

Science Parks' Business Network Furtiveness – why do tenants not co-operate in a science park?

Competitive paper

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Abstract

Various studies propose that companies in science parks seldom cooperate, although the commercial cooperation among companies has been emphasized being one of the main outcomes. Several studies propose that small communities enhance the cooperation between the companies. Inside the communities, the companies can commercially cooperate to develop their suppliers to bring sustainable benefits to their community. Science parks form small communities and, therefore, it was interesting to gain further knowledge why the science parks did not generate business networks between the tenants as companies in small communities are reported to generate. In this multiple case study, I focused on more details why the cooperation did not occur and why the joint development efforts are missed. I interviewed 15 companies in a science park next to Bangkok in Thailand. The companies were selected based on the discussions between the companies, science park organization, and this researcher. The companies' backgrounds varied from being an affiliation of a multinational company located abroad or in Thailand to being located in the science park as a Thai start-up. From those 15 companies, three companies explained having cooperation with other companies in that science park. I found out several categories, why the cooperation did not take place. As many of the companies emphasized the reason being not business related, I further investigated among the companies, how they preferred to be business related. One of the recommendations of this study is to select companies in science parks as follows: (1) have mutual interests being part of the same supply chain, (2) focusing on mutual technologies, (3) developing and employing the same platforms in their product development, or (4) sharing common vision and long-term intent. If the companies in a science park do not have some of these qualities, the science park organization should study how to gain them.

Keywords: Science Parks, Start-ups, Incubation, Business networks

Introduction

The original plan of this study was to explore how from the purchasing perspective companies cooperated in a Thai science park. This approach was selected based on the literature dealing with small communities, as they were referred to cultivate innovations and business networks (Anderson, Park, & Jack, 2007; Markusen, 1996; O'Donnell, Carson, & Gilmore, 2002). Anderson et al. (2007) describe how geographically a small area advances the social interactions inside a firm, between firms, and in a broader social context. They refer to the evolution of a small Scottish town named Aberdeen, which is known nowadays as the 'Oil Capital of Europe'. O'Donnell et al. (2002) find that small companies exchange information relating to their customers' behavior, sharing overload, supplying resources, and assisting each other, although they are in competition. Also, many of the science park literature references discuss the importance of the cooperation in the science parks. Extant studies argue that high-tech firms with similar characteristics and working in the same value chain create strong alliances and completing each other in science parks (Castells, 2014; McAdam, Miller, & McAdam, 2016; Mian, Lamine, & Fayolle, 2016; Triadó-Ivern, Aparicio-Chueca, & Jaría-Chacón, 2015). Some of the IMP literature sources emphasizes the need for a start-up to construct business networks in order to adopt this network on the market needs (Aaboen, Dubois, & Lind, 2013; Aaboen, Laage-Hellman, Lind, Öberg, & Shih, 2016). Small companies do not often have enough resources to realize their ideas, as they do not have capable people, people to know how to export, and many times they also lack capital for investments. In order to overcome these problems, the solution for small companies is to work together with other instances such as other companies, universities, government's offices next to their location. Science parks form small communities usually in a limited geographical area. Similarly, it is argued that companies in science parks are more likely having a relationship with the close universities, but also by other companies in a science park.

Despite the overwhelming amount of literature evidence of the cooperation and benefits of it in small communities, such as in science parks, it turned out soon that this study's matrix of the various connections between this Thai science park's tenants would end up to be practically empty. As a researcher, I started to ponder why this was happening, and if the topic had been discussed profoundly in the previous studies, and what literature I had missed. According to this study, it seemed that the cooperation among the tenants in science parks represented an exception rather than a rule. This view is supported by some scholars as they write that technology firms hardly own any synergies with universities and other tenants in science parks, and are mainly limited to some transaction and social events (Bakouros, Mardas, & Varsakelis, 2002; Massey, Wield, & Wield, 2003; Phillips & Yeung, 2003). Some scholars even continue that geographical proximity is not the driving force for successful entrepreneurship in science parks (Vedovello, 1997). In addition, Salvador et al. (2013) highlight that the tenants in many science parks seldom form any supply chains that help deliver a solution to their customers. This phenomenon of having clear distinguish research results of the benefits of science parks can be called Science Park's Business Network Furtiveness, although this same furtiveness can exist in other small communities (Ruokolainen, 2014). This literature contradiction of the benefits of the science parks for start-ups' cooperation inside the science parks is also observed by other scholars (Bakouros et al., 2002; Phillips & Yeung, 2003)

