TECHNOLOGY PARKS

A redundant model?

(text version - Textversion)

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CHRISTIAN REPNIK

Technische Universität Graz

Erzherzog-Johann-Universität

Fakultät für Architektur

Betreuer: O.Univ.-Prof. Dipl.-Ing. Dr.techn. Architekt Jean Marie Corneille Meuwissen

Institut: Institut für Städtebau

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Introduction

Today there are many hundred technology, science or research parks spread throughout the globe[1]. Yet they are a relatively recent phenomenon that first appeared in the 1960s in the USA and UK but really came to prominence around the world within the last 40 years. Physically they form groups of buildings within a defined area, that might also be made visible as such. They mostly form rather large units that are master planned in advance and subsequently realised more or less in accordance with this plan. Since they concentrate a big workforce and can produce considerable financial output, they are especially interesting as economic and policy regards. While there is serious debate about the actual gain of technology parks, they enjoy ever increasing popularity as a planning typology.

I will take a closer look at this development in Australia and especially examine the Australian Technology Park (ATP) in Sydney. It is located only a few kilometres south of the CBD, on a disused railway yard. Like many precedents, that occupy infrastructural brownfields, it sits amidst a central but unprivileged part of the city. The ATP's creation dates back about 25 years but most claims and hopes have yet to become reality. Many of the problems encountered in relation to technology parks and the ATP, are symptomatic of problems with planning more generally. While technology parks seem to be a silver bullet for innovation and regional development at large, their advantage seems to be of completely different nature. Unlike innovation itself, the "park" represents an insular venture and offers comprehensibleness - the closeness is the key to its success, not in terms of performance but as a planning model.

This approach to planning is in stark contrast to the way concentrations of technology companies and activities in general occur in reality. Big cities like Sydney, with its 4.6 million inhabitants, are complex structures with many contrasting parts, that enable the unplanned and circumstantial to emerge. "The modern city is dialectical, it is both thesis and antithesis" (Ungers 1998, 19). "All of these parts have their own special features, advantages and disadvantages, integrated in a larger, urban macrocosm, a metropolis and landscape made up of these small worlds" (Ibid, 20). Today's city has to be - or maybe yet to become - a representation of an open society, living together in difference. None of its parts is or ever can be complete and none should be entirely self-contained, but connected in a multidirectional way. While some of these parts are very diverse, others can be understood as interchangeable building blocks, with little or no dialogue to the surrounding. Assumed that technology parks are on their own terms - to foster exchange, spur innovation and transform ideas into marketable products - equally or less successful than circumstantial clusters, which arguments remain in favour of their creation? The manageability and controllability of such developments?

Spatial separation of living, working, leisure and so forth already implies the emergence of big, mono functional units. Housing takes on the form of gated communities, while university campuses and business

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[1] The term technology park is used in this thesis, to sum up all these different names and varying definitions that can often not be clearly distinguished.

parks form distinct education and know-how enclaves within the city structure. Likewise there are skilfully internalised worlds of airports and shopping centres, connected to the host city only by a single umbilical cord. As Christopher Alexander already pointed out in 1965, planners often create city structures in which one element is only connected to one other element within a hierarchical order. He described them as tree-structures, in comparison to semi-lattice-structures, that form a network of interconnections, or to put it differently, a condition where every element has various links to, or overlaps with several other elements. Alexander explained further, that people tend to design tree-structures simply because it reflects our mental concept of larger systems. We want to logically organise and group them. It is what Dutch architect and urbanist Kees Christiaanse (2009) described as the nature of society to create analytical units in the landscape. Thus the technology park would be just another example for the disassembling force, wearing away potential difference, that is able to enrich neighbourhoods and cities. All functions that are found in technology parks can also exist within a mixed-use city fabric; but they are extracted from this fabric and clustered in special precincts. This ideology of Modernity, to categorise and separate different functions, held together by excessive, mostly car optimised infrastructure (fig. 2), still shapes the environment we are living in today. Technology parks fit perfectly with this thinking.

Objective

The objective of the research is to provide a spatial and urban design analysis of technology parks in relation to their host cities and to identify successes and failures. The research will provide consistent quantitative spatial analysis and mapping, as well as a qualitative interpretation, that can form the basis for questioning the physical determinism that underpins the planning typology "technology park". The focus is on technology parks in the realm of research, new information and communication technologies or related to activities summed up as creative industries, as opposed to industrial technology clusters. These sectors, often closely related to higher education, are of increasing importance in a knowledge intensive, post-industrial society. This "quaternary sector" is subject to constant changes along with location patterns in industry and new technologies, which can offer interesting examples for novel work place design.

I want to find out why so many attempts to recreate the success of precedents - first and foremost Silicon Valley - fail and what the copyists hope for by recreating this typology. Which different approaches to fostering high-tech development and collaboration are there and what is similar among them? As an architect, there is of course the question what the planning related implications there are for such technology or knowledge intensive areas. Especially since they are mostly large, master planned precincts, that can have significant impact on the city.

The Australian Technology Park in Sydney (fig. 4) will act as my main example, with the aim, to illustrate an alternative future for this site beyond the current master plan. An already revised plan, which is a meagre solution for a seemingly blind spot in the city structure. The alternative design should have wider benefits for workers and entrepreneurs, residents and the city on a larger scale, while simultaneously increasing the economic potential. I believe, that this 14 hectare patch of land has much more potential, that currently acknowledged.

Main research questions (RQ)

1. What is a technology park and where does its planning model come from? What are rationale and interests behind such developments?
2. How are technology parks manifested in the city? What are the morphological characteristics of TPs and there fundamentally different forms of appearance?
3. Are TPs successful measured by their own goals but also by external requirements? Did they react to changed conditions throughout the last decades? In how far does this model meet the demands of its tenants and the host city?
4. Are there alternative models in practice, that try to reach similar goals differently? What are the advantages and disadvantages of these alternative models?
5. The findings and conclusions of the four RQ above will inform a conceptual design approach for the Australian Technology Park (ATP) in Sydney. How can an alternative future for the ATP be shaped, compared to current master plans?

Methodology

To answer the five RQ, a mixed methodology is used. This includes theoretical analysis of historical influences, current planning documents and guidelines, case studies and finally a design approach for the ATP.

By looking at Australian and international case studies - some of which I was able to visit personally - and analysing relevant literature, I want to determine why technology companies are clustered in specially established, more or less mono functional zones in the first place. Which origins this planning typology has and what the implications are for the city. In a first step, I will look at the history of the campus and industrial clusters, planning schemes that among other factors, influenced today's appearance and organisation of technology parks (RQ no. 1).

The selected case studies will help to understand the principles that underpin technology parks today and how these principles are spatially manifested in the city (RQ no. 2). I will compare their quantitative characteristics like size, location, built form and utilisation. The range includes long established precedents such as Stanford Research Park in California or Cambridge Science Park, that are famous for their success in marketing innovation and accumulating venture capital. Likewise I am examining more recent examples, some of them amidst their realisation. I want to explore, how they deal with the issue of fostering a culture of entrepreneurship, cooperation and competition and what the benefits are for their host cities (RQ no. 3). I am also including clusters that are not created by planning, but emerged rather circumstantial. City districts with a high proportion of technology companies, like Surry Hills in Sydney or Silicon Alley in Manhattan (RQ no. 4), that blur into the surrounding.

Finally this research will inform a planning approach for the ATP in Sydney (RQ no. 5). I want to show how the task to establish an inner city technology park can be accomplished without creating a high-tech enclave, since I am convinced that this specific site requires a different approach (see chapter 6). Findings from case studies and the analysis of the ATP's site specific conditions, will help to formulate an alternative concept for

the area. Nonetheless, this conceptual approach can be valid for other projects beyond the ATP site, of course always embedded in their local context.

Hypothesis

The number of technology parks is growing worldwide at increasing pace. "Yet despite this apparently inexorable growth, there has always been a disjuncture between the promise and the reality of the science park model. The great majority of academic evaluations of science parks have invariably failed to show any particularly significant or distinctive benefits arising from science parks in terms of technology transfer between universities and industry, technology and economic development more generally, or local or regional urban renewal in particular" (Phillimore and Joseph 2003, 750). This excerpt suggests, that the technology park is an outdated model, that might be replicated in a desire for innovation and success, but nevertheless frequently fails to come true. The creation of these enclaves is to some extend driven by an world wide competition for excellence and innovation in high-technology, supported by politically correct slogans ad nausea. Claims of international presence and reputation, added value for the community or high quality design are a far cry from reality.

If located outside or at the fringe of cities, they create severe commuter traffic but benefit from lower land and construction costs. If inside the city, they often form islands in the urban fabric, since the suburban typology is simply transplanted. This closed, cul-de-sac model might offer advantages, especially if security is of importance, but it is used as paramount archetype rather than one possible implementation out of many. Such morphologically deterministic developments do not extend or complement the surrounding city structure, but create big units, that often have to be retrofitted themselves. Given that mono functional campuses, especially in the academic realm, are increasingly "re-humanised" by adding housing, improving non-vehicular traffic networks and intensifying public domain, the question arises, whether these aspects can be considered from the start.

Recreating the success of favourable environments, in which activities thrive by mechanically copying their morphological character is virtually impossible. Critiques declare these developments to be short sighted real estate deals, high-tech fantasies and mystified, political instruments. Naturally, it is hard to determine whether they are successes or failures, since there is no agreement on the criteria that define success. Moreover the process of innovation itself is in dispute. Generally current thinking moves away from a linear process, from basic idea to market product, towards a network approach, also against the background of an increasing importance of information handling rather than production of goods.

The hypothesis is, that new technology parks can foster collaboration, innovation and economic development more effectively as "integrated parts of the city". By integration I mean, that such a precinct is physically and socially connected with other parts of the city in various ways. Physical integration should enable people to randomly move through the precinct and complementing functions within the technology park can be socially integrative. This is of course closely linked to questions regarding master planning, ownership and accessibility.

Definition, Background & Evolution

What is a technology park?

There are various names for these precincts, hubs or clusters, some of which describe the focus of their tenants, while others are created in response to an economical or political agenda. Many of them are in single ownership, often by state government or a university, and nonprofit in their organisation. Despite their varying nomenclature and difference in detail, all share a similar rationale for existence. Commonly used terms are the following:

- research park (more common in the US)
- technology park (more common in Asia and Australia)
- science park (more common in Europe)
- technopole (more common in Europe and Japan)
- innovation campus
- knowledge hub
- high-tech cluster
- etc.

All these expressions basically describe centres of high-tech and information-based commercial activities in the quaternary sector of economy. These centres are physically manifest as collection of buildings within a defined area. They offer a number of shared resources, such as uninterruptible power supply, telecommunications hubs, reception and security, management offices, restaurants, bank offices, convention centre, parking, internal transportation, entertainment and sports facilities. A commonly accepted assumption, supporting this model is, that the co-location of companies in the park offers considerable advantages to hosted companies, by reducing overhead costs while improving the performance of every single player.

The appropriate term typically depends on the type of science and research in which the park's tenants engage. Often, technology parks are associated with or operated by institutions of higher education. They differ from high-tech related business districts in that technology parks and the like are centrally managed and planned top-down. Typically companies and organizations in the park focus on research, product advancement and the transfer of academic innovation into marketable products; as opposed to industrial technology clusters that focus on manufacturing or business parks, which centre around administration and services.

