Synergy management at knowledge locations

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Abstract

Many cities have developed "knowledge locations", special areas for knowledge-based development: science & technology parks, creative factories, science quarters, and a wide range of similar areas. This chapter zooms in on the management of synergy in such locations. Based on observations in five European cities (Aachen, Arhus, Coimbra, Dublin and Eindhoven), four synergy management tools are discussed and illustrated: 1) design for interaction 2) managing the tenant mix, 3) shared facilities and 4) promoting networks and communities. We confront our observations with recent concepts and empirics on firms, location, and innovation.

1. Introduction

This chapter discusses the management of "knowledge locations" in Western Europe. The term "knowledge locations", as we use it in this chapter, refers to designated and planned areas for science, knowledge-based or creative industries.

Relatively established types of knowledge locations – developed since the 1980s in Europe – are science & technology parks: spatial concentrations of scientific research institutes and companies, often at or near the premises of a university. However, over the last decade-and-a-half, knowledge locations increasingly came in new disguises and mutations vis-à-vis the earlier science parks and other "Technopoles" (Castells and Hall, 1994): examples are creative factories, science quarters and other types of knowledge and open-innovation campuses. Many contemporary knowledge locations are being developed around thematic fields beyond high-tech, reflecting the growing recognition that the knowledge economy is not restricted to the technological realm. For example, in many cities one can observe concepts for creative industries in general, or focused on specific branches like media, audiovisual, music, design, fashion etc.

Over the last decades, there have been substantial investments in knowledge locations of various kinds, by universities, (local) governments and the private sector, in different constellations (e.g. IASP, 2010; Evans, 2009). Local governments invest in knowledge locations in the hope to create new jobs, to gain a reputation as "creative" or "knowledge city" and to attract the "creative class" (Florida, 2002). Often, universities and other knowledge institutes are engaged in the development, to link up to business and commercialize their research. Knowledge locations are also seen as cradles of new entrepreneurial activity and economic diversification, both in developed and lagging regions (Carvalho, 2013).

These investments reflect, to a large extent, contemporary expectations, insights and fantasies about the effects of co-location on innovation and economic development. Notwithstanding their different types, knowledge locations hold the common promise to produce *synergy,* defined as the interaction of multiple elements in a system to produce an effect greater than the sum of their individual effects. Examples are the increased efficiency in resource utilisation (e.g. infrastructure, skills and specialized services), the creation of images and reputation and the emergence of new knowledge exchange and innovation networks among a location´s tenants. Yet, many proponents

and managers of knowledge locations also increasingly believe that developing "flashy" buildings and co-locate is not enough for creating synergies: they are increasingly active deploying a number of complementary synergy management tools.

In this chapter we explore in what ways synergy is actively being promoted at knowledge locations. There are many studies on the effect of knowledge locations on their tenant firms´ productivity, innovation and cooperation patterns (see e.g. van Winden et al., 2012, for a review). Some studies hint at the possible positive role of played by active management (e.g. Link and Scott, 2005; Löfsten and Lindelöf, 2002); others have been analysing the effects of a location´s management activities in the development of inter-firm networks (Kocak and Can, 2013). In this paper, we start from a policy and practice perspective and systematically explore and describe what types of tools and interventions are currently developed by management bodies of knowledge locations to steer synergy in place, namely 1) design for interaction 2) managing the tenant mix, 3) shared facilities and 4) promoting networks and communities. Subsequently, we confront our observations with recent concepts and empirics on firms, location, and innovation, more concretely on i) the relevance of other dimensions of "proximity" for innovation; ii) the social and multi-scalar dimensions of innovation and iii) the role of physical design and work environment in interpersonal exchange.

This chapter is based on an analysis of a number of knowledge locations in various European cities. For each case, the authors studied policy documents describing plans, ambitions and achievements of that particular location, visited the site (in different moments of time) and held semi-structured discussions with developers, tenants, managers and policymakers in each area, yielding insights into the strategies, expectations and realities of 'synergy management', from different perspectives. Fieldwork was carried out during late 2008 and early 2012, under the setting of three different research projects[1]. For detailed methodological procedures and interview protocol, please see van Winden et al. (2012) and Carvalho (2013).

The chapter is organised as follows. We start by briefly introducing the cases (Section 2), and discussing a number of synergy management activities and strategies on-going at those sites (Section 3). In Section 4 we confront the policy reality with recent concepts and empirics on firms, location, and innovation. Section 5 contains a synthesis, some conclusions and research challenges.

2. Introducing the cases

We studied synergy management practices in six knowledge locations, located in five different European cities, and functioning in a context of highly developed and knowledge-based economies. The exception is the case of Biocant, located in an innovation-follower region (Coimbra-Cantanhede, Portugal), yet in the proximity of advanced scientific institutions (University of Coimbra). All of them focus on one or more specific knowledge-based industries or technologies. Figure 1 depicts the spatial distribution of the cases under analysis.

