The National Innovation System and Policy Implications for Entrepreneurship in Taiwan and Japan

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Abstract

In a knowledge economy, accelerating the pace of knowledge building and the rapid acquisition of knowledge are keys to innovative development. However, the development of the commercialization of research results and formation of new start-up companies are often not as active as they should be with a lack of motivation and incentive being one of the contributing factors for the failure to take action. In Taiwan and Japan, the reason that widely advocated idea of industry-academia collaboration is to help advance the technological capabilities of research and development as well as produce economic benefit. The assistance rendered by the government during the transformation and the assessment of outcomes from entrepreneurial pursuits are key issues explored in this study. The results indicate that the network system in the national innovation system is important for entrepreneurship development. The domestic market of Taiwan is not as large as Japan and new entrepreneurs have to face global market challenges.

Keywords
Entrepreneurship, National innovation system, University-industry cooperation

1. INTRODUCTION

With the globalization trend, knowledge has become an important force and asset for economic growth (Miner, Eesley, Devaughn, & Rura-Polley, 2001). The efficacy of a national innovation system affects its national competitiveness and is a major economic factor (OECD, 1996). As the knowledge economy expands, entrepreneurial activities play an important role in economic growth and the progress of human society. Entrepreneurship is "a series of activities that initiate and manage the rearrangement of economic resources, with the purpose of creating economic values" (Schumpeter, 1934). In contemporary times, entrepreneurship and entrepreneurial activities are considered as leading force of economic growth. A study by Birley & Muzyka (2000) and Au-

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dretsch & Thurik (2001) showed that, the frequency of entrepreneurial activities has a positive correlation with the economic growth rate in OECD member countries; therefore, the encouragement of entrepreneurial activities are effective measures to boost the economy.

The OECD (2003) study indicates that 20–40% of productivity growth in the OECD member countries is attributable to economic growth from productive startups. As for the content of the entrepreneurship, Shane & Venkataraman believe that entrepreneurship should include "how, who, and what factors that can influence opportunity discovering, evaluating, and utilizing".

In an innovation system, the important outputs of system operations will be in knowledge creation and proliferation; however, the industrialization and entrepreneurship of university research results are also a mechanism of university knowledge transfer, which has also been a policy focus in recent years. The promotion of an innovation system can be influenced by the academic culture and economic environments as well as by the effects of the innovation system (Braunerhjelm, 2007). The government can serve as a role of the integrator when properly intervening in the industry-academy interaction; subsequently, this can help establish innovation development and creating stable response to international competition.

When facing the globalization trend, developed countries utilize the knowledge economy rapidly make best use of global resources, the labor, and the market. However, less developed countries must first deal with local and national economic stagnation and the transformation pressure caused by the internationalization of current major national industries before they can catch up. Therefore, how to quickly and efficiently solve this transformation challenge is a crucial subject for the development of a new economy. The development experiences of developed Western countries shows that entrepreneurship is an important factor to maintain industrial activity. Birley & Muzyka (2000) and Audretsch & Thurik (2001) showed in their study of the OECD member countries, that the frequency of entrepreneurial activity has a positive correlation to the economic growth rate; therefore, the encouragement of entrepreneurship is an effective measure to boost the economy.

After World War II, the Japanese enjoyed the benefits of high economic growth because large Japanese enterprises offered a stable and high income, comfortable work environment, lifetime employment, and retirement protection. However, the "Bubble Economy" of the 1990s motivated the Japanese government to boost the innovation energy from universities and research institutes. In addition, the government has modified various infrastructure, laws, and regulations that encouraged industry-academy cooperation to create startups that could help improve the economy (Woolgar, 2007).

The economy of Taiwan has developed rapidly since 1960; however, it has faced transformation challenges in its economic structure since 1990 due to changes in the internal and external environments. Taiwan has had positive growth in its economy over the last 30 years; however, the growth rates have slowed since 2000 and Taiwan now faces a bottleneck in further development. The Taiwanese government has actively promoted industry-academy connection and development in addition to actively planning industrial transformation. The purpose is to encourage innovation and entrepreneurship.

There are many roadblocks to entrepreneurs and the government should provide consultation as well as create a nourishing entrepreneurial environment. This study analyzes innovation systems and entrepreneurship policy development in Taiwan and Japan as well as provides comparisons and suggestions for governments to create a salient entrepreneurship policy.

2. LITERATURE REVIEW

2.1. National Innovation System

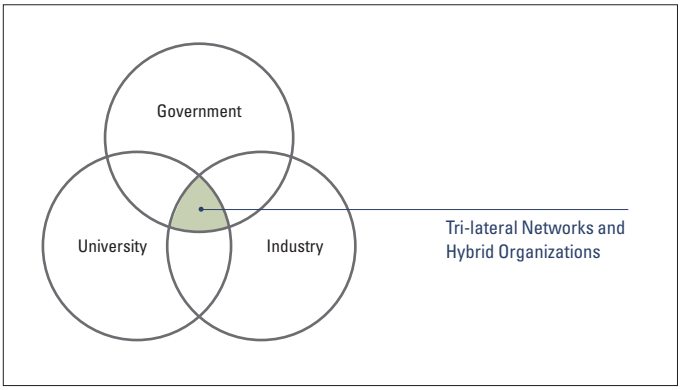
The national innovation system is an organization and system network consisting of members in different sectors (such as enterprises, research institutes, colleges and universities, the government, and overseas sectors) that work independently or collaboratively to produce activity in knowledge creation, proliferation, and value-adding (Metcalfe, 1995). They also combine factors to produce results in the process of knowledge production, proliferation, and usage (Lundvall, 1992; Edquist, 2005). The national innovation system includes the production system, market system, fiscal system, and subsystems where learning happens. In a narrow sense, the national innovation system also includes institutes and organizations that conduct research on innovation such as R&D institutes and universities. In this system, enterprises, industries, research institutes, and universities play important roles. The effects of an innovation system include the realization of individual knowledge creation and application as well as interaction in local, domestic, and international areas (OECD,1999). Metcafe (1995) regards the national innovation system as a group of R&D subjects interconnected in emerging science and technology development that conduct knowledge creation, storage, application, and transfer.