As mentioned earlier there are many names, depending on country, region and specialisation. Likewise there are different definitions of what constitutes a technology, science or research park. One that I found especially interesting, since it also acknowledges the virtual presence of a technology park, is the description by Luis Sanz, Director General of the International Association of Science Parks (IASP):

> *A Science or Technology Park is a space, physical or cybernetic, managed by a specialised professional team that provides value-added services, whose main aim is to increase the competitiveness of its region or territory of influence by stimulating a culture of quality and innovation among its associated businesses and knowledge-based*

institutions, organising the transfer of knowledge and technology from its sources to companies and to the market place, and by actively fostering the creation of new and sustainable innovation-based companies through incubation and spin-off processes. (International Association of Science Parks, 2002)

What all undertaking share, irrespective of name is a similar rationale, of which most points are listed in the definition above, like technological and regional development, knowledge-transfer or synergies between academia and industry. However real estate interests and political will or ideology play significant roles too, since technology park developments are mostly physically large and can create many jobs. Technology parks are encouraged by local government, in order to attract new companies to town, and to expand their tax base and employment opportunities to citizens. Land and other taxes are often waived or reduced along a number of years, in order to attract new companies. Some government programmes for example are meant to strengthen economically underdeveloped areas by locating high-tech industries there, along with housing estates, recreational facilities and convenient infrastructure. Other concepts aim at reviving former heavy industry locations or focus on fields, that are specifically strong in a region, like biomedicine or information technology. The question is, whether the entity of the technology park attracts the interest of financiers and entrepreneurs, can foster networks and exchange across the professions - because of its deterministic nature.

Range of technology parks

The urban precinct

Technology precincts can be located in an urban environment, often closely related to a university campus. They are smaller than their suburban counterparts and compensate their lack of building area with higher floor space ratios and multi-storey car parking. The University Campus at MIT for example, is a mixed use development, including apartments, student housing, lab spaces, offices and a hotel. The eleven hectare site is inserted in the surrounding city structure and part of a bigger high-tech and education cluster around MIT, Boston CBD and Cambridge University. While in this case, the technology precinct is a small urban renewal project on a former brown-field, there are others, that aim at revitalising entire city districts, like the 200 hectare 22@ area in Barcelona[2]. It is however one of Europe's biggest urban renewal projects and an exceptional technology precinct rather than the rule, which I will examine later on. There are obviously many advantages of a central, urban location, concerning accessibility, availability of public transport, a variety of services, restaurants, etc. in the surrounding - proximity in general. Naturally these amenities are connected to a higher price for land and buildings, whereas there are many indirect costs related to remote campuses as well. A main argument against this location is the limitation of space, also for future expansion, of course only under the assumption that everything has to be gathered in one spot. A principle, not really conductive to the resilience of planning. "The U.S. Congress is considering legislation to encourage new science parks by

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[2] see case study 22@ Barcelona, chapter 3.2.3

providing loan guarantees - never mind that U.S. office space vacancies are running at record levels in many cities" (Wadhwa, 2013).

The periurban campus

Availability of cheap space is the major reason to locate a technology park on the outskirts of a city. The High Tech Campus Eindhoven (NL) for example is a typical greenfield project (fig. 8). Like most developments of this kind, it is located along a motorway, close to an international airport and some 15 minutes by car from the technical university. There are other research institutions within close reach and the region between Eindhoven, Aachen (DE) and Leuven (BE) is generally well established in R&D. Its origins go back to a corporate campus of the Philips Group, who is still owner of the 100 hectare site. Since such fringe developments are far off but have to cater for thousands of employees, they include a range of amenities. In addition, they often try to create a "pseudo-urbanity" that compensates for the absence of diversified city life. As a matter of course all facilities are open during office hours only, while at night time they are empty or even non-accessible, also for security reasons. In Eindhoven this civic function is performed by a 400 metre long "Strip" that concentrates all additional functions like restaurants, shops and conference centre.

The corporate campus

A special case of the peri- or suburban model is the corporate campus. Parallel to a revision of conventional campus planning, big organisations retreat to corporate ivory towers. Such large entities are not dependant on the proximity to other companies, supportive expertise or financing. Microsoft, Google and Facebook for instance prefer self contained building complexes, hosing several thousand employees. Most of them are not linked via public transport, yet they get away with this, due to a critical mass to offer shuttle services and a significant amount of parking spaces.

These campuses also represent a distinct typology of low, wide buildings, erected on cheap land, compared to the city, where this would not be viable. The so often cited cross-fertilisation and knowledge spill over is here, if anything, of completely different nature than in dense, urban environment, where parties can exist juxtaposed side by side and on top of each other. This urban quality of unplanned, informal exchange is here compensated with an interiorised "public domain", people meet in break out spaces or simply at the water-cooler. Especially the role model Silicon Valley counts numerous big players, who create their own worlds, with cafes, squares, sporting facilities, bridges and parks.

"[...] global corporations are also increasingly seeking urban design strategies that will encourage inventive and creative potential within their management and research centres and are looking to the academic and high-tech campus as a development model. If modern urbanism can be characterised as the concentration and collision of different cultural, political and social worlds in a defined space, an important prerequisite is the openness of this space to the outside world" (Hoeger 2007, 16). A central quality of true, public domain, that a mimed urbanity cannot offer. But while these urban encounters are inspired by the bustling city, the corporate campus is invading it vice versa. Developments like the Australian Technology Park try to become minutely regulated precincts, instead of engaging with their central location. After all, the requirements for SMEs and start-ups are entirely different than those of corporate firms.

The green campus

This development type already comes closer to a real park, with buildings dispersed over an extensive country side. Many of them have been planned as test fields for novel design concepts throughout Modernity. Their grounds often resemble individual modules or components, arranged along central spines or streets. Since car based planning and the arrangement of buildings around infrastructure did receive much criticism in recent time, the declared goal is mostly to create more urban precincts, "fit for the 21st century". While greenfield campuses are by definition constructed beyond city boundaries, urbanisation sometimes caught up over time and swallowed these parks. Thereby they became fragments within the agglomeration and extended and adapted their structure.

The average technology park

A survey, undertaken by Battelle[3] and AURP[4] displays the profile of a typical North-American university research park. The following averages are based on a median for all 134 university research parks responding to the survey (Battelle 2007, 5). It provides a quick glance at the topic.

Size:

46 hectares
6 buildings
29,209 m^2 of space, 95% occupied (100,000 m^2 at build-out)
Only 30% of total estimated m^2 at build-out currently developed
2,787 m^2 of incubator space

Location:

Suburban community
Less than 500,000 population

Governance:

Operated by the university or university-affiliated non-profit

Tenants:

72% are for-profit companies
14% are university facilities
5% are governmental agencies

Employment:

Typical park employs 750
Major industry sectors: IT, drugs and pharmaceuticals, and scientific and engineering service providers

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3 A private non-profit applied science and technology development company

4 Association of University Research Parks, a non-profit association made up of university-affiliated research parks

Finances:

Less than $1 million per year operating budget

Revenues primarily from park operations but funds also come from universities and state, local, and federal government

Limited or no profitability; 75% of the parks have no retained earnings or retained earnings of less than 10%

Services:

Provide a range of business and commercialization assistance services, including

Help in accessing state and other public programs

Linking to or providing sources of capital

Business planning

Marketing and sales strategy advice

Technology and market assessment

Technology park 101

By looking at Silicon Valley, specifically its hotbed Stanford Research Park, its planning regulations (fig. 12) and built environment, a set of characteristics can be derived, that describe the appearance of such conventional technology parks. These rules make it extremely hard or even impossible to produce something different, than what exists already and do not encourage the emergence of diversity. The outcome are big, flat buildings on huge plots, with many parking spaces, partly camouflaged by greenery.

1. zoning

The technology park is located in a special zone, for example called general industrial district, where certain usages are permitted (light industry, warehouses, offices, etc.) and others are prohibited (housing, retail, gastronomy, etc.).

2. minimum lot size

A lot must have a certain minimum size, mostly a few thousand square metres up to one hectare. This results in a land division pattern with a “coarse grain” and wide plot frontages along roads.

3. lot coverage

The percentage of lot space covered by buildings is much lower, that the remaining open space and hence distances between buildings are rather big. With increasing size, the lots’ maximum permitted coverage decreases further, down to a certain limit.

4. building setbacks

Buildings cannot be aligned with the street, they have to be set back from all lot boundaries, especially along streets. The wider these streets are, the deeper the setbacks have to be, often as much has 30 metres along main roads. Together with the lot coverage rule, this concentrates buildings in the middle of the lot.

5. floor space ratio

The maximum floor space ratio indicates how much floor space can be build in relation to the lot size. This ratio must not exceed 0.5, what means that two square metres of land are "worth" one square metre of floor space.

6. building height

Low maximum building heights, around ten metres, ensure that no more than three storeys can be build. This results in large, flat buildings, increasingly focused on internal conditioning, since many spaces have no direct relation to the outside.

7. parking requirements

A certain amount of parking spaces has to be provided in relation to the amount of floor space. This ratio is much higher than in all other zones, since a lot of workers are concentrated, who commute to work by car. Typical are 2 to 4 spaces per 100 m^2 FS. As a result most lot space, that is not used for buildings, is covered by parking spaces. Overall parking occupies the biggest portion of the lot.

8. landscape screening

Buildings, parking spaces and setbacks cannot be left exposed completely. Trees and other greenery has to be used to, at least partly, conceal parking spaces and buildings. Especially along streets and in transition zones towards housing estates or such.

9. transition zones

Along the boundaries of the technology park or its zone, special transition rules apply, regarding building height, setbacks, parking, landscaping, etc. In general this transition protects housing zones from all other zones.

10. no residential use

As rule number 1 already implies, residential usage is not permitted within the technology park. Other zones, especially dedicated to housing or recreation, surround the technology park. All workers have to commute between these zones.

Background & Evolution

This section deals with RQ no. 1, the historical influences on the planning model of technology parks. Looking at these origins, makes it easier to understand their current appearance and can provide valuable insights for designing alternative solutions. Technology parks are often an unquestioned model intended to foster economic growth and innovation, whereas their actual significance for this process should be elaborated in every single case. Various aspects come together in the formation of the modern technology parks, that cannot be seen in a linear process. There are for example linkages to the model of the university campus, the industrial cluster or district, that emerged more than 100 year ago and the idea of nature as background element in large scale developments.

A brief history of the campus

"Whatever might be suggested by the prescriptions of theorists with axes to grind, the golden-hazed memories of aged alumni, the carefully crafted texts of student recruiting materials, the glossy brochures of capital campaigns, and the idyllic images on the splash pages of websites, American campuses are not clear, consistent realizations of ideas that were specified by visionaries and frozen in place at particular historic moments. They are unstable, evolving registrations of the messy, imperfect, disputatious life that unfolds within them." (Mitchell 2007, 4-5)

While in the English landscape garden, architecture was merely used as background feature - decoration embedded in the artificially naturalised and thereby even more "natural" landscape - today the landscape forms the background for the buildings in campus architecture. Lawns and greenery are used on the one hand in order to create a feeling of openness and nativeness but also to cover up and conceal whatever we do not want to see.

Nowadays the"campus" is a widely accepted and utilised (sub)urban planning tool of Modernity. The term campus has Latin origin and denotes a level field or open space for battle. While today's understanding of a campus emerged in the US, its forerunners are the Universities of Oxford and Cambridge (fig. 13) in England, that both date back more than 800 years. Their collegiate model with students and staff working, studying and living on site, was initially inspired by cloisters, they gather like minded individuals to live a communal life together. Also the buildings look alike: chapel, hall, library and dormitories arranged around a central court yard, a setting that enforces a feeling of belonging to the same community, which is also reflected in the clubs and unions of today's colleges. At the same time it offers protection from the outside world. These English precedents were inspiration for the first colleges in the US, founded in the early 16th century. About 200 years later, the word "campus" was first used to describe the grounds of a college at the College of New Jersey (now Princeton University). Just like the terms yard, court and square, it referred to a specific field on the college grounds. In comparison to the English tradition of independent colleges, scattered across the city, the American Campus was planned as an entity with grand cohesion, often following a symmetrical layout. Thomas Jefferson used the term "academical village", to describe his vision for the University of Virginia (fig. 14), "[...] which can be seen as basic trait of American higher education from the colonial period to the twentieth century" (Turner 1984, 3). The term campus sums up the special setting, that we might call a city within a city today. During the 20th century its meaning expanded, to encompass a whole university property. Since then, all kinds of institutions are using the word "campus" to describe a mostly park-like area, on which separate buildings are placed like pavilions in the landscape. A feature, that also proved to be perfectly compatible with the grand visions of Classical Modernism (fig. 16). Solitaires were planned in the green vastness of the campus, with buildings aligned along infrastructure in logical order.

