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The Role of Geographical Proximity in the Establishment and Development of Science Parks

PARALLEL 2
Factors of location in city-STP Relationships

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The Role of Geographical Proximity in the Establishment and Development of Science Parks

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Abstract: The paper examines the role of geographical proximity in the creation and development of the Cuiping Science Park, China. The research work consists of a literature review of science parks and an analytical framework for spatial proximity in the development of science parks. The qualitative analysis is based on 15 in-depth interviews with 13 managers (directors) from tenant firms and 2 officers from suburban government. The result from qualitative empirical data shows that in comparison to geographical proximity, government policy has an irreplaceably dominant role in appealing new firms to the park during its establishing process. In the development process, the existing spatial proximity in the Cuiping Science has resulted in desirable linkages between different actors to a limited extent.

1. Introduction

"Innovation distinguishes between a leader and a follower", Steven Jobs said. Although technology might be gradually available to everyone by crossing borders, oceans and continents, they are created and initially transferred in certain geographical locations due to a number of reasons such as an endowment of human capital, prepared infrastructure facilities and a well-designed institutional setting[2] . With increasing attentions on the specific regions with high technology capacity, the prosperity of science parks such as Silicon Valley and Route 128 has become the interests to a number of researchers and policy makers all over the world.

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[2] Kemeny, T. (2011) Are technology gaps growing or shrinking in the age of globalization? Journal of Economic Geography, 11: 1¨C35.

The term – "science parks" is common and popular worldwide. However, alternative terms such as technology parks and research parks are also in use[3]. In addition, a variety of definitions of science parks have been suggested by different authors and organizations. For instance, focusing on universities, the United Kingdom (UK) Science Park Association suggests that within a science park, the formal operational relationships with a university can stimulate the formation and growth of knowledge-intensive firms. In addition, science parks can facilitate technology transfer and business awareness. From a governmental perspective, Lai and Shyu argue that the science park, with considerable resources devoted to it by government, provides *"a technical, logical, administrative, and financial infrastructure to help young enterprises gain a toehold for their products in an increasingly competitive market"*[4]. In line with these definitions from different perspectives, the topics of existing literatures on science parks are also diversified, ranging from industrial cluster to regional economic development.

Given the success of some science parks in the West, many emerging countries' governments, particularly those of Asian countries, are keen to replicate the success of Silicon Valley and invest huge amount of money in the establishment of science parks and in enhancing technological capability at country level[5]. As one of these, the Chinese government also makes great efforts to be competitive in this realm. However, since the achievement of Silicon Valley is understood as an outcome of innovative ambition and entrepreneurial spirit instead of pre-established infrastructure facilities, it is nebulous to address whether the proximity of firms to universities in the science parks driven by policy incentives can directly result in technological synergy and generate sustainable growth.

Due to a limited amount of attention on the role of spatial proximity in attracting new firms to the Science Parks in China, this paper aims to explore, from firm's perspective, the nature and extent of physical proximity in the birth and growth of the Cuiping Science Park (CSP) of Jiangning District in the Nanjing, China. This broad research objective is broken down into the two specific questions: (1) what is the nature of spatial proximity in the establishment of CSP? (2) To what extent the reduced geographical distance can result in formal and informal cooperation between universities & industries and between firms?

2. Literature Review

Before bringing an analytical framework for the research topic, a literature review of science parks is given for a fundamental understanding in terms of the emergence of science parks, the rationale behind the popularity of science parks and the recent empirical findings. Later, this paper attempts to envisage an analytical framework for evaluating the role of geographical proximity of science parks. This framework consists with four parts: (a)"an innovative milieu"; (b) cost advantages; (c) a favorable institutional/social capital environment; (d) a thick local labor market.

From a conventional viewpoint, universities play a vital role in society as producers of knowledge through research and teaching. However, in recent times, debate on the University –industry (U-I) linkages is also emerging[6]. U-I linkages are often established through cooperation in human resource development, joint research programs, consultancy, meetings and conferences, etc.[7]. In this linkage process, universities are increasingly promoted in terms of a "third mission": to directly commercialize theoretical science and basic research activities with a view to the operation and production of

[3] Appold, S. J. (2004). Research parks and the location of industrial research laboratories: an analysis of the effectiveness of a policy intervention. Research Policy, 33, 225-243.