Fagerberg, Mowery, and Nelson (2004) believe that the national innovation system includes systems and organizations. The systems include factors such as government policies and regulations, while the organization includes interaction among schools, enterprises, and public sectors responsible for innovation. An investigation of the national innovation system can help show the structure of science and technology development. The connection among each interested party in the current innovation system (including enterprises, universities, research institutes, and operational mechanism) is useful to facilitate the effective development of technology.

The national innovation system is the foundation of the development of the knowledge economy. The OECD (1999) categorizes the system into four major parts: knowledge innovation system, technology innovation system, knowledge proliferation system, and knowledge application system. In the national innovation system, public and private sectors intend to spread knowledge and new technologies to create a systematical relationship that can facilitate interaction among the government, universities, and enterprises. These three relational bodies form the “Triple Helix Model” through innovation interaction (Etzkowitz & Leydesdorff, 2000). The Triple Helix Model proposed by Etzkowitz (2008) emphasizes that the development of a knowledge foundation can facilitate close cooperation among universities, industries, and the government and help develop the national economy. These three roles influence each other and will be reinforced over time. Subsequently,

this relationship will tend to be equal and make long-term cooperation more stable (Figure 1).

FIGURE 1. Triple Helix Model



Source: Etzkowitz (2008)

2.2. Impact of Entrepreneurial Activities on Economic Development

As for the relationship between national economic growth and entrepreneurship, Schumpeter (1934) first proposed the idea of "entrepreneurship" in his "The Theory of the Economic Development". He sees entrepreneurship as the nature of discovering, and promoting a new combination of factors and as an economic development force that is also a source of development. In the book of "Innovation and Entrepreneurship", Drucker (1985) argued, "entrepreneurship is a process of innovation in which new products or new services are identified and created and eventually used to develop new capability of creating values". Therefore, entrepreneurship is a way to refresh the economy, maintain the efficiency of an economic society, and create values in the macro-economy.

As for the impacts of entrepreneurial activities on economic growth, Schumpeter (1934) argued that innovation and entrepreneurship are the driving force of economic growth and social development. Leibenstein (1968) argued that entrepreneurs with professional human capital, accumulation of knowledge stocks, and entrepreneurship are key factors to promote national economic growth and social development. In a study of 84 countries based on the statistics of the World Bank, Klapper and others (2007) indicated that the self-employment rate has a positive correlation with positive economic growth. The study of the German economy by Audretsch and Keilbach (2008) showed that venture capital has a significant impact on regional economic growth and that knowledge input has a positive impact on knowledge-based startups.

However, the establishment of new businesses has a positive correlation with employment growth (Ashcroft & Love, 1996; van Stel & Diephuis, 2004; Acs & Armingon, 2007). Van Praag and Versloot (2007) found that entrepreneurship is very important to employment growth as well as a production rate increase; in addition, the employment effect is higher in the production sector than in the service sector. In a study of 36 countries, Hessels and van Stel (2007) argued that export-

oriented entrepreneurship is more important than regular entrepreneurship; in addition, export-oriented entrepreneurship has higher contribution to GDP growth than regular entrepreneurship in developed countries and transforming countries.

2.3. Entrepreneurship Policy and Environment

In a study of 494 economic regions and six industrial sectors in the US, Acs and Armington (2007) found that regional entrepreneurship with a geographical advantage and abundant human capital stocks positively impacts employment growth. In all sectors (except for the manufacturing sector), new businesses have a higher effect than small businesses. Fritsch and Mueller (2008) showed that regional differences have different effects on new business establishment in regards to employment growth. In these differences, regional environment and product rate are the most significant; however, the effect can be negative for regions with low production rates. The economic development of Hong Kong and Taiwan is mainly the result of the necessity-push entrepreneurship. Small-and-medium-follower businesses make full use of a copy and follower strategy to implement incremental innovation and specialization, establish their brands, accumulate capabilities, and help upgrade the economic structure (Bramwell & Wolfe, 2008).

UNCTAD (2012) proposed an "Entrepreneurship Policy Framework and Implementation Guidance". Many countries do not have an entrepreneurship policy; however, the establishment of an entrepreneurship framework will help emerging countries propose proper policy planning to encourage entrepreneurship while they develop entrepreneurship. This framework emphasizes the entrepreneurship policy and the interaction of the private sector and am economic policy. The "United Nation's High Level Panel on Global Sustainability (2012)" proposed sustainable economic growth and emphasized high value-added, instead of profit. Entrepreneurship policy is a tool to help achieve sustainable development objectives to help improve productivity and solve practical challenges that society and the environment face. Entrepreneurship policy needs to be connected closely with economic policy.

Bryan and Lee (2000) consider the development of a startup (compared to technology licensing) is a more effective way for the commercial transfer of technology that can result in higher profits as well as values. Technology licensing is also viewed as a method only applicable when technology itself cannot form a startup. Universities can increase the probability of a successful transfer if they are continuously involved in the process of transferring research results into a startup. There are three key points in regards of making innovative enterprises help increase economic growth: to increase entrepreneurship, to increase the number of high-growth enterprises, and to increase the R&D of small and medium enterprises (SMEs) to increase their R&D level and quality by building network connection with universities and research institutes (Dahlstrand & Stevenson, 2007).

The US has accumulated numerous years of experience in the application of innovative research results and knowledge to market development (Rosenberg & Nelson, 1994). This development started in 1980 from the important paradigm of the Bayh-Dole Act (Shane, 2004; Braunerhjelm, 2007). The act rapidly increased the number of patents by US universities, licensing become more active,

and schools paid more attention to the efficiency of enterprise licensing patents and the establishment of units for technical transfer that could assist matters in regards to patent technology transfer (Shane, 2004). Research patents were transferred to schools and inventors; subsequently, other countries started to follow this measure as well because of the significant knowledge proliferation and spillover effects.