The Modern campus

"Traditional college planning in the twentieth century [...] usually produced a unified design, specific in its overall form and architectural character. After World War II, college planners began to abandon this tradition of ambitious master plans, in favour of an approach that emphasised principles for future growth. In a sense, the process of planning became more important than the final form" (Turner 1984, 260). The individual building became increasingly important and was sometimes even seen as piece of art, expressing its uniqueness. "The MIT was one of the first institutions to take advantage of this new development and today demonstrates

a collection of many solitaire buildings by famous architects" (Ibid, 260). With Modernism, the concept of "motion" in architecture became part of the aesthetic theory. "Pedestrian and increasingly vehicular movement influenced campus planning and traffic congestions as well as parking space, became serious concerns of planners" (Ibid, 267).

Change over time and especially automobile movement became two prime factors in campus planning and at the same time universities increased in size, complexity and student numbers. Many schemes were arrangements of modules or specialised units along central spines or ring roads. Mega structures, that should reflect and even emphasise the complexity of programmes. With more and more students and staff commuting to university, the question emerged, how a sense of community and a culture of informal exchange could be maintained. In response to the alienation from the traditional collegiate community, plans like for the University of California in Santa Cruz[5] were developed. A cluster of individual colleges, isolated visually but within walking distance of each other, spread out in vast woodlands.

During the last century, particularly the rise of vehicular based individual transport made it possible, to place the campus on a greenfield in fringe areas or even outside the city. And while the postwar university campus of the 1960s is presently undergoing an identity crisis and major revision in Europe, this is certainly not the case in other parts of the world, as recent developments in Asia examplify. "In many Asian countries the extra-municipal, monofunctional campus of quietness and concentration is not perceived as a problem, but as a symbol of progress (and social control)" (Hoeger and Christiaanse 2007, 50). The campus is increasingly used to deal with all kinds of design tasks, not only in the academic realm, and it seems to provide an instrument, used by conflictive schools of thought. Whatever approach these developments follow, depending on size and location, they can have strong influence on the host city. In smaller European cities, they often occupy an area comparable in size to the historic city centre. Campuses can promote inner-city renewal and urban intensifications, as well as extensions of the urban footprint and sometimes they transform remote areas into small towns of their own. The campus seems to be an extremely versatile planning typology of our time. It was very often seen as miniature version of a city and has therefore been object of projection for utopian visions and test ground for radical ideas in town planning. Its transformation goes on and planners are now increasingly discussing the relationship of the campus to the city, again especially in the academic realm.

Evolution

Similarly to the rationalisation of the academic campus, the industrial cluster held the opportunity to make production more efficient and rigorously projectable in the first place. Organisational theory, with shared supply and distribution chains, just in time production and vertical integration, fitted with the cluster or campus model; and just like the campus changed its position in relation to the city, so did the industrial district. "The development of these districts during the first half of the twentieth century has encouraged

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[5] Master plan by John Carl Warnecke & Associates from about 1963. Especially interesting in this context is Kresge College by Charles W. Moore & William Turnball. One of the ten colleges forming the university campus, with a layout inspired by Italian hill towns. A reminder of Jefferson's "academical village", embedded in nature, removed from the problems of the city.

alternative forms of location patterns for industry. For example, with the growth of air transport, location near an airport became important. As patterns of industrial location changed, developments in industrial parks followed" (Phillimore and Joseph 2003, 751). The technology park can be seen as a descendant of these industrial clusters, adopting the typology of the dispersed campus out of centre. Roads and air traffic offered easier access to distribution networks for industry and allow for higher mobility of know-how or "human capital" in modern technology parks. From the campus, these developments inherited the idea of nature as background element, holding together the loose assemblage of buildings. The park forms the matrix for the technology companies, that is then programmed and makes the precinct visible as a whole.

While it can be said that technology parks are by definition master planned ventures, the emergence of their progenitors has sometimes been circumstantial - meaning not planned top-down - and developed over a longer period of time. The importance of Cambridge (GB) and its environs grew out of very local, small scale initiatives, while Stanford Research Park in California is the descendant of a military research establishment. The hotbed of today's Silicon Valley, was a United States Navy research base dating back almost 100 years, heavily involved in the technological warfare of World War II. A significant amount of defence spending and technological expertise went to the area south of San Francisco, that later also became a NASA research site. Back then security by isolation was of major importance, while the (architectural) quality of the buildings was almost irrelevant. Many years later, young entrepreneurs started companies focused on personal computers and electronics in unpretentious buildings or even garages[6]. Still today, space for start-ups is often provided in disused warehouses or frankly any space that is affordable and can be equipped with high speed Internet, irrespective of campus or city environment. It is important to realise, that these environments, thriving of activities, were neither planned nor are they technology parks, but city regions, especially conductive of innovation.

Elaboration

While technology parks exist since about 50 years, their worldwide number roughly doubled during the last decade. These parks grew into a commonly accepted and understood typology. Besides general aims like creation of jobs and economic growth, their foundation is based on the central assumption, that a clustering of companies and people is beneficial in various ways:

1. the juxtaposition or co-location of buildings leads to more exchange between companies and workers, formally and informally
2. synergies emerge, planned and unplanned because of this physical proximity (spill over effect)
3. by bringing different stages of the innovation process together, this process is fostered and accelerated
4. the clustering of companies attracts international players, that add up to the mixture of competence, and can themselves act as new attractors

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6 The famous "HP garage" is the figurative birth place of Silicon Valley

5. the clustering creates a well known brand beyond the physical park itself, which is beneficial for all companies

Furthermore there are assumptions that specifically support technology park clustering close to institutions of higher education such as universities:

6. the proximity leads to collaboration and efficient transfer of ideas, from academia to industry and spurs the development of marketable products
7. the university functions as hub for the technology park and attracts new tenants, what leads to more interaction and innovation
8. companies and research facilities have better access to human capital, due to the pool of students and graduates
9. university allocated technology parks act as spring board for spin-offs by former students and staff
10. small and medium private companies get access to labs and equipment, they could not afford by themselves otherwise

The question is in how far these assumptions support or justify the physical determinism of the campus or "park" ensemble, that so many developments adopt worldwide.

Hardening & Crystallisation

The term "model" has Latin origin and means lesser or little measure. It is a reduced image of reality, in order to conceptualise something and to be able to represent it in the first place. But however powerful the tool of simplification might be, exactly because of its nature to leave out most details, it can trigger some problem. By taking the model itself as point of departure and particularly by confusing it with its, not only scaled up, but much more complex counterpart in reality, proposals do not address real life any more. This process, happening not once, but over and over again, moves the model the original model and its subsequent proposals further and further away from the original, that one may start to wonder, what they are based upon.

Early high-tech clusters, above all Silicon Valley, but also older precedents of business parks, triggered a worldwide appetite for developments of this kind. Innovation and entrepreneurship are the engines of economic growth. "For decades now, cities and communities across the United States have tried to infuse themselves with those two properties by emulating Silicon Valley, a never-ending quest to become the next Silicon Somewhere" (Florida, *What it really takes*, 2012). The technology park model seemingly proved to be successful, because many companies that were established in or moved to environments like Silicon Valley were successful. These areas are especially favourable for technology related development and innovation due to a range of pre-existing conditions. By analysis of key ingredients for their success - in fact only one segment of reality - the model "technology park" became ideologicalised over time. It got linked with innovation, progress, economic growth and so forth, a silver bullet for being leading edge. The words business or technology park were immediately understood by politicians, developers, financiers, etc. and these precinct, just like building in general, became simply another form of real estate investment. Again the peri- or suburban location turned out beneficial, since land can be purchased far cheaper and in big quantities.

Likewise construction costs are lower, in that offices can be produced in the cheapest way possible – low buildings with big, deep floor plates.

Discrepancy

Characteristics of the Garden City movement and the US-American university campus still reverberate in the spatial layout of technology parks, places originally conceived a sanctuary, separated from the ills, stress and distractions of modern city life. First they were physically placed in the lush country side, quiet retreats to centre oneself, to reflect and to create. "Ironically what started as essentially a figment of American anti urbanism became the paradigm for post-war urban university development" (Perry and Wiewel 2005, 8). Even centrally located campuses, often on redundant brownfields, create worlds of their own, landscape parks with pavilion-like buildings scattered across their domain. To some extent, many technology parks seem to continue this mission, while at the same time trying to become more urban or lively. Potentially these places can resemble a small town, yet the problem is, that they are often self-contained and extremely homogenous, connected to the rest of the city by few access points.

Conceptually they are hybrids of the low density, suburban luxury of spaciousness on the one hand and the immediate need for interactive and productive city life on the other. Nonetheless they follow a suburban typology, basically opposed to urban conditions. Their solitary buildings, surrounded by greenery – and many parking spaces – stand in a tradition of escaping the urban congestion. At the same time these parks want to foster exchange and collaboration by gathering buildings and professionals in one place, one of the basic motivation for urbanity itself. Obviously there is the desire to utilise this "urban principle". Something that is also evident in the verbalisation of the ATP's open spaces. There is an "Innovation Plaza" and a "Central Avenue" lined with trees, that funnily enough ends abruptly in a turning circle. Of course people are not fooled by this mere anecdotes of urban life and simply decide not to dwell in these spaces. Today's technology parks are diametrical, with a suburban morphology and an urban spirit.

The motivation behind technology parks

Nicholas Negroponte pointed out that our raw-material based atom culture has moved its value to the information-based bit culture. In today's main OECD countries, more and more jobs focus on some kind of information management, whereas a small and shrinking percentage of workers are related to manufacturing and transport of material objects. Technology parks are - or at least claimed to be - the incubators of this new culture. Surprisingly they are not at home in the shiny towers of mega cities, but special zones, outside the urban boundaries. Is the mental concept of the clearly defined precinct, of an enclosed area, necessary in order to grasp the digital?

Besides obvious and rather straight forward rationales like urban and regional development, economic growth or the redevelopment of declined or peripheral areas, that I will not explore at this point, there are other motivations for technology parks put forward by politicians, financiers and developers. The ease of doing business in a certain region or country can be a driving force. Likewise the availability of human capital is an important criterion, but today's workforce is more flexible than ever before. The place of location is undeniably of mayor significance, but this seems to have little to do with the morphological determinism of

the suburban TP itself. For tenants the incentive to locate in a certain park can be easier access to venture capital and generally the anticipation of some direct benefit for the company, that cannot be achieved as stand alone.

Synergies

Suburban technology parks are designed for the logic of "[...] high-tech companies that worked more like factories. They developed proprietary software systems, designed and manufactured chips, built computers and created the infrastructure that made the Internet possible. [...] they deployed big engineering teams - and they needed big suburban campuses to house them" (Florida, 2012). While manufacturing became less important in high income economies, knowledge and collaboration between academia, industry and government dramatically increased in importance. To bring together manifold knowledge based industries and skilled individuals, with different backgrounds and ideas, in order to foster productive exchange (this can be especially interesting for Australia, since it has little manufacturing industry to start with). Small and medium-sized enterprises or university spin-offs, that lack capital and experience can potentially benefit most from these synergies. However the emergence and nature of these "synergies" is rather ambiguous. Given they are vital for innovation, how can a TP stimulate them better than a truly urban surrounding? If on the other hand the importance of synergies is marginal, why the clustering? As a recent study about the Cambridge Cluster (University of Cambridge, 2012) concluded: "We need to rethink the assumption that tech clusters automatically lead to spillover and knowledge sharing. [...] knowledge Networking just doesn't drive these sectors as much as we might think. [...] the idea that putting all these people in one place will enable knowledge to flow sounds good on paper, but it doesn't take into account people's individual behaviour. We should be careful about our belief that encouraging networking will drive these industries – nobody is going to use a network, however convenient and local it is, if they don't feel it's relevant to their job."