[4] Lai, H. C. & Shyu, J. Z. 2005. A comparison of innovation capacity at science parks across the Taiwan Strait: the case of Zhangjiang High-Tech Park and Hsinchu Science-based Industrial Park. Technovation, 25, 805-813.

[5] Koh, F. C. et al.. 2005. An analytical framework for science parks and technology districts with an application to Singapore. Journal of Business Venturing, 20, 217-239.

[6] Leydesdorff, L. 2004. The university–industry knowledge relationship: Analyzing patents and the science base of technologies. Journal of the American Society for Information Science and Technology, 55, 991-1001.

[7] D'este, P. & Patel, P. 2007. University-industry linkages in the UK: What are the factors underlying the variety of interactions with industry? Research Policy, 36, 1295-1313.

industry, and further to market[8]. Different mechanisms can encourage and reinforce the U-I linkages. In particular, science parks, initiated at Stanford University where in 1951 research and development (R&D) outcomes were first transmitted directly from the university laboratory to the market, have received special attention[9].

Parallel with the science parks blooming, a considerable amount of literature has fruitfully analyzed the popularity of science parks; however, the productivity of science parks has recently been challenged in different regions and from diversified viewpoints. According to Felsensten, the rationale behind the growing establishment of science parks is due to two commitments[10]. The first commitment of science parks is to be seedbeds or enclaves of innovation, and to develop new and small-size high-tech firms, encouraging the transfer of university research to industry as well as promoting innovative products & processes. The second commitment views science parks as having more than an instrumental role in innovation and entrepreneurialism, and also as a catalyst for urban and regional economic growth. Being similar to the two objectives above, most of the studies on science parks concentrate on two broad areas: the institutional perspective and the economic geography perspective[11].

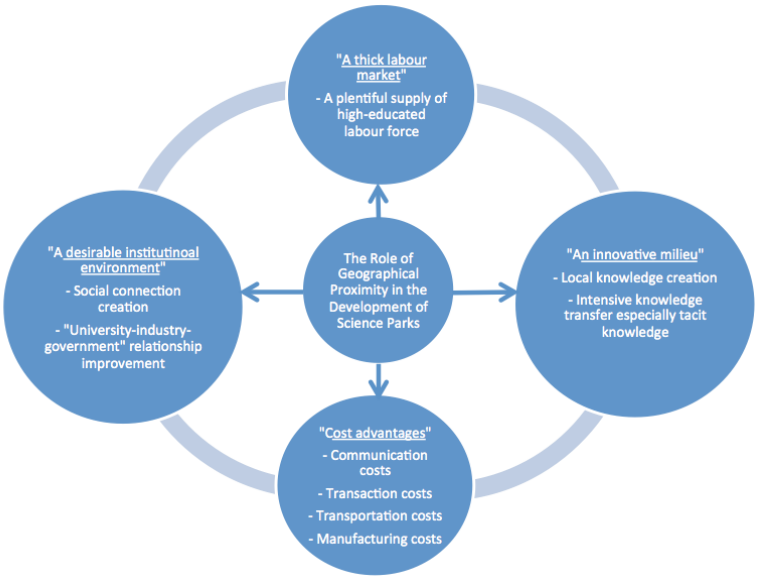
From the institutional perspective, there is one debate about the key action of resource mobility in attracting and ensuring employment growth[12]. Utilizing country-level data in the US for the period between 1960 and 1985, Appold argues that it is the number of laboratories and firms located near the science park rather than the talented people distributed throughout the area that determines the ability to mobilize resources on-site and additionally to influence the success of a science park[13]. In contrast, on the basis of knowledge/technology spillover theory and social capital theory, Filatochev et al. find that there is a significantly positive association between the population of returnees and the degree of their professional skills and innovation within science parks[14]. In addition, they demonstrate that, rather than the distribution of multinational companies, human mobility, especially the elite group moving from developed countries to emerging countries, has played a central role in the global economy.