2.4. Entrepreneurship Policy Framework

National innovation system consists of stakeholders and innovation policies. They are the actors of entrepreneurship ecosystem. It is very important to create an entrepreneurship framework and environment that inspires and enables individuals to start and successfully grow their businesses to facilitate an effective national system of innovation. Entrepreneurship strategy and policy directly impact entrepreneurial activity. The general entrepreneurship policies are based on a national innovation system related to network building among universities, industry and government. Research and development investment, technology transfer and the regulatory framework are also important for entrepreneurship development.

3. JAPAN'S INNOVATION SYSTEM

3.1. The Development of Japan's Innovation System

The Japanese innovation system started from the establishment of Tokyo University in the nineteenth century and was a starting point that Japan came from a close door to economic development (Edgington, 2008). The Japanese innovation system is a centralized system in which the roles of regional governments have become more important. The government is a driving force and the major executors are large enterprises such as international enterprises. As for developing advanced areas, Japan has a global leadership position in some technology due to continuous government input in R&D.

Freeman (1987) studied the science and technology policy of Japan as well as its economic benefits and proposed the idea of the national innovation system. The study says that technology development has a close relationship to the national policy, system and organizational innovation; subsequently, the system needs sustained external global interaction to constitute a close interaction link to facilitate the proliferation of innovation knowledge as well as technology.

Since the 1980s, large enterprises have played an important role in innovation and have developed high-technology products that compete internationally. The R&D input from enterprises accounted for 75% of the total gross production (Edgington, 2008). The R&D departments of large enterprises were independent and closed. Enterprises have offered lifetime employment and encouraged interaction between R&D departments and manufacturing departments that help protect information and knowledge. The accumulated tacit knowledge was one of the major reasons for the Japanese success in the manufacturing industry (Goto, 2000).

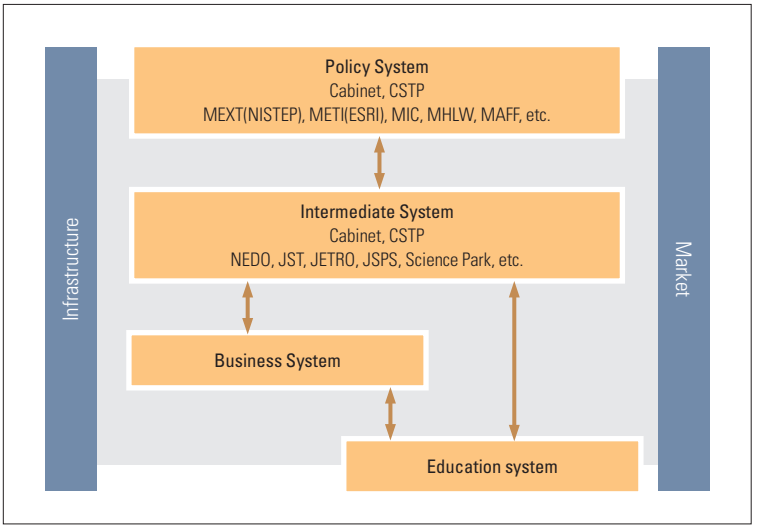
From 1990, industrial relocation became a serious problem due to the increased production cost and made Japan address the issue of de-industrialization. Industrial development based obstacles in addition to the prolonged economic depression and the asset pricing bubble; subsequently, the Japanese started to pay attention to fundamental academic research capacity and technology innovation capacity (Edgington, 2008). Traditionally Japanese enterprises have had cooperation problems with universities. For example, universities lacked the motivation to cooperate, and insufficient protection for intellectual property, and for industrialization effects from research results.

In November 1995, the Japanese government announced the "Science and Technology Basic Law". With technology as its national competitive advantage, Japan further proposed the strategy of "technology innovation as the national competitive advantage". The Japanese cabinet established a five-year "Science and Technology Basic Plan" in July 1997 to implement the idea and regulation of the "Science and Technology Basic Law". The Japanese government decided to continuously increase the input in science and technological research and gradually increase the proportion of basic research input to improve the software and hardware environment for R&D and solidly enhance the innovation capability in science and technology. In 2001, the "Second Science and Technology Basic Plan" was proposed and the "Council for Science and Technology Policy (CSTP)" was established. The SCTP should directly report to the cabinet, organize cross-department organizations in regards to the relevant policies or national science and technology, formulate a strategy for basic policies, establish guidelines for resource allocation, and promote large-scale R&D projects.

Another important organization is the Science Council of Japan established according to the "Academic Meeting Law" in 1949 that required directly reporting to the Prime Minister. It was created to help the Japan science academy and promote the development of science and technology in Japan. Its major promotions included policy proposals for scientific and technological development, the establishment of scientific researcher networks to facilitate scientific interdisciplinary exchanges, international scientific information exchanges, and the improvement of a next generation scientific capability.

Since 2000, the Japanese government started institutional changes and adjustments with organizations related to scientific and technological development. These adjustments first included an adjustment of the functions and authority of the Ministry of Education, Culture, Sports, Science and Technology, the Ministry of Economy, Trade and Industry, and the Science and Technology Policy Council (STPC). Second, some intermediary institutes were also adjusted to integrate national key research institutes and enhance the development of a knowledge transfer (Figure 2). Third, the educational system was adjusted that included university incorporation and promoting mechanisms as well as measures such as an industry-academy cooperation. The joining of the Intellectual Property High Court made intellectual property projection an important protection mechanism in the innovation system; subsequently, the input and exercise of intellectual property started to increase at universities.

