

IP and Innovation: Singapore's Experience

Hang Chang Chieh

Centre for Management of Science & Technology
Faculty of Engineering
National University of Singapore
enghcc@nus.edu.sg

Marvin Ng

IP Academy
Singapore
marvin_ng@ipacademy.edu.sg

Abstract

Intellectual Property (IP) is new to many developing or newly developed nations in Asia. It is also clear from the experience of other developed nations that IP creation and management are essential to the healthy growth of high-tech industries, based on technology innovation. The challenge of building the necessary IP infrastructure and human resource capital to facilitate innovation and the solution adopted by Singapore are discussed.

cycle (IP creation, IP protection and IP exploitation) to power the economy further into the knowledge era. Nevertheless, IP challenges are relatively new to a newly developed nation like Singapore. Strategies to accelerate development are necessary, particularly in the infrastructure and human resource capital areas.

This paper reviews the experience of Singapore in initiating its long-term economic development/upgrading through IP-based innovation. The problems met and their solutions are discussed.

INTRODUCTION

It is widely recognised that knowledge and innovation have played a critical role in the recent growth of world economies. Intellectual property (IP), as an asset, is acknowledged as a key value driver for business growth, economic productivity and wealth creation. Thus, there is increasing awareness among nations and businesses of the need to put in place management mechanisms and policies to identify, protect, develop and commercialise the intellectual assets arising from innovations.

IP AND INNOVATION: SINGAPORE CONTEXT

Although lacking natural resources, Singapore has achieved an impressive 7.8% average annual GDP growth for the past 43 years (Singapore Department of Statistics, 2004 [2]). This economic success can be attributed to a number of factors including its strategic location as a transport, financial and commercial hub, the consistently strong growth in foreign direct investments, its educated and productive workforce, its pro-business government and its excellent infrastructure.

At the firm level, there is also growing recognition that for businesses to benefit from their innovations, they must have access to complementary assets. Complementary assets refer to resources or capabilities that are required to successfully exploit and commercialise a new innovation (Teece, 1986 [1]) and may often be external to the innovating firm. Examples of complementary assets include competitive manufacturing facilities, effective sales force, and efficient distribution systems.

Over the past years, Singapore's economic development emphasis had been on manufacturing for others. It became and still is a major manufacturing hub for global businesses in sectors such as electronics, engineering, chemicals and pharmaceuticals. However, as the world economy evolved, the Singapore government correctly anticipated the need to move towards high-end manufacturing and knowledge-intensive economic activities. Singapore had to create a sustained competitive advantage by focusing increasingly on innovation. Thus, by the late 80s, Singapore started investing substantially in R&D.

Singapore recognises that to stay competitive and prosperous, a small resource-scarce country like Singapore must embrace the knowledge-based economy and build innovation into its economic development strategies. To remain globally relevant, the country has to develop both capabilities and capacities for innovation-driven and IP-intensive activities that will fuel future economic growth. As a result, Singapore has committed significant efforts and investments to build a conducive environment where IP-related activities can thrive, with the eventual goal of establishing a self-sustaining IP life

Singapore's initial research efforts leveraged upon the large manufacturing presence of multinational companies (MNCs) that were already operating in the country. Technologies were transferred from these firms to their local operations as well as local supporting companies. By the 90s, some of the MNCs became more confident in the technical capabilities of the local operations and started establishing worldwide product charters in Singapore. These

local operations began building up both IP assets and complementary assets that were essential to their success. For instance, Singapore hosts Hewlett Packard's worldwide product charters for mobile inkjet printers and ink cartridges. Over the years, HP Singapore has not only built up strong R&D capabilities, but also substantial manufacturing capacity and regional marketing expertise that have enabled the firm to compete successfully worldwide.

