# The Innovation Performance of Regions: Concepts and Cases

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## Summary

This is a publication of the European Institute for Comparative Urban Research (Euricur), based at Erasmus University Rotterdam, in cooperation with UrbanIQ. It presents the results of an international comparative research project carried out on behalf of Skolkovo Foundation.

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# Summary

## Background

In 2010, the Russian government revealed its plans to develop a new high-tech hub near Moscow. This Russian equivalent of Silicon Valley is to become a leading research and innovation centre bringing together researchers and businesses in IT, biomed, energy, space and nuclear technology. The ambitious project includes the development of a new town – 'the city of the future' – covering approximately 4,000 hectares, giving home to around 20,000 permanent residents with different nationalities. The Skolkovo Foundation is responsible for developing this technopole with international status from scratch. The ambition is to create a 'smart city' with state-of-the-art services (not only in transport, communication and security, but also in health, social services and education) and a living lab for innovative approaches and sustainable urban development.

One of the most challenging tasks for the Skolkovo Foundation is to create a self-sustaining ecosystem that attracts and retains high-potential firms and talented people, and at the same time facilitates innovation through knowledge spillovers. To what extent can such systems be created and managed? What can be learned from examples around the world? To answer these questions, the Foundation has asked the authors of this report to analyse a number of successful ecosystems, to disclose what "makes them tick", and to distract policy lessons for the setup of Skolkovo Science City.

This summary consists of three parts. The first part presents a conceptual framework to analyse and compare innovative ecosystems, based on key insights from the (vast) academic and policy literature in this field. The second part introduces and discusses the three ecosystems that have been analysed: Brainport Eindhoven (The Netherlands), Kista-Stockholm (Sweden) and Suzhou Industrial Park (China). The three selected regions are prime examples of strong innovation hotspots, each with their own particular features that makes them stand out. The third part is the cross-case analysis which addresses seven challenges for the development and management of ecosystems, building on insights from

the three cases. The empirical analysis is based on desk research and semi-structured interviews with a great variety of representatives from (large and small) companies, academia, the venture capital community, local government, developers, etc. In total, 41 people have been interviewed for this study.

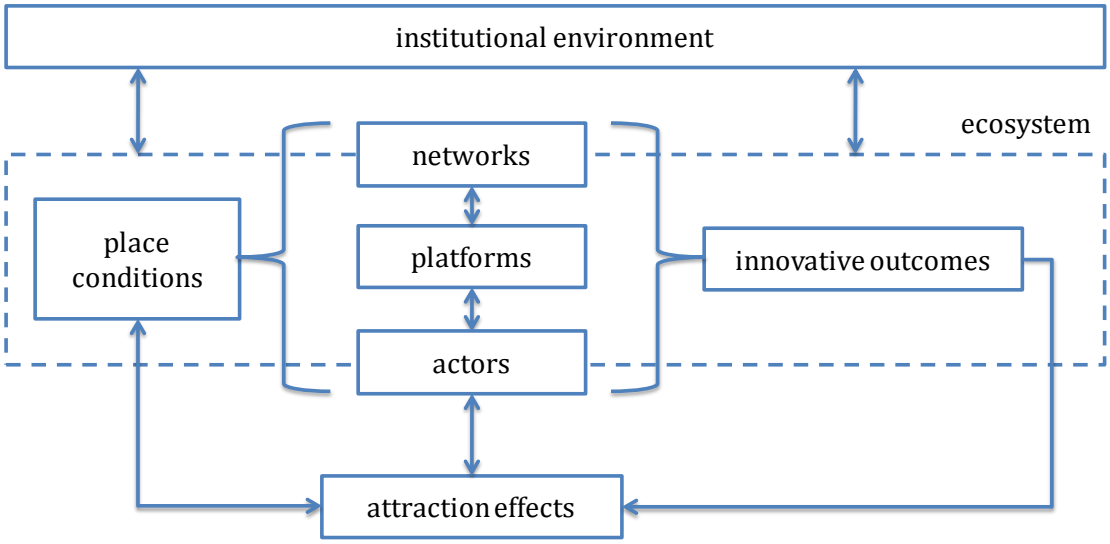
## Conceptual framework

Innovative ecosystems can take many forms and can grow out of different types of clusters, from entrepreneurial districts in large cities to industrial parks, university campuses and science parks. They can grow spontaneously or from a nucleus created by government policy.

Typical for a strong ecosystem is its capacity for renewal and adaptation over time. One of the best examples is Silicon Valley that changed over decades from mainly military innovation to hardware, software & ICT, Internet, web 2.0, and green technologies, always at the edge of innovation (e.g. Saxenian, 1994). Moreover, a successful regional innovation ecosystem is a dynamic platform for global connections. Its constituents (people, companies and institutions) are globally networked, and learn constantly.

The key actors in the ecosystem are companies, research institutes, capital providers, start-ups and talented individuals; they are linked through various types of platforms – innovation communities, organizations and loci (real or virtual, permanent or temporary) – where networks are being built, maintained, and promoted (see figure 1).

FIGURE 1: FRAME OF ANALYSIS




The networks are generators and conveyors of knowledge, ideas, and innovative partnerships, alliances and new ventures. A strong ecosystem functions as a "womb" or "incubator" for innovative outcomes: new products, new ventures, new technologies, patents, new business models, etc. Its success breeds new success: a strong ecosystem grows. It attracts new firms and talented people from outside, who want to become part of the innovative buzz. This virtuous mechanism can only work with favourable "place conditions"

that help to attract skilled people, such as accessibility, quality of life and cultural assets. Moreover, there must be an innovation-friendly institutional environment (formal and informal rules and culture). Below we apply this conceptual framework to the three ecosystems that have been analysed.

## Eindhoven

### Introduction

Eindhoven is the fifth largest city of the Netherlands with about 216,000 inhabitants (2011). It is located in the southern part of the country. The Eindhoven Region has been one of the most successful innovation ecosystems in Europe during the past decades. It has a strong high-tech profile: it is a hotbed of innovation with a vibrant mix of large and small firms, many of them successfully competing on world markets. The technical university attracts bright youngsters, provides graduates for the local labour market, and "produces" spin-offs and start-ups; also it functions as research partner for tech firms. The region attracts talent from all over the world, and stands out as a place for open innovation, supported and sustained by a culture of trust and collaboration between companies and in the triple helix. In 2011, the Intelligent Community Forum selected this region as the most innovative community worldwide.

FIGURE 1: THE LOCATION OF EINDHOVEN

Source: Authors

Philips played a pivotal role in the development of the ecosystem. In 1891 (when Eindhoven was still a small rural community), Philips Electronics was founded by Gerard Philips when he bought an empty textile factory in Eindhoven for the production of light bulbs. Over the last century, the company dominated the cities' development, and invested heavily in R&D, ranging from advanced basic research to application-oriented R&D and design. This resulted in a regional knowledge base from which many successful spin-off firms have emerged (Van Hooff, 2008; Janssen, 2011).

At current, the region has several "leader technology firms": next to Philips, there are ASML, car-producer DAF and the chemical and biotech firm DSM. They are major innovators in their own right, and also played a key role in transforming the entire region into an innovation ecosystem. They employ specialized workers, and contribute to the research infrastructure in the region. Moreover, they are a source of spin-offs and spiders in webs of innovative intermediary suppliers.

During the 1990s, the region faced a deep crisis: some of its leader firms almost collapsed. The restructuring process that followed transformed the region's system of governance, triggering stakeholders to set up a strong regional government layer, eventually culminating in the creation of effective public-private collaborations (Van den Berg et al., 2008).

**Actors**

Key companies ("leader firms") in the region are Philips, ASML, DSM, DAF/Packar, Oce, VDL group. They are on top of high-tech value networks, globally active, but rely on high-tech suppliers in the region. There are many small innovators as well, and high levels of FDI.

The Eindhoven University of Technology has over 9,000 students and 2,000 academic staff. It is strongly industry-oriented: according to a recent study (Tijssen et al., 2009), it is the global #1 in terms of university-industry co-publications. Besides the TU/e, the Eindhoven Region has a number of other key research institutes: TNO, Holst Centre, DevLab, and a University of Applied Sciences. All of them are well connected with the high-tech industry in the region.

**Key Performance Indicators**

Eindhoven scores well on a number of Key Performance Indicators (KPIs), in particular regarding:

- *Start-ups*. The rate of firm creation is comparable to the Dutch average, but in some targeted knowledge-intensive sectors (design and life tech) Eindhoven shows higher rates (CBS, own calculations).
- *Patents*. With more than two patents per 1,000 inhabitants, Eindhoven is Europe's number one in terms of patent applications. Also in absolute numbers, the region is

number one, but the number of patent applications started declining recently (Eurostat).

- *Revenue from innovative products (new or substantially improved products)*. Compared to the national average, in Eindhoven, firms derive a significantly higher share of revenue from new or improved products (17% versus the national average of 6%) (CBS-CIS, 2009).
- *R&D workers as a share of total employment*. R&D personnel take a much more substantial share of total employment in Eindhoven than of the overall Dutch employment (8% versus 1%) (CBS-CIS, 2009)
- *R&D expenditure*. The region stands out in terms of private R&D expenditures: about € 2b (2009) is spent on R&D, which is 2.5% of GDP (data on the level of the entire province); about 80% of R&D spending is done by private firms (Eurostat).

**Knowledge hotspots**

In Eindhoven there are three key knowledge hotspots (special areas with a high density of innovative activity):

- *Eindhoven High Tech Campus*. A former Philips research campus has been transformed into an "open innovation campus". It is an area of only about one square kilometre, housing a large number of firms, many of which are multinationals, and employing about 8,000 workers, most of whom are researchers and other knowledge workers and about 20% expats. The park is exclusively a space for work and research; it does not include any residential space. It is actively managed (see *special features*).
- *Strijp S*. This former Philips location, located near the city centre, is being transformed into a vibrant urban district for creative industries, with a focus on design. It is a mixed development with leisure, housing, cultural amenities and space for big and small firms.
- *University campus*. The currently mono-functional university campus (close to the city centre) is being transformed into a more lively and mixed area. The plan includes up to 700 permanent, high-quality studios and apartments for students, as well as space for companies.

FIGURE 2: STRIJP S (ARTIST IMPRESSION) AND HIGH-TECH CAMPUS

Source: http://www.strijp-s.nl and http://www.hightechcampus.com

**Special features**

The Eindhoven ecosystem has a number of specific features that distinguish it from others. The most important ones are: a broad commitment to open innovation, a strong tradition of 'urban planning for innovation', and highly effective governance mechanisms.