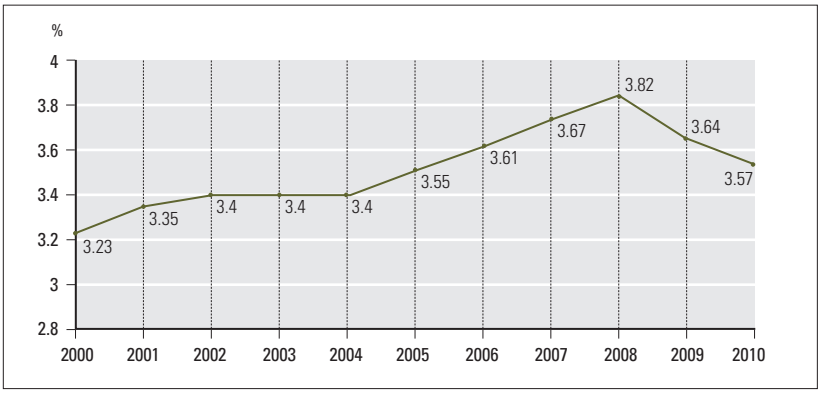
FIGURE 2. Japanese Innovation System Structure



Source: Summary by this Study

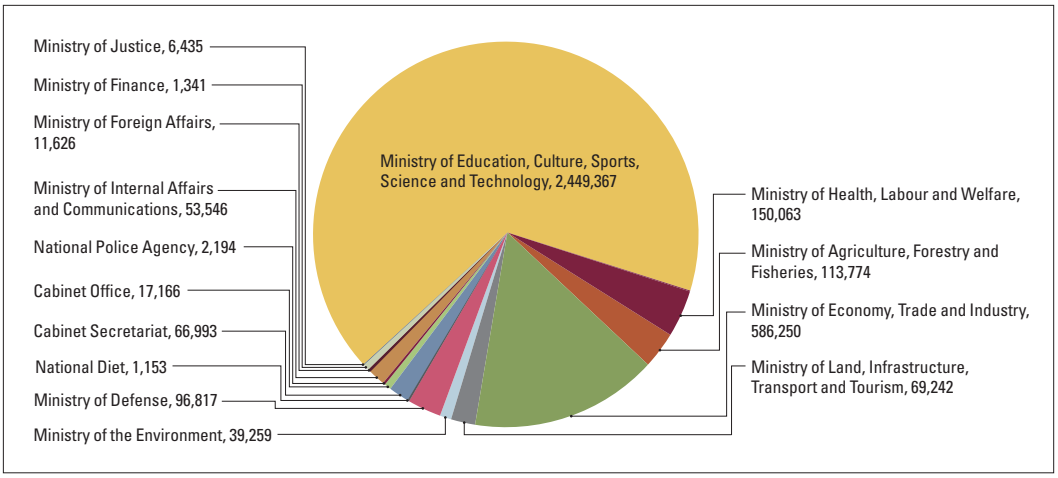
According to recent statistics by the Ministry of Education, Culture, Sports, Science and Technology, Japan has had an increase R&D expenditures in the proportion of GDP by year; 3.23% in 2000 and 3.57% in 2010 (Figure 3). As for the used R&D budget in every ministry, the Ministry of Education, Culture, Sports, Science and Technology had the highest percentage, with 2.445 trillion yen in 2011 or 66.8% of the total budget. The Ministry of Economy, Trade and Industry was second with a budget of 586.2 billion yen or 16% of the total budget. These two ministries used around 82% of the national R&D budget (Figure 4). As for the source of the budget in 2010, governments and the central governments accounted for 19.3%, enterprise expenditures for 69.8%, private universities for 9.6%, and non-profit organizations for 0.8%.

FIGURE 3. Japanese Innovation System Structure



Source: White Paper on Science and Technology 2012

FIGURE 4. Percentage of each Minister's R&D Budget in Japan



Source: Statistics of the Ministry of Education, Culture, Sports, Science and Technology, Heisei 24 Version (2013/01)

3.2. Relevant Policies and Effects of Japanese Industry-Academy Cooperation

In the 1960s, the Japanese educational system relied on strict management and most universities and colleges were managed by the public sector. Industry-academic cooperation tended to be informal. For example, enterprises might send their employees to learn from university professors and serve as visiting scholars, or they might share the research costs of professors to replace the formal cooperation contracts. The patents of research results were often transferred to enterprises by professors and universities; addition, professors often applied for patents (Kato & Odagiri, 2012).

After "Science and Technology Basic Law" was passed in 1996, the regulations on science and technology research cooperation became more flexible in order to encourage industry-academy cooperation. Professors were able serve as directors and supervisors in the private sector; in addition, universities could receive funding through research cooperation with enterprises and officially accept enterprise researchers as university laboratory employees. In addition, universities were able to establish industry-academy cooperation institutes that could specifically promote industry-academy cooperation. These institutes could provide space for startups with cheap rent or provide specific services for startups established by universities. These enterprises could enjoy tax incentives through industry-academy cooperation (Edgington, 2008).

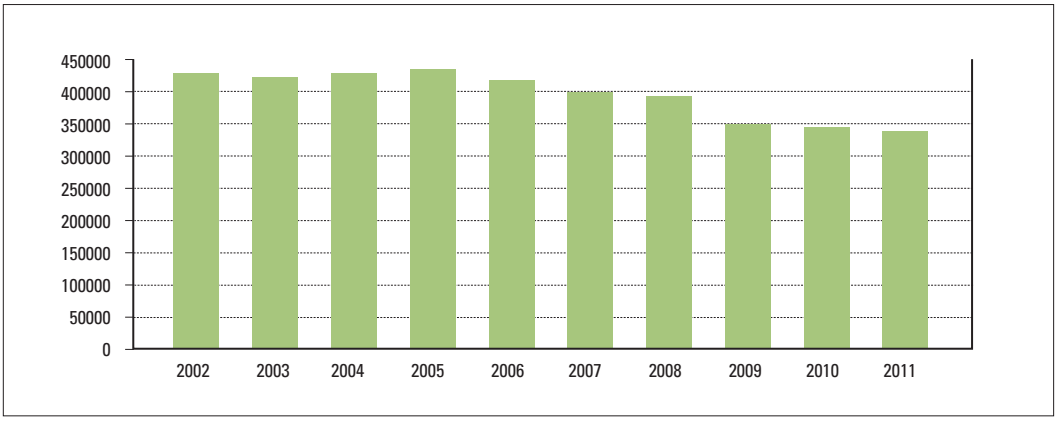
Two other important bills influenced the development of Japanese industry-academy cooperation. The first was the 1998 "Industry-Academy Technology Transfer Law" and the second was the "Industry Revitalization Law" (Table 1). The "Industry-Academy Technology Transfer Law" allowed technology transfer centers in universities to assist in technology transfer activities, while the "Industry Revitalization Law" led to a phenomenal increase in the number of patent applications from schools and in the number of transfers (Kato & Odagiri, 2012). In 2010, the number of applications exceeded 340,000 (Figure 5).

