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The Study of the Relationship between Southern Taiwan Science Park and Regional Innovation Network

Roundtable 1

Cooperation among Innovation Support Structures

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The Study of the Relationship between Southern Taiwan Science Park and Regional Innovation Network

Executive summary

The aim of this paper is to provide empirical evidence to study the role of Kaohsiung Science Park (KSP), the branch of Southern Taiwan Science Park(STSP)in the regional Innovation networks by studying the actors participating in the project "Taiwan Bio-Medical Instrument Industry Cluster Project".We find that Southern Taiwan Science Park Administration (STSPA) cooperating with local research institute,Metal Industries Research & Development Centre (MIRDC),as "gatekeepers" are the centre of regional innovation network of medical device industry (MD) in which the gatekeeper have the capacity with R&D capacity, transferring and diffusing different type of knowledge, and organizing social network. STSPA, MIRDC and local government are responsible for the dialogue with central government; while university and MIRDC are to provide ideas and knowledge to the central government and firms. Innovation platform provide the public space tointegrate resources and knowledge, to stimulate collaboration, and to foster innovation with different actorswithin the regional innovation network. We think the model of innovation platform could be the practical tool to realize the triple helix idea.

Keywords

Southern Taiwan Science Parks (STSP), Regional Innovation Network, Social Network Analysis

1. Introduction

Innovation is greatly regarded as an important tool to stimulate economic development. How to promote innovation is still the issue needed to be discussed.

Some evidences showing that the development of innovation is gradually toward to the type of network-centric innovation or open innovation model, such as regional innovation system. The regional innovation network is understood as a system of innovation networks located within a certain geographical area, in which firms and other organizations are systematically engaged in interactive and collective learning through an institutional milieu characterized by social-economic linkage. The member of linkage may come from the global or local actors. Both strong and weak linkages are important to innovation. Strong linkage (formal and informal relationship) includes a common language and high level of trust, whereas weak linkage (formal relationship) enables the flow of novel information to the system.

According to some real cases such as Silicon Valley, Stanford Research Park, and Cambridge Science Park, it is showed that science parks could be one of an effective way to encourage knowledge transfer and technological innovation within the regional Innovation network. From the definition, we know science parks could be defined as a geographical area in which firms and knowledge institutions (universities and research institution) have a common location. Some evidences also showed that proximity to university laboratories and other research centers as providing nearby firms with easier access to scientific expertise and research results, and then it will facilitate transfer of research into commercial application. In other words, this means we could use region as a specific area to construct a regional innovation environment in which the university, industry and science parks administration (government) are important actors in which science parks administration could be a "gatekeeper" within the structure hole for the formation process of collective learning system. However, it is still less studies to test whether it works or how it could be work in the fields of science parks planning.

In the Kung et al. (2011)[1], they found why the past experience to develop TFT-LCD of Tainan Science Park (TSP) can't be applied and how the KSP can attract local industries and stimulate upgrading by innovation platform.KSP is still at relatively young status; and then it is not easy for them to attract them. We think that the main task for a young science parks is how to construct an environment to attract it or even to shape it from existing firms in local area or related sectors. Innovation platform was developed by STSPA in 2009 as the tool and environment to integrate resources and knowledge, and to stimulate collaboration with different actors.

Based on the concept above, we think that science parks in Taiwan should not only provide lands, hard infrastructures and one step services, it still could play a strategic role in the formation of innovation environment by supporting, stimulating, and increasing local and global the innovation network. Therefore, we want to use the Kaohsiung Science Park (KSP), the branch of Southern Taiwan Science Park (STSP), and Metal Industries Research & Development Centre (MIRDC) as the case to study its innovation networks participating in the project "Taiwan Bio-Medical Instrument Industry Cluster Project".

In the following passages, Section 2 will describe the development of KSP and its policy to promote innovation. Section 4 will analyze the empirical result of interview. Finally, section 5 concludes and summarizes the paper.