*Open innovation.* Eindhoven has emerged as a region that stands out in open innovation. A major catalyst was the culture change within Philips. The electronics giant used to be an inward-oriented innovator, with big walls around its strong knowledge base and relatively few innovation partnerships. After the crisis of the 1990s, the firm downsized and rationalized its R&D policy. Rather than funding a large number of internal R&D projects from a broad range of scientific disciplines, the firm decided to concentrate on a few core disciplines and to use external sources of knowledge whenever possible. In 2003 Philips' directors connected their policy with Henry Chesbrough's ideas on open innovation (Chesbrough, 2003). Philips gave open innovation a specific meaning by creating the High Tech Campus (HTC). This campus, located at the outskirts of Eindhoven, used to be an exclusive and highly secretive Philips research laboratory. When Philips made its turn towards open innovation, it removed all Philips signs from the area (a very symbolic gesture) and allowed other firms and institutions to locate on the campus. Currently, the HTC houses most of Philips' R&D labs, besides major Philips spin-offs like NXP, and other major national and international high-tech firms and service providers. Moreover it provides office space to new start-up firms and offers the Philips clean rooms for rent to firms which otherwise may not have had access to such an advanced research facility. Open innovation is not restricted to Philips, but rather part of a collaborative culture that characterizes the region. Key players are the Holst Centre and the DevLab, high-tech research centres where companies (often competitors) and research institutes develop new technologies together, often in the pre-competitive stage. Thanks to high level of trust, it is common practice to work without binding contracts for the first two years of a research project, and only when concrete results are starting to emerge, contracts are written down to set rules on property rights and returns

of the project. When asked about the origins of this 'software' of trust and willingness to cooperate, stakeholders in the Eindhoven Region point to the strong, historically rooted sense of local community.

*Planning for innovation.* In Eindhoven, innovation is considered too important to be left to chance. There is a long tradition of planning and designing the city in such a way that innovation is boosted. Prime examples are the High Tech Campus (HTC) and Strijp S. The HTC's physical layout is such that it encourages human interaction (which would stimulate the exchange of ideas and collaboration). Facilities are concentrated in one, central area ("the strip"), and walking paths are designed to optimize the chance to bump into someone else.

The campus is actively managed, to ensure that the tenant mix remains balanced (only firms operating within particular technology fields are allowed). Also, the campus management encourages the formation of communities, by organizing all sorts of social and professional events, etc. Partly as a result, the HTC has developed as a brand, a recognized hotspot for innovation which firms like to associate themselves with. This value is reflected in premium rent levels. The area of Strijp S (a former industrial Philips area adjacent to the inner city) is another recent example of "urban planning for innovation". This area is being transformed into a lively urban design district, a vibrant habitat for creative industries and inhabitants. It combines tradition and new technology, culture, culinary delights, entrepreneurship, and innovative ways of living. It is an interesting mix of top-down master planning and "grassroots" bottom-up development in which inhabitants can design their own spaces. The environment is not ready-made: new inhabitants are encouraged to use their creativity and realize their own ideas in the area.

*Strong governance and PPPs.* The crisis of the 1990s was key in the development a culture of pro-active public private collaboration (Van den Berg et al., 2008). At current, Eindhoven has a unique ecosystem governance model, which is an international reference. Strategic directions are set in a foundation that is led by key leaders from the triple helix. Four board members are mayors from local governments in the region; four are leaders of knowledge institutes, and the remaining four are leading business people. The president is the Mayor of Eindhoven. The strategy is developed in close consultation with all the relevant actors, and all the actors are committed to it. The partners have agreed on a common agenda (see Brainport Development, 2011, for the most recent strategy agenda).

The actions that follow from the strategy are taken up by the partners in the triple helix. The strategy serves to guide regional actions, investments and interventions, but also works as an effective lobby agenda towards the national government, and the EU.

Thus, unlike in many other regions, the strategy is not only a piece of paper: it is shared, and consistently implemented. For this, the region set up a powerful cooperation organisation named "Brainport Foundation", with 50 people staff in its development company Brainport Development. This organisation organises a wide variety of actions: it runs business parks, it kick-starts projects, it provides support for funding and subsidies, it markets and promotes the region at home and abroad, and it supports the strategy building

process. Normally, it does not run projects for a longer time: The policy principle is that actors in the triple helix must develop and fund their own actions. The Brainport Foundation is owned and funded by a large number of municipalities in the Eindhoven Region, and it enjoys a high level of trust. The effect is a depolitisation of knowledge policies, and a long-term orientation.

#### Current debates

The Eindhoven region is successful but not complacent. There are debates and discussions about the following issues:

*The risk of overspecialization*. The region is overspecialized in the high-tech systems and materials sector, which is highly innovative but also very vulnerable to cyclical ups and downs. Moreover these clusters are dominated by a small number of large firms at the top of extensive value chains, increasing the vulnerability of the region. If any of these leader firms were to offshore their R&D or relocate out of the region altogether the repercussions of this would ripple through the region's value chains and potentially create a new crisis like the one the region faced in the 1990s. The rapid emergence of the design sector holds promise to help the region diversify into a more recession-proof industry, and the Strijp S redevelopment project may play a key role in this.

*The lack of fast-growing start-ups*. The region has a reasonable number of start-up firms, but so far very few starters grow into large firms. Most respondents argue that the main problem holding back new firm creation is a shortage of available venture capital. A wide range of start-up incubation initiatives are currently being undertaken in the region, providing useful examples of policy options for other ecosystems facing a similar problem. A related problem is the increasing specialisation of Philips (the "mother" of many spin-offs) and its reduction of broader research programmes. Some worry that this tendency reduces the chance of new spin-offs.

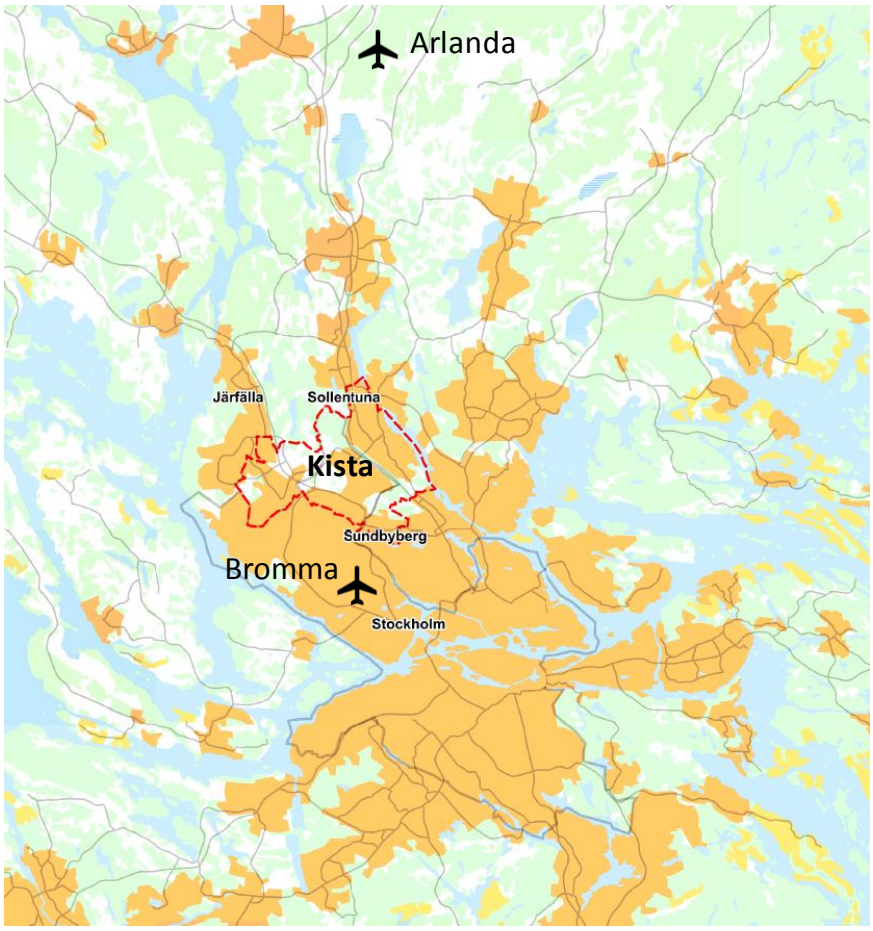
*Attracting talent*. A key challenge is to attract the best and brightest among the world's knowledge workers. Eindhoven faces shortages of skilled technical workers; the population is ageing, and few Dutch students are taking technical studies and majors. This makes it crucial to quickly boost the attractiveness of the region to international knowledge workers (see also: Research voor Beleid, 2006).

## Kista, Stockholm

#### Introduction

The Kista ICT cluster is located in the north-west quadrant of Stockholm, about 15 km from the Stockholm city centre. As the home base of ICT giant Ericsson and other cutting edge firms and universities, Kista has been the world's leading cluster in wireless ICT for over two decades. Kista is one of the major knowledge hot spots of Stockholm, which as a whole shows a strong innovation performance and was selected as Intelligent Community of the Year 2009.

FIGURE 3: LOCATION OF KISTA SCIENCE PARK




Source: Kista Science City AB, authors

Kista's development as an innovation ecosystem started with in the 1970s when two subsidiaries of Ericsson and IBM Sweden decided to move to Kista. This set off a chain reaction, quickly giving the area the image of a high-tech engineering hub and making it an attractive location for other electronics firms and their suppliers (ICT). In the second part of the 1980s it became a hotbed for innovations in wireless communication technology, with support of the Swedish government that created an Institute for Microelectronics (as part of a national programme) and put pressure on two universities to set up ICT-related departments, all at Kista (Bingtsson et al., 2011).

**Actors**

Today (2012), Kista is home to more than 1,100 firms in the ICT sector, which includes about 300 "micro companies". Together they provide employment to about 23,000 people. Two-third of all ICT-related jobs is supplied by the thirteen largest companies of Kista, including well-known names such as Ericsson (with its head office and much of its R&D facilities located at Kista), Microsoft, Nokia and IBM. Kista is clearly specialised in ICT, with shares of about 10% of the firms and more than 30% of employment in this sector (Kista Science City, 2011).

Kista hosts a total of 7000 students attending classes at three institutions: the famous KTH Royal Institute of Technology, the smaller but growing Stockholm University and the recently created European Institute for Technology (EIT-ICT).

**Urban development**

Originally, Kista was planned as an industrial zone of a suburban new town, often referred to as Järva, the name of a former military zone encompassing this area. Over time, policies for the development of Kista Science City have expanded to include not just Kista itself but the entire Järva area, referring to it as the Kista Region or Kista Science City region. The socio-cultural structure of the Järva region is one of deep segregation: in 2004, only few of the people working in Kista lived in Kista or its immediate surroundings. Many inhabitants are (children of) non-Western migrants and the average education level is low (Barinaga & Ramfelt, 2004).