The reasons for companies' no cooperation in small communities, such in the science parks, are scantily discussed. The extant studies discuss, why the cooperation between the companies

in small societies occurs, but they do not discuss, what the reasons are for cooperation not to occur. This is a real problem as it limits start-ups to access the resources they need for business network adaptations and, thus, for their success (Aaboen et al., 2016). It can be concluded that we need to update our theories and related concepts: a clear research gap has been identified and actually also demonstrated in a real case.

In addition, it can be asked what would be needed to be done to enable the creation of the business networks. The content of the cooperation is also discussed in extant studies, for example, in terms of resources and knowledge sharing (Aaboen et al., 2013, 2016; Anderson et al., 2007; Markusen, 1996), but, what we also miss in extant studies, is the further analysis, what enables the business network cooperation.

This study contributes to the extant pool of the scientific knowledge by bringing more light of the reason, why companies in a science park representing the small community, do not cooperate. This study aims at advancing the discussion of forming the business networks in small communities by interviewing the companies about the reasons for their intent not constructing business networks with other companies in science parks. It is further contributed to the extant pool of knowledge by discussing, what would enable the cooperation and, thus, building networks.

In this qualitative study, we focused on Thai Science Park located next to Bangkok metropolitan area. Thai Science Park is located closely to the many universities and research institutes. The interviews were coded in order to investigate how current theories should be amended for understanding the reasons for this phenomenon. In the next chapter, relevant theories are explored. After that, the company cases are visited, and lessons learned are summarized. In this study, I employed case study methodology. I interviewed totally 15 companies in 2014 and 2015. With a couple of real examples, we gave more flesh on the top of bones to gain a more profound understanding of this phenomenon. Aaboen et al. (2013) also write about the need to further discuss the success the university spin-offs in the geographical dimension.

Literature study

The dimension of the science parks' tenants cooperation can be studied in the light of two studies. (1) Markusen's (1996) focus is on the categorization of the industrial districts. (2) Ruokolainen's (2014) focus is on the classification of purchasing co-operations in small communities. Both studies can help us to gain further understanding of the phenomenon in the question. Markusen(1996) categorizes industrial districts into three classes that are Marshallian Industrial, Hub-and-Spoke, and Satellite Platform districts: (1) Marshallian Industrial District, and especially the Italianate variant of it, emphasizes cooperation between competitors in sharing risk, innovations, and stabilizing markets. Usually, strong industrial associations and governmental organizations exist in such districts, and they provide a shared infrastructure for the industry in the question. Small and locally owned companies, and long-term cooperation with suppliers within the district characterize Marshallian industrial districts. (2) In Hub-and-Spoke district, the trade is dominated by one or several large companies that are surrounded by suppliers. Cooperation between the dominant companies and the suppliers includes long-term contracts and commitments. Hub-and-spoke districts can be differentiated from a Marshallian industrial district by the fact that the hubs do not share innovations with their competitors. (3) Companies have a minimal intra-district trade in satellite platform districts, which comprise externally owned and headquartered companies. It

can be argued that a science park can be classified accordingly depending on the dominating player(s) of that area.