From the economic geography standpoint, which occurs first –science parks or an established local economic and technology development environment –is a controversial question, since this decisively influences the effectiveness of the econometric model in assessing a science park[15]. Athreyeargues that in the Cambridge (US) high-tech clusters, the rise in the employment rate can be explained by the increasing number of new firms established[16]. As for the condition of the city of Cambridge, there is only a weak linkage with local firms, and the direct instrumental role of university knowledge spillover is also small. As a counter example of Cambridge case, Hu suggests that, in China, the strong industrial base, solid infrastructure and plentiful supply of technological resources are the three pre-conditions for science parks being established[17]. Therefore, this makes the causal relationship between the performance of science parks and local economic development even more ambiguous. Compared with the other two authors, Appold appears to put forward a relatively fair opinion that there are

[8] Chen, S. & Choi, C. J. 2004. Creating a knowledge-based city: the example of Hsinchu Science Park. Journal of Knowledge Management, 8, 73-82.
[9] Smith, H. L. 2007. Universities, innovation, and territorial development: a review of the evidence. *Environment and Planning C: Government & Policy,* 25**,** 98-114.
[10] Felsenstein, D. 1994. University-related science parks--[] seedbeds' or [] enclaves' of innovation? Technovation, 14, 93-110.
[11] Koh, F. C. et al.. 2005. An analytical framework for science parks and technology districts with an application to Singapore. Journal of Business Venturing, 20, 217-239.
[12] Molotch, H. & Logan, J. 1987. Urban fortunes: The political economy of place. Berkeley: University of California Press.
[13] Appold, S. J. 2004. Research parks and the location of industrial research laboratories: an analysis of the effectiveness of a policy intervention. Research Policy, 33, 225-243.
[14] Filatotchev, I., et al..2011. Knowledge spillovers through human mobility across national borders: Evidence from Zhongguancun Science Park in China. Research Policy.
[15] Appold, S. J. 2004. Research parks and the location of industrial research laboratories: an analysis of the effectiveness of a policy intervention. Research Policy, 33, 225-243.
[16] Athreye, S. 2000. Agglomeration and growth: a study of the Cambridge hi-tech cluster. Open Discussion Papers in Economics.
[17] Hu, A. G. (2007). Technology parks and regional economic growth in China. *Research Policy, 36*(1), 76-87.

unmeasured factors which may affect outcomes and the measurement of these activities appears to be biased and unreliable[18].

As discussed in the previous section, science parks have become one of the main mechanisms of the U-I linkage; at the same time, researchers have shown increased interests in the role of geographical proximity. The fundamental rationale behind the importance of geographical proximity initiates from Marshall[19], who puts forward that knowledge spillover, the existence of down-stream and up-stream linkages and the advantage of a thick labor market decisively drive the creation and development of industrial clustering[20]. In Michael Porter's seminal article, he defines a cluster as "*a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities*"[21]. To understand why spatial proximity is conceived as a pre-condition for attracting new, small and high-technology firms to the science parks, it is necessary to explore the different explanations behind the importance of geographical proximity in the context of science parks. This analytical focus on geographical proximity does necessarily adopt neither the institutional perspective nor the economic geography perspective. Rather, through a wide-angle lens, it may be possible to discover the truth behind geographical proximity in the formation and development of science parks. Figure 1 presents such a theoretical framework to analyze the role of physical proximity from four independent but not mutually exclusive directions, though with a number of challenges and questions.



Source: Compiled by the author

Firstly, and most importantly, the agglomeration of academic scientists, engineers and entrepreneurs can create "an innovative milieu" and promotes the synergy not only "between university and technology firms" but also "developed among firms"[22]. As an expected result, local knowledge creation and intensive knowledge transfer in the process of similar and related economic activities are achieved and improve. In the science park context, it is argued that the required knowledge in high-tech or innovative firms tends to be tacit-complex- and systematic-specific; therefore face-to-face communications and inter-personal contacts between individuals can significantly facilitate the