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[1] These projects were called "Developing Locations in the Knowledge Economy" (carried out by the European Institute for Comparative Urban Research and commissioned by the participating cities); "EURODITE – Regional Trajectories to the Knowledge Economy" (EU FP6, consortium coordinated by the University of Birmingham) and "REDIS – Restructuring districts into Science Quarters" (URBACT II).
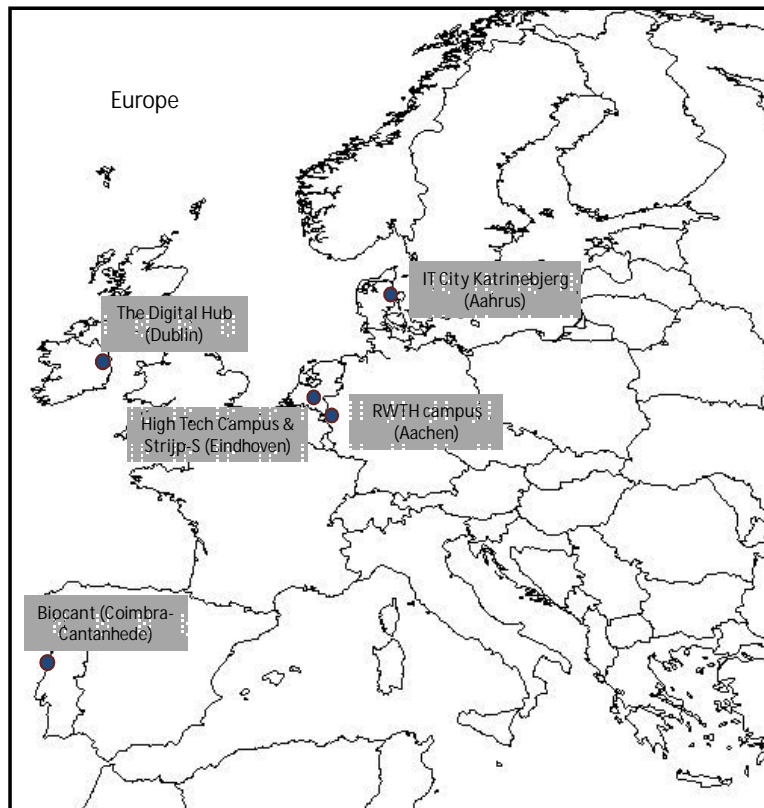
Figure 1. Geographical distribution of the knowledge locations

Source: Own elaboration (map from www.worldatlas.com)

The **RWTH campus** in Aachen is the new campus concept of the University of Technology. The distinguishing feature of the campus (with a total investment of €2 billion) is its concept, based on clustering academic institutes and companies around multi-disciplinary themes (e.g. Eco-friendly sustainable energy, photonics, bio-medical engineering, drive systems, etc). The developers hope to achieve synergies by co-locating business and academic institutes in a "sub-cluster" and nudge them towards co-operation. The sub-clusters are built on academic research strengths (multidisciplinary, with sufficient critical mass). The university created a special vehicle, the RWTH Aachen Campus GmbH, in order to realise the project. By the time of this writing, 92 firms had committed to locate at the campus. Most of them were not located in Aachen before. The leading person behind the development of this vision is the Vice-Rector for Industry and Business Relations at RWTH; in his view, academia and business need each other to prosper and innovate, and physical proximity is a key condition for success.

IT City Katrinebjerg is located in Arhus, Denmark. The Katrinebjerg area is situated to the Northwest of the historic city centre, between the university campus area and the city centre. It is part of a run-down neighbourhood in full transformation towards a 'world class environment' for IT firms. The redevelopment process started in 1999, when the idea and vision of the IT city Katrinebjerg was born in a working group under the regional IT council. The area was (and still is) a mixed business area with a variety of functions. Of relatively recent date are the buildings of the Alexandra Institute (2004), an IT research institute, the Department of Computer Science (2004)

and INCUBA Science Park Katrinebjerg (2006), where around 80 mixed-sized firms are located, among others a Google R&D subsidiary. The university is expanding in the area and has concentrated all its IT research and education there (over 1.800 full time IT students). Unlike other cases, IT city Katrinebjerg has no formal management body. The first ideas for the IT City were developed in the late 1990s by a handful of enthusiast and influential people from the University and the corporate sector, who involved the Municipality latter on. Actions in the area are coordinated by a working group consisting of individual leaders within the key tenants in the area, supported by the municipality (who works on market and branding, sets the legal margins and the area´s master planning).

