot be separately estimated, this method is of higher significance. In this method, the operating earnings after taxes are estimated, the fair return on average balances of other assets are subtracted and net present value of resultant cash flows is considered as the value of the IP.

There are some other IP specific valuation methods including "The Twenty Five Percent Rule", Ranking and Rating, Monte Carlo Analysis and Real options.

As per the "Twenty Five Percent Rule", the licensor should receive 25% of licensee's gross profit attributable to the licensed technology. This percentage could be adjusted upward or downward on a case to case basis to reflect respective investment and risk in licensed technology. This method is better for process than product technology.

Ranking & Rating methodology is a qualitative approach where the IP is ranked and rated on some important parameters. This is a useful qualitative method for comparative analysis between various intellectual properties and is a good tool for making important strategic decisions for better management of IP.

In the Monte Carlo simulation, a probability is assigned to a set of random values within a range and these values are assigned to the variables used in the valuation process. These variables could be price variables like price premium and additional units sold or cost variables like cost of goods sold and selling & general administrative expenses. Calculation of net present value of the cash flows derived on the basis of the variables is repeated for a number of times and multiple NPVs are then plotted by frequency of occurrence, to obtain most likely NPV. But the point to be noted here is that the NPV values are no better than the range of extreme values selected.

Real option is viewed as an option to develop the IP further or to abandon it or sell it depending on future technology and market information. This method is most useful for IP investments with long-term returns and high risks because it recognizes that risk of IP investment is not uniform over time as additional technical and market information becomes available.

Care should be taken not to over simplify the process involved. The valuer should identify the primary methodology that best satisfies the valuation criteria and where possible should support or cross check the valuation with other acceptable methodologies. In other words, an enterprise should take steps to understand the tools, means, methodologies and techniques that could help them to deal with and quantify both the upside potential and downside risk related to these situations. In addition to developing an awareness of the various methods and approaches available for valuing the IP, it is crucial that the IP team should understand which of those methods best suit their company's unique circumstances, and then get mastery over the science and art of applying them correctly.

The failure to understand and master IP valuation by the IP finance team would result in poor performance and umpteen suboptimal decisions, while the acquisition of the essential skills would ensure a bounty harvest of the value vested in an IP. In the current economic climate, the team that makes the right calls on key decisions would emerge stronger post-recession, and would be perfectly-placed to enter the global IP marketplace of the near future.

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Announcing the STEM Annual Event in IP & TT 2009

The keenly awaited must attend technology transfer event in India, the STEM Annual Event in IP and Tech Transfer will be held at Hotel Taj Banjara in Hyderabad, Andhra Pradesh, India from August 19-22, 2009. The event comprises of two events, and interested delegates have the option of registering for both events.

Dr Arundeep Pradhan, President of the Association of University Technology Managers (AUTM) will be in attendance, alongwith a host of other IP and Technology Transfer experts, policymakers, scientists from across the world.

STEM Professional Development Program for Technology Managers (PDP-TM) August 19-21, 2009

The program is designed to equip the participants with the required knowledge and skills to:

- Identify, Manage, and Capture value from intellectual property
- Develop an understanding of protecting intellectual property.
- Explore how marketing, finance and technology units can better integrate IP in their respective business strategies.
- Examine how to extract maximum value from technology licensing.
- Explore how strategic alliances can leverage competitive advantage.

STEM Annual Summit August 22, 2009

The STEM Annual Summit will be held on August 22, 2009 and is designed as a platform for senior technology transfer and IP personnel to meet, share insights, discuss and explore ways to maximize their revenue through IP and technology transfer, and network with one another to creatively and effectively improve their technology management culture.

Please get in touch with Prabhu Ram at prabhur@sathguru.com in case you have questions or wish to seek clarifications.

Stem Annual Event in IP & TT

Venue: Hotel Taj Banjara, Hyderabad

Dates:

STEM Professional Development Program for Technology Managers (PDP-TM) August 19-21, 2009

STEM Annual Summit, August 22, 2009

Fees:

http://www.stemglobal.org/registration.html

To Register:

http://www.stemglobal.org/registration%20form.pdf

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