[18] Appold, S. J. 2004. Research parks and the location of industrial research laboratories: an analysis of the effectiveness of a policy intervention. Research Policy, 33, 225-243.
[19] Marshall, A. 1920. Principles of Economics (1920: 1890) English Language Book Society. London.
[20] Hu, A. G. (2007). Technology parks and regional economic growth in China. *Research Policy, 36*(1), 76-87.
[21] Porter, M. E. 1998. Clusters and Competition: New Agendas for Companies, Governments, and Institutions, on Competition, Boston, MA., Harvard Business School Press.
[22] Chan, K. & Lau, T. 2005. Assessing technology incubator programs in the science park: the good, the bad and the ugly. Technovation, 25, 1215-1228.

diffusion and transmission of knowledge[23]. Although Antonelli[24] and Roberts[25] argue that globalization has benefited the transmission of knowledge and reduced the importance of geographical proximity, other studies argue strongly against this. For example, Saviotti[26], who models a negative correlation between the degree of knowledge codification and the distance from the technological frontier, argues that highly-codified knowledge can be better transmitted over a short distance. Furthermore, Leamer and Storperalso show that, with rapid economic development, the connections required by the economy increasingly depend on "handshake" interactions rather than mere "conversational" interactions that can be achieved via the Internet[27]. Empirically, although it is argued that international connections and agglomeration effects are equally important in leading science parks such as Silicon Valley, for many other science parks, including the pioneering Cambridge Science Park, the localized knowledge spillover has a more decisive role[28].

If the first benefit of geographical proximity is related to knowledge per se, including its formation and diffusion among different firms and academic institutions, the second is ascribed to the cost advantage which is associated with proximity to innovative milieu. Scott suggests that an increased agglomeration of innovative firms within a specific geographical location can mitigate the costs of communications and transactions[29]. Furthermore, geographical proximity can provide cost advantages to industries of being close to academic institutions. However, Smith criticizes this view because it ignores the evidence that innovative firms are not confined to establish linkages with spatial limitation[30]. On the other hand, it is argued by Lauren et al. find that high R&D intensive firms do not consider geographical distance in their decision to collaborate with university or not[31]. The other explanation of this cost advantage can be related to a supportive environment in the vicinity including the closeness to a thick high-skilled labour market and production China[32]. This argument can be applied to the evidences in the Hsinchu Science Park of Taiwan and Zhongguancun Science Park of China in which two parks the geographical proximity of science park to city promotes the backward and forward linkage of the firms within and nearby the science parks[33].

The third advantage of geographical proximity in the story of science parks is that it can enhance the local institutional environment. Recently, more and more attention has been paid to the embeddedness of institutions in on-going social and economic activities. Institutions, according to Felsenstein[34], "*are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction*". Coleman puts forward that the local institutional environment is not only a matter of the formal legal framework, but also includes the concept of "social capital" which implies the characteristics of the relationships among actors rather than the actors themselves[35]. Regarding the relationship between geographical proximity and social capital, the earliest and most convincing empirical investigation comes from Festinger and Back[36]. They find clear

[23] Smith, H. L. 2007. Universities, innovation, and territorial development: a review of the evidence. Environment and Planning C: Government & Policy, 25, 98-114.
[24] Antonelli, C. 1999. The evolution of the industrial organisation of the production of knowledge. Cambridge Journal of Economics, 23, 243-260.
[25] Roberts, J. 2000. From know-how to show-how? Questioning the role of information and communication technologies in knowledge transfer. Technology Analysis & Strategic Management, 12, 429-443.
[26] Saviotti, P. P. 1998. On the dynamics of appropriability, of tacit and of codified knowledge. Research Policy, 26, 843-856.
[27] Leamer, E. E. & Storper, M. 2001. The economic geography of the internet age. National Bureau of Economic Research.
[28] Koh, F. C. et al.. 2005. An analytical framework for science parks and technology districts with an application to Singapore. Journal of Business Venturing, 20, 217-239.
[29] Scott, W. R. 1987. The adolescence of institutional theory. Administrative Science Quarterly, 493-511.
[30] Smith, H. L. 2007. Universities, innovation, and territorial development: a review of the evidence. Environment and Planning C: Government & Policy, 25, 98-114.
[31] Laursen, K., Reichstein, T. & SALTER, A. 2011. Exploring the Effect of Geographical Proximity and University Quality on University–Industry Collaboration in the United Kingdom. Regional studies, 45, 507-523.
[32] Chen, S. & Choi, C. J. 2004. Creating a knowledge-based city: the example of Hsinchu Science Park. Journal of Knowledge Management, 8, 73-82.
[33] Tan, J. 2006. Growth of industry clusters and innovation: Lessons from Beijing Zhongguancun Science Park. Journal of Business Venturing, 21, 827-850.
[34] Felsenstein, D. 1994. University-related science parks--seedbeds or enclaves of innovation? Technovation, 14, 93-110.
[35] Coleman, J. S. 1987. Norms as social capital. Economic imperialism: The economic approach applied outside the field of economics, 133-55.
[36] Festinger, L. S. & Back, K. W. 1950. Social Pressures in Informal Groups: A Study of Human Factors in Housing. New York: Harper.