Ruokolainen (2014) divides the community purchasing behavior into four classes based on the companies' vertical, supply chain, and horizontal, e.g. competitors, coordination. This companies integration that can be presented in a 2x2 -matrix. Although the focus of that study is on purchasing, the model can be extent to describe the cooperation of dimensions in a community such as Science Parks. The community purchasing differs from co-operative (Gobbi & Hsuan, 2015) or enterprise purchasing (Keough, 1993) by seldom being centrally and formally coordinated: it is based group tacit knowledge that develops in a community in a long run (Erden, von Krogh, & Nonaka, 2008). Deleuze (1998) describes this kind of cooperation as rhizome cooperation that is not centrally led or without having a control center. The actors of a community do not own a centralized power structure, and they create new connections dynamically.

Purchasing in a community can vary drastically in its various industries. In the same limited area, several variations of the community purchasing can exist. For example, Phuket's tourism industry's community purchasing was well developed with active sharing information and long-term commitments to suppliers without formal agreements (Ruokolainen, 2014). A Marshallian Industrial District includes same elements that are possessed by the advanced purchasing, cooperative purchasing, function in an enterprise (Keough, 1993) or in an advanced community (Ruokolainen, 2014). On the other hand, in Phuket, it also obtains an industry that did not see any benefits from cooperation in purchasing or cooperation generally, as they did not share the same technologies. Ruokolainen's (2014) paper, with the help of the 2x2-matrix, describes how this industry in a community integrates into neither dimensions. The companies of that industry execute their purchasing solely in a community with an arms-length approach to their suppliers. In enterprise purchasing, Keough (1993) calls this mode of purchasing as a factory only or a clerical purchasing. The aim is just to satisfy the need for the material in the production. These phenomena are proposed to be reflected into science parks as they can possess several approaches for cooperation in their limited geographical area.

In order to understand this part of the phenomena further, it was decided to investigate it in a science park. Science parks provide an excited example of the small community with close cooperation with nearby universities, other research institutes and having tenants from various industries. Durão, Sarmiento, Varela, & Maltez (2005, p. 238) report that the science and technology park's (STP) definitions have following common elements:

“Among the definitions presented, there are several common concepts for an STP: (1) they should be sustainable, (2) they should have operational links with universities, R&D centres and/or, other institutions of higher education, (3) they should encourage and support the start-up and incubation of innovative, high-growth and technology-based companies, (4) they should stimulate the transfer of technology and business knowledge, and (5) it is specifically mentioned that they should be property-based initiatives.”

Phillips & Yeung (2003) write that some of the organizations prefer less limited definition for science parks for example by accommodating wholly R&D-oriented organizations. Guy (1996) writes that the objective of science parks is to provide the infrastructure that assists technically, administratively and logistically start-ups to gain a foot-hold in the market. Science parks are artificially created communities, and in many times they are supported by

governmental incentives including subsidies space, tax advantage, entrepreneurship training and closeness to laboratories and their devices.

In a science park, the proximity is proposed to play a central role as in small communities, and small communities are known enhancing innovative behavior (Anderson et al., 2007; Boschma, 2005; Cheng, van Oort, Geertman, & Hooimeijer, 2014; Etzkowitz & Leydesdorff, 2000; Markusen, 1996; Vedovello, 1997). The proximity is a multidimensional element as it can consist of social, cognitive, institutional and geographical proximities (Salvador, Mariotti, & Conicella, 2013). Cantù (2010) proposes that, in addition to the previous proximities, one should also take into account technology and vision proximities. Boschma (2005) discusses that the geographical proximity enhances the development of other proximities. Nicholson, Tsagdis, & Brennan (2013) propose that generative proximation is found to be the most prominent in the region. Ruokolainen (2014) continues that the long-term cooperation enhances community purchasing as it matures social, cognitive and institutional proximities. It can be proposed that non-geographical proximities can be related to group tacit knowledge and maturity level of it in an industrial district (Erden et al., 2008).