TABLE 1. Relevant Laws and Regulations of Japanese Industry-academy Cooperation Development

Years	Related Policies
1995	Science and Technology Basic Law
1996	The 1st Science and Technology Basic Plan
1998	Technology Licensing Organization Act
1999	Act on Special Measures for Industrial Revitalization
2000	Development of the Technology Enhancement Act
2001	The 2nd Science and Technology Basic Plan
2002	Intellectual Property Basic Act
2004	Incorporation of National University
2006	The 3rd Science and Technology Basic Plan
2011	The 4th Science and Technology Basic Plan

Source: Summary by this Study

FIGURE 5. Changes in Patent Application Number

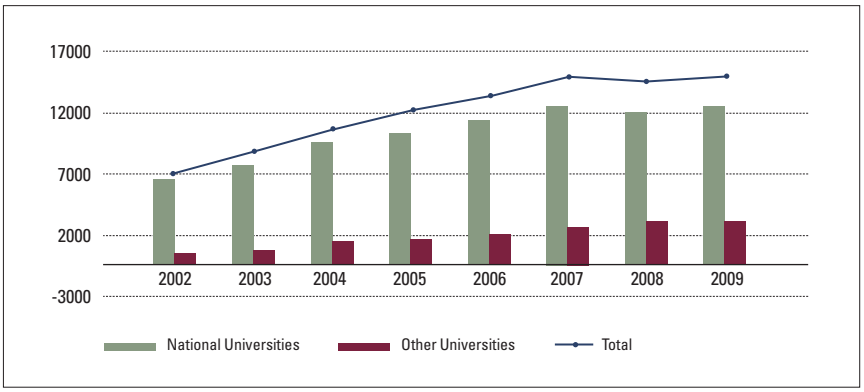


Source: Japan Patent Office Annual Report (2012)

In 2004, Japan started an institutional reform of national university incorporation; subsequently, universities became an organizational form of a corporation no longer regulated by the Civil Servant Law. Universities could own patents and actively promote technology transfers. The passing of the law also provided incentives for universities to participate and execute industry-academy cooperation. This helped promote industry-academy cooperation as well as increased the output of industry-academy cooperation research.

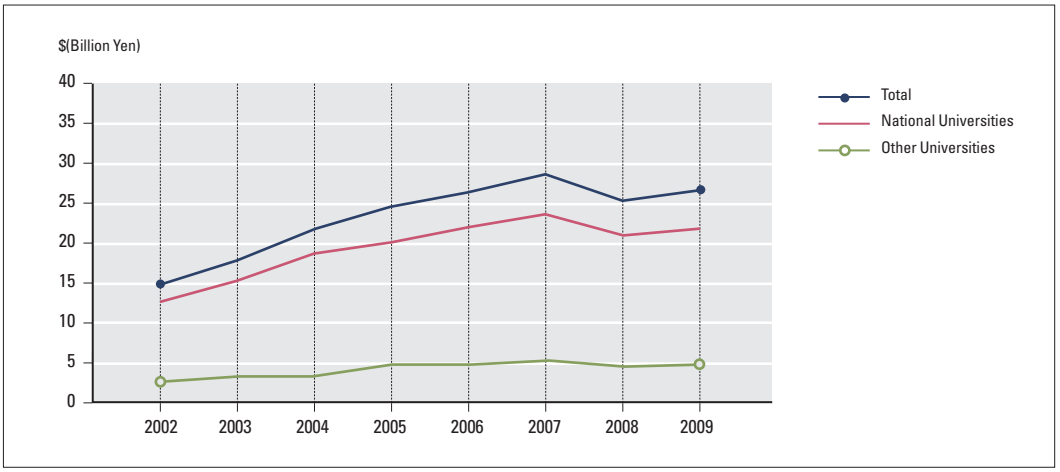
According to the survey results of Japan's Ministry of Education, Culture, Sports, Science and Technology (in regards to industry-academy-government connection development) the project number of cooperative research by universities and civil institutes increased from 7,248 in 2002 to 12,544 in 2009. Major cooperative parties of enterprises were national universities and there were 12,361 projects in 2009 (Figure 6). The income from research expenditures increased from 15.2 billion yen in 2002 to 31.4 billion yen in 2009. The income for research expenditures at national universities was 25.5 billion yen (Figure 7).

FIGURE 6. Number of Cooperative Research Projects by Civil Enterprises and Universities



Source: White Paper on Science and Technology 2012

FIGURE 7. Income for Research Expenditures for Cooperative Research Projects by Universities and Enterprises



Source: White Paper on Science and Technology 2012

3.3. Development of Japanese Startups

According to the entrepreneurship survey of GEM (Global Entrepreneurial Monitor, 2012), the administrative procedure to establish a startup in Japan required eight procedural steps versus Canada that required only one-step to register a startup. As for the administrative time after the application (in regards of the development experiences of several major countries), Japan takes 22 days to complete the process versus seven days in Canada, six days in the US, and seven days in Korea. Japan is a country with substantially longer application days and administrative commitments.

In regards to becoming a startup entrepreneur, the GEM surveyed Japanese citizens 15-64 years old on their entrepreneurship attitudes. The results showed that the Japanese perceive the fewest oppor-

tunities for startups among citizens in all surveyed countries. The percentage of Japanese that believed that they have the ability to establish a startup is lower; in addition, they have the highest risk perception for startup failure. The Japanese show a lower willingness to bear the uncertainty of the startup compared to statistics from other countries. GEM also surveyed citizens not yet involved with entrepreneurial activities to investigate their entrepreneurial intent in the following three years. The Japanese result was 2.9% and the Total Entrepreneurial Activity Index (TEA Index) was 3.3%.