evidence that physical distance decisively influences social connections. Since the university-industry-government relations becomes progressively fatal in the institutional environment and innovation process, there is a reason to believe that geographical proximity can favour the social capital environment and the further upgrading of institutional capacity building. Nevertheless, this is not the whole story: a counter-example can be seen in Hsinchu – a science park where most formal and informal relationships are built with the United States and without considerations of distance[37].

Last but not least, the proximity of firms to universities is expected to make a great contribution to the supply of a highly-educated labor force. Nonetheless, this advantage has been questioned by several studies. On the one hand, it is difficult to assess the direct increase in employment transfer from universities to industries within science parks in developed countries[38]. On the other hand, it is evident that returnees from universities overseas are playing an outstanding role when employed by innovative firms in developing countries such as Taiwan, India and China[39].

As mentioned at the beginning of this section, these benefits are not mutually exclusive but interdependent. Hence, we can conclude that science parks can take advantage of geographical proximity in the following ways : (a)"an innovative milieu"; (b) cost advantages; (c) a favorable institutional/social capital environment; (d) a thick local labor market. Even though Boschma[40] proposes that "*geographical proximity per se is neither a necessary nor a sufficient condition for learning to take place*", we should not neglect the contribution of decreased physical distance to the science park as a ground for knowledge and technology-intensive players.

3. A case study of Cuiping Science Park (CSP)

Cuiping Science Park is located in the Jiangning District in the city of Nanjing, which is the capital city of Jiangsu Province in the development area of East China. Due to the infrastructure facilities and transportation system, the commuting time between Nanjing and other developed region such as Shanghai as well as Su-Xi-Chang metropolitan area can be achieved in two hours. There are 42 high-technology firms in the CSP (Nanjing Entrepreneurship Talents "321" Plan Repot, 2011). Since only at a qualified technology (innovative) level can firms establish in the CSP, the criteria of selecting companies are the accessibility and availability to the respondents. The qualitative analysis is based on 15 in-depth interviews with 13 managers (directors) from tenant firms and two officers from suburban government (Appendix 1).Recording and manual notes were taken through all the interviews given the approve of interviewees..

Interestingly, it seems that there is a hierarchy in the science park conceptualizations given by all respondents from the sample companies. Figure 1 illustrates this hierarchy.