Singapore also promoted the parallel upgrading of local industries by encouraging and facilitating cooperation between the local industry and the public research sector. The aim was to enable the flow of technology expertise from the public research sector into the private sector, thereby strengthening the capabilities of the local industry. For example, the government directs the public research institutes to perform mission-oriented research that will accelerate the pace of science and technology advancement in Singapore and to attract foreign talents in R&D, who would subsequently move on to positions in the private sector.

By early 2000, Singapore realised that to move forward, it had to establish additional infrastructure and build up key capabilities that support activities further down the IP life cycle i.e. IP protection and IP exploitation. Central to these efforts, was the creation of the Intellectual Property Office of Singapore (IPOS) in 2001. IPOS, which is a statutory board of the Ministry of Law (MinLaw), has the mission to formulate and regulate IP law, promote IP awareness, and provide infrastructure to facilitate greater development of IP in Singapore. Working closely with other agencies like the Economic Development Board (EDB), the Standards, Productivity and Innovation Board (SPRING Singapore), the Infocomm Development Authority (IDA), the International Enterprise Singapore (IE Singapore), the Media Development Authority (MDA) and the Agency for Science, Technology and Research (A*STAR), IPOS plays a critical role in realizing Singapore's aim to become an IP-intensive nation.

DEVELOPMENT STRATEGIES

Singapore is in the process of transforming itself into an IP intensive nation in a systematic and pragmatic manner. The government has taken a multi-agency approach that deals with the challenge from a number of different angles. In the next few sections, we will examine the framework of action that has been adopted. The key components of this framework are:

- Building solid infrastructure and a conducive environment that support innovation-driven IP-intensive activities;

- Establishing education and training initiatives; and
- Providing attractive incentives.

Infrastructure and Environment

Singapore has established a strong R&D infrastructure to support both public and private sector research activities. Since the early 90s, A*STAR had already set up a number of public research institutes (RIs) to support the growth and development of specific technology sectors in Singapore (Hang, 2001 [3]). These RIs play critical industry support roles that include the training of research scientists and engineers (RSEs) and providing R&D support to industry.

In addition to the benefits of research manpower training and core capability development, publicly-funded research activities have also created commercialisable IPs. As in other developed countries, the universities and RIs have strengthened their technology transfer offices to protect, aggregate and exploit the commercialisable knowledge. These offices have become additional key components of Singapore's R&D infrastructure.

In the private sector, Singapore plays host to a number of R&D operations belonging to well-known research-based companies. Philips, Seagate and Novartis have all set up multi-million dollar research centres here that conduct high-value R&D activities. These centres have become part of Singapore's R&D infrastructure and help enhance the nation's R&D capabilities.

Various government agencies have also committed significant efforts and investments to build up IP capabilities in the industry that complement the IP infrastructure. For instance, the IP Strategic Business Unit of the EDB actively promotes Singapore to overseas IP service providers, with the aim of attracting these companies to set up operations here, thereby completing the value chain of IP activities.

IPOS has developed a number of very useful IP resources that augment Singapore's R&D infrastructure. The Intellectual Property Education and Resource Centre (ipercc) is an education and training unit, which offers a range of resources including IP information, IP clinics, IP talks and conferences, IP publications and IP roundtables. There is also an online portal (SURFIP) that delivers a complete range of IP management services to businesses and individuals via the Internet. IPOS' SNIPS (Singapore Network of IP Service Providers) provides a directory listing of IP expertise located in Singapore. These are useful resources that the industry can tap upon.

In contrast to the hard infrastructure represented by the research facilities mentioned above, soft infrastructure plays an equally important role. A robust IP infrastructure is vital for the promotion of innovation and the growth of IP-related activities. Singapore recognises that strong IP protection is critical to attracting foreign investments, as well as recruiting and retaining world-class research talents. Thus, it has built a comprehensive set of IP laws that meet international norms (in particular, the standards set by the WTO/TRIPs Agreement); in fact, Singapore's IP laws have attracted much limelight in the international IP community because of the state of the art protection it will soon provide as a result of the ground-breaking Free Trade Agreement we signed with the US in May last year. Having a strong legal framework 'on paper' is not sufficient; we have also put in place effective administration and strict IP enforcement policies. In this area, the responsible ministries work closely with the relevant government agencies, in particular IPOS, as well as the business community. They ensure that policies shaping Singapore's IP infrastructure are sound and consistent with the development needs of the industry and the nation.