A real estate deal

Technology parks in the wider sense, like building in general, transformed form a necessity to an amenity. They became one of many forms of real estate investment, what means that the very concept itself is not challenged any more. Rather than asking what we are trying to achieve with a technology park, and how; the central issue suddenly is, how one can minimise risk for investors. Without being judgemental about the concept of maximising one's gain, this fundamental shift of rationale has to be acknowledged. Simultaneously the marketing department immediately tries to create a positive connotation and labels everything premium, international, state-of-the-art, cutting-edge and most of all sustainable. But these places lack of dialogue with the rest of the city. This task has for too long been handled with non-functioning campus models lacking urban life – artificial event spaces with false nostalgia and imitated cityness, carried out with political correctness ad nauseam.

Place marketing

Technology parks are mostly top-down, master planned entities on greenfields, embedded in a suburban community. Boundaries seem to be an integral part of most projects - frequently referred to as precinct (from Mediaeval Latin: precinctum = enclosure, boundary line) - that help to point out their special character and purpose. Prestige is an important aspect in this regard, "[...] very important to park owners and sponsors,

especially governments, who are keen to demonstrate their commitment to modern technology development through showcase developments such as science parks" (Phillimore and Joseph 2003, 753). The defined boundaries of the technology park make it easier to grasp and to control the project itself and possible success. Whether this is a positive or negative quality, at least it gives the impression that something distinguished has been done to encourage progress and innovation. Technology parks are purpose built innovation machines and their purpose is not to be interfused with any further intentions.

Not infrequently, technology parks are vessels for an ideological promise of change for a better future. Especially in countries that want to catch up with high-income economies, grand schemes are realised more or less unquestioned. Like the Multimedia Super Corridor, south of Kuala Lumpur, a 50 km long high-tech zone, capped by the flagship project of the Petronas Twin Towers. This development is imagined in state discourse as part of a transition to a "multimedia utopia" benefiting all Malaysians throughout the national territory (Burnell 2002, 265). Technology and quality of life are here strongly intertwined with an ideology, that is common to large-scale modern projects.

The deterministic utopia

Utopias generally suggest, that the society or in this case innovation is "makeable" by design, by providing well planned organisational structure, buildings and spaces. I think that architects and urban planners should be optimistic about the impact their work can have on a community but must also be aware of the "fallacy of physical determinism" (Gans 1968, 34-35) regarding urban vitality. The assumption, that the physical environment is a major determinant of society and culture and can be planned in a way, conductive to a "good society". Gans argues, that social conditions and needs result in a certain built environment, not the other way round, what is also a point of critique of Jane Jacobs' conclusions about Greenwich Village in Manhattan. Likewise technology parks are promising more than they can deliver by planning efforts. Not only do they claim economic success, based on the assumption that their layout fosters innovation, new technology precincts also promise a desirable lifestyle in high-quality built environments. "[...] the buzz concepts of being clever, smart, skilful, creative, networked, connected and competitive have become some of the key ingredients of knowledge based urban developments" (Yigitcanlar, Velibeyoglu and Martinez-Fernandez 2008, 8). A MIT research initiative about so called "New Century Cities" - large-scale projects deliberately located at the intersection of technology, urban design, and real estate - describes these developments as eminently liveable. "A condition to attract the younger generation of creative workers to these live/work/play environments that melt the old boundaries in space and time between residential, office, and retail/entertainment real estate" (MIT Center for Real Estate 2004).

Denotation and vision of newly planned TPs vary, but in general they seek to include premium office spaces, sufficient greenery and parking, as well as - at least on paper - nice cafes and neat plazas bustling with civic life even if the precinct is uninhabited. This is also what the visualisations promise. If however existing precedents are examined, you come along many that are quite the opposite and "[...] wheather knowledge precinct development [in its current state] is a panacea for our most recent obsession of knowledge city formation [...]" (Yigitcanlar, Velibeyoglu and Martinez-Fernandez 2007, 17) has to be questioned. Instead of a Utopia they rather produce a Heterotopia with an absence of real life. Realised utopian visions that lack of history,

juxtapose places that normally do not appear together and are defined by boarders that are meant to include and exclude certain people (cl. Foucault 1967). After all, these developments are mostly the product of public-private partnerships and rather exclusive of public domain.

The idealised knowledge precinct also shows another nature of the Heteropia, the creation of an illusion and compensation for the space outside it, that seems to become unreal in comparison because of its less complete and harmonic environment (cl. Foucault 1967). While trying to recreate a distilled version of the ideal urban village, its unreality is apparent immediately when wondering around in such an area after office hours, given you are allowed to enter. This leads to the ever returning struggle in architecture and urban planning of the (master) planned versus the "organically grown" or circumstantial. This growth however does not mean that nobody planned anything, but rather that the plans were smaller and numerous, and had much more time to be evaluated, altered and added piece by piece. Or as Jane Jacobs (1964, 16) put it: "cities are an immense laboratory of trial and error, failure and success, in city building and city design". It is this complexity, inhabiting the margins of the planned environment, that we appreciate as human beings. It is what we experience in everyday life as the choice between many small retailers, walkability or the café, occupying a space, which planning-wise is ludicrous. It is also "what the knowledge worker wants when not at work" (Yigitcanlar, Velibeyoglu and Martinez-Fernandez 2008, 8).

A good example for an utopian vision is a design put forward by Zaha Hadid and Patrik Schumacher (2008), who promotes his Parametrism, stating that it is "a new global style for architecture and urban design". The office describes the proposed master plan for the 200 hectare One-North technology zone in Singapore as follows: "Realizing the avant-garde architect's dream – of an urban architecture which truly embraces the spatial repertoire and morphology of natural landscape formations – One North takes shape, creates its own skyline, in Singapore – applying for the very first time, the concept of artificial landscape formation to an entire urban quarter" (Zaha Hadid Architects). If the scheme really is a dream or after all rather an egocentric megalomania, strangely justified by being derived from nature itself and therefore untouchable, remains unclear. Schumacher is often referring to "natural" shapes and how they can be produced through computation. The ten thousands of people supposed to work and live there are not really in the centre of attention. The conceptual massing image of the One-North precinct, with its organ-like morphology, suggests a structure grown by chance; here nature is not only embodied in the green landscape setting but in the built structure itself. Of course the real street layouts and plot divisions are less complex than the master plan illustrates.

Case Studies

The focus of the following analysis lies on Australian, European and US-American examples. Case studies range from technology parks with few hectares up to large clusters or entire city regions. Knowledge based developments can appear in form of urban renewal and regional planning schemes. There are European examples, that are motors of inner-city regeneration and extension, while suburban technology parks and university campuses are combined to extensive precincts.

Monash Science Technology Research and Innovation Precinct (STRIP)

Melbourne	
inhabitants	4,170,000
size in km^2	2,080
STRIP	
size in ha	~ 620 (incl. 110 ha uni campus)
residents	none
workers	~ 33,000
university students	25,000
total floor space in m^2	no data

The so called "STRIP" (Monash Science Technology Research and Innovation Precinct) is located in the City of Monash, some 25 km east of Melbourne's CBD. With 178,000 residents (22 per ha) and 121,000 jobs, one of city's major municipalities and by far the biggest suburban job centre. Along the predominantly residential character, there are substantial commercial and industrial areas. These areas form a loose cluster of about 600 hectare around Monash University's Clayton campus. The name "STRIP" was created in 2010 to describe an area containing a high density of high-tech enterprises as well as industry, office and warehouse uses. The city describes it as a "world-class precinct" and Melbourne aims at becoming a knowledge city by promoting IT and multimedia under the slogan "Connecting Victoria". In the urban design guide of the City of Monash from 2008, it becomes clear however, that there is also a misty-eyed, romantic vision of a green precinct. This should be achieved by introducing deep setbacks along all streets, that have to be landscaped and equipped with trees. The "Garden City image" of Monash should be maintained. The whole area may have a diverse mixture of technology related firms, but on the other hand a very monotonous urban fabric and planning is entirely car dominated. Phrases like "quality of built form" and "high amenity streetscape" are highlighted, without further explaining how this could be achieved.

"[...] the precinct is also home to a large number of office, industry and warehouse uses of high quality built form, set in high amenity streetscape environments" (City of Monash 2007, 4). "[...] building setbacks [...] provide [...] mature landscapes and gardens to soften the hard edged interface [...] between the road and its adjacent built forms [...] to maintain and enhance the [...] well treed, parklike image along the main roads, in compliance with the Garden City character objectives [...]" (Ibid, 8)

Melbourne is in general heavily car dominated, with 80 percent of all journeys to work travelled by car. The low residential densities of Melbourne's suburbs and the metro region seem to make it impossible to support proper public transport. Paul Mees, Associate Professor in the School of Global, Urban and Social Studies at RMIT University, thinks differently however and cannot accept, that suburbia is an excuse for not reducing car use. Instead of claiming that density is the pre-condition for public transport, as followers of new urbanism and the compact city argue, Mees explains that "density is not destiny" (Mees 2010, 7). Urban form

has been an excuse for not tackling public transport service quality. He supports a network approach with convenient and fair-friendly interchanges as observed in European cities and suburbs.

The Claton campus, forms the heart of the STRIP and is surprisingly well connected via public transport, at least to the city centre. Due to its rather remote location, this campus is entirely self contained. If you are there, you feel more like stranded on a desert island. You cannot go for lunch to some place across the street like in the city. The industrial cluster around the campus emerged unplanned or organically, but interaction that sometimes happens randomly in the city, is harder to maintain here. The campus centre basically looks and works like a shopping centre. Blanc facades from the outside, with an internalised maze of facilities. Eateries, cafes, bookshop, travel agent, hairdresser, bank, health service, even a cinema, you can find everything you need, but there is no choice, nothing can emerge "in the margins" like in a city. RMIT university in contrast is located in the inner city, loosely clustered among other facilities. It can be reached by a variety of tram lines and also easily by bike, given that you life close the inner city. The RMIT buildings are significantly bigger than their neighbours, but it is still possible for small houses to exist right next to these blocks.

>>> Lessons learned

acknowledge the importance of organic or serendipitous development of innovation precincts
realise the potential of a circumstantially grown cluster and very carefully steer coherent planning, improving undesired aspects such as transport or housing
technology clusters can grow into major employment sub-centres within a metropolitan region

Technology Precinct Bentley

Perth	
inhabitants	1,800,000
size in km^2	1.566

Technology Precinct (target figures)	
size in ha	314 (incl. uni and existing 42 ha tech park)
residents	13,000 (6,000 dwellings)
workers	50,000
university students	18,000 (currently at Curtin Univ.)
total floor space	400,000 m^2 commercial & tech facilities,80,000 education & research

The 314 hectare, suburban precinct in Perth is mainly located in the municipalities of South Perth and Victoria Park. Two predominantly residential areas (up to 20 res. per ha) that consist of detached single family homes, with some educational, commercial and industrial areas, as well as substantial parklands. The technology precinct would be one of Perth's largest urban redevelopment project and includes the existing 42

hectare Western Australian Technology Park (WATP) in the north, Curtin University in the east and interestingly, a golf course in the west. In between, the new core or town centre of the development is proposed, currently just a big road intersection. The master plan by Hames Sharley architects from 2009 aims to provide housing for 13,000 people in the precinct as well as 50,000 jobs.

The WATP was opened in 1985, what makes it Australia's second oldest TP and currently houses some 110 companies. It is the implementation of the peri-urban, green campus model par excellence, providing ample parking.