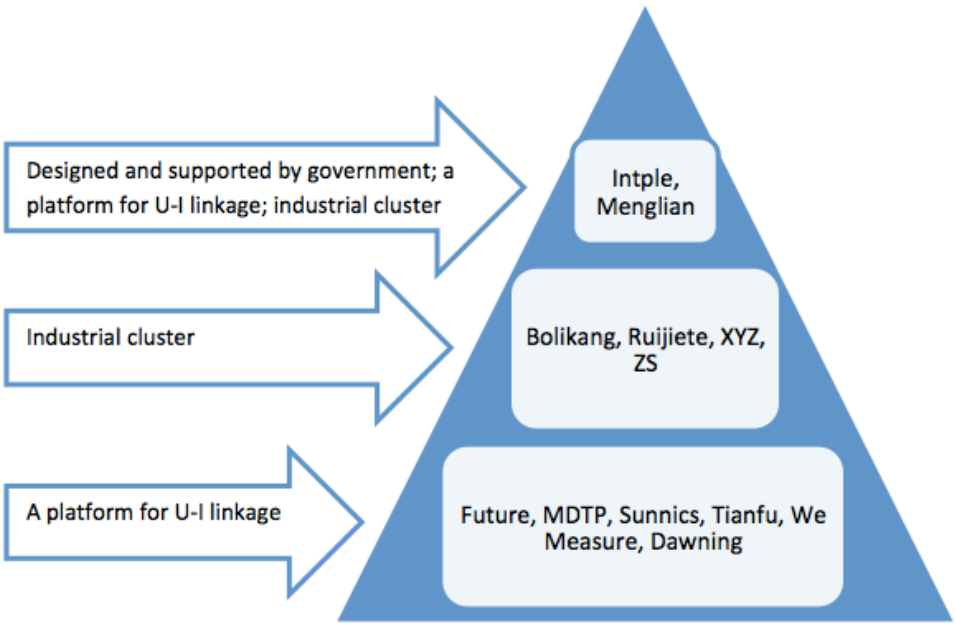
Figure 1: A hierarchy of science parks conceptualization

[37]Chen, S. & Choi, C. J. 2004. Creating a knowledge-based city: the example of Hsinchu Science Park. Journal of Knowledge Management, 8, 73-82.

[38]Storey, D. J. & Tether, B. S. 1998. Public policy measures to support new technology-based firms in the European Union. Research Policy, 26, 1037-1057.

[39]Saxenian, A. L. 2005. From brain drain to brain circulation: Transnational communities and regional upgrading in India and China. Studies in Comparative International Development (SCID), 40, 35-61.

[40]Boschma, R. 2005. Proximity and innovation: a critical assessment. Regional studies, 39, 61-74.



Although there is no agreement on an universal definition of the science park, evidence from the CSP shows that entrepreneurs with overseas experience have a more complete and intensive understanding of this in comparison with other interviewees. Moreover, most of the firms can basically discover the importance of university-industry linkage in the science park rather than solely considering it as an industrial cluster. As for the role of geographical proximity in the science park conceptualization, all of the firms believe that the nature of this is the consequence of governmental behavior. In other words, that government support and public policy is the only force behind the creation of spatial proximity.

The evidence shows that the role of spatial proximity among firms within Cuiping Science Park is acknowledged by most of the respondents, although the effects and results are in some question. Several interviewers from small-size innovative-firms complained that after establishing these firms, they expected the local government can further guide them to build business collaboration with neighbor firms; without the introduction and assistance of government, they even do not know the name of each other company. However, Michelle Zhang, a local government officer defended that

"There is an existing exhibition including the information about tenants firms and supporting policies on the ground floor in the biggest building of CSP. The government has already built a prestigious environment and attracted a large number of innovative firms for the growth of CSP. But we know little about the professional knowledge and industrial characteristics, it should not be government's responsibility to monitor and support a firm from birth to mature step by step."

It is apparent that although this geographical proximity cannot directly result in formal collaboration among firms, almost all of the interviewees pay great attention to potential informal networking. Since most of the firms within the park are small and in their infancy, they do not behave very actively in organizing events but overwhelming depend on the government.

On the other hand, from the academia-industry linkage perspective, CSP is surrounded by 15 universities, which are at different research level. However, result of this paper shows that for these high-technology firms, spatial proximity is not taken as an important factor in choosing universities to cooperate with. It is strongly argued that the top universities and research institutions at the country level, such as Tsinghua University and the Chinese Academy of Science are the first choice for R&D cooperation (Bolikang; Dawning; Future; Ruijiete; Tiantu; XYZ; ZS). With regard to the universities

around CSP, companies only cooperate with an extremely limited number of the leading universities among these, such as South East University and Nanjing University of Aeronautics and Astronautics. The rest of the local universities are not on their option lists, although from the geographical perspective they have great advantages for establishing collaboration with these firms.