2. The Innovation Policy in KSP for the development of MD industry

The KSP is established in 2003 as the second site managed by Southern Taiwan Science Park Administration (STSPA). The distance between KSP and TSP is about twenty kilometres, there had been ideas of utilizing KSP as a spill-over site for the fast expanding TFT-LCD industry in TSP several years ago, however, the stronger calls from both local communities and STSPA expected that KSP should construct some core industries of its own, preferably, some new industries that may have closer relationships with the existing industries and may act as catalyst to transform local economy.

[1]Kung, S.-F, Y.-C.Yen, C.-W.Chen, C.-M.Chen, B.-W. Huang, 2011, Innovation Platform as the Tool to Shape the Environment for the Emergence of Flagship Firm – the Case of Medical Device Industry in Kaohsiung Science Park, XXV IASP World Conference on Science & Technology Parks.

Before the establishment of KSP, Southern region of Taiwan were famous for its complete steel and chemical clusters. Kaohsiung has been the major steel and petrochemical industrial centre in Taiwan. With the variety of materials and the convenience of the biggest harbour of Taiwan, metal works and precision machinery SMEs have clustered in Kaohsiung and the southern Taiwan region, and are still a significant industrial sector in the early 21st century (Yen and Kung, 2008). Yet, with the uprising industrial competition from China and ASEAN countries, many of these SMEs have to find new ways of production or higher value-added and more sophisticated products if they choose to stay instead of moving out to other lower cost countries. Therefore, STSPA tried to apply the successful experience of formatting the TTF-cluster into the upgrading projects.

MD industry is chosen under the trend for upgrading with the three main reasons. Firstly, MD industry has the opportunities to combine different field's high-tech technologies with metal, precise machine, chemical, and plastic industry in which it has high reputation in manufacturing sector. Secondly, the MD industry is comparatively a new industrial sector all over the world, even the major associations in the USA, for example, MDMA and MassMEDIC, have been established only since the 1990s. Thirdly, it is widely recognized as very potential in the future, basically because of the global increase of ageing population as well as the rising awareness of the value of health. Different research estimated the global market of medical devices at about 200 billion US dollar per year between 2006 and 2008, with an annual growth rate between 6-9%. In Taiwan, the medical device industry was also assessed as one of the very promising industries that Taiwan may feature in the global market, and the central government of the Republic of China has included it in the list of new and strategic industries (MOEA, 2008).However, it is failed in the early stage, and there are only 3 firms tenanted in 2009. According to the interview, we found that there are three main reasons.

Firstly, in order to produce high-level MD products needs firms to upgrade their original technology or develop a new technology, and to get the market information and consumer needs, which often takes long time and large investment to integrate complex idea, technologies, and researches. The innovation of traditional industries is often based on the application or novel combination of obtainable knowledge with low levels of R&D. They are largely incremental and often arise from the firms' persistent efforts to satisfy requests from customers. In addition, medical industries have high professional and closed-market characteristics; and then it is very different in the distributing and sharing knowledge with the other industries. Therefore, although most of them are located in the southern region, it is also involved with different expertise and belonged to very high closed-market and different approach for innovation. Secondly, industrial upgrading in traditional industries is like the radical innovation or disruptive innovation in technology base and business model in which it needs to invest many resources and capital (Christenson, 1997 ; Davila et. al., 2005); however, most of them are small and medium sized enterprise (SME) with low capital; it is not easy for them to forecast the future market trend and connect the technology resources such as university, research institute, large firms and multinational corporations (MNCs) by themselves. Thirdly, it is very important for the MD industry to consider safety and efficiency carefully since it is going to be used in human body for the life-saving and working. Due to the high product certification and competition, it is not easy to estimate whether the product can pass the examination and when the product can enter the market. It will cause the high operation cost, low survival rate and high entrance barrier of the small and medium sized firms in the early stage.