>>> Lessons learned

- recognise the assemblage of university campus, technology park and related firms as suburban centre and adapt planning accordingly
- a town centre within the precinct is a beneficial amenity for a wider community in the surrounding and can smooth the extreme difference between CBD and suburbs

a unified precinct could also make it easier, to strategically attract major companies

Macquarie Park Corridor

Sydney	
inhabitants	4,600,000
size in km^2	1,687

MP Corridor (current state)	
size in ha	164 (excl. 126 ha uni)
residents	a few 100
workers	29,000 (648 firms), increase 800 workers / year
university students	37,000
total floor space	770,000 m^2 (of which 350,000 office, 83,000 shopping centre), increase 22,000 / year

Macquarie Park (MP) is a suburb in north-western Sydney, with residential, commercial, industrial and institutional land uses. It has only 7,000 residents (9 per ha) while the majority of employees within the City of Ryde[7] live elsewhere and commute to work. The MP Corridor houses many head offices of mayor Australian companies and Macquarie University, at the western end of the suburb. It is "occupied mainly by large campus-style commercial buildings [and] faces a range of planning issues, including large land holdings,

[7] The City of Ryde is the local municipal area (40 km^2) that MP belongs to

large block sizes, poor permeability and limited connections with the surrounding neighbourhood and street network" (Allen Jack + Cottier 2008). In 2009 the extension of the underground train line, with three new stations across the MP Corridor was completed, to better connect it with the centre of Sydney and the suburbs in the north-west. The Metropolitan Plan for Sydney 2036 identifies this cluster as one of three high growth areas for ICT industries, among the CBD and the ATP in Eveleigh. The city's future directions for this strategic or specialised centre (Sydney 2036 2010) are:

- Support high density office and education uses within walking distance of rail stations.
- Support a vibrant office market by encouraging building forms with a variety of spaces, including small office suites.
- Support growth of Macquarie University, including commercial uses.
- Improve urban design of public domain to support walking and cycling.
- Maximise the benefits of improved public transport access.

The edges of MP Corridor are defined by wide commuter roads and a national Park to the north-east. There are only a limited number of access points and the corridor is made up of large lots arranged to big street blocks (fig. 32). The main building typology is the large, freestanding office block or warehouse. Buildings are very far apart, due to extensive parking spaces and green buffers along either side of the roads (fig. 33). The train lines considerably improved accessibility but commuter traffic is still car dominated, with 84 percent of journey to work traveled by car. Due to its urban form it is a very discouraging environment for cyclists and pedestrians.

NSW Defence is currently developing a high-tech defence hub, which further underlines the importance of the MP Corridor as employment centre.

>>> Lessons learned

- provide convenient public transport for a technology cluster, especially in peri- or suburban location, since these are big concentrations of workers who travel at peak hours, traffic congestions are otherwise preprogrammed
- train stations can create new focal points including commercial micro-hubs
- break down large plot subdivision into smaller pieces, create a finer grain of streets and lanes

Surry Hills

Sydney	
inhabitants	4,600,000
size in km^2	1,687

Surry Hills (current state)

size in ha	133
residents	15,300
workers	8,600
university students	none
total floor space	no data

Surry Hills' urban character is a mixture of residential, mainly low rise Victorian terraced houses, commercial and few light industrial areas. Its urban structure is made up of a great variety of building densities and types. Some offices and cafes inhabit buildings that once were residential while some people live and work in transformed warehouses and factories. Surry Hills illustrates the resilient potential of mixed-use and flexible typologies. It lies in the middle of Sydney's global economic corridor, an area of concentrated jobs and activities, stretching from Macquarie Park in the north to the airport in the south (see chapter 5).

Sydney and Melbourne are the two largest hubs for IT in Australia and account for the majority of tech start-ups and venture capitalists. Surry Hills start-up firms could raise $25 million in 2011 (Sharma 2012). While Melbourne has a bio-medical technology focus, Sydney is especially strong in software, media and financial services, that are mainly concentrated in the CBD. Besides the inner city, Surry Hills together with the neighbouring suburbs Ultimo, Pyrmont, Eveleigh and Redfern forms an evolving hub called "digital precinct" (NSW Government 2012, 24). In recent years a city owned tech hub for young start-ups and a network called 66 Meetups was established, to attract entrepreneurs and investors to the area. The digital precinct is home to mayor firms like Google and IBM as well as Australian digital media and broadcasting companies.

>>> Lessons learned

- diversity uses and live-work environment is attractive for young professionals and regenerates an area, providing benefits beyond a projectable mix
- circumstantially evolved "innovation milieus" like Surry Hills do not seek branding as such by themselves

Docklands Melbourne

Melbourne	
inhabitants	4,170,000
size in km^2	2,080

Docklands (target figures)	
size in ha	146 (plus 44 ha water)
residents	6,500 (2012) / 20.000 (by 2025)
workers	22,500 (2012) / 60.000+ (by 2025)
university students	none (46,000 at Melb. University nearby)

total floor space in m^2	2,600,000
green space	4 ha
waterfront promenades	6.7 ha
open space (squares)	1.3 ha

The Docklands in Victoria are a mixed use precinct adjacent to Melbourne's CBD with approximately the same size. It includes planes for a 4.4 ha (220,000 m^2 FS) technology hub called Digital Harbour and is a recent, commercially orientated example for master planned inner city renewal. Construction began in the late 1990s and is roughly half way regarding total floor space. The forecast for mix by floor space is as follows (VicUrban 2009, 69):

- commercial 44%
- residential 44%
- retail 7%
- hotel 1%
- other 4%

The area was divided into seven superlots up to 35 hectare and developed almost entirely by private investors. However this no cost for government approach turned out to create a precinct which "[...]had been ruled a soulless, dispiriting, windswept failure, its waterfront dominated by soaring towers" (The Age 2012). On closer examination of planning documents, the Docklands turn out to be less mixed than it might seem. "81% of the 3,400 existing dwellings are one or two bedroom" (VicUrban[8] 2009, 21) and "over 85% of Docklands' office space is contained in campus style buildings" (Ibid, 24). Something that is immediately noticeable when visiting the area. Tall residential buildings and bulky office blocks face the public spaces, promenades and immoderately wide streets without transition, resulting in a lack of the so called human scale and functional diversity. Far too much decisions where made by the private sector, due to a lack of public control, what finally lead to a debate about retrofit and redemption of the project, this time with public funds. RMIT professor Michael Buxton said "It just reinforces [that] as soon as you get government out of the equation on all these sort of planning issues, then the community pays for it down the track. A classic example of failure of government leads to future problems" (The Age 2009). Considered as a whole, it seems that this master planned precinct after all occurred haphazardly in big junks, with some (in fact about 60%) left over, undeveloped space that is then declared to be the public realm. Land ownership is generally handed over to developers after they meet design and financial standards, except for public spaces, roads and so on.

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[8] VicUrban is now called Places Victoria, a government agency overseeing sustainable development in Victoria.

Since the area is in direct proximity of the CBD, only separated by the Southern Cross railway station, public transport (mainly tram) is very convenient. Nonetheless the city did not really capitalise on this big location advantage. As of 2009, there were 14,600 permanent car park spaces completed or under construction, of which 4,300 are for residential use only (VicUrban 2009, 13). A lot, given its location and the fact that a total of 28,000 where living or working in the area.

>>> lessons learned

- start with strong public / governmental vision and plan, no private investment at this stage
- publicly control the development during the first stages (public domain, streets, transportation) and involve private investors gradually in following stages
- ultimately keep land and thereby development in government ownership and control, companies own buildings but lease land

Europe

University of Cambridge and environs

Cambridge	
inhabitants	123,000
size in km^2	115

Silicon Fen (current state)	
size in ha	loose regional cluster with 40 km radius
residents	130,000 (entire Cambridge)
workers	43,000
university students	22,000
total floor space in m^2	no data

The so called Silicon Fen, an allusion to Silicon Valley, roughly encompasses a 40 km radius around the University of Cambridge and is home to some 1,400 high-tech companies. The second oldest university (after Oxford) of the English speaking world, is completely woven into the city structure, university and city are inseparable, morphologically and conceptually (fig. 38).

Since Cambridge Science Park[9] was founded by Trinity College in 1970 without public support, the area experienced significant phases of development during the 1980s and again in the late 90s, closely related to the

[9] 61.5 ha, 145,000 m^2 floor space, 100 companies, 5,000 workers

ICT industry. Silicon Fen companies had a considerable share of 24% in 2004 of the UK's venture capital; that is 8% of the entire EU. However the huge importance of the area has not caused any special treatment by the central government so far, as result of expansion the standard of living is seen as inconvenience by locals and entrepreneurs. New business and science parks around the city grow at random locations without a grand cohesion, except the fact that they are all part of the Silicon Fen.

The Cambridge Phenomenon

The term Cam. Phenomenon was first coined in the 1980s and "describes the incredible explosion of technology, life sciences and service companies that has occurred in the city since 1960" (The Cambridge Phenomenon). Spacially, like SV, it related to a city region, not a specific TP.

The former market town of Cambridge, in England, reveals how a practice, embedded in its local context and specific point in time, becomes a grand model for future developments. Great Britain's, maybe even Europe's oldest example of its kind, the Cambridge Science Park (fig. 40), is a paradigm for a typology of pavilion-like buildings, scattered across a landscape park. Cambridge Science Park was established to cater for the demand of existing firms, rather than to create that demand. It initially provided low cost, short-term facilities to already established small companies (Worthington, 1999). Regarding the park's layout, every building was and still is equipped with a huge parking lot; the seemingly random distribution of buildings is only held together by a circular road that connects all of them. Size and layout of each building vary greatly and they do not form a streetscape or public places, like in the old town centre, a few kilometres to the south. What finally unifies the whole site is the greenery.

Quintas, Wield and Massey (1992, 161) had a closer look at science parks in the UK and stated that "[...] the science park model itself is problematic". "The evidence presented [...] suggests that research linkages are not significantly greater for science park located firms than similar firms located elsewhere" (Ibid, 169). The model of technological development which lies at the core of the science park phenomenon is essentially a linear model; [...] basic research leads to applied (or 'mission oriented') research, which in turn leads to experimental development, then product development, and thence to production (Ibid, 170). Finally there is "[...] the danger with the science park approach is that it gives the concrete appearance of something being done to bridge the UK gap between research and production, when the evidence suggests that this is not, in general, the case" (Ibid, 173). What their survey finally proves, is that there is no or no significant relation between the built form of the technology park and the performance of its tenants. However one evaluates a specific TP in the Silicon Fen, as a region, the Cambridge cluster is highly successful and an attractive destination for professionals.

>>> Lessons learned

- a cluster that emerges bottom-up is an ideal environment for spin-outs and start-ups
- a diverse and simply bigger cluster offers more job opportunities without major relocation of its workforce, which makes it attractive for professionals to relocate there

TU Delft - Technopolis

Delft	
inhabitants	96,000
size in km^2	24

Technopolis (current state)	
size in ha	120 ha (excl. 90 ha TU)
residents	a few 100 (more planned)
workers	12,000 - 15,000
university students	17,000
total floor space in m^2	500,000 gross (235,000 net FS for R&D)

Delft is located in South Holland, between the larger cities of Rotterdam and The Hague, a densely populated region with several million inhabitants, sometimes coined as Randstad.

TU Delft, the Netherlands' biggest technical university, started developing the Technopolis in 2008. Historic city centre and university are currently about equal in size, the Technopolis will increase the campus' size several times though. The project combines the university's main campus and the 120 hectare extension that will house spin-offs and private companies. It will be realised in stages over at least 25 years, with the aim to become one of Europe's major research and innovation hubs. While the northern part of the existing campus will function as connecting element towards the old city centre, the Technopolis will extend the campus to the south on currently undeveloped land. Included in the scheme is a tram line extenxion, to intensify shared activities along the campus' central axis, following a master plan by Delft based office Mecanoo. The aim is to enhance this central spine, that already runs through the entire campus from north to south. Shared functions will be located along this "slow traffic strip", specialised ones are further away. Together with Rotterdam (especially around its harbour), the region forms the so called Science Port Holland (fig. 45), a cluster of high tech locations, well connected by all kinds of physical infrastructure.

Besides the Technopolis, the non-profit research organization TNO[10] is headquartered adjacent to TU Delft's main campus. One of the first tenants of the Technopolis is incubator YES!Delft, created in 2005. They describe themselves as a society of young entrepreneurs that supports and coaches students, professionals and researchers, who want to start up a high-tech related company.

Due to its smallness, and flat terrain, Delft has a significant amount of cyclists. A survey from 2009 (TU Delft) revealed, 48 % of staff cycles to work, while only 16 % use mainly public transport, compared to 30 %

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[10] Netherlands Organization for Applied Scientific Research, Europe's second biggest research institution after the German Frauenhofer Society. Its Australian counterpart would be the government organisation CSIRO

car users. This is likely to change though with the extension of tram line 19, directly through university campus and Technopolis.