Besides investing in infrastructure, Singapore is also nurturing a pro-enterprise environment that will stimulate creativity and innovation in both existing and new companies. These businesses will be able to utilise the infrastructure and tap upon available resources to fully exploit their IP assets. To create such an environment, the government has taken a broad multi-agency approach to promote awareness and appreciation of the various components of the IP life cycle and their importance to Singapore's economy development.

*For instance, IPOS, A*STAR, EDB, IE Singapore and MDA, have come together on occasions, to organise programmes and events that aim to promote greater awareness about IP. Industry groups like business associations and chambers of commerce are often invited to participate as well. This allows the pooling of resources and extends the reach of the promotional efforts.*

Agencies like MDA, IE Singapore and SPRING Singapore are also developing specialised programmes, to raise awareness of IP and enhance the IP know-how of the industries under their charge. For example, MDA, with the support of the IP Academy, organised a customised IP workshop in April 2004, to equip media professionals with the necessary knowledge needed to handle media-related IP issues. The interest in the media industry was first drummed up through large-scale seminars providing industry sharing and smaller clinics to address specific concerns co-ordinated by MDA, IPOS and IP

Academy, with the support of local IP experts. Through the concerted efforts of the various government agencies and institutes like the IP Academy, IP know-how and IP tools are gradually being disseminated to the industry.

Training and Education

Singapore's ability to innovate and create IPs is dependent on the availability of quality research scientists and engineers (RSEs), who will create the competitive advantage for businesses and enhance the human intellectual capital of the nation. Singapore's strategy is to build up a local pool of quality RSEs and supplement it with foreign talents from abroad. The RIs were established to help accomplish this goal, by growing and hosting a critical mass of RSEs, with strong capabilities. Besides serving the MNCs and local customers in terms of contract R&D, technology transfer, high-level problem solving and manpower training, the RIs also help the local universities to attract local and foreign students to their post-graduate programmes. In addition, experienced RSEs in the RIs have contributed to graduate education programmes, by becoming co-teachers or co-supervisors for academic programmes, as well as becoming instructors in professional short-courses that aim to upgrade the practising RSEs in industry.

Just as it is important to innovate technically, Singapore must have the ability to commercialise the innovations created by its people. Its ability to commercialise IP is linked to the level of 'IP-savviness' among its RSEs and the availability of expert IP professionals to facilitate the process. By early 2000, it became apparent that the IP manpower capabilities in Singapore lacked both breadth and depth. The IP Academy was set up in January 2003 precisely to address this issue. It was given the mandate to rapidly build up both the quantity and quality of IP manpower capabilities, through partnerships with leading teaching and research centres, IP thought-leaders, researchers and industry players, both in Singapore and abroad. As a key IP education institute, the Academy develops and delivers a comprehensive suite of IP-related training programmes. These range from short executive workshops to full-fledged certification programmes that target a variety of audiences including IP professionals (such as patent attorneys), senior management executives, entrepreneurs, scientists and engineers.

*Besides the IP Academy, other IP-related programmes are also conducted by organisations such as the Centre for Management of Science and Technology (CMOST) at the National University of Singapore and Exploit Technologies which is the technology transfer arm of A*STAR. CMOST will*

*conduct structured programmes that aim to provide scientists and engineers with a formal technology management education. Exploit Technologies runs in-house IP training for A*STAR researchers.*

The IP Academy has also been tasked to promote research in IP-related fields, with the intent of helping Singapore gain thought leadership in selected IP fields. The Academy conducts leading-edge research projects and research collaborations with internationally renowned IP institutes and IP organizations. These projects are conducted by both local and eminent foreign IP researchers and allow Singapore to be exposed to the latest developments in the global IP arena. They also represent opportunities for Singapore IP researchers to learn from renowned experts and strengthen Singapore's indigenous IP research capabilities. Thus, there is a growing availability of IP-related research and education programmes that will help Singapore create a large pool of highly qualified and, hopefully over time, experienced IP professionals with the necessary IP skill sets.