Biocant is a science & technology park exclusively dedicated to biotechnology. It locates in the rural municipality of Cantanhede, 25 Km from the city of Coimbra. Biocant resulted from a partnership between the Municipality of Cantanhede and the Centre of Neurosciences and Cell Biology (CNC, a leading research centre linked with the University of Coimbra), with the ambition to support the development of life sciences in the region and commercialize the university´s research in the field. The former Vice-President of CNC is now Biocant´s director, an active network broker inside and outside the location. Biocant opened in 2005 and presently hosts eight specialized technology transfer centres, 20 dedicated biotechnology firms in start-up and early growth stages and a venture capital firm. Some entrepreneurs and lab directors are graduates from Harvard, Houston and the MIT. One leading biotech firm was recently taken over by a large North American multinational. Biocant is currently developing two new buildings to cope with the rising demand. During 2011, despite the financial distress and overall economic crisis in Portugal and Europe, Biocant labs reported a 30% increase in the volume of contract research (Biocant, 2012).

The **Digital Hub** in Dublin is located at a former Guinness brewery area, on the edge of Dublin's city centre, in a distressed neighbourhood (The Liberties). The brewery's offices and other property have been reconverted into offices and labs for digital and new media firms. By 2011, there were about 70 firms located at The Digital Hub – including animation, design, learning, multimedia, e-commerce, software, gaming and mobile technology firms – providing 800 highly-skilled jobs. A key catalyst for the Digital Hub was the establishment in Dublin of the MIT Media Lab Europe in the early 2000s – the Hub´s first anchor tenant (who left the site in 2005 due to business difficulties). In 2003, the State created a dedicated development organization – the Digital Hub Development Agency (DHDA) – to enable the redevelopment and management of the area, with the involvement of State Agencies, the City Manager and a representative of the community association. One of the key priorities of the DHDA is now to facilitate synergies between tenants in the location; moreover, as the City government did not want the Digital Hub to become an 'elitist island' in the middle of a deprived area, it took several measures to link the Hub with its surroundings. For example, DHDA has signed agreements with 16 schools in the area to deliver training related to IT and new media.

Strijp-S, just next to Eindhoven´s city centre, is a former manufacturing site of Philips now being redeveloped as mixed creative quarter. The idea is to make Strijp-S 'the best practice of an historical important industrial complex [transformed] into a dynamic post-industrial city district, in which culture and technology play a key role' (KuiperCompagnons, 2007, p85). The area is being planned to become a "buzzing" district of designers, new media companies and other creative businesses and education institutes. Strijp-S used to be a gated place; only Philips employees could

enter. Gradually, Philips has left the area, relocating its manufacturing activity to low wage countries and its research functions to other places in Eindhoven. The area should help to give Eindhoven a stronger hip and urban image, and address the brain drain of creative young people to the larger cities of The Netherlands. Strijp-S is managed by a management company called "Strijp Park Beheer", owned by the Municipality and a real estate developer.

Also in Eindhoven, the **High Tech Campus** is a science & technology park for innovative businesses, situated at the city´s southernmost edge and covering 103 hectares. Parts of it were already in use as business areas before it was transformed into a "campus". At the moment, approximately 7,000 people are working on the campus. The Philips Research division is one of the mayor tenants (1,800 employees), and the 'launching costumer'. There are single and multi-tenant buildings, a business accelerator, and different knowledge institutes. The campus is owned by a private investor; the management team of the campus is charged with operational management and with guarding the "open-innovation" concept though tenant selection, liaison management, and organising all sorts of events. The Campus is actively managed in order to foster innovation. A 'Technology Liaisons Office' maintains close contact with tenants and creates potentially valuable connections between them. Furthermore, the campus management created an 'Intellectual Property & Standards-office' that searches the campus for new ideas that may be patented.

3. Synergy management

In this section, supported by illustrations of the previous cases, we describe four tools by which the management of the knowledge locations seeks to promote synergy in their sites, namely: 1) design for interaction; 2) managing the tenant mix; 3) offering shared facilities and 4) promoting networking and communities. Table 1 synthesizes some (non-exhaustive) examples from the cases.

Table 1. Synergy management tools in knowledge locations

	Design for interaction	**Managing the tenant mix**	**Shared facilities**	**Promoting networks and communities**
RWTH campus (Aachen)	Public and semi-public meeting and working places Mixed-use buildings	Research "sub-clusters" Long-term R&D framework contract	Laboratories	"Matriculation": integrating firms in the University´s activities
IT City Katrinebjerg (Aarhus)	Public and semi-public meeting and working places	Not enforced (self-selection for IT-related companies)	Advanced IT and broadband facilities (e.g. in R&D institutes and incubators)	Coaching, networking and experience sharing
Biocant (Coimbra)	Public and semi-public meeting places	Dedicated biotech firms (health, agro & environment)	Laboratories	Mentoring and tailor-made bio-brokerage
The Digital Hub (Dublin)	Public and semi-public meeting and working places	Digital value chains; new media related companies	Exhibition and piloting space, showrooms	Tailor-made brokerage Social media tools (e.g. Digital Hub TV)
Strijp-S (Eindhoven)	Route and staircase design to foster encounters Cultural and consumption facilities	Cross-subsidizing for small creative companies Market research for prioritizing inhabitants	Experimentation spaces to link art and technology	Cultural events and festivals Bottom-up social media profiling
High-Tech Campus (Eindhoven)	Enforced collective spaces, walking trails, mixed-use buildings	Five technological domains and types of companies (anchor, small and start-ups)	Clean rooms, laboratories and piloting spaces	Many social events (e.g. sports for expats) Technical seminars; liaisons club

Source: fieldwork (derived from van Winden et al., 2012; van Winden 2011; Carvalho, 2013).