>>> Lessons learned

- the transformation into a combined university campus and technology precinct can lead to more interaction if good inter-personal and organisational relations are in place already
- TPs can form large entities, therefore provide public transport within the precinct, here along an existing central spine
- encourage none-vehicular transportation modes as much as possible

22@ Barcelona

Barcelona	
inhabitants	1,600,000
size in km^2	101

22@ district (target figures)	
size in ha	198
residents	13.000 (4,600 existing dwellings + 4,000 new)
workers	130-150,000 (now 56,000)
university students	25,000
total floor space in m^2	3,000,000

The 22@ Barcelona master plan is a transformation programme for the former industrial zone 22a in the inner-city area called Poblenou ("new town" in Catalan). The aim is to create a mixed-use district, dedicated to technology and innovation. The 198 hectare development, of which one third or 66 ha is street surface, consists of 115 city blocks, what makes it one of Europe's biggest urban regeneration schemes. Since (heavy) industry has moved to locations further out, the redevelopment of the area has been blocked, in residential and commercial regards. New housing was not permitted, while the constraints due to the proximity to the centre, made it unattractive for industry. Therefore the city altered the 1976 Metropolitan Plan in order to encourage higher densities to transform the former industrial activities into "urban productive activities". The redevelopment of the 22@ district is embedded in a recent redirection of urban renewal towards the east of Barcelona. It started with the 1992 Olympics and the Villa Olímpica residential project, followed by the Front Marítim and Diagonal Mar. Around the 22@ area, another three large-scale urban development projects are under way. The Sant Andreu-Sagrera project based around the new railway station for high-speed trains, the restructuring of the Plaça de las Glories as a hub of cultural centrality and the Frente Littoral-Besò operation related to the Forum of Cultures 2004.

Within the 22@ district six selected areas, accounting for 56 hectare or 45 percent of the total building area, are developed by public initiative to lead the transformation of the district, while the rest is developed by public or private investors. In total 4 million square metres gross floor space will be constructed of which 3.2 million are productive activities. About 130,000 employees will work in the district and 4,000 new state-subsidized housing units are added, supplementing 4,600 existing dwellings (fig. 46), what increases the residential density from 20 to 43 dwellings per hectare. The renewal process is based on two simple principles: Firstly the change of land use regulation of the exclusively industrial orientation of 1976, now allowing of all non-disruptive urban activities. Secondly the general FSR was raised from 2 to 2.2 with an additional 0.5 FSR added, given the project includes "@-activities" like media, ICT, biosciences, etc., and another increase of 0.3 is possible under public ownership aimed at subsidised housing. This flexible planning framework makes it possible to adapt to a changing context over time, since it does not principally establish morphological constraints, except for the already existing grid structure of Barcelona of course. It provides for a mix of public and private undertakings and projects of different scales, like entire blocks with about 12,000 m^2 surface area, single plots with less than 2,000 m^2, industrial buildings or facades to be preserved (78% throughout the district).

One city block can now house up to 36,000 m^2 FS compared to 24.000 in the old scheme. Here is an example development of one standard block with 12,000 m^2 gross surface area:

- the general FSR is 2.2
- this results in 26,400 m^2 of floor space compared to 24,000 in the 1976 plan
- if the project includes any @-activities, the FSR is raised to 2.7 resulting in 32,400 m^2 floor space, of which 6,000 are for @-activities
- if the project also includes public housing, the FSR is raised to 3.0 (even 3.2 in special cases) resulting in 36,000 m^2, of which 3,600 are for subsidised housing (about 45 dwellings)

With the 22@ project, the city intends to attract innovative companies, which previously did not consider setting up in Barcelona, what is clearly a challenge. Although about 1,500 companies moved to the district between 2000 and 2010, there has not been a great rush of outside firms. Many of the companies moved within the city, at the expense of the central Eixample area and it is questionable if a significant amount of them really engages in innovative activities. Big international players that can function as hubs are still missing, since they prefer the capital Madrid to locate their businesses, as well a local entrepreneurial culture (Charnock and Ribera-Fumaz 2011, 12). The idea of concentrating research and development, education centres, high-tech companies and so on in a pre-defined area, does not guarantee exchange between them. As observed in technology parks this process mainly depends on the existence of appropriate financing mechanisms, the availability of venture capital and an innovative market in general. The 22@ area has the potential to become a thriving inner-city district but if the focus on technology and innovation is to be taken seriously, the municipality must encourage innovative activities in major companies, small and medium enterprises and university spin-offs.

The realisation of 22@ started in 2000, is more than half way and can be identified as successful, judged on its own terms. Cerdá's grid proved to be an efficient and versatile structure, providing for high densities and a very compact urban form. Despite the city's huge urban renewal accomplishments in the last decades, recently there is more and more critique of the increasing involvement of private investors in the shaping of Barcelona's future. Residents' organisations formed, questioning the economic logic of such large-scale urban renewal projects and bemoaning the gentrification process of Poblenou. Like so often, the problem of the urban poor is shifted to other area further out rather than resolved.

Despite any legitimate criticism about affordability and the questionable innovativeness, I got the impression of quite a lively (given I was there in the middle of winter) and socially mixed area. Public transport is convenient, there are bicycle stations[11] and lanes all over 22@ and footpaths are designed generously with many little places to dwell and street furniture. There are for sure some bold office buildings with a rather windswept open space but there is just as much well proportioned public domain. The Rambla del Poblenou - a little version of La Rambla in the historic city centre - forms the commercial main street and has the feel of a traditional Barcelona barri. Due to the many new hotels and conference buildings, the area attracts lots of business people and it will take some time to develop a strong, indigenous identity. However, with its attractive public domain and integration of historic structures, there is much potential. It is of course vital that enough old buildings, especially dwellings, are not only kept morphologically but also in terms of yield necessary to be economically viable.

>>> Lessons learned

- integrate the high-tech functions into a mixed use city quarter rather to re-humanise an exclusive technology zone, let city intrude into the site and vice versa
- allow higher building densities for desired functions as reward for their integration
- include affordable / social housing to encourage a mix of users

Hamburg HafenCity

Hamburg	
inhabitants	1,800,000
size in km^2	755
HafenCity (target figures)	
size in ha	128 (+30 water)
residents	12,000

[11] Citywide network of about 400 bicycle pick up stations called "bicing". It was introduced in 2007, is in government ownership and provides 6,000 vehicles, that are used about 80,000 times each day.

workers	45,000
university students	1,600
total floor space in m^2	2,315,000

Although there is no technology focus, Hamburg's 128 hectare inner-city development, the HafenCity is an interesting case study to look at, as example for a master planned, mixed use district. To provide an overview of the land use of the HafenCity Hamburg (2012), these are the approximate shares of above-ground floor space area in the total development:

- residential 30%
- commercial and public amenity areas in ground floors (i.e. retail, catering, exhibition space and services) 9%
- office space 48%
- education, academia, culture, leisure, hotels and other 13%

The master plan by Kees Christiaanse and his office KCAP of 2000 follows his approach of the "Open City". Despite he speaks of the project's preconditions as being far from ideal, a "large scale, top-down, capitalist development with a single client, it may still lead to a vibrant urban district" (UrbanAge, 2009) over time. The ideal in contrast would be a mixture of many owners, more like in a 19th century city.

The planning concept for the HafenCity was summed up by Christiaanse as follows (Urban Age 2009):

1. Start with the status quo, that is then transformed (not with an abstract plan)
2. Be very aware of traces and identities
3. Create a multidirectional street network for communication between parts of the city
4. Create a condition in typologies that activate public and private
5. Make a mobility concept
6. Create neighbourhoods
7. In these neighbourhoods work with a varied mix of densities, uses, typologies and scales

The most important thing about the Open City is, that it is not an actual city but a fragile balance in constant change. It is not implemented through a conventional master plan but by means of its values, such as forming smaller planning units and establishing more connections between them. In the case of the HafenCity, a completely new part of the city was planned on a former dockland area, so the challenge was and still is to encourage the creation of open spaces and public infrastructure, that communicate between the different quarters, to foster urban catalysts and strengthen interconnections. In the new edition of the master plan (HafenCity Hamburg GmbH 2006, 63), "certain sub-areas have been combined to form sections which have similarities regarding geographic location, use, town-planning typology and the likely date at which they will be developed. Furthermore, the sub-dividing process has taken into account the intended step-by-step development of HafenCity from west to east. The HafenCity site is divided up into 18 sections assigned to eight [by now ten] quarters."

Development management authority is the HafenCity Hamburg GmbH, a 100 percent subsidiary of the Free and Hanseatic City of Hamburg. The supervisory board of HafenCity Hamburg GmbH consists of five members of the city senate. It has a physical representation within the precinct to inform the public. HafenCity Hamburg GmbH pulls the strings, overseeing all activities as the city's manager of development, property owner and developer of infrastructure (except the subway). It is responsible for administration of the "special city and port fund" under public law: sales of land and areas of HafenCity almost completely owned by the City of Hamburg finance the lion's share of public investment, notably roads, bridges, squares, parks, quays and promenades. In addition to this financing responsibility, HafenCity Hamburg GmbH also clears and prepares sites, plans and builds infrastructure and public spaces, acquires and contracts real estate developers and larger users, and is responsible for public relations and communication.

There is a special process that precedes the sale of a real estate site in HafenCity called exclusive option period (Anhandgabe in German). Initially a plot is handed over to a potential developer or user for an exclusive planning phase, in which he can conduct an architectural competition, examine the site, determine costs and request building permission. HafenCity and client are in constant dialogue and in consideration of specific property provisions and the framework of the building concept, they negotiate the sales agreement towards the end of this period. The client has the advantage to finance the purchasing price after completing the process and moreover has enough time, to optimise the product, secure financing and maybe acquire additional users. The city retains the possibility to influence the development in this phase and can make sure, that utilisation concepts and time frames are met. For the city this is a process to ensure architecture, utilisation and time related quality. If the client does not meet the requirements of the contract, the property can be withdrawn without administrative effort. Thereby, a cooperative attitude is encouraged and risk minimised.

Recently there was growing critique about the high prices for dwellings, a general problem of Hamburg, that are out of reach for most incomes as well as the lack of openness for the unplanned. This results in very homogenous user groups, despite the mix of uses and scales.

>>> Lessons learned

- mix uses within the quarter and preferably each building or block (e.g. commercial ground floor activation)
- integrate the precinct by extending the surrounding street pattern and including community functions
- allow for many different actors or groups, what includes the need for a certain percentage of affordable housing
- keep something back to ensure that public interest is met

North-America

MIT and environs

Cambridge / Boston	
inhabitants	105,000 / 625,000
size in km^2	16 / 125

MIT (current state)	
size in ha	68 (main campus)
residents	5,000 + 1,800 planned
workers	10,700 + 3,500 (University Park)
university students	10,900
total floor space in m^2	1,013,000 + 149,000 planned + 200,000(University Park)

The Massachusetts Institute of Technology, a private research university, is located between Harvard University and Boston's CBD. Its 68 hectare main campus stretches almost two kilometres along the Charles River Basin. There are some 10,000 students, of which many live on campus, mainly on the western end towards extensive sporing facilities. The architecture is very diverse and contains many iconic buildings from the last decades. MIT concentrated on the (architectural) quality of its individual buildings rather than a grand ensemble. A central aspect of campus planning are pedestrian circulation routes, existing buildings are connected with each other and new ones have to be integrated in this existing network. "Different departments are located next to each other to encourage the cross-pollination of ideas. Facilities serve multiple uses for the same reason. For example, a laboratory may be next to a classroom and an administrative office may be nestled among lecture halls and laboratories" (MIT Centre for Real Estate).