Incentives and Support

Singapore has used incentives to promote investment, innovation, manpower development and enterprise development. For instance, to attract inward investments, the EDB provides tax incentives and R&D grants to MNCs setting up significant research operations in Singapore. In return, these companies create jobs, develop local capabilities and help boost the status of Singapore as a preferred location for R&D investments.

*To encourage innovation among Singapore-based companies, agencies including EDB, A*STAR and IDA support the R&D activities of these companies in a number of ways. The incentive may come in the form of R&D grants, tax deductions for R&D expenditures or financial incentives for manpower training, such as the Initiatives in New Technology (INTECH). Furthermore, to encourage companies to protect their IP assets, the EDB has a Patent Application Fund (PAF) scheme that helps companies defray some of the cost associated with patent application.*

Complementing the general financial incentive for manpower training in science and technology, both IPOS and EDB offer incentives for local companies to build up in-house IP capabilities. These incentive schemes provide assistance to help reduce the burden on companies and promote the growth of a pool of local IP professionals.

To encourage the commercialization of innovations and the creation of new enterprises, programmes such as the Proof of Concept (POC) programme and

Startup Enterprise Development Scheme (SEEDS) were developed. Under the SEEDS programme, the government will provide startup funding to companies, matching the amount that the companies are able to raise from third party investors. The scheme was administered by the EDB and focused predominantly on technology startups.

Singapore has committed itself to create a pro-enterprise environment, where start-ups can thrive and businesses can tap on readily-available resources, to continually upgrade themselves to compete globally. The intent is to create a sizeable pool of local enterprises that can both innovate, and transform their innovations into viable global products or services.

*To help existing businesses strengthen their competitiveness, there are a range of initiatives and resources, to assist companies build up specific capabilities. For instance, to help local firms build up their technology capabilities, A*STAR started the Growing Enterprises with Technology Upgrade (GET-UP) programme (Hang, 2003 [4]), which provides local enterprises with technical and human capital assistance to help them compete globally. Through the programme, A*STAR researchers may be 'borrowed' by the local enterprises to take on specific critical R&D projects. Taking a different approach, agencies like EDB and IDA have created the Local Industry Upgrading Programme (LIUP), which aims to bring together MNCs and their local supporting companies in mutually beneficial collaborations.*

Similarly, to help businesses establish or build up their capabilities in the area of IP and commercialization, IPOS created the "IP - Creation, Exploitation and Protection" programme (IP-CEP). It is a collaborative effort with other economic agencies, business chambers and industry groups. The programme aims to raise awareness of IP in the industry, and make available IP information and resources, as well as to encourage better IP management practices in the industry. More recently, IPOS has taken the next step and developed an "Intellectual Asset Management" programme (IAM) to help promising IP enterprises upgrade their IP management capabilities.

SPECIFIC CHALLENGES OF LOCAL ENTERPRISES

The IP and innovation strategies as outlined in the previous sections have worked well for the MNCs and the small number of large local enterprises, which have successfully globalised. This is not the case for the small and medium local enterprises which lack

both resources and knowledge. Hence they are not able to develop at the same pace as MNCs and large local enterprises, in spite of the good IP infrastructure and other favourable factors for innovation. We shall broadly address two groups of companies: those with IPs and those with complementary assets.