The concepts that are related to a science park are Institutional Thickness and Local Embeddedness (Phillips & Yeung, 2003). The elements that are related to Institutional thickness are defined as follows (Amin & Thrift, 1995): (1) strong institutional presence; (2) high-level interaction between the institutions locally; (3) structures for interaction and coalition; (4) mutual awareness. Local Embeddedness consists of wide social relations that are spatially bound by these relations in locational and organizational strategies, for example, realized in the proximity of R&D activities. Based on the literature study on the collaboration in a community following elements discuss the quality of the interaction

Table 1: Overview of the topics discussed in the literature concerning science parks and small communities

Concept	Explanation	Relevance for this study	Source
Marshallian industry district	Dominated by small companies, industrial associations, and intra-district cooperation	Science parks are employed for business incubation of small companies	(Markusen, 1996; Mian et al., 2016)
Hub and Spoke	Dominated by large companies with collaboration with local companies	Some of the tenants of a science park are large enterprises	(Markusen, 1996; Phillips & Yeung, 2003)
Satellite Platform	Minimal intra-district communication of large enterprises	Some of the tenants of a science park are large enterprises	(Markusen, 1996; Phillips & Yeung, 2003)
Community purchasing matrix	Divide the cooperation into the four categories depending which dimensions, horizontally or vertically, cooperation occurs	Classification of the cooperation in science park based on their cooperation mode	(Ruokolainen, 2014)

Community purchasing	Not centrally led and connections created dynamically based on the group tacit knowledge, Rhizome setup	Marshallian like a science park	(Deleuze, 1998; Erden et al., 2008; Ruokolainen, 2014)
Clerical Community Purchasing	No intra-district cooperation among the companies	No cooperation in a science park	(Bakouros et al., 2002; Keough, 1993; Massey et al., 2003; Phillips & Yeung, 2003; Ruokolainen, 2014)
Science Park	State incentive based premises with spatial proximity to accelerate the growth with the support of the research institutes	Definition for science park	(Massey et al., 2003; Phillips & Yeung, 2003)
Geographical Proximity	Refers to spatial or physical distance	Science park's quality	(Boschma, 2005; Salvador et al., 2013)
Social Proximity	Refers to socially embedded relation such as friendship	Science park's quality	(Boschma, 2005; Salvador et al., 2013)
Institutional Proximity	Sharing same rules, cultural habits, etc.	Science park's quality	(Boschma, 2005; Salvador et al., 2013)
Cognitive Proximity	Sharing same knowledge and expertise learn from each other	Science park's quality	(Boschma, 2005)
Organizational Proximity	Refers to extent to which relations are shared in organizational arrangements	Science park's quality	(Boschma, 2005; Salvador et al., 2013)
Technology proximity	Actors are characterized by similar knowledge and equipment.	Science park's quality	(Cantù, 2010)
Vision proximity	Refers to deeper development of long-term relationships influenced by the shared vision and gradual convergence of objectives characterizing by the	Science park's quality	(Cantù, 2010)

	share vision		
Institutional Thickness	Strong institutional presence	Science park's quality	Amin and Thrift (1994)
Local Embeddedness	Wide social relations in the location	Science park's quality	Philips and Yeung (2003)

Markusen's (1996) and Ruokolainen's (2014) studies propose that geographical proximity might or might not ensure the cooperation between companies in geographically limited areas. Science parks can be occupied companies that have from minimal to maximal intra-district horizontal and vertical cooperation with each other or with local universities. Science parks can be dominated by the strong institutional leaders e.g. a university or research institute. In that case, a science park is "owned" by a horizontal i.e. technology or science platform driven player. If the science park is "owned" by large enterprise than the science park can be said to be cluster driven as it is constructed to support existing business of that large enterprise. Institutional proximity may lead to Institutional Thickness that prevents the creation of the new ideas and thoughts other than inherited from geographical close university or institute.