In the last decade visions have been presented to transform Kista from a science park into a science city. Aims are to reduce social segregation and to improve the career and educational opportunities for the largely disadvantaged population, while at the same time addressing public safety issues, improving the attractiveness of the area (making it more vibrant) and upgrading its image.

**Key performance indicators**

Kista is one of the innovation hotspots in Stockholm. Other hotspots are the city centre (creative industries, software development) and the medical cluster around the Karolinski Institutet located to the northwest of the city centre. Stockholm has a strong innovation performance, with the following Key Performance Indicators (KPIs) as evidence:

- Start-ups. The Stockholm region is able to vigorously generate new firms, and has become increasingly able to do so over time; with about 10,000 new companies in the City of Stockholm (including Kista) and another 6,000 in the 25 neighbouring municipalities for 2010 (Tillväxtanalys, 2012).
- Patents. With more than 700 patents a year (2008), Stockholm is the third most innovative region in the EU; it has strengthened its position over the past decade (Eurostat).
- R&D expenditure. Very high levels of R&D investment are a significant strength of the Stockholm region. About 4% of GDP is spent on R&D (two times as much as the EU average), with a private-sector share of approximately 70% (Eurostat).

**Special features**

What are the features that make Kista an interesting example for other innovation ecosystems? Let us discuss the three most distinctive elements.

*High degree of specialization.* The most prominent feature of Kista as an innovation cluster is its strong specialization and clear identity. It has an unusually strong focus on a small range of interrelated industry sectors, centred around Ericsson's specialty of wireless

communication systems. Kista's specialization emerged spontaneously and was not foreseen by the original developers of Kista (Bingtsson et al, 2011). In recent years Stockholm has started to discourage the development of new manufacturing facilities in Kista as opposed to headquarters and R&D facilities, but besides that there are no rules aimed to steer the tenant mix. Similarly the organizations active in the marketing of Kista have no formal policy of specifically targeting firms in certain sectors. The strong focus on wireless ICT is a market-driven process, in which relatively high land prices make it only sensible for firms that benefit from being close to other firms in wireless ICT to pay these prices. At Kista not only is a large fraction of its firms focused on ICT, but also the university branches at Kista (KTH and Stockholm University) carry out research and education almost exclusively in ICT. Kista-based firms indicate that being located in Kista gives them good access to university research that is relevant and useful, and to advice from other firms in the same business, e.g. in terms of recruitment and what events to visit.

This high degree of specialisation helped Kista to achieve critical mass – with a substantial pool of specialized workers – and a strong reputation in Europe, the US and beyond. This strong and specific reputation was found to be especially beneficial for start-up firms, as the Kista brand improved their access to VC investors and customers.

*Institutional environment.* A second factor is the institutional environment, i.e. the written and unwritten rules prevailing in Swedish society in general and in Kista in particular, that can either stimulate or obstruct innovation.

At the scale of Swedish society in general the most salient characteristic is a strong and broadly shared interest in new technology. Swedish firms, public institutions and consumers have been remarkable early adaptors of technologies from the GSM phone and its precursors, to high-capacity wireless Internet access. Large sections of the Swedish consumers are willing and able to try out new technology, and the Swedish government is eager to stimulate and facilitate this (Karlsson & Lugn, 2009. In this way Swedish society as a whole has functioned as a test bed for ICT innovations, and it continues to be well ahead of most advanced industrial countries in adapting to the latest technologies. In Kista, for example, the shopping mall functioned as living lab for context-aware mobile services.

Another institutional factor is the fact that Sweden is a small, open and crowded market. The low appetite for protectionism forces firms to innovate to remain competitive and attempt to become exporters from an early stage rather than aiming to dominate the domestic market. From the very beginning competitors of Ericsson were allowed to set up R&D facilities and even regional head quarters in Kista. Interviewees admit that existing firms may not always benefit from the entrance of (foreign) competitors, but they consider it more important to maintain the open atmosphere of Kista and keep a healthy sense of competition and rivalry.

*Strong governance and public-private partnerships.* The third feature concerns the way how Kista is governed, not only by the City of Stockholm but also through networks of public and private actors.

While Kista was developed in the context of a powerful top-down planning system, the actual local governance structure is more complex, requiring more initiative by non-government actors. As the municipality owns all the land, it can more or less force real-estate developers to take the City's social planning objectives into consideration. In addition, the City tries to involve companies on a voluntary basis (e.g. in educational and environmental programmes), in their role as good corporate citizens.

Besides the local government the other important player in the local governance of Kista is the Electrum Foundation with a board that includes the Mayor of Stockholm, the President of the KTH University and CEOs of large Kista firms. Its mission is to promote the development of Kista and bring together the three Triple Helix actors – industry, academia and government – to jointly address any issues and challenges faced by Kista's tenants and other stakeholders. Electrum has five councils that each covers one aspect of Kista (higher education, innovation, infrastructure, marketing and research). These councils operate as think tanks and organize meetings and other events. Electrum Foundation owns two subsidiaries to help it implement its goals: the STING business incubator and Kista Science City AB which facilitates interaction between the Triple Helix actors.

**Current debates**

Kista is very successful, but how to improve the performance even more? The following issues are 'trending' in the current debate:

*Creating urban vibrancy.* Kista's high level of specialization also has its drawbacks. Respondents identify Kista as professional and competent, but also boring and nerdy. Firms that are active in 'soft' ICT such as games and app developers strongly prefer more vibrant areas such as the Stockholm city centre. Its 'nerdy image' will make it hard for Kista to diversify into other sectors and to transform it from a science park into a real city. Many young entrepreneurs and knowledge workers indicate that they would not consider living in Kista, but strongly prefer the vibrancy and atmosphere of the Stockholm city centre.

Since the ideas emerged to develop the Science Park into a Science City several measures have been taken to make the area more attractive and vibrant by investing in cultural events & centres (such as the NOD building, to be opened in 2014/2015), student housing, high-end apartments, more attractive and lively walking routes and improved transport connections with the city centre and the airport. Whether these measures will be effective remains to be seen.

FIGURE 4: IMPRESSION OF THE NOD BUILDING


Source: Scheiwiller Svensson Arkitektkontor

*Keeping the Kista brand strong*. Various marketing organisations have been important in spreading the story of Kista Science City among relevant target audiences across the globe. The reputation of Kista as a world-leading 'Wireless Valley' is a strong factor of attraction.

As long as Ericsson remains a world-leading ICT firm this reputation is likely to retain its power. However it is uncertain whether Kista's reputation would remain strong if at some point in the future Ericsson relocates or loses its leading position in ICT. Possibly the reputation of its university departments, of which especially KTH (known in English as the Royal Institute of Technology) is well-known abroad, might be strong enough to carry on the reputation of Kista.

A bigger challenge is the marketing of Kista as a science city. While foreign observers might be persuaded that Kista and its surrounding region constitute an integrated region, the facts on the ground currently do not support this view. Only when the high level of segregation is addressed and Kista becomes a more urban and lively area with attractive housing and facilities, it would actually be possible for visitors to experience it as a true city.

*Attracting talent.* The dense concentration of ICT firms in Kista has created a vibrant local labour market which, due to its high level of specialization, offers excellent job opportunities to specialized engineers. But the supply of human resources has not kept up with demand, leading to shortages and rising wages. Addressing these shortages is a challenge for Kista's universities, as well as for the municipalities' housing policy. The origins of the human resources shortages are partly demographic but also stem from a worrying

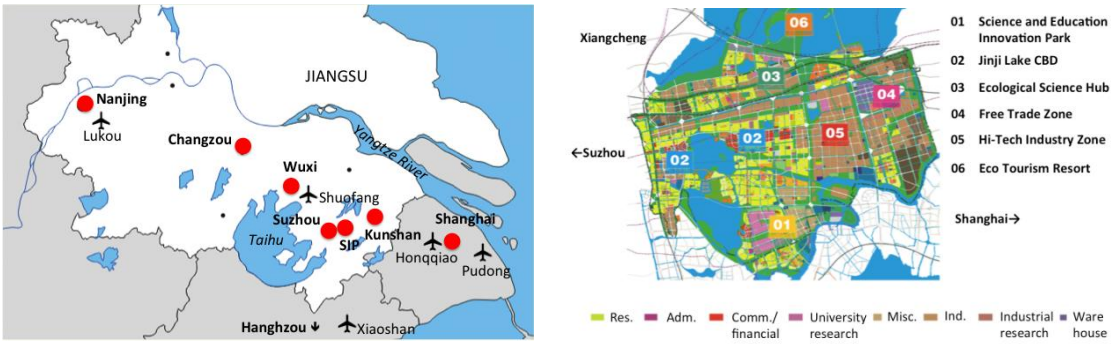
decrease in interest in ICT majors among Swedish high school graduates. Several initiatives have been launched to promote a career in ICT.

## Suzhou Industrial Park

### Introduction

Suzhou Industrial Park (SIP) is the main science park in the Chinese city of Suzhou, located near Shanghai in the Yangtze River Delta. Suzhou is a second-tier city with a population of 4 million and administrates a municipality with a total of 10.5 million inhabitants. While still an industrial backwater in the 1980s, Suzhou grew into an industrial centre and one of the key magnets for foreign direct investments of Eastern China. With about 700,000 residents and 20,000 firms, a quarter of which are foreign firms, SIP is the main engine behind Suzhou's growth. It took SIP only 18 years to grow from a rural area into a large industry park, and from the early 2000s on it started its transformation from industry to science and innovation. Currently the park hosts 23 university departments with a student population of 72,000 (18,000 at Master's level), including a growing number of universities co-founded with an international partner institute. Moreover as of 2012 the park attracted about 1500 returning overseas Chinese, who are expected to become the backbone of research and entrepreneurship at the park.

FIGURE 5: LOCATION AND ZONING OF SIP




Source: Suzhou Industrial Park Investment Guide, authors

### Background

SIP was founded in 1994 as a collaboration project between the Chinese and Singaporean national governments. SIP is the largest of a series of Regional Industrial Parks or "mini Singapores" set up by Singapore in emerging East-Asian economies, with the aim to export its governance model and urban planning expertise. Besides generating revenue, Singapore hoped these parks would reaffirm the city-state's position as business centre of East-Asia. China on the other hand wanted to use Singapore as a model of business administration and urban development, learning how to attract world-leading MNCs and nurture high-tech industry. Large numbers of Singaporean experts were sent to plan and guide the development of SIP, and an ambitious 'software transfer' project was set up to immerse

Chinese park managers with the Singaporean business culture and style of administration (Pereirra 2004, 2007).