According to Kung and Yen (2009), flagship firm is still the important driver for the formation of industrial clusters and the growth of firms in science parks. However, KSP is still at relatively young status; and then it is not easy for them to attract them. Therefore, STSPA think that the main task for a young science parks is how to construct an environment to attract or even to shape the flagship firms from existing firms with related sectors. From the Kung et al. (2011), we know that innovation is an important factor for the local firms to upgrade as the flagship firms. The most important task of the science parks is to provide an innovation environment such as a "public space" to integrate diverse resources, to break different boundaries, and reduce the waste of the transaction cost, negative externalities and risk of failure in the structure hole in which who is the gatekeeper also plays an important pole in the success of innovation environment.

The policy, named "Taiwan Bio-Medical Instrument Industry Cluster Project", were proposed to solve these problems including product R&D projects, human resource training projects, and innovation platform to integrate different resources. The structure of the project is shown as figure 1.The proposed areas of this project include dental instrument system, orthopedics instrument, cosmetic surgery equipment or instrument, medical alloy, and other sub-areas such as developing

technology, training talents, and building platform for research and development among potential bio-medical instrument products. It aims at lending an impetus to the development of national bio-medical instrument industry cluster, inspiring industry to research and develop the required technology actively, and integrating relevant academic power and establishing the platform for training professionals and expertise among bio-medical instrument industry filed; furthermore, to promote the national competency, to construct an ideal and superior environment for academic research, and to integrate the national research and development force toward required technology for training hi-tech professionals and expertise and developing novel industry cluster.