Methodology

In this study, case study research methodology was employed (Eisenhardt, 1989; Yin, 2013). Mainly (Eisenhardt, 1989) "Within the case and across the case" study approach was executed. I interviewed totally 15 companies, and I visited in some of the companies several times 2014 and 2015. I stayed at Thai Science Park's campus first time three weeks, in 2014, meeting the companies, i.e. tenants, and representatives of the science parks. Most of the interviews were conducted in Thai Science Park at the office of that company as recommended by (Wood, 1997) to overcome limitations of the verbal communications. Some of the companies left already Science Park and, therefore, we met the companies in their premises in the Bangkok capital area. In 2015, I revisited at Thai Science Park to hear an update on Thai Science Park development. During the same trip, I met two companies representatives to gain further information on their current entrepreneurial status. The companies were selected to get a mixture of large companies' units, start-ups, Thai and foreign companies based on their availability during the visit.

The interviews were conducted by two persons, myself and the representative of the Thai Science Park. The semistructured interview protocol was employed with the topics that related to company's background, company's cooperations with other companies, universities and institutes inside and outside the science park, preferred and non-preferred partners and recommendations for partnering and any other topics. During the interviews, the secondary material was also collected at the site of that company (Wood, 1997). The observations were discussed daily with representatives of the science park. A briefing event was also arranged at the end of the visits with the Thai Science park management of the initial analyses of interviews.

First, the write-ups from two initial cases were written as it is advised by (Eisenhardt, 1989). These two initial cases helped with the start of the coding of the observations with the rest of 13 companies. The data was further coded based on the notes done during the interviews. In some of the cases, the companies were reinterviewed to clarify further the results of the

earlier interviews. The semi-structured interview protocol was used: some questions were repaired before the meetings, but mostly I let the entrepreneurs tell their stories.

Data

Thai Science Park

Thai Science Park was established 2002 under Minister of Science and Technology. The National Technology and Science Agency Institute was located in the area of Thai Science Park. It consisted of four national research centers namely MTEC, NANOTEC, BIOTEC, and NECTEC. MTEC concentrated on metal and material sciences and NECTEC on the electronic and computing sciences. Thai Science Park offered attractive tax benefits for local and foreign companies that planned to establish their subsidiaries into Thai Science Park. Thai Science Park was located next to Thamassat University, which was one of the major universities in Thailand. Asian Institute of Technology is also located nearby. More than 60 companies were located in Thai Science Park with various backgrounds: being a Thai company, coming overseas and various sizes from start-ups to well-established companies' subsidiaries.

Descriptive data of the sample base

Totally 15 companies from Thai Science Park were interviewed. Table 1 describes the descriptive statistics of interviewed companies. Table 1 shows that there was a mixture of different kinds of companies starting from start-ups to well-established foreign companies.

Table 2: Descriptive data of the companies interviewed

2014/2015	Start-Up	Subsidiary or department	Origin in TSP	Foreign	Thai	Technology area
Comp1		X			X	Cosmetics
Comp2	X				X	Nano
Comp3		X	X		X	Enzymes
Comp4				X		Food
Comp5					X	Rubber
Comp6	X		X			Medical
Comp7	X				X	Mechatro
Comp8	X		X		X	Position
Comp9		X			X	Food
Comp10		X			X	Paper
Comp11		X	X			Mechanics
Comp12		X		X		Rubber
Comp13		X		X		Tooling
Comp14		X		X		Food
Comp15		X		X		Standard.

Case stories

Next, the two company cases' write-ups are introduced. The write-ups describe the history and thoughts of these two entrepreneurs. The phenomena that were observed from these two cases were the starting point to investigate the topic further in the 13 other company cases in Thai Science Park. The coding helped classify the companies based on their descriptive data, their explanations for 'no cooperation reason' and how they preferred to be 'business related' with other companies in Thai Science Park