Built on a former landfill area, initially surrounded by industrial brownfields, the MIT could easily be extended over time. Many private companies set up in close proximity to MIT towards the north-east. "In the early 1960s, MIT embarked on one of Cambridge's first large-scale commercial developments: the Technology Square research and development park. University Park, a mixed-use development centered around biotechnology firms, followed in the late 1990s. It was developed by a private firm on MIT-owned land, originally in partnership with the Institute. More recently, the Kendall Square area, a long-time seedbed for start-up firms located in old industrial facilities, has been transformed by private developers into a landscape of modern buildings housing high-tech and related companies. Half-way between University Park and Kendall Square, the four corners of Main and Vassar Streets are one of the world's pinnacles of successful R&D" (MIT Centre for Real Estate). For zoning and tax reasons these technology parks are not directly on MIT's main campus.

University Park at MIT

- 27 acre (10.9 ha) north of MIT main campus
- 140,000 m^2 of research facilities in 10 buildings

670 residential units + 1 hotel
2,700 parking spaces in 3 multi-storey car parks

>>> Lessons learned

- juxtapose different university departments, private firms, student housing, research facilities, etc. and leave some things open
- create a pedestrian network between and within buildings, make people walk around between facilities to enliven a campus

Stanford Research Park & Silicon Valley

Silicon Valley metro-region (fig. 56)

inhabitants	5,100,000
size in km^2	8,600

Stanford RP (current state)

size in ha	283
residents	none
workers	23,000
university students	15,000 (at Stanford University nearby)
total floor space	930,000 m^2

This 40-mile by 10-mile strip on the peninsula south of San Francisco, stretching from Palo Alto to the southern suburbs of San Jose, "has become the popular epitome of entrepreneurial culture, the place where new ideas born in a garage can make teenagers into millionaires, while changing the ways we think, we live, and we work" (Castells and Hall 1994, 12). Spatially, there is no such thing as a clearly defined high-tech precinct. "Silicon Valley is not just a region, but an idea" (Silicon Valley Economic Development Alliance). It is a cluster occupying the southern part of the San Francisco Bay Area and touches two major US Metropolitan Areas: San Francisco-Oakland-Fremont and San Jose-Sunnyvale-Santa Clara, which together count over six million inhabitants. One cannot separate what is high-tech precinct and what is host city, there are multiple hubs, some more concentrated, some more spread out, in total about 40 cities from big to small (fig. 56).

Silicon Valley's historical nucleus and probably the most famous of all technology parks, was built in 1951, as Stanford Industrial Park in Palo Alto (fig. 42), claimed to be the world's first technology-focused office park. Early tenants included Hewlett-Packard, General Electric, and the former aerospace company Lockheed. The park covers 700 acres (283 hectare) in an area surrounding Page Mill Road, south of El Camino Real. It is now run by the Stanford Management Company which was established in 1991 to manage the university's

financial and real estate assets. The park's 162 buildings hold 23,000 employees who work for 140 different companies. The park houses no residents and is mainly surrounded by living quarters of detached single-family houses.

The area of today's Silicon Valley has already been a major site of United States Navy research and technology since the early 20th century, with dramatic growth especially after World War II. After the military the forerunner of NASA took over, until the focus of innovation gradually shifted towards financial interest and revenue. This means that the research park has a long history and did not occur with the development of the personal computer or the Internet. Its location can ultimately be traced back to Stanford University, established 1891, by a railroad magnate, who chose their farm estate as the university's site.

>>> Lessons learned

- Silicon Valley is not one TP or a technology cluster, but a major city-region with several million inhabitants, comprising an area comparable to a large metropolitan region
- the specific morphology of SV is the result of a rather circumstantial development over decades and is neither related to its own success nor a general rule for success
- a thriving entrepreneurial culture is of major importance for invectiveness
- SV has an incredibly large catchment to attract talent, firstly a conurbation of 5 million, secondly a strong network worldwide, success depends on those people

Facebook Headquarters

Silicon Valley[12]	
inhabitants	1,780,000
size in km^2	~ 3,367 (1,300 sq miles)

Facebook HQ (current state)	
size in ha	23
residents	0
workers	3,600 (will grow to 6,600)
university students	none (15,000 at Stanford Uni nearby)
total floor space	93,000 m^2

The new headquarters of Facebook (East Campus) in Menlo Park are a good example for the corporate technology park phenomenon. This 23 hectare (57 acres) campus along US highway 101, originally built for

[12] These numbers represent the conservative estimate to equate Silicon Valley with Santa Clara County.

Sun Microsystems in the mid 1990s, is comprised of nine buildings totalling 93,000 square metres (one million sq feet) of floor space. Floor space ratios for this industrial zone are limited to 0.45 and site coverage cannot exceed 50 percent. Most of the site is covered with parking spaces since the majority of employees commutes to work by car. Nonetheless, the 3,450 parking lots, what equals one per 27 square meters of office space, would not meet current standard requirements, which are one parking lot per 18.6 square metres of floor area and would result in 5,000 parking spaces. The rectangular and L-shaped buildings are two or three stories high and arranged along a curved, central spine, forming an long court yard. Before Facebook moved there, the number of employees was limited to 3,600 due to the concern of increased traffic congestion and available parking lots. However this limit has been raised to 6,600 as Facebook plans to use more shuttle buses and somehow encourage the use of bicycles.

Similar campus schemes are repeated across Silicon Valley on different scales. Big floor plate buildings forming islands in a sea of parking spaces that are necessary because the entire planning typology is car based. This cannot be the role model for technology precincts worldwide, especially in cities. Nonetheless the attempt to repeat the success story of Silicon Valley can be found all over the world. Concerning urban planning, this is definitely not the way to go.

Although the San-Francisco-Oakland-Fremont metropolitan region is overall among the densest in the US, this does not apply for Silicon Valley. The mode of transport is closely related with the appearance of the technology park, normally parking lots cover most of the surface area. As long as land is cheap, it is not economically viable to build multi-storey parking, which costs about ten times as much as the simple on ground solution, not to speak of underground parking, which increases the price per space by factor 20. Likewise the office buildings tend to be large and rather flat and of course height is limited by the municipality. In the case of Stanford Research Park that is nine meters, what is barely enough height for three floors. Altogether the regulations support development, that looks more or less like what is there already. Deep building setbacks along wide streets, used to create buffer-zones of greenery, hiding industrial buildings and more important, vast parking areas.

West Campus by Frank Gehry

9.6 ha site
39,000 m^2 for 2,800 employees = 13.9 m^2 per employee
FSR = 0.45 what means 40,000 m^2 office space max.
building on stilts with 1,500 car parking spaces underneath
one continuous “10-acre-room”
8 metre high ceilings
rooftop garden
connected via tunnel to East Campus

The devotion to horizontal space in the pursuit of collaboration leaves Facebook stuck in Menlo Park’s land of interaction-repelling office parks. Half the company’s staff lives in San Francisco where the city hosts human networking far richer than the most brilliantly designed office environment does. You can’t find room for a 10-

acre floor in the densely built-up city, though. Facebook shuttles city dwellers 30 miles to its campus with its own bus fleet (Bloomberg, 2012).

The concept of the proposed head quarters' extension takes the typology of the suburban campus building to its extreme. The site is one big car parking landscape surrounded by a green belt or buffer. A warehouse like, continuous room on stilts, covers most of this car park and is equipped with a garden of top. From above the entire site is a green carpet, from street level, the building is barely visible behind the vegetation. The inside forms a landscape of work spaces, scattered across a suggestively public domain. It sure is exciting in comparison to former office blocks, filled with cubicles, but at the end of the day, it is one big office slab, owned and used exclusively by a single corporation. Different "break out spaces" are planned, but there are no gaps for the unplanned to emerge. The potential of the urban virtue of over-denotation and overlap are lost to a significant extent.

>>> Lessons learned

- big corporations prefer exclusive campus sites to centre all or most employees in one place
- everybody is working for the same employer, the interiorised "public domain" of large corporate campuses to enable chance encounters is of completely different nature than in a TP

Silicon Alley

New York City	
inhabitants	8,300,000
size in km^2	1,213

Silicon Alley (current state)	
size in ha	~ 200
residents	605,000 (NYC NTA's 2010 census)
workers	90,000 ("high-tech" jobs in all five boroughs)
university students	~ 66,000 (lower & midtown Manhattan)
total floor space	no data

Silicon Alley is a rather vague description for an area comprising Lower and Midtown Manhattan (up to 59 Street), with a concentration of high-tech and new media companies. Over the years, with more and bigger companies, it became a general term referring to the dot-com-industry in New York City as a whole. After the burst of the Internet bubble, the migration of many financial institutions to other parts of Manhattan or the suburbs and finally the 9/11 tragedy, the area is going through a new revitalization period. Since the early 2000s Silicon Alley has seen a steady growth in the number of start-ups and has joined the ranks of Boston and San Francisco as one of the three leading technology centres in the US. As a whole, the New York metro area even surpassed Boston as second largest technology hub in the USA (Florida, 2011).

The Downtown Lower Manhattan Business Improvement District (BID), managed by the Downtown Alliance[13], is an initiative to improve street scape design, transportation, tourism programs, the availability of wireless LAN and so on. Simultaneously NYC is aiming to once again increase the number of residents in the area by providing affordable housing.

NY Tech Meetup[14]

Today meetup.com is a social network platform with several million users, facilitating offline, real life meetings all over the world. It basically brings together people with similar interests that may have never met without first browsing the meetup database. Besides tech related groups, there are many about sport, food, language or simply going out at weekends. The NYTM was first launched in 2004 by Scott Heiferman (together with Dawn Barber), who is also co-founder of meetup.com. "NYTM centres around its monthly events, where members gather to watch emerging companies demo new ideas, hear leading-edge thinking on technology topics, and build their networks to develop their businesses" (NY Tech Meetup, n.d.). The NYTM has 28,000 members to date, what makes it the biggest group on meetup, and schedules meetings at least once a month. However there are several off-springs with a NY Tech prefix like NY Tech Woman, NY Green Tech Meetup Group or NY TECH Ping Pong, "because we believe that the conversations sparked over a friendly game of ping pong can lead to the creation of new relationships and ideas that can change the world[15]". Big players such as Tumblr, today a company valued at 800 million USD, launched their product at a NYTM demo event. The group is also creator of "Made in New York City[16]", a brand for web pages mostly coded in NYC, with at least 10,000 visitors per month.

Manhattan Borough President Scott Stringer (2012) recently published a paper called "Start-up City: Growing NYC's Entrepreneurial Ecosystem For All", in which he investigated the opportunities for NYC related to high-tech businesses. Among few other things, he identified extending public transport and an affordable housing market as key assets for a growth in this sector and beyond. "[...] we need a transit system that reflects where people live and work today, not 100 years ago" (Ibid, 3). This attracts talent but also keeps skilled locals from leaving the island. Other challenges are of bureaucratic nature - founding a business or getting a visa as entrepreneur or investor. As can be seen in Silicon Valley, immigrants are a driving force in the high-tech world.

>>> Lessons learned

- the virtual presence is as important for a high-tech community as the physical presence

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13 available at www.downtownny.com

14 available at www.meetup.com/ny-tech and nytm.org

15 available at www.meetup.com/NY-Tech-Ping-Pong

16 available at www.nytm.org/made-in-nyc

- there benefits for entrepreneurs, but also a bigger cross section of the population by improving public transport and supporting affordable housing
- make it (financially) attractive for young graduates to start-up a business locally

Critique & Alternatives

> *The advent of the machine age has caused immense disturbances to man's habits, place of dwelling and type of work; an uncontrolled concentration in cities, caused by mechanical transportation, has resulted in brutal and universal changes without precendent [sic] in history. Chaos has entered into the cities.*[17] *(J. Paul Getty Trust)*

If we consider the Athens Charter of 1933 (CIAM) as pamphlet trying to get a grip of the city's dirtiness and congestion, we could now charge planning with uniformity and boredom. Planning tries to equalise our cities. Sometimes in a literal way, but more importantly already at the conceptual level. The process of city-making became tidied up, institutionalised and normalised, at least in high income economies. Planners, governments and investors produce projects, that are measured monetarily in every aspect, aiming at maximum calculability. Buildings are not build to suit personal needs but as commodity to trade with, and investors understandably seek minimal risk. That means no experiments, repeating what worked out previously - business as usual without potential for new thinking to emerge. Good design in all its facets, public places that feel right, might rank high in glossy brochures but fail to become reality most of the time in big, master planned developments.