But the park's early development was slower and more costly than expected and by 1999 its future was uncertain. Singapore had insisted on a strict urban design with high-quality facilities, requiring vast sums of investment capital and leading to higher rent levels than in competing industry parks. Moreover a conflict erupted as SIP's Singaporean managers accused the Suzhou local government of neglecting SIP and instead aggressively supporting its own industry park called Suzhou New District (SND), which is fully owned by the municipality (Inkpen & Pien, 2006). The conflict was resolved by switching majority ownership from Singapore to its Chinese partners, and by giving local Suzhou administrators a leading role in the further development of the park. By 2001 the new park management succeeded in making the park profitable for the first time, by attracting large numbers of tenants as well as developing extensive residential areas in the park (Dolven, 2001).

After a few years of rapid expansion SIP started to experience a shortage of vacant land. Moreover while a low wage level used to be the main selling point for foreign MNCs locating in SIP, workers' wages were rising and it became clear that a new development strategy was needed. SIP's administrative committee (SIPAC) decided to change its focus from expansion to upgrading, and to transform SIP from an industrial park to a science city. In 2003 within SIP development of the Dushu Higher Education Zone Town started. This new development core of the park combines many functions related to knowledge and innovation. It hosts Chinese and international university departments (both education and research centres), provides student housing to a massive student population (about 73,000 by 2012) and it includes several clusters of innovative firms and start-up incubators dedicated to a specific industry sector (most notably Biobay for the biotech sector, and Nanopolis for the nanotech sector). Moreover an incentive program set up by the Chinese government attracted large numbers of overseas Chinese to return to China and set up their research teams or innovative companies in SIP. Another source of entrepreneurial talent is formed by Singaporean academic researchers who receive incentives and seed funding to apply their research findings through a start-up firm in SIP. In addition to a shift to research and innovation, SIP is also in the process of diversifying its economic profile by developing a substantial business services sector and by developing itself into a tourism destination.

**Actors**

Key companies in SIP include Hitachi and Samsung. Both firms were among the early tenants to move into the park, and went on to draw many of their suppliers into the park as well (Walcott, 2002). Recently Samsung has also established close bonds with local education institutes, especially the SIP Institute of Vocational Technology (SIPIVT). Samsung provides this vocational education institute with advanced electronic equipment (such as dying and sawing equipment used in the semiconductor industry), in return for which SIPIVT offers Samsung tailor-made education programs (China Youth Daily, 2011; Suzhou Daily, 2011). In

other words Samsung can be counted as a leader firm that is strongly embedded in SIP, and is willing to invest in the future development of the park. Since 2003 SIP also hosts the largest PC factory of China, owned by one of China's most important high-tech SOEs Founder Technology.

Other key actors in SIP are Soochow University and the Chinese-British joint venture Xi'an Jiaotong-Liverpool University (XJTLU), which are the earliest and most important education institutes of SIP. Recently the National University of Singapore also set up a SIP subsidiary that may play an important role in the development of education and research, and its research centre NUSRI is a source of innovative start-ups for SIP.

**Key Performance Indicators**

SIP has come a long way in its process of upgrading from an industry park to a science city. This can be measured using a number of key performance indicators.

- *Start-ups*. As of 2012 a total of about 3000 start-ups are founded in SIP per year (SIPAC). Many of these firms are founded by returning overseas Chinese with experience and networks in Silicon Valley and other innovative regions.
- *Patents*. According to SIP's official statistics (SIPAC) the park had a patent output of 3014 in 2010, which is double the number in 2009 and triple the number of 2008. In other words SIP has recently reached a very high level of patent output which continues to increase rapidly. However these figures may not be directly comparable to those of Western innovation ecosystems due to differences in patent registration practices.
- *Employment in high-tech sectors*. In 2010 in SIP 60.4% of workers of industrial firms worked at firms classified as 'new and high tech industry', which includes aviation, ICT, the biomedical sector, electrical equipment, new materials and new energy. For 2024 a target of 75% has been set for SIP (SIPAC).
- *R&D expenditure*. In 2010 R&D expenditure as a percentage of GDP stood at 4.4%, having steadily increased from 2.9% in 2006. For 2024 this is planned to increase to a level of 6% (SIPAC).

**Knowledge hotspots**

The following knowledge hotspots are being developed in SIP:

- *Biobay*. This 'park-in-a-park' cluster with a size of 0.9 $km^2$ is a zone within SIP that is tailor-made for biotech firms and research institutes. Biobay was opened in 2007. Like Nanopolis and Creative Industrial Park, Biobay is located in Dushu Higher Education Town in close proximity to SIP's universities and academic research institutes. Biobay is inspired on the Biopolis cluster in Singapore, which is designed as an attractive location for high-tech firms and hosts many subsidiaries of foreign biotech multinationals. In addition to this Biobay also includes extensive start-up incubation facilities, and hosted 275 start-up firms as of 2012.

- *Nanopolis*. This is a cluster similar to Biobay but aimed at the nanotech sector, which is currently under development. Construction started in 2011, and when finished Nanopolis will be a 1.5 $km^2$ cluster that includes R&D facilities, small-scale production and pilot testing facilities and convention and exhibition facilities. Moreover the cluster will offer business space for the HQs of a limited number of nanotech companies, and incubation space for start-ups in the nanotech sector.
- *Creative Industrial Park.* This is a 0.8 $km^2$ cluster founded in 2006 and completed in 2011, dedicated to software (outsourcing), game development, advertisement and animation design. By 2012 it had attracted 105 firms with a total of 5500 workers. It has a younger image than the other clusters in SIP and aims to include creative design and art in addition to software and business services. Start-up incubation is a major focus of Creative Industrial Park. An incubation building named Idea Pumping Station is dedicated to housing and offering support facilities to start-ups. Firms are housed in lofts (flexible housing spaces) and interaction is stimulated in shared exhibition spaces. Currently this building houses 31 firms, about half of them in advertisement and the other half game development and animation design (including Snail Animation, China's first and most successful 3d animation firm).
- *Genway I-Park.* I-Park, or "Suzhou 2.5 Industrial Park", is a 0.6 $km^2$ cluster currently under development in SIP, about 1 km northeast of Dushu Higher Education Town. In contrast to the other specialized clusters within SIP, I-Park is aimed at the business services sector rather than ICT or natural sciences. The first phase of the park opened in 2010 and houses firms and firm subsidiaries that carry out services such as product localization and marketing, which MNCs like IBM and Kraft Foods have outsourced to them. I-Park offers its tenants human resources services, a shared exhibition space, a manager club and an industry forum, and next year it will open high-end residential facilities for international workers employed by firms in the cluster. The design of the cluster is inspired on American university campuses, with the aim of promoting unplanned meetings and a sense of community.

**Special features**

Suzhou Industrial Park as an innovation ecosystem has a number of defining characteristics:

*Institutional environment*. While reliable and supportive local administration is an important asset for any innovation ecosystem, it is the single most defining characteristic and key selling point of SIP. The uncertainty and mixed reputation of China's institutional environment created an opportunity for SIP to attract investors by offering transparency, reliability and a service-oriented administration. To instil these values, SIP's Singaporean founders have spared no expense to train all SIP administrative personnel in its 'software transfer' project, inviting hundreds for training courses at Singaporean state ministries and public institutions at the highest level. Examples of SIP's institutional environment are planning stability (the park's zoning and design plans are strictly carried out), a transparent

and corruption-free environment of "Singapore quality", and a comprehensive SME Service Center in which tenants can complete all their administrative duties (registration, tax payment, etc) in a 'one-stop shop', besides enjoying many additional services (e.g. help with filing patents).

*Deep university-industry collaboration for human resources development.* To ensure a sufficient quality and quantity of human resources, SIP has attracted 23 university departments with a focus on science and engineering majors. These universities are located next to biotech, nanotech and other specialized firm clusters that include start-up incubation facilities. Colleges of vocational education are even more tightly integrated with local industry. For example the local SIP Institute of Vocational Technology (SIPIVT) supplies graduates 'on order' to key SIP-based firms such as Samsung according to their specifications, and receives expensive industrial machinery for training purposes in return (e.g. equipment for training in semiconductor production, donated by Samsung).

*Extensive government VC funding.* To compensate for a paucity of venture capital, a Fund of Funds has been set up by the Chinese government to fund VC funds (up to 30%; leaving 70% for private investors to contribute) which in turn provide seed funding to innovative start-up firms. Moreover incentive programs have succeeded to attract about 1500 overseas Chinese researchers and entrepreneurs to return to China and set up their research teams or innovative start-ups in SIP.

**Current debates**

SIP also faces a number of challenges, of which the two most pressing ones are the following:

*So far SIP can only attract innovative start-ups from outside, not create them locally.* SIP, much like its development model Singapore, has so far depended on attracting entrepreneurs and innovative SMEs from elsewhere, especially overseas Chinese working in Silicon Valley. In other words the 'spark' of the innovation happened in a different innovation ecosystem rather than within SIP itself, and SIP's role is limited to nurturing an existing business idea. To really become a sustainable innovation ecosystem SIP should become a place of cutting-edge research in which innovation breakthroughs and serendipitous meetings of minds lead to the creation of new ideas. So far scientific research at SIP and the entrepreneurial culture in China have not reached this level yet (see also Wei et al., 2009).

*The transition to a science city is hampered by holdovers from SIP's industrial era.* SIP did not start as a science park, but rather as a location for low-cost manufacturing outsourced by multinational companies. If SIP wants to make the transition from industry park to science city, it needs to overcome the brand image of a factory zone as well as deal with existing tenants that do not fit the new profile of a science city. Low-tech manufacturers who have purchased land at SIP at relatively cheap prices early in the park's development are reluctant to make way for more innovative firms, since relocation is costly and rising land prices make SIP land a lucrative investment they are keen to hold on to. However SIP's transition to a science city is helped by the fact that from the start the park was planned according to high

quality specifications. Expensive investments in the attractiveness and efficiency of SIP's infrastructure, natural environment and amenities (including the state-of-the-art Suzhou Culture and Arts Centre opened in 2007) are now paying off as they help the park attract residents and even tourists, and make SIP an attractive location for conferences and expositions.

## Cross-case analysis: seven challenges for innovation ecosystems

### Challenge 1: Fostering university-business linkages

Universities play a significant role in innovation ecosystems. As educating institutes, they are prime attractors of talented young individuals, and play an important role to train professionals. As research strongholds, they may develop partnerships with companies in the ecosystem, to conduct pre-competitive collaborative R&D, or more mundane contract research; this may help to make the companies in the system more innovative. Finally, universities can be a source of new business ventures, when academics or students start their own science-based businesses.

For most interviewees (in each case study), the prime role of the university is to attract talented young people and provide them with skills relevant to the local industry. The high-tech clusters in Eindhoven and Stockholm would cease to prosper without the new influx of talent. In Suzhou, during the early days of the industrial cluster development, there were no universities. But when the area upgraded towards an innovation hub during the last decade, companies felt a great need to have reputed universities nearby, primarily as a source of new talent. Currently, about 24 university branches (mostly foreign) have opened up in the area.