Local Enterprises with IPs

There is an increasing number of high-tech startup, or established companies which have invested heavily in R&D in order to upgrade and globalise. They possess good capabilities, which are used to develop innovative products and services. Yet, they generally lack IP management capabilities although most of them have filed patents to protect their innovations. For instance, they could not afford dedicated manpower in IP management activities. Typically, the IP management responsibility either falls on the shoulders of busy managers, who have many other responsibilities, or is outsourced to a third party IP firm. Therefore, they lack the necessary discipline and management bandwidth to use professional tools, such as patent mapping, patent portfolio analysis, patent valuation, etc to control their R&D budget, product development strategies, IP licensing and any other ways to ensure financial return from their IP assets.

Local Enterprises with Complementary Assets

Increasingly local enterprises with strong manufacturing technologies, good marketing/distribution channels/ experience and other complementary assets for commercializing innovative products/ services have either started to invest in R&D or acquire smaller companies, which have product design capabilities and IP assets. They are in very good positions to grow their businesses, but have difficulty either in attracting talented R&D people, or identifying partners with good IP assets. It is an area where Venture Capitalist firms or other agencies could contribute in match-making, but it is still not a set practice. There also exist cross-border opportunities and these could be promoted more actively.

Possible Solutions

The problems faced by the local enterprises need to be addressed by the country, if it wants to develop indigenous IP-intensive innovation. Current measures as outlined in the previous sections are unfortunately insufficient and more need to be provided. There are no quick answers and the following are possible solutions which are being explored:

- There is a need for good IP consulting/service companies that can serve

the local enterprises by identifying relevant IPs for licensing to them; they can also help local enterprises to develop cost-effective patent management systems; foreign firms with such capabilities will be most welcomed by Singapore.

- The RIs can play a more proactive role in licensing affordable IPs to local enterprises; from interacting with local enterprises and identifying their longer-term needs, the RIs can also adapt their R&D strategies accordingly; they can also help companies simplify radical innovations into those suitable for disruptive innovations (Christensen, 2003 [5]) relevant to local enterprises.
- A longer-term solution is to ensure that the future generation of R&D engineers and managers are all IP-literate and well-educated in IP management; for instance, CMOST at the NUS has made IP management a core module in its MSc programme and has encouraged all Engineering Ph.D students to access this module. These graduates will be more confident to help the local enterprises innovate and maximise the gain from the IPs.
- To promote cross-border collaboration, Singapore companies and RIs with complementary assets and secondary innovation (EAP Report, 2001 [6]) capabilities should be proactive in attracting foreign inventors and companies, with basic IPs to partner in co-innovation ventures, which will maximise the success rate of new innovations; the R&D and IP infrastructure, regulations and pro-business environment of Singapore are favourable factors.

CONCLUSION

Many developing nations have already learnt from advanced nations systematic ways to build R&D infrastructure and develop their human capital. However, this is not sufficient. They need to quickly address the challenges of facilitating IP and IP-based innovation, in order to strengthen their positions for commercialization in a globalised knowledge-intensive world. It is hoped that the experience of a newly-developed nation like Singapore will be useful to others which are facing such challenges and opportunities.

REFERENCES

- [1] David J. Teece, Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy, Research Policy, 1986, pp. 285-305.
- [2] See Singapore Department of Statistics report for 1961-2003 http://www.singstat.gov.sg/keystats/hist/gdp_1.html
- [3] Hang Chang Chieh, Science And Engineering Research Institutes: A Source of Competitive Advantage For Knowledge-Based Industry Development, 2001.
- [4] Hang Chang Chieh, Growing Enterprises through a Technology Upgrading Strategy, NUS Seminar on Small and Medium Enterprises, 11 Nov. 2003.
- [5] Clayton M. Christensen and Michael E. Raynor, The Innovator's Solution, Harvard Business School Press, 2003.
- [6] EAP Report, A New Paradigm of Technological Innovation in China's Enterprises: Innovation Portfolio, National Science Foundation Tokyo, 2001.