CSP has a radically different history compared to the pioneer science parks and old-established Chinese science parks such as Silicon Valley and Zhongguancun. According to Saxenian[41] the origins of Silicon Valley can be tracked to the year of 1937, when two students of Stanford University established Hewlett-Packard Company (HP) under the guidance of a professor at Stanford. It can be said that Stanford's tradition and reputation for academic excellence, scientific innovation and research environment already created "a culture of great independence and exchange among individuals in the Silicon Valley region"[42]. As for the first science park in China, Zhongguancun Science Park was established in May, 1988. However, since the 1950s, Zhongguancun had been nominated as an educational and scientific research district. Compared to the two parks, the geographical proximity of individual university and high-technology firm in Cuiping tends to be instantly created by local government. Therefore, it is not geographical proximity, but the special policy and service awareness of local government that are regarded as the attraction to tenant firms. From this perspective, the suburban government of Jiangning district endeavours to be a magnet for high educated and rich experienced talents to establish firms in Jiangning. In contrast with Silicon Valley and Zhongguancun in which parks the nature of geographical proximity is path-dependence, this study concludes that the nature of spatial proximity of Cuiping Science Park is government-led. Notwithstanding, the nature of geographical proximity is the characteristic in science parks not only in China, but also in Singapore; empirical evidence shows that the favourable infrastructure and support service offered by government is the top-ranking reason cited by tenant companies for locating in the Science Park, rather than "links with suppliers and industries"[43].

Undoubtedly, if one of the motivations for establishing science parks is to set up a physical environment with short distance between universities & industries and among firms[44]; the government-led spatial proximity in the Cuiping Science Park has achieved it. However, applied the empirical evidence to the analytical framework, this paper has found that the role of geographical proximity in the growth of tenant firms and development of Cuiping Science Park is relatively nebulous. From the perspective of "an innovative milieu", result shows that the decreased distance between actors within Cuiping Science Park does not seem to promote the creation and spillover of knowledge, as most of the high-technology firms absorb knowledge from only a small number of leading universities and research institutions within the entire country even across national border. On the one hand, the finding illustrates that in China, universities and research institutions are still lack of the cutting-edge knowledge. On the other hand, this result contradicts the principle –"intellectual breakthroughs must cross hallways and streets more easily than oceans and continents"[45]. From the viewpoint of cost advantages, I have found that the agglomeration of innovative firms fails to bring a decreased communication and transaction cost since the formal collaboration is limited within the CSP. This is consistent with the argument from Quintas et al.[46] who claim that the contribution of many science parks can be only restricted to provide luxury real estate with few synergies generated from industries and universities. However, result indicates that the CSP, like Hsinchu Science Park, appears to access to cheap production cost including raw material cost and labour cost because of the close distance to developed region such as Nanjing and Shanghai as a whole[47]. In terms of social capital, this study suggests the geographical proximity within Cuiping can directly result in the informal network among firms although there is more space for firms to enhance this network. This finding is in line with the

[41] Saxenian, A. L. 1996. Regional advantage: Culture and competition in Silicon Valley and Route 128, Harvard Univ Pr.
[42] Audretsch, D. B. & FELDMAN, M. P. 2004. Knowledge spillovers and the geography of innovation. Handbook of regional and urban economics, 4, 2713-2739.
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[44] Matthias, P. 1986. Report on the Working Party on the Private Sector Funding of Scientific Research. Advisory Board for the Research Councils.
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[46] Quintas, P., et al. 1992. Academic-industry links and innovation: questioning the science park model. Technovation, 12, 161-175.
[47] Saxenian, A. L. 2002. Transnational communities and the evolution of global production networks: the cases of Taiwan, China and India. Industry and Innovation, 9, 183-202.

argument from Boschma interprets that since social interaction and trust establishment can be encouraged by short physical distance, "geographical proximity is most likely to stimulate social proximity"[48]. Finally, with plentiful supply of high-educated people in its vicinity, CSP becomes more attractive to the tenant firms in their establishing process. Nonetheless, this study shows the geographical proximity between Cuiping Science Park and a thick labour market does not result in a convenient recruitment because there is a mismatch between supply and demand of labour force. This finding confirms that human capital has become increasing mobile and not restricted to particular geographical areas[49]. However, this result does not support the previous studies that the geographical proximity of science parks can stimulate the agglomerating of high-educated labour[50].