3.1 Design for interaction

A first way to promote synergy is to design the knowledge location (its buildings, public spaces, and infrastructures) in such a way that interaction and communication between individuals and firms is facilitated or even promoted. The underlying rationale is that interaction (planned and unplanned) between people can be enhanced by a clever design of offices and public spaces, and that ultimately, interaction may lead to knowledge exchange and perhaps innovation.

In all our cases, the knowledge locations are equipped with shared rooms and facilities, open public and semi-public spaces and meeting places that are considered inviting and welcoming. People working in the knowledge location may easily meet each other there. Buildings are often purposely made of transparent and light materials, to create an open atmosphere, open to outsiders and "inviting" to collaboration. This is for example the case in Katrinebjerg.

Other knowledge locations have specific design and architectural features to promote interaction. For example, in Eindhoven's Strijp-S the staircases are designed in a very particular way to function as loci for spontaneous meetings. Moreover, the cultural offering in the place, as well as the first cafe´s and shops are also considered as supportive to interaction between tenants and visitors.

Eindhoven's High Tech Campus is the most sophisticated case. The campus is explicitly and consciously designed to promote encounters. The spatial organisation of the campus is dominated by the centralized position of collectively used facilities with a concentric zoning of different functions around it. In the heart of the campus, collective functions (a restaurant, shops and meeting rooms) are organized in one single building called "The Strip". Next door, there are buildings with shareable facilities, containing clean rooms, laboratories and other specialized spaces.

More towards the edges of the campus, there are several collective parking facilities in between buildings with mixed functions and users. Cars are not allowed in and walking trails are designed to maximize the chance of bumping into somebody else. Facilities for sports, children's day-care and a business accelerator (for start-ups) are also located at the edge of the campus. The maximum walking distance between the centralized shared facilities and other functions on the campus is approximately 8 minutes. The area is carefully landscaped to encourage employees and visitors to walk during lunchtime in order to increase the chances of casual encounters. Within the individual buildings there are no meeting rooms allowed beyond 8 persons. These facilities are collectively offered within "The Strip". It's also not allowed to have lunchrooms or café's within the individual buildings. Again, these are offered collectively. Even the collective sporting facilities purposely focus on team sports, in favour of individual workouts.

3.2 Managing the tenant mix

Controlling the tenant mix is a second commonly applied management practice to promote synergy in knowledge locations. Here, the management of the area actively restricts admission to tenants from specific industries or technologies, or only allows a certain percentage of "unrelated" firms on their premises. The rationale is that a careful tenant selection helps to increase the chance that tenants can work together and benefit from each others' presence. Also, having a sufficient mass of similar tenants offers scope to sustain specific common facilities or infrastructures, such as specific labs, machinery or design workshops. Finally, a specific tenant mix may help

to build the identity and reputation of the knowledge location, as the "place to be" for specific types of firms.

We found different degrees of "strictness" of tenant selection practices. The management of the High Tech campus in Eindhoven campus adopts a rather selective acquisition/admission strategy. Potential tenants have to be R&D intensive organizations, related to (one of) the five main technological domains in which the campus wants to stand out (i.e. microsystems, life-tech, high-tech systems, infotainment and embedded systems). Also, the management wants to maintain a balanced mix of three types of potential tenants, relying on differentiated location factors: 1) 'Triple-A' tenants: larger, established companies for which the brand of the location is important, 2) smaller technology firms for which the access to specialized facilities – like specific labs they can't afford on their own – is critical and 3) technology start-ups, who can benefit from entrepreneurial and networking possibilities. The campus management considers itself as defender/keeper of the park's concept, deciding which tenants are allowed to rent premises at the campus.

The same happens at Biocant and at The Digital Hub. Their management team analyses company applications one-by-one and judge on whether they can benefit from (and contribute to) the location´s atmosphere. Biocant only takes companies active in biotechnology, preferably whose activities can benefit from the location´s labs; moreover, it does not accept very early stage start-ups – the company must have already a promising technology and business model. At The Digital Hub, tenants must be associated with IT and digital media solutions and their tenancy application is closely scrutinized by the management board.

At the other end of the spectrum, we found knowledge locations that, despite their specialisation, do not apply or enforce any type of tenant selection. Aarhus' IT city Katrinebjerg is a case in point. Here, a self-selection mechanisms has set in; the area mainly attracts IT firms because so many other IT firms are already there, and because of the availability of specific infrastructures and labs.