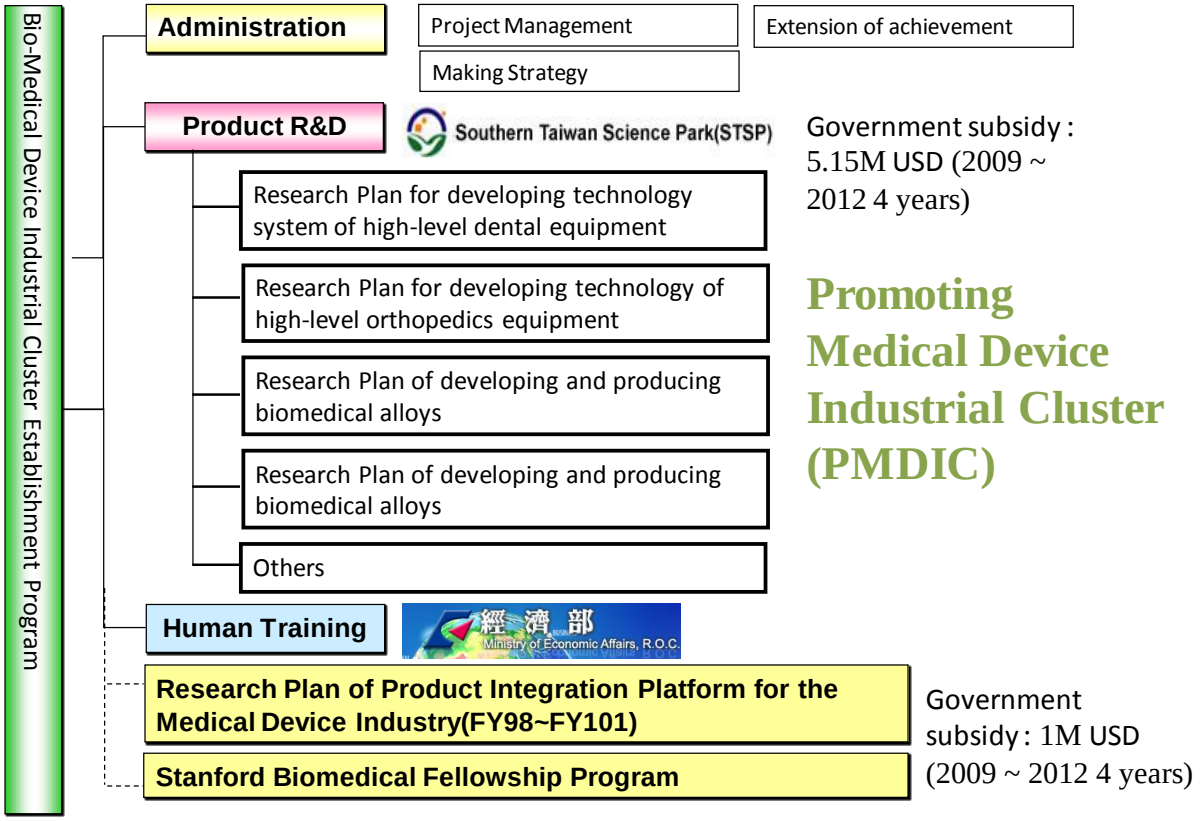

Figure 1: The gaps in the production process of MD products

The planning idea of the innovation platform is to make the real product as the final target to think about how to plan the function and organization of the innovation platform. By analysing the MD production chain, there are at least three big gaps (Figure 1) which are very difficult for a single small or medium-sized firm to deal with alone.In order to fix the breaks of production chain and integrate different resources to foster innovation, STSPA cooperated with local institution, Metal Industries Research & Development Centre (MIRDC), as the important gatekeeper to run the platform. The goal of the subsystem of this platform is to bridge the break for the formation of production chain by organizing and coordinating different innovation actors and finite resources (figure 2). The platform encompasses the set of components and rules employed in common in most user transactions (Table 1).

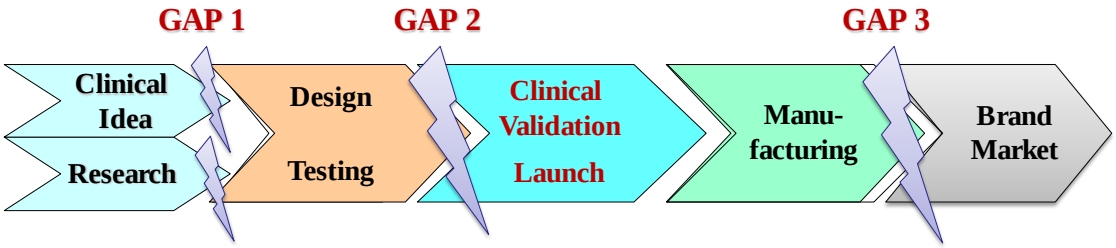

Figure 1: The gaps in the production process of MD products
Table 1: The responsibility and information of innovation platform

Core system	Subsystem	Mission	Supply-side users
Technology Service	Clinical Information Platform (CIP)	• Increase the information exchange during R&D • Setting up the professional team • Evaluation the clinical testing	• MC • HO
	Technology Merging Platform (TMP)	• Analyse the key technology in developing MD industry • Studying and selecting proper firms • Merging the proper firms • Explaining and diffusing R&D results	• UNI • RI • Firms
Product Service	Product Certification Platform (PCP)	• Setting up one window operation model • Integrating the existing certification resource • Setting up GLP laboratory • Setting up GLP certification	• RI • UNI
	Product Marketing Platform (PMP)	• Participating the international exhibition and information exchange • Raising the industrial image • Setting the common marketing mechanism • Planning the product exhibition site	• RI

MS: Medical School; MC: Medical Center; HO: Hospital; UNI: University; RI: Research Institute

The platform encompasses the set of components and rules employed in common. Components include:

A. Platform providers:
National Science Council (NSC) and Ministry of Economic Affairs (MOEA)
   - Providing the fund to support the operation of platform.

B. Gatekeeper:
Planning office (PO) composed of STSPA and MIRDC.
   - Responsible for determining who could participate in a platform network,
   - Contracting that specify terms of trade and the rights and responsibilities of network participants,
   - Developing its technology,
   - Setting up operation rules such as how to govern information exchange, innovation resources, and knowledge transfer.