Company Case Innophene

The company, Innophene, was established in 2011 to investigate the conductive ink, which originally was developed by NSTDA research institute. The conductive ink is based on the use of graphene material, which is a nanoparticle. The company got a large amount of capital injection to start their work on the top of the technology came from NSTDA. In 2011, the company had about eight people. The company owner felt at the time of the first interview that he was strongly supported by Thai Science Park as the initial technology came from there, and the company was able to use NSTDA's facilities in Thai Science Park. However, he felt that his business was not related to any of the other companies in Thai Science Park. He expressed that some other companies should employ the company's conductive ink to develop new innovative products. He also decided to produce some conductive ink products by himself. His approach was similar to the thought having a cluster of companies inside in the park to learn and to jointly develop end products and new ideas. He explained that the big companies from his point of view were too rigid and bureaucratic. He also explained the government organization was inflexible in its budget planning. In 2013, Innophene, as it ran out of the capital, started to minimize its operations. The owner of the company in 2015 told that he had problems with the product itself as some of the formula's components did not exist anymore in the market and they needed to redevelop the formula.

Company Case Flexoresearch

The company, Flexoresearch, was established 2003, and it moved to Thai Science Park 2006 right after it was established. The first product was an enzyme for recycling laminated paper. The enzyme was the first of its kind and rather innovative, and it got plenty of interest also from overseas. The company has several products nowadays including making protein from insects and asphalt mixed with rubber. The company is now active in incubating Thai entrepreneurs, and it has steady incomes from licenses. The owner explained that he got much help from Thai Science Park in the form of education to marketing and book keeping. He explained that the use of the facilities of Thai Science Park including NSTDA's laboratories was a great benefit for starting his business. He explained that in technology wise he was not getting any help, as there was not that kind of knowledge in Thai Science Park that could have helped him. He explained that his company was not business related with any other companies in Thai Science Park. He developed egg trays from recycled paper and tried to offer them to one of the companies working in the food sector in Thai Science Park in 2014. However, in 2015, he worked directly with egg farmers and insect farmers to whom he sells his egg trays.

Coding and categorizing

It was clear that there were many activities ongoing between NSTDA research institute and tenants at various levels. Thai Science Park was also active in supporting the technology start-ups with marketing, book-keeping and searching for finance and educating them. As there were only a very limited number of cooperation cases between the tenants, the focus

was shifted to understand why there were no co-operations. From tenants, it was asked the reasons. The given reasons are coded and classified in Table 3.

Table 3: No cooperation reasons among the tenants in Thai Science Park

No cooperation reason	Ground	Number of answers
No intent	Use all benefits only	1
No interest	No one else has knowledge	1
No, or scarce knowledge of tenants	Not been informed	2
No business case	Need to build business case to maximize the profit	1
Not allowed	Everything controlled by the head office	2
Not in the same wavelength	Large enterprises inflexible	1
No time	Need to mind my own business only	3
Not business related	No direct or short term interest	8

Especially the foreign companies controlled their subsidiaries tightly in Thai Science Park not leaving space to co-operate with local or other companies. Some of the companies were not very well aware of the other companies' activities in Thai Science Park. They were usually surprised about the information on the companies working in the same technology sector as they did. In some of the cases, the large companies focus was only to gain tax and business benefits that Thai Science Park gave to the companies in the park. It might say that these tax-based benefits were the driving force for many of the large companies to join Thai Science Park. Some of the small companies complained about the difficulties to deal with large companies. In several cases, the companies said that are not business related with other tenants. I decided to open further the topic, and I asked what they meant by that. The companies had a various understanding on the meaning of the 'business related'. Table 4 describes the categories that the companies gave.

Table 4: Meaning of business related.

Business-related means	Ground	Source
Sales driven	More sales	Comp3
Product development driven	R&D support	Comp2
Cluster-driven	Customers involved	CompN
Opportunities driven	Creating partnering for future business	Comp9
Explorative driven	Testing new ideas actively and learn	Comp1
High-level commitment and trust driven	Share long term vision	Comp13
Platform driven	New platforms for products	Comp9
Technology driven	Common core technologies	Comp10
Business case driven	Minimize expenses and maximize benefits	Comp4