A particular type of tenant selection is applied in Aachen's RWTH campus. The Campus GmbH (the management body) invites industrial companies to locate near the academic institutes at the campus. Not any firm is welcome, however: there are strict admission criteria. To be allowed at the campus, firms have to sign a long-term R&D framework contract in which they commit themselves to conducting contract research with the university, in a particular cluster-field, and also to deliver lectures at RWTH. A firm has to sign a 10-year lease contract, and must actually base part of their (research) staff at the campus premises. The aim of the concept is to improve the quality, scale and relevance of research in the various fields by mixing the resources and knowledge of business and academia. Also, the university hopes to improve the quality of teaching by having lectures from industrial partners. The latest insights from the business world are transmitted to the students. Moreover, employees of the 'embedded' firms can take Master courses at RWTH at reduced rates. Importantly, co-operation is never exclusive and may never block new developments. Naturally, any institute keeps the right to sign deals with other industrial partners who are not on the campus; new clusters may emerge, and spinning out is encouraged.

Some knowledge locations use cross-subsidizing to achieve an appropriate tenant and functional mix. In Eindhoven's Strijp-S, the management offers lower rent levels to dynamic but less wealthy tenants such as start-up companies or cultural institutes. It is believed that their presence can have positive spill-over effects on the others: they are

believed to build the areas' reputation, and attract specific audiences. A cultural fund was set up, offering financial support for organisations that want to organise events in the area that fit with its desired creative-vibrant image; moreover, the management also subsidizes the location of particular tenants (e.g. a trendy restaurant, an indoor skate court and some other alternative sports and cultural facilities). Quite unconventionally, some form of inhabitant selection was introduced too. Trudo (the housing corporation that committed to develop a large chunk of the housing stock as well as some amenities in the area) hired a market research agency that developed a questionnaire to find out whether or not applicants for rental apartments would match the profile of "urban" and "creative". The better the match, the higher the applicant would end on the list.

3.3 Shared facilities

A third tool, applied in all the analysed knowledge locations, is to boost synergy by offering shared facilities. It is very common to have "low tech" facilities that can be shared (such as meeting rooms, cleaning and security, business plan support, etc.) but these services can be found in other business parks too. In this section, we focus on rarer, more advanced facilities.

IT City Katrinebjerg has special facilities for innovative IT firms. For example, the INCUBA institute has built commercial premises to meet the specific requirements of its tenants, offering switchboard and very fast broadband services, among others. The high-tech campus Eindhoven has clean rooms and many labs that can be rented by tenants; having this infrastructure is especially appreciated by smaller tenants who can't afford to have their own labs.

At the RWTH campus, lab sharing is an essential element. The campus is to evolve as a patchwork of thematic clusters, where each one has to be large enough to allow for specific investments in facilities like laboratories. New clusters can be set up only when particular and precisely defined levels of 'critical mass' is achieved. The campus management allows a new cluster to start if there are at least 150 staff members (and a realistic growth perspective to have 350 staff in 3 years time), 10 research partners, 2 university institutes, and 9000m2 of rented property. In Biocant, the first lab facilities were developed upfront, even before any tenant had settled in the location. Having state-of-the-art labs was seen as a unique selling point and a magnet for new large and small bio-ventures; moreover, in biotechnology, labs are a privileged place for social interaction.

In other more "creative-oriented" locations – such as The Digital Hub and Strijp-S – shared facilities have less of a high-tech, laboratorial dimension, but are also equated as places to nurture synergies among tenants. For example, The Digital Hub has shared showrooms where new digital media solutions can be showcased and early tested together with larger audiences. The Strijp-S is endowed with workshops and experimentation-oriented spaces, adjusted to the needs of smaller and big companies. Some anchor tenants in the area (e.g. Baltan Labs) offer experimentation facilities to connect art, design and technology.

3.4 Promoting networks and communities

A fourth type of synergy management is the active promotion of networks and communities in the knowledge location. The underlying idea is that innovation is, to a large extent, a social process. People will more easily share ideas and knowledge (or eventually collaborate) when they know each other and share a sense of togetherness

and belonging. Hence, managers of knowledge locations try to promote networking and community formation in several ways.

In all the analysed sites the management promotes the formation of professional communities, for example through the organisation of technical seminars and external lectures about themes that are interesting for the community in the area. In this way, a meeting arena is created where people can gather, exchange ideas and network. Seminars and events form a bridge between the knowledge location and the outside world. The location may become a kernel living room or meeting place not only for the tenants of the location but also for other firms and individuals that work in similar activities.