4. Discussions and Conclusions

The most obvious finding to emerge from this study is that the rationale of geographical proximity from the perspective of Marshall's industrial cluster is not applied in the context of CSP. In the process of location selecting, tenant firms are attracted to CSP mainly due to pecuniary benefit offered by government in the form of rental and tax subsidies, as well as land support. However, after the formation of CSP as a physical agglomeration of a number of high-technology firms, this geographical proximity only contributed a little in promoting knowledge transfer, business collaboration and high-skilled labour force gathering.

The second major finding is that the contribution of suburban government in appealing and supporting high-technology firms to science parks is like a double-edge sword. On one point of view, to create an innovation and entrepreneurship environment, Jiangning district government takes a proactive stance in attracting high-skilled talents and high-technology firms to CSP from the nationwide even worldwide. The performance of government in the establishment of CSP has been acknowledged by the tenant firms. On the other point of view, the strong support to companies in their formation process results in a severe unhelpful dependence of firms on government. Hence, in the company development process, the absence of government instruction hugely impedes the advantage of geographical proximity that Jiangning district government expected when they established CSP.

Thirdly, the result indicates it is controversial that a concentrated, or alternatively a diverse but complementary industry (industries) should be pursed in the CSP. At some extent, the current mix industrial structure might lead inefficiency in terms of taking advantages from geographical proximity. From the perspective of firms, especially those small-size companies, they appreciate the importance of geographical proximity and consider the firms in the same industry within CSP as their potential partners. From the stance of government, various industries can be complementary to each other and meanwhile decrease the requirement of application for potential firms. Clearly, the co-existence of concentrated "Cloud computing" firms and firms from other individual industries failed to meet the expectations of both industry and government; the role of single industry firm is limited to be a land tenant in CSP.

As the example of CSP shows, government policy can play an unequivocal role in establishing science parks, appealing high-technology firms to science parks and further creating a geographical proximity in science parks. However, the supportive policy environment indirectly results in an over-dependence of firms on governments, so that the firms ascribe the responsibility of a weak collaboration within parks to government, rather than considering their own problems. Hence, in order for the government-led geographical proximity to bring positive effects on the growth of tenant firms and the development of science parks, there is an urgent need for a fundamental reform. The change should not only utilize the geographical proximity but also make these parks function as the centers of R&D activities. On the one hand, local government is expected to improve their service awareness and be able to response to the problems and requests of tenant companies more efficient. More importantly, government should

[48]Boschma, R. 2005. Proximity and innovation: a critical assessment. Regional studies, 39, 61-74.
[49]Flatotchev et al.. 2011. Knowledge spillovers through human mobility across national borders: Evidence from Zhongguancun Science Park in China. Research Policy.
[50]Audretsch et al. 2004. Knowledge spillovers and the geography of innovation. Handbook of regional and urban economics, 4, 2713-2739.

pay close attention on how to perform as an efficient liaison between universities and firms, as well as among firms in the growth of tenant companies. For example, liaison officers of local government may need to be more proactive in organizing regular informal event which can directly promote the knowledge spillover and indirectly encourage the formal business links between firms. On the other hand, it should be suggested to tenant firms to be self-reliant by taking initiative in communicating with different actors in the science parks and further seeking business collaboration opportunities.

Science parks have a number of roles, not only including to facilitate the development of new, small and high-technology firms, and encourage inter-firm synergies and the synergies between university and industry, but also containing to promote the regional economic development. These objectives are long term so that it is inappropriate to evaluate to what extent they are achieved over a short period of time[51]. Accordingly, the emergence of science parks in China including CSP is a comparatively new phenomenon, so the process may not yet be mature enough for conclusions to be demonstrated. In order to enhance the reliability of the findings and to examine in more depth the role of geographical proximity in the creation and development of science parks in China, further analysis of a long-term development of science parks in the broader regions is needed.

[51] Storey, D. J. & Tether, B. S. 1998. Public policy measures to support new technology-based firms in the European Union. Research Policy, 26, 1037-1057.