C. The core systems:
Technology Service and Product Service System. The subsystems are
   - Clinical Information Platform;
   - Technology Merging Platform;
   - Product Promotion Platform;
   - Certification Platform.

D. Supply-side users of the platform:
Universities, medical schools, medical research centres, hospitals, and regional and local research institutes.

- Offering complements employed by demand-side users in tandem with the core platform.

E. Demand-side users of the platform:

- Firms from TI, HI and MD industry, commonly called the end users.

F. Other support system:

- Capacity building, technical training and educational activities.

4.The Regional Innovation Network between STSP within Southern Region

In the Silicon Valley and Cambridge Science Park, university is like a gatekeeper to foster the innovation and spin-off in which most of them are private organization with flexibility. However, the developers in Taiwanare the central or local and government;therefore, STSPA can't work like a gatekeeper such as the university played in the Silicon Valley or Cambridge Science Park because they are the government officer with less flexibility. But it is easy for STSPA to get the trust between different actors in the region. We found STSPA and MIRDCas the gatekeeper developing an innovation platform in KSP with division of labour (figure 2), do played an important role in the formation of RSI in which knowledge creation and transmission for innovation are the central force to connect different actors.

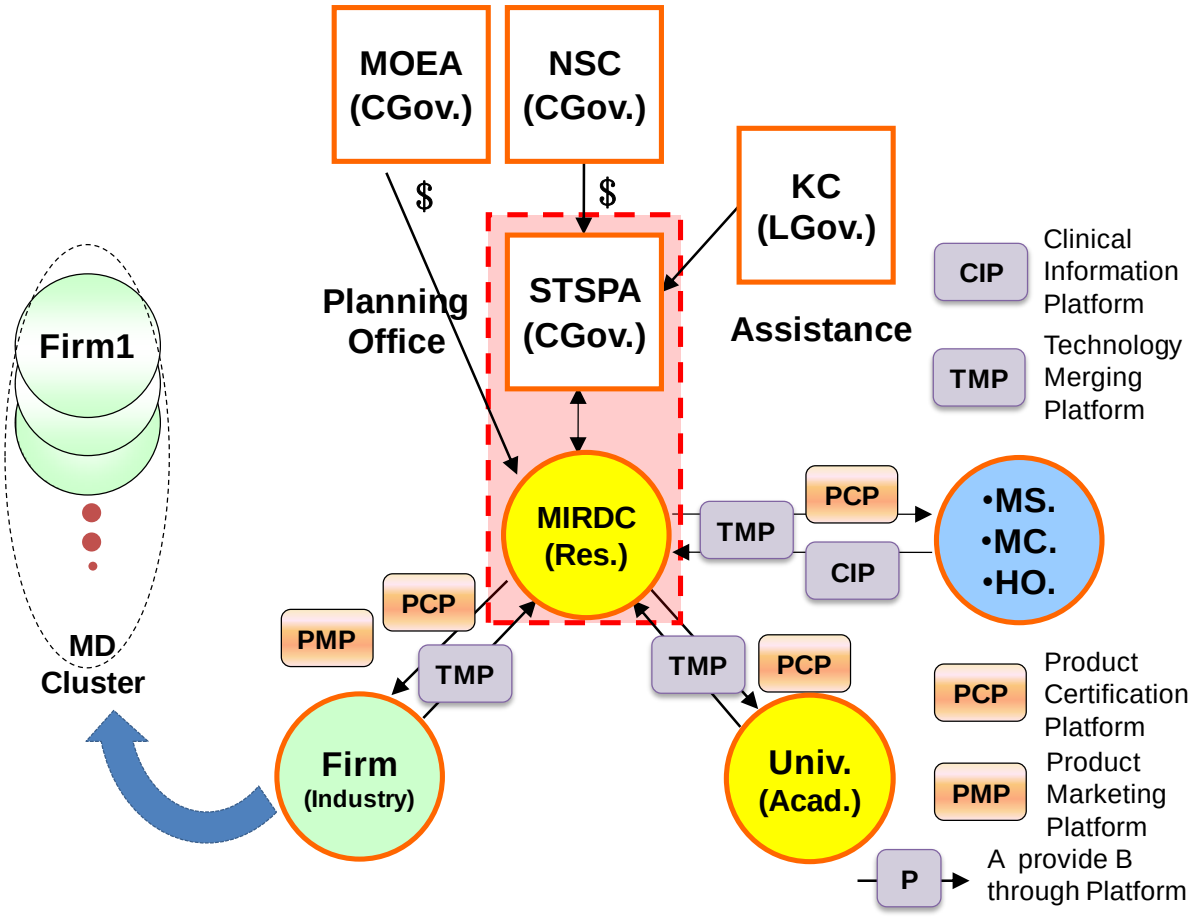

Figure 2: The Regional Innovation Network of Medical Device Industries in KSP

From the government side, STSPA and MIRDC are responsible for the dialogue with Legislative Yuan to get the project, while Kaohsiung county government is responsible for persuading the Executive Yuan to get the fund (figure 3). From the private side, University and MIRDC in this structure are to provide ideas and knowledge to the central government and firms. Under this structure, there are many actors in this network, and how to make good use of this advantage to fix the breaks of production chain and integrate different resources to foster innovation are the important issue needed to be resolved.