Some of the studied locations top-up seminars and events with other formal and informal community building interventions. One option (applied in Eindhoven High tech Campus) is to organise or facilitate non-work related events, for example sports tournaments or music shows. Participation may help knowledge workers to gain new contacts, and give them a sense of belonging to the park community. This is especially relevant at Eindhoven's High Tech Campus, with thousands of expat workers from all over the world. Moreover, the technology liaison office organises workshops, business meetings and network happenings to enhance knowledge diffusion. It has also initiated the 'Campus Technology Liaisons Club', a network organisation of decision-makers and 'influencials' on the campus. The office essentially tries to build and maintain a community of practice; as said, "in the end, the purpose of this community is to have the feeling you work on the campus instead of with an individual company".

In the case of Eindhoven's Strijp-S, network management started bottom-up. A tenant took the initiative to promote networking: he opened a member-based website (strijp.is) where tenants can upload their profile, as a "who-is-who" for the area. His aim is "to bring the creative professionals closer to each other". (Eindhovens Dagblad, 2013)

In Aachen´s RWTH campus, the entire model is about forming new communities of companies, universities and R&D institutes. The University uses the term "Matriculation". By "matriculating", companies gain a special position: they get influence on the research focus of the coming years, they obtain discounted access to R&D and education for the 'matriculated' staff members. Moreover matriculated companies have direct access to the brightest new talents of the university.

The Digital Hub´s managers explicitly focus on fostering synergies between tenants, as this is perceived as one of the main missions of the location. However, there are no formalized or regular initiatives (apart from running an internal Digital Hub TV). As explained by the strategy and communication director:

> "We used to arrange formal networking events and CEO meetings but stopped doing that. It proved too imposing and artificial. If a company needs support to arrange meetings with other companies [e.g. around a certain technology or business theme] we are here to arrange it, but we prefer to keep it a bit less structured and more bottom-up (...) They often know better than us, and we don't like to be too pushy and overwhelm them with initiatives."

In Biocant, community building is a highly valued activity but also works in an informal, tailor-made fashion. Biocant´s managers provide networking opportunities

and actively support the relocation (and new firm creation) of international talented PhDs and star scientists, namely through the managers´ own personal and professional networks. Biocant´s managers often take seats in the advisory boards of new ventures; besides acting as mentors for new companies, they often link the capacities of firms and researchers to one another and pave the ground for new partnerships (recent examples are a new project for heart-disease solutions based on stem cells; or the joint commercial distribution of health kits). Over time, older entrepreneurs also mentor newer ventures, contributing to the development of a supportive, problem-solving ecosystem in place, highly valued by venture capitalists.

4. Empirical and conceptual considerations

In the last section we described a number of current management approaches to promote synergy at knowledge locations. In this section, with an eye to tenant´s interaction and innovation-related synergies, we confront the policy reality with some insights from the literature. We focus on recent conceptual and empirical contributions to the debate on the value of knowledge locations as synergy enhancers, in general, but also on concrete synergy enhancing tools and strategies, in particular.

4.1 Neo-regionalist arguments

Overall, our cases indicate that the designers and promoters of knowledge locations are typically inspired and guided by neo-regionalist arguments that stress the role of geographical proximity in innovation processes (see, e.g. Moulaert and Seskia, 2003). From a neo-regionalist perspective, knowledge locations can be seen as "micro-agglomerations", where hyper local characteristics can influence the configuration and density of knowledge and innovation networks. From a Marshallian and industrial district's perspective, one could interpret knowledge locations as places where positive externalities materialize; knowledge spillovers could more easily occur, with the possible effect of more rapidly spreading innovation and the emergence of a competitive and dynamic spirit in the area. From an institutionalist and innovative milieu perspective, which emphasise the role of trust, shared culture and institutions as conducive to innovation networks, these locations can be interpreted as "trust enhancers": co-located firms are close to one another and may develop personal relationships and shared frames, which would enhance innovation.

The neo-regionalist perspective on knowledge locations is problematic for several reasons. First of all, most of the mechanisms and social relations proposed in these theories act on the level of the region, rather than the much smaller unit of a specific knowledge location. Second, in the last decade, the neo-regionalist position itself is increasingly being challenged for its overemphasis on geographic proximity and local/regional factors explaining innovation. There is mounting evidence that the role of local networks is less important than often conceptualised (Garnsey and Hefferman, 2005, Giuliani, 2007; Malmberg and Maskell, 2006; Vale and Carvalho, 2013). Many innovative firms do not acquire knowledge from geographically nearby partners, but rather source internationally (Davenport, 2005). This is especially true for firms with high levels of absorptive capacity (Drejer and Vinding, 2007).

Over the last years, there have been several empirical enquiries into the added value of knowledge locations, confirming the limitations of a neo-regionalists thesis. Most studies focus on science & technology parks, and try to estimate the effect of on-park location on the tenants' performance in terms of innovativeness, R&D productivity, survival, and growth (for a review, see e.g. van Winden et al., 2012; Carvalho, 2013).