Most companies that we interviewed consider the research function of universities as less important. In each ecosystem we studied, only a limited number of high-tech firms (mostly large ones) are engaged in substantial collaborative research programmes with the university, and university research is not primarily locally (or regionally) oriented. Typically there is a long road (if any) between basic/fundamental research and commercial application[1]. Smaller, science-based firms tend to have research connections to the university where the owner obtained his or her PhD degree (not necessarily the local university). In each case, the gap between academia and smaller companies is large. Also, in all of our cases (in contrast to the situation in some successful US universities), there is very little labour mobility between business and academia. This is widely seen as a problem.

[1] Note that research and education are deeply linked: research is an important driver of education and PhD education is fully intertwined with research.

*Aligning business and academia*. Evidently, the chance of a productive marriage between business and academia in the region is higher when both work in the same (technology) fields or specialisations, and when firms have the "absorptive capacity" to use and exploit the knowledge developed in the university. What policies would help to improve this strategic connection, when universities are fully independent and free to choose their own research and education directions? We identified 4 types of interventions: 1) put university and business physically together in the knowledge hotspot 2) promote staff exchange between the two systems 3) attract universities from outside that neatly fit the interests of the industry and 4) create dedicated platforms/organisations where university and business collaborate.

In Eindhoven, there is a long and continuing tradition of industry-university alignment based on the Philips culture that dominated the ecosystem for a century. Philips always had a significant influence at the university, with leading Philips researchers holding university chairs, ensuring a strong connection between industry interests and university research. Over time the TU/e became less dependent on Philips, but it continued to be perceived (and to perceive itself) as a university in service to local industry. In Stockholm and Suzhou, a different dynamic was at work. In Stockholm, the answer was to increase physical proximity: the city managed to convince the universities to re-locate their IT departments and faculty from the city centre to Kista, where the IT industry – led by Ericsson – began to agglomerate. Physical proximity made it easier for students to take internships in Kista companies, and for companies to spot talents and develop partnerships. The universities helped the area to obtain a global reputation as IT hotspot. At current, the area hosts about 7,000 students. In Suzhou companies were in the lead: they were invited to formulate their need for competences, and the SIP management lured universities from abroad to meet this demand.

*Platforms*. A common way to bring academia and business together is by creating platforms and institutes for university-company collaboration. In Eindhoven and Stockholm, the key decision makers from academia and business meet each other at strategic "triple helix" platforms (Brainport and Electrum Foundation, respectively) where they discuss strategic directions and find solutions for bottlenecks for the region, and commit themselves to common agendas. On the operational level, there are organisations where academics and companies work on common projects. Eindhoven has its Holst Centre, where companies and academics (not only from Eindhoven) develop innovations, typically in the pre-competitive stage. It has a partnership model with industry and academia based around shared roadmaps and programs. It has over 180 employees from 28 nationalities and a commitment from close to 40 industrial partners. PhD topics are defined in collaboration with the three technical universities in The Netherlands (Delft, Eindhoven, Twente), and many Master and PhD students from these universities are working on the technology programs at Holst Centre. Industry partners may benefit from (commercially interesting) breakthroughs of

fundamental research; in return, the universities get market insights and can draw on the experience of the industrial partners to help focus their research activities.

A prime example from Stockholm is the Mobile Life Centre (MLC) in Kista, an institute in the area of mobile services. It is a joint venture of several large firms (including Ericsson, Microsoft, Nokia and IKEA), and the universities KTH and Stockholm University. It is 33% funded by the state research investment agency VINNOVA, and 67% by its industrial members. Research undertaken is by and large pre-competitive, providing input into the long-term R&D efforts of all partners involved but not usually leading to immediate applications which firms prefer to develop in-house. When MLC research does lead to practical IPR, complicated negotiations about the ownership of this IPR are avoided with the simple rule that all partners have equal rights to all IPR resulting from MLC research.

The cases of Eindhoven and Stockholm illustrate that collaboration between industry and academia can be very fruitful, but seems to work only with substantial public funding. Active interventions are necessary. It also shows how difficult it is to involve smaller companies: typically, the large MNCs have more absorptive capacity to collaborate with university and benefit from these institutions.

**Challenge 2: Attracting talent**

Talented people play a crucial role in the development of successful innovation ecosystems. Regions with a high innovation performance are able to attract and retain talents first and foremost because they provide access to opportunities in employment and education. In all three case studies interviewees emphasize that the attraction and retention of talent is a key challenge to be addressed. Surveys among (international) knowledge workers in Eindhoven confirm that professional and academic opportunities are the most important reasons to come to Eindhoven. Although the accumulation of talents in innovation hotspots is a self-reinforcing, market-driven process, policy interventions can to some extent influence the ability to attract and retain students, researchers and (international) knowledge workers. The three case studies provide us insights on how this can be done.

*Attracting universities, research institutes and firms.* Interviewees indicate that universities, research institutes and (large) firms play a critical role in attracting talented people and ensuring that they acquire the skills and knowledge needed in local industries. This can be realised through education, participation in research projects and job experience. The question is now if cities can steer this process of attracting 'talent attractors'. The answer is "yes, to some extent". In Eindhoven they managed to convince TNO Industry (a national research institute founded by the Dutch government) to move its activities to the campus of TU/e, hiring former employees of Philips who might otherwise have left the region. The development of Kista would have been less successful without the pressure of the Swedish government on two Stockholm-based universities to move their ICT and electronics-related departments to this area in the 1980s. More recently, Suzhou Industrial Park succeeded to acquire around 24 university branches (mostly foreign) in the transition from an industrial

cluster to an innovation hub. In response to an increasing need among companies to have reputed universities nearby, primarily as a source of new talent, the SIP administration stimulated universities to settle down by offering them five-year rent reliefs.

*Attracting (international) knowledge workers.* Another way to attract talent is developing specific programmes, facilities or incentives targeting (international) knowledge workers. The aim of these interventions is to create an environment that takes away all kinds of barriers for (returning) migrants from other regions or other countries. With this objective in mind, the City of Eindhoven invested in a high-quality international school. Also the development of Strijp S – with innovative living concepts that meet the specific demands of international knowledge workers – fits in a strategy to make the city more attractive for this specific group.

**Condotoren: an innovative living concept in Eindhoven**

The Condotoren is a 24 story building in Strijp S (Eindhoven), for which construction is expected to start at the end of 2012. The tower can be seen as an innovative urban living concept with apartments and services that are tailored to the needs of the future residents, which are expected to include a large share of international knowledge workers. The rental apartments are relatively small but completely furnished, giving the feel of comfortable hotel suites. The limited size keeps rental princes relatively low. Residents will be able to make use of public space on the ground floor and semi-public facilities on each floor of the building, such as shared working and lounge spaces, guest rooms and rooms suitable for organizing a small party (to be rented on a daily basis).

In Suzhou, the attraction of international knowledge workers is high on the agenda. While so far it has been difficult to attract Western knowledge workers and entrepreneurs, the park has seen a large influx of talents from the overseas Chinese community. The main policy for attracting them is through the 1,000 talents programme. Entrepreneurs and researchers are offered subsidies or VC investments if they relocate to SIP. Moreover incentives are offered in the first two years, in the form of a lump sum relocation compensation and assistance in finding suitable housing and arranging tax and other legal issues. Moreover in case returnees arrive with their family, advice is offered on finding good education for the children. In the interviews returnee entrepreneurs say that what mattered most for them were the VC investments offered through the 1,000 talents programme, while other financial incentives and subsidies did not play a role in their relocation decision. Moreover very few of them arrive with their wife and family.

*Improving international accessibility*. An important condition for international knowledge workers is international accessibility. In all three case studies we observe local policy initiatives to improve the connection between the innovation ecosystem and the nearest international airport (Amsterdam Schiphol Airport, Stockholm Arlanda Airport and Shanghai Pudong Airport respectively). The accessibility of Kista Science City, for example,

will be improved with the extension of a commuter train connection to Arlanda airport. In the two other case studies (Eindhoven and Suzhou) local policy makers are putting pressure on decision makers on a higher level (the national government, national railways, etc.) in order to realise more frequent and/or faster connections.

*Improving the inflow of talents from the commuter region.* Talents can be attracted from abroad, but also from within the commuter region of the innovation ecosystem. The ability to attract talents from the region depends, for one thing, on the accessibility of the innovation hotspots. Suzhou Industrial Park and Kista Science City benefit from good connections with neighbouring cities such as Suzhou and Shanghai, and Stockholm respectively. Another relevant factor is the inflow of talents from local universities and schools. This inflow is partly dependent on demographic factors (natural growth), but also on the popularity of technical studies and jobs among young people. Particularly in Europe – where the transition to a services-based economy has progressed much further than in China – regions are struggling with a decreasing interest in "technical careers" among high school graduates. In Kista the Electrum Foundation has anticipated this threat by organizing "Future Friday": an annual event that promotes ICT majors to prospective students (drawing about 1,000 visitors every year). Moreover they convinced engineers and entrepreneurs from Kista-based firms to make regular visits to secondary schools in the Järva area and to organize site visits. Also worth mentioning here is the Digital Art Centre (see the box below).

**Digital Art Center**

The Digital Art Center (DAC) is an interactive space for exhibitions, meetings and workspaces, in which artists, researchers and firms, both from Kista and elsewhere, can showcase their work. In this way the technology and research results developed at Kista can be made visible to a wider audience in an accessible and inspiring way. The Center's target groups are school children and engineers, but also for example tourists who want to get a feeling for what happens behind the closed doors of Kista R&D labs. DAC expositions focus on interactive objects such as educational games, but can also include non-interactive art or consumer products developed by Kista firms. Moreover firms are welcome to organize their product launches and other events at DAC.

**Challenge 3: Promoting entrepeneurship (spin-offs and start-ups)**

Another key building block of innovation ecosystems is entrepreneurship. High rates of new firm creation coupled with a supportive environment for start-up allows the ecosystem to continually renew itself. Entrepreneurs identify and exploit valuable knowledge created at universities, research institutes, and lead the regional economy into new industry sectors, preventing the region from becoming dependent on stagnating sectors. However in each of the three cases of innovative ecosystems studied, start-up entrepreneurship was a relatively problematic aspect of ecosystem development, and regional actors are still experimenting

with policy interventions to strengthen it. The major problem, experienced in all three cases, was a lack of a well-developed venture capital community. Private angel investors are lacking in all regions, and government agencies fill this gap by providing small seed investments to promising start-ups. But after the seed phase most start-ups require a much larger second round of VC before they are mature and stable enough to attract investments from regular investors, and this second stage VC is too scarce in all regions studied. This problem by itself keeps start-up rates below their potential level in the three regions, and pushes some entrepreneurs to leave the region and look for an ecosystem where VC is more readily available.