In the technology driven case, Comp10, a researcher told that she had high hopes with a new tenant especially because both had the same basic component in their products. However, the cooperation never occurred, as they were busy with their current tasks. One of the foreign companies, Comp13, explained that the interest was to create high-level commitment and share a long-term vision with Thai companies and government representatives prior to the cooperation. One of the small companies, Comp1, explained that they were keen on working with other companies to create to test and learn together. However, this did not occur yet. One large Thai company, Comp9, explained that they were ready to study various opportunities with other companies. Actually, this company was one of those rare ones having cooperation with some other tenants in Thai Science Park. Business case driven case the company, Comp4, explained that if they could prove the business benefit, then they could justify the cooperation back to their host company. In sales driven case, the company, Comp3, saw only the opportunity for cooperation via generating further sales. This company owner was pretty straightforward in his cooperation approaches at that time of the first interview. In product driven case, the company, Comp2, was willing to have partners who could have employed his innovation in their products or develop new products with the help of it.

Lesson learnt

Some of the previous studies propose that Japanese electronics companies' subsidiaries tend to have closer relationships with their parents' firms than with local economies (Phillips and Yeung, 2003). This study proposes that not only Japanese companies have that tendency: it can be rather a general feature of large enterprises. Based on the authors' knowledge of large enterprises' R&Ds is that they are tightly controlled R&D processes in time, and budget wise not leaving much space for social or cognitive learnings from other companies. Large enterprises also have a tendency to protect their R&Ds from outsiders. The parent companies that are located in Japan, Europa or the USA may not share the cognitive, institutional or social proximities, although they can have their local representatives from the parent companies. Often, the focus and the interest of the large enterprises, both local and foreign, are on cost savings and gaining the tax benefits proposed by the states. It may so that subsidiaries of the large enterprises do not contribute on the local embeddedness through their R&D knowledge and innovation networks as a subsidiary from the large enterprises'

perspective is just a small cogwheel in their huge gearbox. Philips and Yeung (2003) who talk about non-local linkages of firms' R&D support this view. Accordingly, this phenomenon can be called as Large Enterprises' Non-Local Linkage.

The story for small or start-up companies that were technology based was diverse. Usually, the local embeddedness for these companies existed as the roots were at the local university. The small companies seemed to have good contacts with NSTDA or other institutes nearby. However, the cooperation with other tenants occurred rarely. One of the reasons given was not being on the same wavelength with the large enterprises. It is known that large enterprises tend to cooperate with other large enterprises (Wilkinson, 2005). From the small companies' perspective, large enterprises are bureaucratic, and the start-up can face insolvency while waiting for the decisions for their efforts (Ruokolainen, 2008). This phenomenon can be called 'Missing Wavelength Between SMEs and Large Enterprises'.

However, the small companies seemed not to cooperate with other small companies in this science park. The reason given was that the representatives of small companies did not have time to put effort for learning from their colleagues. It was mentioned there was also no interest as from the technology wise they did not see anything to learn from the others. Markusen(1996) reports that Marshallian industrial districts consisting of small and medium sizes companies have strong cooperation e.g. they share knowledge and have strong industrial associations. It can be speculated now that if the industry has some common elements e.g. they can be focused on food production, tourism or software manufacturing, then they cooperate. However, Ruokolainen (2014) reports, although the software industry serves tourism industry in Phuket, they hardly cooperate due to not employing same technologies. In Singapore, the local science park does not appeal companies with spatial proximity rationale. Actually, none of them choose the science park due to being close to their supplier or industry. Instead, the reasons related more to image and infrastructure rather than cluster rationale (Phillips & Yeung, 2003). Based on these aspects, it is understandable why the small companies might not have a tendency to search for cooperation with other small companies. This phenomenon can be called as 'Small Companies' No Cooperation'.