They cast serious doubt on the physical proximity-innovation nexus. Despite a few positive indications that firms within science parks have stronger relations with universities than other firms (e.g. Detwiller et al, 2006; Chan and Lau, 2005) there is little evidence that they more likely to collaborate or exchange information with local universities or neighbouring firms on-site. (Bakouros et al. 2002, Quintas et al, 1992, Lindelof and Lofsten, 2003, Fukugawa, 2006). Overall, knowledge locations are not – at least per se – the 'local innovation network catalysts' they often pretend to be, confirming the growing consensus in the literature not to overrate the importance of geographically-close knowledge networks.

4.2 Beyond the buildings: innovation as a social practice

However, beyond the neo-regionalist arguments that still ground the proposition of many knowledge locations, our cases also seem to suggest that the managers of knowledge location do not fully believe that geographical proximity is – at least per se – the exclusive driver of synergies. The fact that they are increasingly active deploying synergy enhancement strategies reflects precisely that. In reality, some of the currently deployed synergy management policies and practices can be interpreted as reflecting the relevance ascribed to three different types of conceptual and empirical arguments; i) the relevance of other dimensions of "proximity" for innovation; ii) the understanding of knowledge exchange and learning as socially-situated practices, operating through different multi-scalar and spatial configurations and iii) the role of physical design in interpersonal exchange.

First, the attention paid to the tenant mix reflects the rising awareness that synergy and interaction require more than geographical proximity. Some studies ascribe the scarcity of interaction in science & technology parks to the fact that tenants are not in complementary businesses, or do not have complementary resources that compel them to collaborate (Lowegren-Williams, 2000; Chan and Lau, 2005). In a study on the effects of management interventions in 12 science & technology parks in Turkey, Kocak and Can (2013) find that sector homogeneity at science & technology parks is associated with greater prevalence of knowledge sharing, joint development, and common client ties. These findings for knowledge locations are in line with the arguments of Boschma (2005) and Gertler (2008), who support that geographical proximity is only one relevant factor for innovation networks to unfold: other types of proximity can be equally or even more relevant – *cognitive* (sharing a common vocabulary and frameworks), *organizational* (capacity to coordinate and exchange knowledge), *social and cultural* (culture and language, micro-level social ties of friendliness and trust) and *institutional* (macro-level routines, rules and regulations). Actually, the synergy management tools described in the last section seem to be tuned with the insight that networks and exchange are more likely to occur in settings where different types of proximity coincide. Moreover, selection criteria based on platform themes (e.g. RWTH and High-Tech Campus) and value chains (e.g. The Digital Hub, Biocant) suggests the relevance ascribed in mixing related portfolios of skills and not just tenants that share too much similar types of competences (e.g. Boschma and Frenken, 2011).

Second, and related with the previous, some location´s managers increasingly seem to understand that knowledge exchange and innovation are, to a large extend, social practices (e.g. Amin and Roberts, 2008) – thus their efforts nurturing new networks and community felling in their locations. It has been suggested that building social capital among entrepreneurs is becoming the most important function of knowledge

locations (e.g. Hansson et al., 2005; Youtie and Shapira, 2008). The role of highly connected individuals, linking and bridging networks inside and outside the site, has also been pointed as central for a location´s growth and innovation potential (Link and Scott, 2005; Hommen et al., 2006). These findings are in line with the recent literature on the role of gatekeepers and boundary spanners for innovation, i.e. actors that generate local novelty by combining local and external knowledge sources (e.g. Graf, 2011). In this sense, localized learning and innovation becomes increasingly reliant on local "buzz" but also on selective "pipelines" to the outside world, in a multiscalar and relational fashion (Bathelt et al., 2004). The case of Taiwan´s Hsinchu Science Park (e.g. Chen and Choi, 2004) has been a leading model, namely by nurturing local innovation communities is close interaction with other counterparts abroad (in California). Many contemporary event-promotion strategies, liaison clubs and mentoring initiatives in knowledge locations pursue a similar nexus. The networking and community-building strategy in Biocant has been paradigmatic in this respect, by helping to connect a peripheral and emergent bio-community to advanced business and research networks in the US.

Finally, many knowledge location proponents increasingly put a special focus on its physical design and work environment as a driver of interpersonal exchange among tenants. The carefully designed layout of Eindhoven's High-Tech Campus is exemplary of this belief. To our knowledge, no study has analysed these claims in knowledge locations as a whole. However, there is a large body of research on the links between physical space and collaboration in knowledge work settings (Heerwagen et al., 2004; Rashid et al., 2006). This literature tends to agree that the working space is an "organizational resource" that can be mobilized to support awareness, interaction and collaboration among individuals. Spatial layouts – e.g. through better accessibility, visibility and short walking distances – tend to affect the frequency of face-to-face interaction in offices (Heerwagen et al., 2004) and university research centres (Toker and Gray, 2008), and Penn et al. (1999) defends that increased frequency leads to more "useful" interactions over time. Moreover, there seems to be also a relation between physical space layouts and the formation of organizational cultures and collective identities (Peponis et al., 2007); it is also suggested that, over time, both impact on the creative performance of knowledge workers (Dul et al., 2012). These findings tend to support the relevance of community formation and spatial layouts as synergy enhancers in knowledge locations.