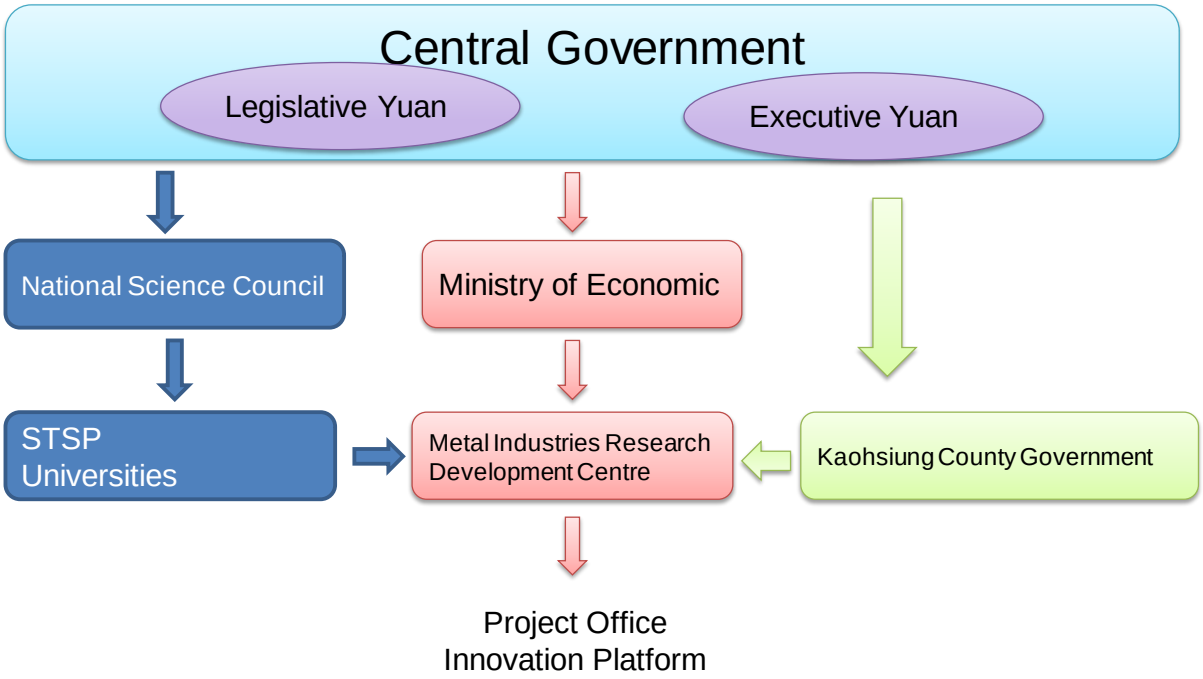

Figure 3: The division labour of different actors

We found that STSPA use innovation platform as the environment to integrate different resources (fund, idea, and services) from different actors to reduce the negative externalities (structure hole) from production to marketing (Baxter and Tyler, 2007[2]; Lester and Piore, 2004[3]). The goal of the platform is to bridge the break for the formation of production chain by organizing and coordinating different innovation actors and finite resources.The innovation platform could be seen as the practical model to realize the triple helix idea in which research institute as the centre of government, industry, and academia (Cooke and Morgan, 1998[4]; Etzkowitz, 2008[5]; Nabisan and Sawhney,2008[6]).

The gatekeeper of the innovation platform is composed of the MIRDC from the research institute side and STSPA from the government side. Therefore, the gatekeeper has the political power to get the trust between different actors and has the ability to identify, integrate, and to transmit the knowledge.The planning officeauthorizes the department which is experienced among administration or techniques in practice to establish the project office and to conduct the following investigating and administrating procedures:

- Conducting the investigating procedure among application and other relevant document for the project, the qualification for the applying institution, and its financial situation.
- Organizing the techniques investigating committee for the “Developing Southern Taiwan Bio-tech Medical Instrument Industry Cluster Project” (hereinafter referred to as “committee”), and conducting the techniques investigating procedure case by case.
- Conducting the investigating procedure of the modification among application for the project.
- Submitting application for the project to the administrating institution for investigating.
- Other administrating procedures relevant to this project.
- Committee will consist of several members in accordance with each sub-area, who are recommended by the project office from government institutions, industry, and academic

[2]Baxter, C. and Tyler, P. (2007) Facilitating enterprising places: the role of intermediaries in the United States and United Kingdom,