The Japanese government has engaged the issue with an expansion of the policy focus for small and medium enterprises (SMEs) that includes support for startup companies. The Organization for Small & Medium Enterprises and Regional Innovation JAPAN (SMRJ) supports a network for startup companies. Financing business ventures is an important issue for Japan because the supply of risk money is minimal in Japan. A major reason is that Japanese national universities are not allowed by law to invest endowment money in risk assets that include VC funds; however, this regulation may be liberalized (METI, 2012).

4. TAIWAN'S INNOVATION SYSTEM

4.1. The Development of the Taiwanese Innovation System

Taiwan was colonized by Japan and has close economy links with Japan. Taiwan's early infrastructure, industrial technology, and industry development were all impacted by Japan (Eriksson, 2005). Taiwan's science and technology policy development started from the "Guidelines for the Long-range Development of Science" approved by the Executive Yuan in 1959 in order to "solidify the foundation for science development". In 1968, the "Twelve-year Science Development Plan" was approved and its implementation focus was to improve science education for schools at each level, to develop basic and application science research, and help science and technology correspond to national development (Yearbook of Science and Technology, Taiwan ROC, 2010). In 1999, the "Science and Technology Basic Law" was passed to require the government to undertake necessary measures to upgrade the national science and technology level, to facilitate economic development, and to realize the sustainable development of society.

The Taiwanese organizational system to facilitate innovation development is divided into three parts: science and technology administration organizations, intermediary institutes, and the evaluation system. The purpose to promote the administrative system is to facilitate science and technology development policies. The National Science Council (NSC) follows the "Science and Technology Basic Law" and it should hold a national science and technology meeting every four years. The NSC should later follow a consensus reached in the meeting to propose a new "Development Plan of National Science and Technology" that can be implemented after approval by the Executive Yuan. Other governmental ministries (that include the Executive Yuan and the Ministry of Education) should follow the "Development Plan of National Science and Technology" and its requirements. The members of the NSC should be served by Ministers Without Portfolio responsible for technology affairs and domestic as well as foreign scholars. In addition, the NSC is also responsible

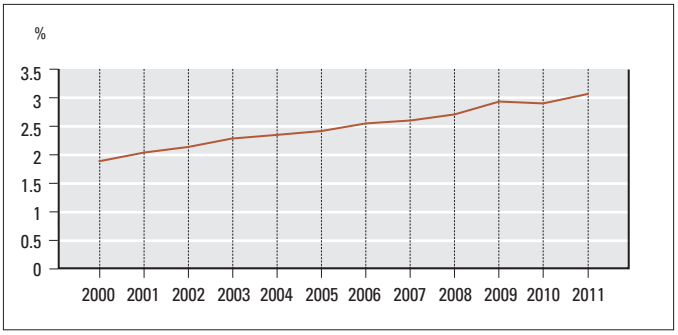
for promoting national science and technology development, supporting academic research, and the development of a National Science Park. Its purpose is to achieve technology innovation as well as value creation that realizes a quality of life vision and a sustainable society.

Intermediary institutes mainly consist of corporate institutes and academic research systems, including corporate entities such as the Industrial Technology Research Institute as well as the National Health Research Institutes, Academia Sinica and universities and colleges. They are in charge of basic research, applied research, and commercial development that helps implement the science and technology policy. In addition, a National Science Park is also an important goal for the applied research of technology and technology development as well as commercialization.

Science and technology development has high risks; therefore, to utilize resources, the government has established technology development policies as well as promoted the medium-term and long-term assessment of the plan. The purpose is to apply planned execution feedback to the formulation and execution of key science and technology plan development.

From 2007 to 2010, the average growth rate of the Taiwanese government technology budget was 4.5%. The national total R&D budget continued to increase and accounted for 2.94% GDP in 2009 and 3.02% in 2011 (Figure 8). In the R&D budget, the input from enterprise sectors had the highest percentage at 69.7% in 2011 while the second highest was for government departments at 28.9%.

FIGURE 8. Percentage of National R&D Budget in GDP



Source: Science and Technology Indicators, NSC of the Executive Yuan, 2012

4.2. Industry-academy Cooperation Development and Effects in Taiwan

Taiwan faces international competition and market-opening pressure; however, SMEs also face operational challenges. Therefore, the Small and Medium Enterprise Administration of the Ministry of Economic Affairs established the Innovation Incubation Center to enhance support for SMEs. It hopes the Innovation Incubation Center can become a communication media and platform that can support small and medium enterprises. This center can effectively transform the rich academic research energy of institutions of higher education into a knowledge economy that can facilitate industry-academy cooperation to better integrate and apply academic resources.

To promote the exchange and cooperative research between technical colleges and industries, the Ministry of Education integrated resources, innovation knowledge, and technology of industry, government, academy and research institutions to strengthen industrial competiveness. Since 2002, six regional industry-academy cooperation centers were established to promote affairs of industry-academy cooperation. The positioning of industry-academy cooperation centers became a technical and strategic alliance for regional industries that serves as an integration and contact center for the resources of industry, government, academy and research institutions. These centers were responsible for the execution of industry-academy cooperation and educational training programs, integrating related faculty, cooperatively executing industry-academy cooperation and human resource training programs, forming industrial alliances in key areas, and the promotion of development of industry-academy cooperation plans.

According to the survey of the Higher Education Evaluation and Accreditation Council of Taiwan (2011), the government budget for industry-academy cooperation was 697 million NT in 2007, 591 million NT in 2008, 934 million NT in 2009 (57% higher than that in 2008), and 727 million NT in 2010 (22.14% lower than that in 2009). It was 2.66 million NT in 2007 for the industry-academy budget of enterprises; subsequently, it increased by year to 4.06 million NT in 2012.

The income return from intellectual property also increased annually relative to industry-academy investment. According to the survey results, the income was 277 million NT in 2007, increased to 456 million NT by 64% in 2008, and 676 million NT in 2010 (Table 2).