5. Synthesis and discussion

In this paper we described and analysed a number management practices to achieve synergies in knowledge locations. Table 1 synthesises the findings. The left column discerns a number of potential synergetic effects of co-location in a knowledge location and the right column links each synergy effect with potentially enhancing synergy policies.

Table 1. Potentially synergetic effects and synergy management

(Potentially) synergetic effects of co-location	Synergy management strategies
Easy access to new knowledge, ideas, skills and expertise "next door"	Managing the tenant mix Promoting networks and communities Design for interaction
Access to internal and external-to-the-location networks	Promoting networks and communities
Provision of specialized infrastructure and services	Managing the tenant mix Shared facilities
Credibility, reputation and image formation	Design for interaction Managing the tenant mix Shared facilities Promoting networks and communities

Source: own elaboration

One conclusion of our study – already drawn by others as well – is that managers and policymakers tend to overestimate the potential of their knowledge locations as interaction and innovation-enhancers. The language of their websites and brochures is inspired by neo-regionalist claims, depicting knowledge locations as "hotbeds" of innovation networks. But there is little evidence that they are, at least *per se*.

Having said that, the evidence from our cases and extant literatures suggest that knowledge locations do offer synergetic effects/possibilities, and that synergy management tools can enhance those synergies. In other, words, co-location is not sufficient but synergy management can help. Managing the tenant mix and promoting networks and communities seem to be among the most relevant strategies; while the first is important to ensure learning potential and complementarities, the latter can be the "glue" that binds the "pieces" together. Moreover, there is evidence to suggest that a location´s physical design and shared facilities are also important supportive factors. For example, the formation of image, credibility and reputation is synergetic effect that largely benefits – directly and indirectly – from the four synergy management strategies under analysis. Further research is needed to better understand and assess the different revealed effects of synergy management in different types of knowledge locations, as well as their potential complementarities and interactions.

From a policy perspective, if the creation of synergies is among a location´s most important *raison d'être*, and if this seems to depend (at least to some extent) on synergy management, the role of a location´s managers is an increasingly important (and knowledge-intensive!) one. Managers have to decide on the right mix of policies, and permanently evaluate what works and what does not. The tools and strategies analysed in this chapter provide some first steps and hints, but there are many challenges ahead.

First, the "right" tenant mix is far from easy to define and to achieve. Namely in difficult economic times, tenant selection is difficult to maintain; the management is tempted (or urged) to fill vacant spaces to generate rental incomes. Moreover, it is not straightforward for the management to assess whether a new tenant will add synergetic value to the area, and what that value consists of. One may argue that firms in similar or adjacent related technology fields or industries are most likely to benefit from each other (Boschma and Frenken, 2011), but it may well be that seemingly unrelated activities may produce surprising combinations (Jacobs, 1969). In some cases, tension can arise if a new tenant is the competitor of existing companies in the area. Moreover, in order to keep the tenant mix appropriate, tenant selection should perhaps be complemented with an "exit" policy: over time, tenants may lose their strategic value for the location, for example if it takes new strategic directions, become active in new technologies, or when they are taken over by other firms.

Second, the type of networking and community building strategies might differ across types of locations and activities. Innovation processes are notably different across industries (e.g. Asheim et. al., 2007; Malerba, 2002), with management implications for knowledge locations. On the one extreme, knowledge networks in high-tech systems seem to be particularly structured; unplanned meetings within a park are not the way companies like Philips search technical knowledge and innovate. Managers of these types of knowledge locations should focus less on creating random local networks but rather on offering shared labs/facilities and on organising highly specialised seminars and tailor-made brokerage. On the other extreme, we find local spontaneous networking to be much more relevant in some segments of creative industries, and it is even promoted by the tenants themselves (e.g. in Strijp-S).

Third, the physical layout and spatial integration of knowledge locations have to cope with a rising number of societal changes. The suburban model of the late 1980s (Castells and Hall, 1994) is being challenged under influence of e.g. the rise of open and networked innovation practices; the blurring of boundaries between disciplines and emerging interplays between technology, design, finance, and behavioural science; changing preferences of skilled people concerning their working environment; changing balances between work and social life; and a shift from hierarchical structures to networked and project-oriented ways of working. Under influence of these insights and trends, mono-functional hotspots and campuses are being redesigned to include more functional diversity besides businesses and research (e.g. residences, amenities, cultural and consumption facilities, education), in places with strong identity (vs. anonymous suburban areas). A key challenge for the 21st century´s knowledge locations and their synergy-searching managers will be to balance tensions between planning and spontaneous development, between functionality and serendipity, between uniformity and diversity, between creating a "city in a city" and defining the knowledge location as part of a larger functional urban area.

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