Many of the companies answered that they were not business related with other companies in Science Park. It can be argued that these small companies deliberately try not to avoid cooperation with other companies, but the content of the cooperation is missing. Table 4 describes the dimensions of the cooperation whether they exist horizontal or vertical spaces. Sales, Product Development, and Cluster-driven elements propose that cooperation preferred to be vertical towards the customer. Platform and technology driven cases propose that the cooperation can be horizontal instead of being a part of the supply change. Platform and technology type of cooperation may also be the element for letting companies change information and resources related to technologies. The previous study proposes that R&D activities need a certain level of synergies among tenants in a science park for cross-fertilisation of ideas and knowledge (Phillips & Yeung, 2003). This potential for synergies either in horizontal or vertical dimensions can be called as 'Potential of Being Business Related'. If the expected synergies exist on the too high level, as in the names of the NSTDA's unit, it does not reach the practical level on which cooperation could occur i.e. Local Embeddedness is missing in practices.

Discussion and Conclusions

This study describes some of the reasons why the cooperation despite the geographical proximity of the companies in Thai Science Park did not occur although that could have led

to the cooperation with each other either vertically, e.g. supply chain wise, or horizontally, e.g. technology wise. The geographical proximity led to cooperation with NSTDA research institute as individual companies. From NSTDA's perspective, there might be less interest to generate co-operation between tenants, although it could leave more focused technology development in the new technologies area. The same core technologies could be used more extensively in various product or product development cases. This study increase more understanding on the phenomenon reported by Ruokolainen (2014) related cooperation in small communities.

This Science Park can be classified to be Hub-and- Spoke type (Markusen, 1996), although the hub, NSTDA, is not the main part of the supply chain delivering commercial products to customers. Small companies were more or less part of Hub-and-Spoke set-up of NSTDA. Large enterprises focused on gaining tax benefits by being part of the science park with more or less with Satellite Platform district approach. They also seemed to miss local embeddedness. To conclude with employing Ruokolainen's (2014) study, some of the large enterprises were neither vertically nor horizontally integrated with other companies in the science park. Small and some of the large companies were integrated with NSTDA horizontally. Companies and NSTDA form several various layers of industrial districts inside of Science Park. The only form that seems not to exist was Marshallian industrial district, or it was not dominant. This study challenges the understanding of industrial districts as several industries can form a complex setup of industries from the 'Markusen's layers in the same geographical area'. This study also proposes that extant theories concerning Science Park could benefit earlier studies on the industrial districts (Markusen, 1996).

One can propose that without the NSTDA's active role in this science park the companies could have learned more from each other than from NSTDA. It would have meant less Institutional Thickness and Institutional Proximity. However, Thai Science Park would have existed hardly without NSTDA. The dominant player in Thai Science Park was NSTDA from which the main economic benefits were gained in terms of the resources i.e. office space, laboratories, researchers and economic advisors. This can be a topic to be studied in the future: does institutional thickness affects negatively with local embeddedness ?

The topic can also be discussed from the perspective of the various proximities (Boschma, 2005; Salvador et al., 2013):

1. The geographical proximity to Thai Science Park is well presented as all the tenants are located on the same campus next to NSTDA, Asian Institute of Technology and Thammasat University.
2. Institutional proximity refers how the companies share the same rules, cultural habits, and values. Although Thai Science Park was governed by a semi-governmental unit, and the companies there were ruled with the same principles, it looks like that the companies did not share the values of the science park: they did not want to pull the same rope together to develop their businesses and the science park community jointly.
3. As many of the companies regarded not being interest in cooperation with each other, the social proximity among the tenants was pretty low, although Thai Science Park arranged various events and activities to let tenants learn to know each other.
4. Cognitive proximity refers to what extent the companies can learn from each other: sharing the same knowledge base and expertise that can learn from each other. It may be that the largest gap was in cognitive proximity.

Companies highlighted in many cases that they were not business related or not even willing to be: mutual cognitive base was pretty shallow. However, social and cognitive proximities may increase in time being as the tenants may learn to know each other better. The cognitive process in small communities can be a topic to investigate further to gain understanding the nature of its formation, for example, in the light of group tacit knowledge (Erden et al., 2008).

In general, this study contributes to extant knowledge by discussing why a science park's companies do not cooperate and how these companies would like to see the cooperation.

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