TABLE 2. Intellectual Property Licensing 2007-2010

	Intellectual Property Licensing Return (million NT)	Growth Rate
2007	277.6	
2008	456.1	68.28%
2009	474.0	3.91%
2010	676.2	42.67%

Source: Higher Education Evaluation and Accreditation Council of Taiwan (2013)

4.3. Taiwan Entrepreneurship Development

The Taiwanese entrepreneurship policy first developed from an SME policy that belonged to an extension category of the SME policy. In 1966, the International Economic Cooperation Committee of the Executive Yuan set up the "SME Counseling Work Team" to manage small industrial loans and operational fund affairs to meet the capital demands of SME owners. It had an organizational restructuring in January 1981; subsequently, the Small and Medium Enterprise Administration, Ministry of Economic Affairs was established as the dedicated counseling institute for the sound development of SMEs. Additionally, it was also responsible for the development and planning of key entrepreneurship policies that are parallel to relevant SME policies.

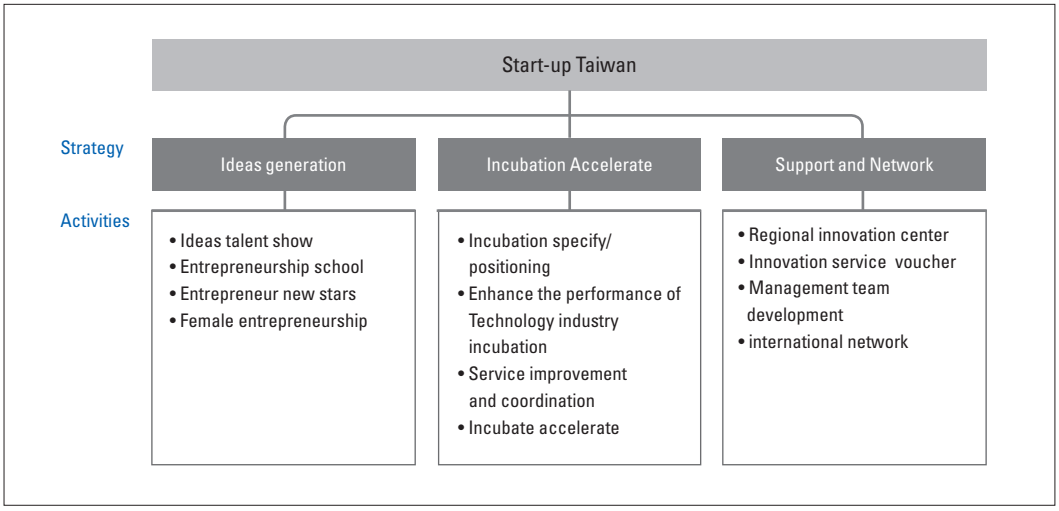
In 1990, to encourage entrepreneurial development, relevant governmental institutes proposed many financial load policies to encourage entrepreneurship such as the Youth Entrepreneurship Loan and the Micro-Entrepreneurship Loan. There are also special population loans for females

and aboriginals. The purpose of providing entrepreneurial loans is to make funding more accessible for entrepreneurial activities.

In regards to Taiwanese academic research results, Taiwan's SCI and SSCI publications were 16th worldwide in 2010, and the number of citations ranked 19th worldwide. As for the patent applications in the top five international patent offices, Taiwan had most patent numbers in mainland China (22,419), the US (20,151), and Japan (3,240). However, Taiwan has less control of business development opportunities. Many regional universities have established incubation centers to facilitate commercialization development; however, there are qualification requirements and only incorporated enterprises are eligible to enter and operate in the center.

To effectively facilitate research and the commercial development of R&D results, the Small and Medium Enterprise Administration proposed the "Start-up Taiwan" project in 2012 that targets the integration of all previous entrepreneurship resources offered to SMEs in order to facilitate the development of startups. The key operational strategies are the "Start-up Taiwan" project that include the "Ideas Generation", "Incubation Accelerate", and "Support and Network" (Figure 9).

FIGURE 9. Start-up Taiwan Project

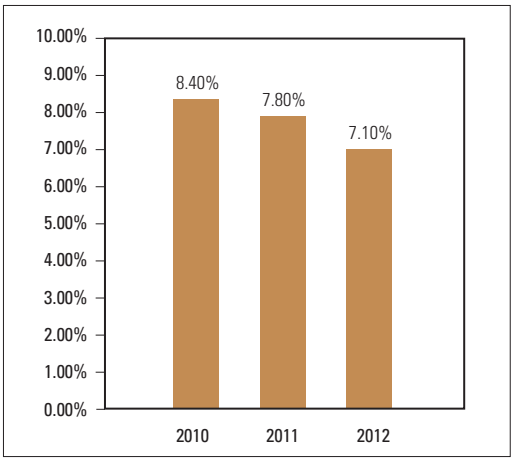


Source: Small and Medium Enterprise Administration (2013)

4.4. The Development of Taiwanese Startups

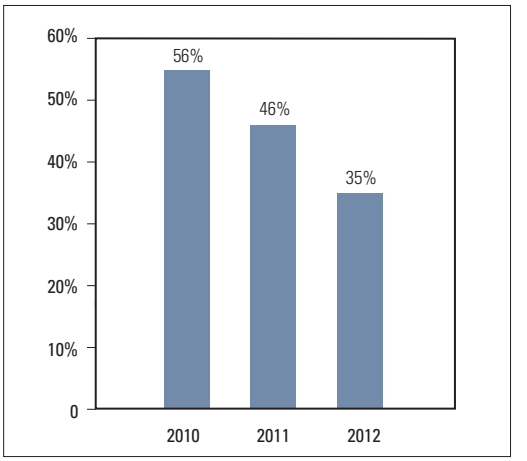
According to the study of entrepreneurial activity in the GEM Executive Report, the statistics show that the Taiwanese percentage of "Total Entrepreneurial Activity (TEA)" has decreased in recent three years from 8.4% in 2010 to 7.10% in 2012 (Figure 10); however, the percentage of "nascent entrepreneurship" has decreased from 56% to 35% (Figure 11).

FIGURE10. Total Entrepreneurship Activity (TEA)



Source: Global Entrepreneurial Monitor report (2012)

FIGURE 11. Nascent Entrepreneur



Source: Global Entrepreneurial Monitor Report (2012)

According to the GEM survey results for Taiwan and the world yearbook in 2010 (Kelley, Bosma, & Amorós, 2010), the perception of Taiwanese citizens on entrepreneurship opportunities was 29.6% and the perception of entrepreneurial capability ranked 3rd from the bottom. The GEM also surveyed citizens not involved in entrepreneurial activities in order to investigate entrepreneurial intent over the following three years; subsequently, the percentage for Taiwan was 25.1%.