Despite the shortage of venture capital, the Eindhoven region has produced a limited number of highly successfully start-up firms. The most important of these are spin-offs from existing firms, mostly notably Philips which supports spin-off formation as part of its 'open innovation' strategy. A special feature of the Eindhoven region is the high level of trust that exists among firms and other local actors, resulting in a supportive environment for start-up firms. Employees of firms and research institutes are supported to start their own firms and are welcomed into the region's supply chains. But the rate of new firm creation is not as high as may be expected of a leading innovation ecosystem, and there is an unhealthy dependence on the region's leader firms as there are few other sources of start-ups that grow into mature firms. Kista is another example of a successful innovation ecosystem that depends on large established firms rather than a vibrant start-up community. Compared to Eindhoven, major Kista-based firms are less open to spin-off activities of their employees, and even within the firms themselves engineers have often struggled with a conservative management board to get innovative ideas implemented. Finally SIP has only recently begun the transformation from a manufacturing park to a science and innovation hub, and is still building up the knowledge base and infrastructure needed for generating and nurturing start-up firms. It has the ambition to become a source of indigenous start-up entrepreneurs, but so far it still depends on attracting entrepreneurs from elsewhere to build up and diversify its ecosystem.

*Venture capital.* Many different policy interventions have been developed in Eindhoven, Kista and SIP to support entrepreneurship, and from these three types of intervention can be distinguished. Firstly the three regions have developed ways to tackle the main problem of a lack of (second round) venture capital. In contrast to small seed investments, second round investments require very large sums (depending on the industry sector it can be in the order of 1 to 10 million dollar or more), which makes it impossible for most governments to fill the gap singlehandedly. Since these investments are still quite risky private investors are unwilling to supply enough money, but in SIP an intermediate solution is tried. A state-funded Fund of Funds has been set up which provides VC funds with a base of 30% of their funding, leaving 70% of the funding to be supplied by private investors. In case of losses on the VC investments made by these funds the government takes the first hit, so only major losses will filter down to private investors. In this way funds have been created

that are large enough to supply investments beyond the initial seed funding stage. However this approach still requires very large public investments which not every state can afford.

In Eindhoven and Kista a different approach is taken which focuses on the mobilization of networks of private VC investors. In regions such as Silicon Valley networks of private angel investors are able to raise large sums of money, because they share the investment risk and because the investors themselves are intimately familiar with the technology they invest in (since many of them made their fortune as start-up entrepreneurs themselves). Attempts are made in Eindhoven and Kista to bring angel investors into contact with each other and with the start-up community that needs their investments, hoping that a vibrant VC community will emerge. However one can question whether a 'Silicon Valley mindset', of high-profile, risk-taking investors who take pride in enabling successful IPOs, can be engineered in this way.

*Incubators and creative hot spots.* The second type of policy intervention is the creation of start-up incubators. In addition to providing VC investment, a broad range of other services can be supplied to entrepreneurs, including coaching by experienced entrepreneurs, (subsidized) business space, access to expensive facilities such as cleanrooms and training courses on for example pitching a business plan to potential investors. These services are relatively inexpensive compared to the cost of seed investments, and can increase the returns on these investments by allowing start-ups to avoid common mistakes. The STING start-up incubator is a good example of such an integrated approach of stimulating entrepreneurship, making a strict pre-selection of candidate start-ups and then providing these high-potential start-ups with relatively generous support. In SIP start-up incubation is taken a step further by not only providing a broad range of services to start-ups, but by creating specialized innovation hot spots that are intended to create the ideal environment for start-up firms to succeed. For example Biotech firms are incubated in the Biobay cluster, in which they are surrounded by biotech firms, academic research and education institutes specialized in biotech and of course other biotech start-ups. Similar tailor-made clusters are under development for the nanotech, ICT and business services sectors. Great care is taken to make these clusters highly attractive environments for working, living and studying, and every cluster has its own organizations to organize meetings and stimulate the formation of social networks among the cluster's tenants.

A somewhat comparable approach is taken in the Strijp S project in Eindhoven, in which entrepreneurs in the design sector are offered an affordable and attractive working and living environment, which also includes museums, galleries and a design academy. However while such initiatives can be helpful for nurturing entrepreneurial talent, they only provide the hardware and cannot substitute for an inadequate software (talents and mindset) and orgware (networks and regulations). Especially in SIP heavy investments are made in creating these innovation hot spots because they are intended to attract entrepreneurial engineers from outside of the park, as the park lacks a well-established academic infrastructure. So far they have been successful in attracting returning overseas

Chinese (many of whom were planning to return to China anyway), but it is questionable whether the approach also works for attracting entrepreneurs from other countries.

*Educating entrepreneurial engineers.* A more sustainable approach than depending on attracting talents from outside the ecosystem is to educate them within the ecosystem itself. In Eindhoven and Kista local universities are developing courses to train entrepreneurial engineers with the skills needed to create high-tech start-ups. In most regions (with only rare exceptions such as Silicon Valley) there is a disconnection between engineers and entrepreneurs. Engineers are trained as specialists with advanced technical skills, but without the skills and mindset needed for entrepreneurship. On the other hand young entrepreneurs tend to originate in business schools and lack the technical skills for identifying valuable technical knowledge and applying it in innovative products. To address this, at the Technical University of Eindhoven (TU/e) entrepreneurship courses have been made mandatory for engineering majors.

At Kista an even more radical approach is tried out in the form of the Stockholm Science and Innovation School, a high school that cooperates closely with Kista-based high-tech firms to instil an interest in technology and even offers international traineeships through the network of MNCs like Ericsson. Such interventions can create the software needed for a vibrant start-up community, but their success depends on the willingness of local firms to take part. Moreover organizational changes are needed before the gap between engineers and entrepreneurship can be closed. Academic researchers should be free to try out entrepreneurship without losing their (cosy) tenureship, and it should be easier for knowledge workers to cross over from private to academic positions and back. This is especially a problem in Kista, and to a lesser extent at Eindhoven. At SIP by contrast it is much easier to combine an academic position with start-up entrepreneurship, but there it is not the result of a healthy orgware but rather a lack of regulation. This results in university professors investing public funds into their private enterprises, and unclear IPR ownership situations. Clear but flexible regulations are needed to facilitate the entrepreneurial engineer.

**Challenge 4: Building communities**

Another important issue in the development of innovation ecosystems is community building. Two main types of communities can be discerned: urban communities (residents of an urban area that share a certain identity and form all sorts of social networks) and innovation communities (networks of people and firms that share or use each other's knowledge and competences to create innovations, i.e. a more functional type of network). In a science city, the two types may partly overlap. Urban communities are place-bound by definition, whereas innovation communities have no strict geographical boundaries. In our study, we focused on innovation communities, with special attention for their local components.

The development of communities – characterised by strong networks, social capital and high levels of trust – is to some extent a matter of history and regional culture. In Eindhoven and Kista, for example, two major firms – Philips and Ericsson – played a key role

in the development of communities: many talents in the ecosystem used to work at one of these firms or their parents did. This shared background has created a high level of trust and hence facilitates interaction between actors. This is all very informative, but maybe not so helpful for regions that want to develop their ecosystem from scratch. How to *create* places in which researchers, engineers, entrepreneurs and venture capitalists meet each other on a regular basis? Is it possible to develop urban areas where residents have a strong sense of community? What interventions can stimulate planned and unplanned meetings? The three case studies provide some answers to these questions.

*Planning for interaction.* One strategy to stimulate community development is "planning for interaction": stimulating spontaneous meetings between people through the design of buildings and zoning of areas. In Kista they tried to enforce interaction through the design and location of the iconic Electrum Building, built in the 1980s. It has a strategic location between the university campuses on one side and business premises on the other side, with the main entrance on the central axis through Kista. The ground floor was planned to function as an indoor street, with restaurants and shops, while the other floors accommodate academic institutes, firms and R&D labs. They all have their entrances – linked by elevated walkways – towards the open gallery. Facilities are concentrated in specific rooms, thus inviting users to cross through the gallery frequently. Most walls are made of glass, again to stimulate interaction (Bingtsson et al., 2011).

But did it work? Not really. On most days visitor traffic on the ground floor is too limited, except during events and exhibitions. Not that many shops and restaurants have opened their doors due to high rental prices and insufficient customers. One explanation for the disappointing visitor flow is the invisibility of the open gallery from the street. Furthermore there are doubts if the regular flow of workers through the building has actually resulted in unplanned meetings, since there are few places that invite them to stop and stand, or sit down.

Similar examples can be found in the case of Eindhoven. In Strijp S, all main buildings have large public cafes on the ground floor enabling residents and workers to lounge and meet each other. At High Tech Campus, people are more or less obliged to have lunch in one of the centrally located facilities of the Strip, as other private canteens have been banned by the campus management. This physical layout surely encourages human interaction, but if it also succeeds in stimulating the exchange of ideas and collaboration is hard to prove. Maybe it does, but only in combination with other interventions to be discussed below.

*Organizing meetings and events*. A second strategy to stimulate community development is organizing meetings and events, thus facilitating encounters between people with the same backgrounds, similar interests and/or complementary competences. Clearly these interventions recognize the relevance of social, institutional and cognitive proximity in community building.

In Suzhou Industrial Park interaction between actors in the same industry sector (cognitive proximity) is not only stimulated by trying to concentrate them in the same area

(e.g. Biobay and Nanopolis; geographical proximity) but also by organizing cluster meetings on a regular basis, leading to social proximity. Interestingly we see that top-down policies are combined here with bottom-up initiatives undertaken especially by one group of foreign knowledge workers, namely "returnees" with Chinese roots (cultural proximity). These returned Chinese researchers and entrepreneurs have organized themselves in clubs that provide assistance with financial and legal issues, thus also functioning as meeting places. One of the returnees we interviewed even bought a restaurant together with other returnees working at SIP as a meeting place for their community. In other words in these "park-in-a-park" clusters in SIP many dimensions of proximity are combined, creating the opportunity for strong communities based on mutual trust to emerge.

The High Tech Campus and Strijp S not only stimulate interaction by design (as we discussed above) but also through the organization of meetings. When a famous scholar or entrepreneur visits one of the firms located at HTC, the campus management organizes a "meet-and-greet" session. The developer of Strijp S organizes networking events for residents.

**Challenge 5: Creating a vibrant urban culture**

In this study, we analysed innovation ecosystems at several spatial/geographical levels: the region, the city and a specific part of the city (Kista, High Tech Campus Eindhoven, Strijp S, and Suzhou Industrial Park). Crucial questions in this light are: what is the impact of the environment (not only physical/geographical but also social and cognitive) on the innovative behaviour of people and firms, how can environments evolve that foster innovation, and what spatial scales (hyper-local, the city level, the level of the urban region?) are relevant? These are crucial questions for developers of science cities or any other type of knowledge hotspot. What have our cases taught us?