[3]Lester, R. K. and Piore, M. J. (2004)*Innovation: The Missing Dimension*, Cambridge, Mass.: Harvard University Press.
[4]Cook P. and Morgan, K. (1998) *TheAssociational Economy: Firms, Regions and Innovation*, Oxford: Oxford University Press.
[5]Etzkowitz, H., 2008, *The triple helix: university-industry-government innovation in action*, NY: Routledge.
[6]Nambisan S &Sawhney M, 2008, *The Global Brain, Roadmap for Innovatingfaster and smarter in a networked world*, New Jersey, Pearson Education.

andresearch institutions, and employed after submitting to the administrating institution for approval.

MIRDC is the only actor who can use the CIP to collect the clinical needs.They have highly contacts and trusts between local mental firms and local government, and have full information about their technology base and development.From the theoretical theories, we know knowledge is asymmetries, and the process of knowledge creation requires a larger variety of knowledge sources and inputs, and needs a dynamic interplay and transformation between tacit and codified forms of knowledge within and between diverse organisations (Kallio et al., 2009[7];Keeble and Wilkinson, 1999[8]; Tödtling and Trippl, 2005[9];Vedovello, 1997[10]; Viljamaa, 2007[11]). Most of MIRDC's researchers are coming from the National Cheng Kung University (NCKU) or other National Universities; and they also can connect the knowledge infrastructures. Therefore,MIRDC plays the key role in dealing the knowledge transmission.

In the operation of innovation platform, they use the social network to construct the relationship with hospitals such as NCKU Hospital, Kaohsiung Medical University Chung-Ho Memorial Hospital (KMUH) and E-Da Hospital to get the right information from final product users, and to cooperate with them to develop the native MD products.Not only the social network they need to have, but also the capacity of R&D, transferring and diffusing different type of knowledge to evaluate what the feasible direction to develop MD products and technologies is, and whether the proposals is workable and deserving to invest. Therefore, choosing proper local research as the gatekeeper is a critical factor to fill in the breaks within structure hole and to guarantee the success of the innovation platform.