Taiwan is an export-oriented economy and emphasizes market internationalization. The GEM 2010 survey data indicates that Taiwan has 11.9% as a high-internationalization orientation (with more than 25% of customers as overseas customers) in TEA and 19.56% as low-internationalization orientation (with 1-25% customers as overseas customers). The Taiwanese TEA indicates only 31.46% with a certain level of internationalization performance and percentage is slightly higher than the average percentage of factor-driven economies (27.69%); however, lower than that of efficiency-driven economies (42.18%) and that of innovation-driven economies (56.94%). This shows that the internationalization level of Taiwan's TEA is relatively low.

Commercial development must be established on access to market information to help startups to become market-oriented. In this phase, it is important to have significant access to market information and financial support. The government Ministries of Taiwan have provided relevant policies and financial resources to facilitate innovation and entrepreneurship development. Since 1990, Taiwan has started to promote entrepreneurship-relevant policies that provide entrepreneurship loans to help startups resolve financing problems. Since 2012, the Small and Medium Enterprise Administration has been in charge of the promotion of the "Start-up Taiwan" project to integrate all available entrepreneurship resources and encourage the development of startups. Financial support is a challenge for startups in Taiwan. Most of the entrepreneurship funding is from the public sector and rarely from venture capital. There is no risk money for entrepreneurship development at universities. Venture capital is not as active in Taiwan as in Western countries.

5. CONCLUSION

The Taiwanese and Japanese governments have exercised comprehensive measures to improve national competitiveness in order to improve national competitiveness when challenged by global economic turmoil and internationalization. Using science and technology policy can lead to industrial development; subsequently, technology has become a key strategy. Taiwan and Japan have established long-term economic trade relations and historical interactions. A comparative study of these two countries is concluded with several prominent characteristics that serve as references.

5.1. Innovation System Development Structure

Taiwan and Japan both have a basic law basis for their innovation system development structures to implement the development of the science and technology policies. Japan has the 1995's Science and Technology Basic Law and formulates a science and technology basic plan every five years to serve as the central principle for science and technology and industry development. Taiwan has the Science and Technology Basic Law of 1999 and holds national science and technology meetings every four years to formulate a development plan for national science and technology. Taiwan and Japan have similar entities for innovation system development. However, Japan has higher input than Taiwan in regards to the R&D expenditure percentage. The established Japanese R&D and basic technology support can serve as a reference for Taiwan.

5.2. Industry-Academy Cooperation Development

The development of industry-academy cooperation and application linkage of practices are helpful for the commercial application of research results. A comparison of Taiwan and Japan shows that the major funding sources of industry-academy cooperation are government-led funds and the percentages of enterprise funding that have only recently increased. Practical economic benefits and licensing returns have gradually increased in recent years and shows that enterprises have a higher gradual demand for and emphasis on research results from academia and research institutes. This observation is very meaningful for innovation system activities.

5.3. International Expansion of Entrepreneurial Activities

Compared to Japan, Taiwan has promoted the "Start-up Taiwan" project and has a definite entrepreneurship development plan. Its value expansion of entrepreneurial activities focuses on taking advantage of market opportunities and on increasing market values. Taiwan enterprises have small scope of domestic market; therefore, the main markets for startups are international markets. This increases the importance of taking advantage of market opportunities and value chains.

The GEM survey shows that the Taiwanese internationalization level percentage for TEA is higher than that of Japan (20.77%) and China (19.41%); however, lower than South Korea (44.65%), Israel (55.28%), or the US (80.82%). Compared to the Japanese focus on the domestic market economy, the Taiwanese economy is export-oriented and emphasizes international development. Taiwan

should pay attention to internationalization in order to facilitate commercialization development and value upgrade. However, international market expansion requires significant resource investment and startups generally short of adequate capital to develop international markets. Therefore, startups may have difficulties to increase their business size.

The research analysis of this study provides several suggestions for the current entrepreneurship policy development of Taiwan:

5.3.1. Support and Establish a Network Environment for Startup Development

Taiwan has higher entrepreneurial motivation and more active entrepreneurial activities than Japan; however, there is room for improvement. Entrepreneurship development is based on quality research and continuous interaction with an established network; therefore, the innovation system should continue to establish an environment and mechanism for industry-academy interaction. In addition, it should improve and enhance entrepreneurship counseling mechanisms. The analysis of Taiwan and Japan shows that it is difficult to understand the real value of capital investment, especially the investment by venture capital. The capital environments of Taiwan and Japan are relatively week when compared to the US entrepreneurship environment; subsequently, there should be a mechanism to monitor capital flow and startups in order to understand the capital system and capital demand of entrepreneurial activities. The current system can connect with venture capital; this system can be reinforced through a connection of the networks of domestic and international venture capital.

5.3.2. Counseling for Expansion into International Markets

To expand into international markets, enterprises will need sufficient resources and access to market demand dynamics. Startups have limited resources and have difficulties expanding into international markets. Therefore, the government can establish an international network; in addition, mentorship resources and government overseas trade institutes can be connected to provide startup assistance to enter international markets. The government can provide adequate subsidies or help them in financing when startups need capital for international marketing; subsequently, so these startups can enter international markets and increase the market value of new technology and services. Furthermore, the government should timely review and improve core capabilities and values for the development of existing startup technology or service design. Most enterprises decrease their R&D investment or slow down their innovation technology development after setting up their startups that later effect their international competiveness.

A venture capital investment society in Taiwan and Japan is not active as the United States. Financial support is important but difficult for new entrepreneurs in Taiwan and Japan. Government funds are the major source for both countries and the venture system plays an important role in the entrepreneurship environment.

By observing the innovation system and entrepreneurial activities of Taiwan and Japan, we can find that continued R&D investment is a real government policy commitment and the application of output results will require more opportunities and interaction to connect innovation system activities and entrepreneurship.

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