*From the science park model to urban innovation concept.* In each of the cases we studied, we found that policy makers are convinced that the "ivory tower model" of innovation is not appropriate anymore. In this model – based on a linear view on innovation, and with the traditional science park as archetypical expression –innovation hotspots were developed as stand-alone, monofunctional places, somewhat isolated from the urban fabric, where scientists and scientific entrepreneurs could elaborate their ideas, and turn scientific discoveries into new products.

This suburban or even "anti-urban" model is being challenged under influence of a number of new insights and fundamental changes: the rise of open and networked innovation practices where companies innovate together and work in all sorts of alliances; the blurring of boundaries between disciplines and emerging interplays between technology, design, finance, and behavioural sciences in the development of new products and services; new insights into the nature of innovation processes and human behaviour; changing preferences of skilled people concerning their working environment – they increasingly prefer an identity and amenity rich "social" place; changing balances between work and social life; and a shift

from hierarchical structures to networked and project-oriented ways of working (a "project economy").

By the second decade of our century, developers and planners in Europe have trashed the science park model, and replaced it by a more urban "New York City" innovation concept: vibrancy and compactness as central notions, with liveliness and diversity in a densely built environment, a mix of old and new, with amenities such as restaurants, hotels, all sorts of leisure and consumption opportunities, cultural facilities etc. These sorts of areas generate a dynamic identity, and give rise to unexpected encounters, plenty of networking, and are believed to be hotbeds for innovation and attractors of talented people. Innovation is not planned or managed; it "emerges" in this dynamic urban cocktail. Proponents of this new model call for mixing functions and open architectures, with many meeting places and central points. They advocate self-governance: instead of rigid zoning or planning, give people and firms room to shape their own innovative environments that fit their needs best.

There is increasing empirical evidence that these urban innovation environments are gaining ground: New York's urban and high-density "Silicon Alley" is rapidly approaching California's spread-out Silicon Valley as leading innovation hotspot in the US. In one of our case studies, the Kista area (a stand-alone monofunctional IT hotspot) is no longer the only eye of the storm: it is being challenged by a fast-growing cluster of new media companies (apps, social media, gaming) in the most dynamic parts of the city centre.

The best examples of this type of innovation hotbeds are found in or near the cores of old cities (mostly capitals, or cities with a strong intellectual tradition) in Europe and the US, and typically, there have grown autonomously, without active and deliberate policy intervention. The question remains whether such areas can be planned, and if so, how and to what extent.

In our case studies, we see that developers face tensions between planning and spontaneous development, between functionality and serendipity, between uniformity and diversity, between creating a new city and defining the hotspot as part of a larger metropolitan area. Also, we have indications that different types of innovation might prosper in different types of environment; finally, there is a cultural component. The European love for micro-mixed areas is not equally shared in Asia and parts of the US.

*Redesigning mono-functional hotspots.* All over Europe, older, mono-functional hotspots and campuses are being redesigned or "retrofitted" to include more diversity. New functions are added, such as residential zones, amenities, cultural facilities, education; it is tried to generate "buzz" by attracting visitors from outside the area, through events, cultural amenities, or by adding consumption functions like shopping malls or cinema's. Kista (see box) is a good example where all of this happens. The question of critical mass always pops up: will the new inhabitants and visitors ever generate sufficient buzz to make the place somewhat comparable to a lively inner city?

**Urbanizing Kista Science City**

Kista, Stockholm is a prime example. This area has developed since the 1970s as a prime IT hotspot (mainly focused on telecom network technology), with Ericsson as leader firm. It is a work-only area, and the employees commute from other areas in the Stockholm region. After office hours, the area is dead, except for the shopping mall that is built on top of the metro/train station. In the last decade, the need was felt to make the area more urban. Although Kista is functioning well (its companies are flourishing, many new ones came in), key decision makers in the area believe that leaving the area unchanged would undermine Kista's long-term innovative identity, and make it increasingly difficult for companies in Kista to attract skilled staff. Hence a massive "urbanization offensive". Over the last years, the main street was redesigned, and now has shops, coffee houses, restaurants etc. The Kista Tower (a recent high-rise) also has a lot of amenities on its first floors, and attracts many people at lunchtime. A shopping mall connects Kista to the surrounding residential areas, but these are mainly inhabited by poor inhabitants (many of them immigrants), and do not provide the "New York City" type of urbanity that appeals to Kista's employees. Recently, new plans were drawn up to further urbanise the area: there are plans to build a high-quality residential quarter, to open a secondary school –with a technology profile –, and also to build "The Nod", an open building that should function as exhibition space, as a centre where technology meets culture and arts, and as a place for start-ups. It occupies a central place in Kista, and should attract visitors from outside into the area.

Central Stockholm's city planners envision a larger "Kista Science City" that integrates Kista with its surrounding poorer neighbourhoods, while allowing for building high-quality housing in Kista that meets the needs of wealthy and skilled knowledge workers.

*Developing urban innovation hotspots from scratch.* Based on the same philosophy, newly planned hotspots are being developed as urban, mixed and diverse places from scratch; the new Strijp-S area in Eindhoven is being developed in this vein. It should become a vibrant and mixed creative quarter of Eindhoven. Old Philips buildings are refurbished and turned into apartments and offices. Several urban amenities, like restaurants, bars and indoor sport facilities (including a skateboard park) should make the area attractive for young, dynamic "creatives". Design-related events are organised to attract people from outside, and to shape the identity of the area as a design district.

*Monofunctional areas: good and quick access to city amenities.* A recurrent question is how "urban" a knowledge hotspot really has to be, especially when it is located very near a larger city or city centre. In Eindhoven, the High Tech Campus has some features of an old-school science park: it is mono-functional, and after office hours, the place is empty. Nevertheless, it is very popular, and firms are ready to pay premium rents to locate there. They benefit from the facilities, the networking opportunities with neighbours (there is tenant selection), and the brand name of the area. The city centre, with all its amenities, is very near (about 10 minutes drive), and there is sufficient high-quality housing available for

the many (international) knowledge workers. This case suggests that well-functioning mono-functional areas can thrive as long as they have a clear and identity, are well-managed, and there is good and quick access to city amenities. The same story goes for SIP, although this area is much larger; actually, SIP is a city in its own right, but one with a rather strict zoning plan. There is diversity, but on a rather high scale level. University and office campuses are not "micro-mixed" with housing and amenities, but locate in their own dedicated zones; there are separate residential quarters. SIP has some central "CBD-like" districts offering all the needed amenities –shopping malls, restaurants, cinemas, sports facilities etc.). Some outstanding facilities even attract many visitors from outside.

*Mixing technology with art and design.* Another debate is whether "diversity" is helpful or even necessary to promote innovative behaviour. The new orthodoxy claims it is, innovations would emerge from mixing technology with art and design, from blending different types of people in multi-disciplinary teams (with Apple as the mother of all examples). Spatial monocultures simply would not cater for that. In our study, however, we found two highly successful areas (Kista, and High tech Campus, Eindhoven) with little urban characteristics, focusing on a well-defined "hard" technology core. In Suzhou, that used to be a place for "hard" technological innovation, policymakers try to infuse the area with creative inputs from artists, designers and more creative industries. The Creative Industry Park with the Idea Pumping Station start-up incubator, aimed at among others animation and game design, is the main example of such policies. While the Idea Pumping Station is also open to artists, so far none have settled there. Moreover SIP has invested heavily in its state-of-the-art Suzhou Culture and Arts Center with a broad offering of classical (Western and Chinese) and modern performances, but also a public library focused on art and culture and an art training centre that draws visitors from all over Suzhou. So far, there are no measurable indicators that this approach has led to results; also, none of the companies we interviewed mentioned it as very relevant for their business processes.

**Challenge 6: Branding**

In all three cases the brand of the ecosystem is very important. These brands are not logos or symbols. It is the accumulated reputation ('having a good name') of the ecosystem. The brand is a marker for quality, reducing risk for investors and helps to build trust.

*Building a brand through strong associations.* The 'good name' or reputation exists as a network of associations in the minds of relevant stakeholders. These associations could be leading firms (Ericsson, Philips), cutting-edge start-ups, high-quality universities (such as KTH - the Royal Institute of Technology) and other research institutes (such as the Philips Natlab), innovations, famous people, landmark buildings, previous experiences (SIP's historical relation with Singapore) and other special characteristics of the area (such as the classical gardens and the historical town of Suzhou). Building a brand for an innovation ecosystem involves increasing the number of positive and fitting associations in the mind of the relevant audiences. These associations cannot be artificial of superficial, but need to be

based on real developments. Next, these developments have to be communicated systematically to the relevant target audiences.

*Acknowledge the path-dependency of place brands and that change is incremental.* One of the lessons from the case studies is that the brand of an innovation ecosystem is to some extent path-dependent. In the two European ecosystems, it started with the relocation and growth of a major corporation (Philips in Eindhoven) and the location of two subsidiary companies of a major corporation (Ericsson in Kista). In the Chinese example the brand started to evolve with the agreement between Singapore and China to create an industrial park according to the 'Singapore approach'. The precise loading of these brands has evolved over time. The path-dependency does not imply that you cannot influence building the brand of an innovation ecosystem. However, it does set the margins for changing the brand and the cases show that most changes are incremental. Only in case of big shocks to the system – such as the crisis in Kista around the start of the new millennium, the economic difficulties in Eindhoven in the late eighties and early nineties and the decision of Singapore to reduce its share in SIP – change can be more drastic. As said before though, it is crucial to acknowledge that most changes in terms of building up a strong brand are incremental.

*Transform a business location brand into a city (sub) brand.* Another interesting observation is the ambition to develop the brand of a business location into a city (sub) brand in the case of Kista and Suzhou. For Kista, it has even been suggested to use Kista as the name for a much larger area (including a large part of the Järva area) but this was politically not feasible. However, the planners would still like to see spill-over effects of the strong Kista brand to the surrounding areas. For Kista itself, the ambition is to be no longer seen as a science park but a science city. Some of the plans and ambitions have already been discussed elsewhere in this chapter. This involves a major change in the brand of Kista. The Kista brand scores high on its business and technological reputation but it is not perceived as a very attractive place to live. Kista needs to change physically to be able to make this shift in the hearts and minds of relevant audiences. This process could be helped by eye-catching projects with the NOD as the chief accelerator of this brand change.

In the Suzhou case, SIP has been branded as a full-fledged city (which fits the reality), not as an industrial park. However, the chosen brand name Suzhou Industrial Park (SIP) creates confusion among target audiences as it is clearly not an industrial park. Several discussion partners have suggested changing the name into Suzhou Innovation Park or Paradise. You could say that from the very beginning the founders of SIP (Singapore and China) used a brand name people would normally associate with a business park. This is a strategic mistake that does not help the development of Suzhou's brand at all. In Eindhoven, the situation is different. Eindhoven's ecosystem is not bound to one location but can be found on several locations in the city. There are important locations such as the High Tech Campus, but the brand is Eindhoven itself. The reputation of Eindhoven in several high-tech sectors has led to its election as the world's Intelligent Community of the Year in 2011. In the last year the city of Eindhoven has decided to create a stronger focus in their city marketing

and branding strategy and to develop the Eindhoven brand around technology, design and knowledge.