Planning Office has dense connection with final product user such as Hospital and Medical Centre to understand and make sure the firm's future market.Final consumer is the important driving sources to understand customer's needs and foster innovation (von Hippel, 1998[12]). Moreover, hospital is also the main purchasing group for MD products. However, both of them are very close and not easy to access especially for the TI firms. In addition, substitute products emerge faster (Fennelly and Cormican, 2006[13]). CIP provides the channel to gather and discuss the information from doctors in hospital and medical center. This strategy makes firms having confidence to enter KSP to develop and produce their products.

Based on the discussion above, we know Taiwan has fought very hard to gain market access to the world through its capacity in OEM/ODM productionin the past; such as the steel and metal products in the traditional sector and electronics and IT products in the high-tech sector (Amsten and Chu, 2003). It has also learned through sweaty practice that marketing and branding are even harder than manufacturing. Yet, the MD industry of Taiwan is still in the emerging stage, not even a major OEM/ODM manufacturer in the global market. With the much stricter regulations on MD products, without a brand name that is familiar to the hospital or major end users, the gap between manufacturing and selling could be very wide. Therefore, the most important task of the science parks is to provide an innovation environment such as a "public space" to integrate diverse resources, to break different boundaries, and reduce the waste of the transaction cost, negative externalities and risk of failure in the structure hole in which who is the gatekeeper also plays an important pole in the success of innovation environment.

7. Concluding Remarks

The science park builders and researchers have been continuously trying to make sure that the prosperity is not reserved within the park alone. Much of the effort in the construction and

[7]Kallio, A., Harmaakorpi, V., and Pihkala, T. (2010) Absorptive Capacity and Social Capitalin Regional Innovation Systems: The Caseof the Lahti Region in Finland, *Urban Studies*, 47 (2): 303-319.
[8]Keeble, D. and Wilkinson, F. (1999) Collective learning and knowledge development in theevolution of regional clusters of high technology SMEs in Europe, *Regional Studies*, 133(4):295-303.
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[10]Vedovello, C. (1997) Science parks and university–industry interaction: geographical proximityamong agents as a driving force, *Technovation*, 17(9):491–502.
[11]Viljamaa, K. (2007) Technological and Cultural Challenges in Local Innovation SupportActivities—Emerging Knowledge Interactions in Charlotte's Motor Sport Cluster, *European Planning Studies*, 15 (9): 1215-1232.
[12]VonHippel, E. (1988) *The Sources of Innovation*, New York: Oxford University Press.
[13]Fennelly, D. and Cormican, K. (2006) Value chain migration from production to product centred operations: An analysis of the Irish medicaldevice industry, *Technnovation*, 26(1), pp 86-94.

development of the TSP has been paid to the local concerns, although many industry-academic collaboration programs have been created and transplanted to many places in the world or even adapted to suit local situations. Yet, how to realise the potential of the innovations generated from these programs in the market place terms is still much waited.We think that science parks in Taiwan should not only provide lands, hard infrastructures and one step services, it still could play a strategic role in the formation of innovation environment and the innovative performance of firms by supporting, stimulating, and increasing the number of channels through which knowledge develops at a local or global level.

By studying the regional innovation network of STSPA, the case of the innovation platform for the medical device industry at the KSP has been described in this paper, and may be attributed as a collective wisdom simultaneously evolved among the STSPA, the MIRDC, the local industrial communities and the regional HEIs may shed a light on the development of the concerned principles and good practice. Therefore, science parks administration and research institute in Taiwan could be a “gatekeeper” within the regional innovation network for the formation process of collective learning system, and innovation platform could be a possible model to promote industry upgrading with innovation and to create the good environment for the formation of flagship firms.