*A brand requires a compelling story.* It is also evident from the cases of Eindhoven and Kista that building a brand is fundamentally developing a 'story' that grasps the essence of the ecosystem and that can be told over and over again with small variations. More importantly, this story has to be credible and compelling and local stakeholders need to be able to identify with that story and have experiences that fit with the story. For example, the story of the crisis of Philips and DAF in the Eindhoven region and the joint response to become stronger in response to this crisis is an 'evergreen' that still can be heard from many stakeholders. Additionally, many stakeholders will point to the widespread and effective local networks where stakeholders meet and get to know each other leading to new innovations. Several studies have shown that this is really a strength, but it is also an achievement that so many stakeholders tell this story as well. In Eindhoven's ecosystem many stakeholders are 'singing from the same hymn sheet'. In the case of Kista, one can identify a similar pattern where many stakeholders share the same ideas of Kista as an innovation ecosystem and a growing number of stakeholders are also adopting the story of the needed transformation from a science park to a science city. In Suzhou, we see some attempts to "rebrand" Suzhou Industrial Park as a hotspot for innovation and R&D replacing the old image dominated by (low-cost) manufacturing industries. The SIP Administrative Committee is leading this process, but also other stakeholders tell the same story, promoting SIP also as an attractive place to live: with better environmental conditions and lower costs of living than in nearby Shanghai.

In the Dutch and Swedish case, there are organizations – Brainport and its predecessors in Eindhoven and the Electrum Foundation and Kista Science City in Stockholm – that aim to strengthen the ecosystem and at the same time safeguard and develop the brand. In both cases these dedicated organizations have played a major role in developing the stories of Eindhoven and Kista. The branding strategy of these organizations does not rely on large advertisement campaigns or other traditional ways of brand communication in the mass media. These organizations lack the budgets to deploy such instruments and more importantly, it is considered to be ineffective for their objectives. The story telling about Eindhoven or Kista should primarily be done by third parties. These could be local ambassadors (for instance successful entrepreneurs and universities) but also by giving information and feeding the story to professional media and let them tell the story as well. In Suzhou, the SIP Administrative Committee is the leading organization responsible for the brand. They started with a more traditional branding strategy by giving seminars and presentations, as awareness of SIP (which started from scratch rather than around a leader firm like Philips or Ericsson) was low at first. As brand awareness increased, the focus of the branding strategy shifted to promoting the "park-in-a-park" clusters (Biobay, Nanopolis, etc) specifically to firms in their target industry sectors, setting up these sub-clusters are brand names in their own right. Also most promotion now occurs through current tenants: if they

know a supplier or peer company that is interested in relocating to SIP, a promotion team is sent to target this specific firm.

**Challenge 7: Designing a good governance framework**

For all six challenges we discussed above we have been able to identify policies and policy instruments (interventions) that can be used to steer the functioning and improve the competitive performance of innovation ecosystems (see Table 1). The seventh challenge is how to organize, manage and finance these interventions: this is what we refer to as 'governance'. It comprehends the institutional environment (written and unwritten rules) and the top-down political-administrative framework (the division of tasks and responsibilities among various levels of government, e.g. regarding urban planning) but also the bottom-up development of public-private partnership.

TABLE 1: GOVERNANCE INVERVENTIONS

| Challenge | Interventions |
|---|---|
| Fostering university-business linkages | Develop hotspots with university and businesses physically together |
| | Promote staff exchange between universities and businesses |
| | Attract universities that fit the interests of industry |
| | Create platforms/organisations for collaboration |
| Attracting talent | Attract firms, universities and research institutes by giving incentives |
| | Attract knowledge workers with programmes, facilities and incentives |
| | Improve international accessibility |
| | Improve the inflow of talents from the commuter region |
| Promoting entrepreneurship | Supply government-funded VC and mobilize networks of private VC |
| | Create start-up incubators |
| | Educate entrepreneurial engineers |
| Building communities | Plan for interaction |
| | Organize meetings and events |
| Creating a vibrant urban culture | Redesign mono-functional hotspots |
| | Develop urban innovation hotspots from scratch |
| | Ensure good and quick access to city amenities |
| | Mix technology with art and design (attract creative people) |
| Branding | Brand or re-brand innovation hotspots |

| | |
|---|---|
| | Use ambassadors (third parties) to tell the story |
| Designing a good governance framework | Change contextual conditions (transferring governance models) |
| | Develop good local governance (given the local circumstances) |
| | Develop partnerships and involve leader firms |

*Contextual circumstances.* In all three case studies governance-related factors have been identified as important strengths explaining the current innovation performance. Often these factors relate to unique contextual circumstances that are strongly rooted in the history and culture of the region or the country: examples are the shared Brabant and Philips mentality in Eindhoven and the openness of the Swedish society to innovation and the entrance of foreign companies. It will be difficult to create similar circumstances in another region, although the case of SIP demonstrates that it is not impossible. In Suzhou they managed to create a legal, administrative and political micro-environment that is substantially different from the macro institutional conditions in China. Suzhou is the first successful example of cooperation between Singapore and China, with the development of a Singapore-style science park (mini-Singapore) on the Chinese mainland as result. Several other regions in China copied this model, again with support of the two nations. The conclusion is that governance models can be transferred. In China, employees of SIPAC give on-the-job trainings for other science park managers, just like Singapore did for SIP.

*Good local governance.* Local governments can stimulate the development of innovation ecosystems in many ways. It is difficult, however, to formulate general requirements for good local governance. The case studies show that the preferred role of the government – what tasks to assume and how to implement these tasks – depends on the institutional environment. In SIP the Administrative Committee assists firms with patent registrations, legal and financial issues (including VC) and trade licenses, which is seen as an important selling point. In Eindhoven and Kista this has appeared less relevant. Another example: the SIP government works with a master plan – promoting strict zoning and planning stability – which would be somewhat outdated in the European context of Eindhoven and Kista.

*Developing partnerships.* Another governance factor is the management of the ecosystem and the development of public-private partnerships. One of the challenges is how to involve leader firms and leading knowledge institutes in the management of ecosystems, using their knowledge and expertise but also their "global linkages". If we compare the three case studies we must conclude that the two European regions have been more successful in this respect. Both the Brainport region and Kista Science City are managed by economic development organizations and foundations with representatives of the Triple Helix. Projects that aim to improve the innovation performance and the attractiveness of the ecosystem are initiated and managed not only by the government, but by non-governmental actors as well.

Apparently both regions have an environment in which governments allow other actors to take the lead and in which these other actors are willing to look beyond their short-term private interests. Samsung's leading role in the SIP Institute of Vocational Technology (SIPIVT) might be seen as a first step towards more private-sector involvement in Suzhou Industrial Park.

## To conclude: 10 takeaways

The three case studies - Brainport Eindhoven, Kista Science City and Suzhou Industrial Park - provide valuable lessons for Skolkovo and other initiatives to develop innovation hotspots from scratch. We have shown that the development of an innovation ecosystem is a very complex and essentially long-term process. Developers need to be aware that each ecosystem finds itself in a unique contextual setting, requiring specific approaches in different stages of development. This brings us to the following recommendations, which we present as 10 "takeaways" for policy makers and managers of ecosystems:

**Takeaway 1: Be realistic about the influence of planners on innovation**

Urban planning for innovation is problematic in its own right. Most successful knowledge hotspots were never planned as such. They emerged out of a diverse and thrilling urban environment. This is especially true for the current wave of innovations in new media, that are socio-cultural inspired rather than technological only.

**Takeaway 2: Try to find a balance between openess and protection**

The dominant discourse about open innovation hides an important reality: the struggle of innovators to find a balance between openness and protection, between sharing and hiding, between giving and taking. Innovation planners are wise to take this into account when planning knowledge hotspots.

**Takeaway 3: Try to find a balance between specialization and diversity**

Specialization of a hotspot (e.g. through strict tenant selection) will give it a distinct identity, and perhaps increases the chance of meaningful interactions between tenants (as they are in similar fields). But it reduces the scope for unexpected, out-of-the-box combinations. A somewhat more diverse profile could facilitate such combinations.

**Takeaway 4: Stimulate the development of conceptual innovations**

An innovation hotspot will fail as innovation catalyst when stakeholders/tenants merely see it as a new premise to continue their business as usual. The challenge is to use the development to achieve conceptual innovations.

**Takeaway 5: Be aware of the trade-off between short-term profits and long-term concept value**

Building a thriving knowledge location takes times, and this could mean that short-term profits must be forgone to protect the concept. Can a developer refuse a large but unrelated tenant to rent a large premise and dominate the place? This can be a painstaking dilemma, especially in difficult market circumstances or when the concept has not yet clearly proven itself.

**Takeaway 6: Pay more attention to software and orgware**

Physcial interventions ("planning for interaction and serendipity") are insufficient to promote innovation. Software and orgware elements are needed as well: networking institutions, events, community-building efforts.

**Takeaway 7: Attract knowledge from other regions**

Generating and incubating innovative start-ups is one of the hardest steps in building an innovation ecosystem. Even some of the world's most successful innovation ecosystems struggle to educate entrepreneurial engineers, and VC funding tends to be inadequate. Attracting entrepreneurial knowledge workers from abroad can be a viable strategy for kick-starting entrepreneurship, and the case of SIP suggests that it's also possible to learn VC funding from experienced (foreign) partners.

**Takeaway 8: Improve the entire VC chain instead of focussing on the seed funding stage only**

Making VC funding a strength rather than a weakness for an ecosystem requires getting the entire chain right, from early-stage angel and seed funding to 2nd stage funding for maturing start-ups, and to later-stage funding of expanding young firms. If one stage in the chain is weak, as is nearly always the case, the potential for entrepreneurship is seriously weakened. Policy initiatives tend to focus on the seed funding stage, but this is not enough. Public-private cooperation (e.g. CSVC in SIP) and building a strong local VC community is needed to make 2nd stage and later-stage VC funding work.

**Takeaway 9: Target the right audiences in your branding strategy**

The ecosystem should develop a strong brand ("have a good name") among knowledge workers, venture capitalists, researchers and corporate leaders while the perceptions amongst the general public, policy makers and real estate developers are far less important.

**Takeaway 10: Develop a compelling and credible story**

Building a strong brand of an ecosystem implies developing a compelling and credible 'story' that grasps the essence of the ecosystem and that can be told over and over again with small variations by local stakeholders and the media to stimulate positive word-of-mouth.

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