Questioning the physical determinism

Technology parks create distinct precincts, that are intended to spur innovativeness by designing the ideal environment for collaboration and exchange. But the determinism that underpins this assumption is nonsense. This is not the way innovation is happening; and it is insufficient in this context, to acknowledge a non-linear innovation process and simultaneously claim, that "the magic" will somehow happen within the orthodoxy of the exclusive innovation-realm. Furthermore "[...] the rigid adherence to the 'winning formula' may reduce or stop the emergence of other patterns that may be equally of even more 'successful' if allowed to happen" (Simpson 2013).

Master plans of technology parks ignore surrounding city structure, street patterns and urban grain - they create their own, more or less green domain. A reverberation of medical scientists, poets and painters of the 18th century, who discovered the myth of an unspoiled country side and its strong and healthy people. Removed from all problems of the overcrowded city, providing light and air for everyone. An ideal that many early Modernists adopted. "Still today, […] there is a general idea [...], that the remedy for mutilated urbanism

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17 Excerpt from The Athens Charter, produced 1933 at the Congress Internationaux d'Architecture moderne (CIAM)

is nature; and in fact the remedy for wounded and mutilated urbanism is good urbanism, good buildings, not just flower beds […]" (Kunstler, 2011).

Just like back then, when people discovered the country side, someone recently discovered certain city-regions, especially equipped with an innovative culture. But just as the greenery cannot heal failed planning, so are the manifestations of clusters not the key to innovation.

Location

Real estate agents keep telling, that it is all about location. This is also true for technology companies, maybe not in a sense, that the actual building or street address is important, like for retailers, but rather a regional context. Like Dave McLure[18] (500 Startups, 2011) put it, "we have 10,000 square feet of office space, 15 minutes away from Facebook, Google, Apple [...]". He provides office space and strategic advice for young entrepreneurs who want to found a business. Still, many people migrate to Silicon Valley although primarily designing software, that could be coded and distributed from anywhere. It is about the social and professional network, face-to-face contacts, financing and a specific entrepreneurial environment, that accumulates in the San Francisco Bay area.

Nonetheless, there in an increasing internationalisation in the competition for good location, often represented by rankings, trying to verify, quantitative and qualitative aspects of cities. One of these quantitative lists concerns the conditions of doing business[19] - basically a summary of factors like the ease of starting a new business, dealing with construction permits, trading across borders, resolving insolvency, etc. - that are also of major importance to the success of technology parks. Likewise it is crucial for entrepreneurs to have access to venture capital and funding to start up a business. There has to be sufficient support for unconventional ideas and taking risks; a "culture of failure", since statistics prove, that only a few out of many business ideas score. All this has little to do with the physical determinism of technology parks, especially for ICT, software, media and creative industries. Many of the companies, that emerged in the last decades, are not bound to big production or distribution lines, lab spaces or share infrastructure other than high-speed telecommunications.

Then there are qualitative rankings, regarding overall quality of life or "liveability". Liveability rankings are basically designed for employers assigning hardship allowances as part of job relocation. Cities listed on top of these various surveys, for sure offer aspects, that contribute to "the good life": political stability, personal safety, the availability of health services, education and infrastructure, to name a few. Cities in war zones understandably score last but overall there is not much to be learnt from these rankings. The criteria are very generic, what explains why the different lists vary so greatly, and why should not a small city offer a high

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[18] Dave McLure is founding partner of 500 Startups, a Silicon Valley based incubator and investment fund, that to date invested in several hundred companies all over the world. Available at www.500startups.com

[19] For more information go to www.doingbusiness.org, a project launched by the World Bank Group that measures business regulations for local firms in a certain country or region.

quality of life? They are represented far less in such surveys, although their number is much greater and one could argue that especially small and medium size cities offer a desirable lifestyle.

In the competition for attracting the so called "knowledge workers", liveability is seen as an important criterion to allure skilled immigrants. But the point is, that location cannot "be made", neither can the specific virtues of Sillicon Valley be replicated by co-locating research institutions and industry, nor the liveability of certain cities by remodelling fragments of their urban structure. Such an approach would be comparable to designing a computer, shaped like a brain, in the hope it might somehow also work like one.

Co-location

While in the industrial realm, there is strong evidence for the benefit of shared infrastructures and physically juxtaposed steps of production, this "surplus" remains ambiguous in the case of technology parks. Industrial clusters are, due to logistics, located in rather remote, suburban areas along heavy traffic arteries, especially dedicated to industry by means of zoning. Creative industries and companies related to ICT, media, software, etc. have different requirements for work space than industrial technology companies. Yet the technology focused office park, is used as paramount typology, to provide all of these companies with working environments, even if located in more central, urban areas.

Although co-location can be beneficial for small companies, the physical determinism of exclusive "innovation precincts" is indefensible. Since technology parks are large developments, they are also real estate deals and political show-case projects. Proximity can foster informal exchange - what is generally considered important for knowledge intensive undertakings - but the quality of this closeness is crucial, just as density alone does not create a medieval city. Moreover it is just one out of many options to spur exchange between individuals. Collaborating across different professions is integral part of cities ever since and lies at the heart of their morphological and professional density. But neither formal nor informal exchange demands the formation of campus style office park environments.

Exchange of knowledge

There is without a doubt the need for immediate exchange in today's knowledge society, no matter how connected we are via digital networks, but does that automatically justify the physical juxtaposition of buildings in technology parks? And more importantly, does this juxtaposition facilitate face-to-face exchange? Basically three concepts of exchange can be observed in technology clusters[20].

- Hosted like in a planned TP - different companies are grouped in a confined space, exchange should happen in between these companies
- As network of entrepreneurs like in Manhattan - exchange is related to individuals and dispersed, not bound to morphology

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[20] for the mentioned examples see case studies, chapter 3

- An “all in one” solution like Facebook's HQ - many employees are gathered in a single building, exchange happens in an interiorised, shared space

From my findings it becomes clear[21] that being close to other institutions does not necessarily result in more interaction among them. Sometimes the formal and informal networks reach far beyond the boundaries of the technology park, for example because they have already been established before the company moved to the park. As we all know, it is quite easy nowadays to find someone with similar interests or skills, even in niches, without living close to that person. In our modern cities it is common to know people who live or work far away much better than our neighbours. On the one hand we live in our particular neighbourhood and we make use of local offerings but that does not necessarily represent our social life or network of people we interact with. In big cities a neighbourhood does not function like a village or small town, a misconception of some urban planners. A technology cluster might have local connections to the same extend as an intensive exchange with partners far away. There are of course examples where the forced proximity did encourage collaboration and sharing the same address lead to fruitful interactions, but a culture of exchange proves to be even more present in unplanned networks. “The Silicon Valley-style suburban nerdistan office park model” (Florida 2012, *Strategies for increasing Diversity ...*) exists in parallel to an inner city entrepreneurial culture that mingles with the city dwellers and has far less or no spatially defined boundaries. Circumstantial clusters like “Silicon Alley” in NYC heavily depend on the superposition of like-minded entrepreneurs who form a sort of innovation network, intruding into Manhattan’s grid and subsequently attract more firms. This means that the phenomenon of utilising the advantage of proximity, of a cluster that becomes more than the sum of its parts, can emerge in many different ways. Technology parks however do not allow for this emergence - if it might happen or not - since they believe to have found the high road to innovation and see no need to keep back unprogrammed potential. In contrast to this, NYC’s “tech-meetup[22]” is open to everyone willing to participate and it is organised an hosted by the entrepreneurial and start-up community itself. Exchange is facilitated via digital networks and regular, real-life meetings. “Silicon Alley” forms just one layer of an extremely heterogeneous city.

Planning issues of technology parks

A major point of critique of technology parks is related to master plans. They are undoubtedly emblematic for issues in current planning more generally but become eminently manifest in technology parks. Today, there is the general tendency among (progressive) theorists and planners towards a process-related understanding of planning. An open system has to replace the closed system of modernity, that failed to produce good cities - most of all high quality public domain (fig. 71). Richard Sennett (2006) uses the term “Brittle City” in this

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[21] see for example Quintas, Wield and Massey, 1992; Florida, *Strategies ...*, 2011; University of Cambridge, 2012; Wadhwa, 2013

[22] see case study Lower Manhattan chapter 3.3.4

context, a city created by over-determinism, a symptom of the desire for equilibrium and integration into grand schemes. The technology park has its fixed mission in the frail balance of urbanity, just like every other city-unit has, such as shopping centres, recreational parklands, suburban dormitory towns, etc. It is just one of the big urban typologies, that have emerged as the last gasp of modernism, underpinned by car dependent urban patterns. Several issues of planning technology parks come together here, that are basically centred around the failings of master plans.

Zoning and disintegration

The CIAM proclamation of separation of functions was intended to bring order into the overcrowded, industrialised city of the 19th century. Use became the paramount criterion in modernity and even if we reconsidered other proclamations of the CIAM, use is still a primary planning tool. While it made sense to spatially separate heavy industry from living quarters, this also created islands of single uses in other fields, such as housing, retail or leisure. The continuing disintegration of cities and the increasing difficulty to traverse these islands is of major concern for urban planners today. Exclusive zoning is outdated in many regards of city re-development or extension, but technology parks form such special zones, mainly containing office use and it is still common practice to build them as homogeneous entities.

In order to encourage, that technology parks grow into integrated, mixed use districts, planning must take a different approach. Simple rules for lot sizes, buildings heights, setbacks, maximum floor space ratios and so on are not sufficient. Especially with the technology park returning to the city, literally but also ideologically, planning has to be altered, looking at the bigger urban picture. Why should young start-up companies, apartments and retail stores not be located in the same building? In old city centres, working and living is - or at least was - mixed horizontally and vertically. Today's cities are more complex and spread out and we cannot simply copy this scheme. As Christopher Alexander already pointed out in 1965 (16): "you must have the right overlap and this is for us almost certainly different from the old overlap which we observe in historic cities. As the relationships between functions change, the systems which need to overlap in order to receive these relationships must change too. The recreation of old kinds of overlap will be inappropriate, and chaotic instead of structured."

The master plan

> *An odd aspect of neoliberalism resides in the contradiction between its ostensible liberalism and its deterministic practices regarding urban development. This determinism is epitomised by the master plan, a commercial real estate instrument of control and calculability in order to acquire equity capital. (Fiedler 2009)*

Modern top-down planning from big to small scale, implies that everything can be planned and thereby controlled, but the concept of the master plan is problematic in itself. "Large lump developments" (Alexander 1975, 71) are not flexible enough to adapt and be improved over time, as the failures, that every project has, become visible. It is much harder for everyday users to relate to buildings around them, if they are not empowered to somehow participate in planning and changing them. Master plans try to predict the future, but mostly they become irrelevant as time goes by and that rather quickly. In reality, the framework, that informed the master plan, changes and makes it gradually less valid, until it is of no use any more. The reason for this is, that these conventional master plans depict a vision of a more or less finalised, perfect design, that is

then subdivided into realisation stages, over two decades or more. Based on current conditions, the plan "solves" current issues and suggests a very concrete solution, but not surprisingly, many of these conditions change, disappear or are replenished. The finalised, morphologically specific master plan cannot react accordingly and becomes obsolete in the end. Given the rapid, sometimes disruptive changes in high-technology, this is even more relevant for master planed developments of technology clusters. But "because they typically die a slow death, you don't read about the failures on the front pages of newspapers", argues entrepreneur and academic Vivek Wadhwa (2010).

The master plan is not only prevalent in property based development. Policies themselves, providing advice how innovation should be tackled are often the result of "top-down studies, focusing on national or supranational framework conditions rule today" (Drewe 2010, 11). "It is not correct to jump from an aggregate analysis to a level of conclusion concerning the individual behavior of business firms" (Ibid, 9).

What architect and urban planner Kees Christiaanse observed for example (Urban Age 2009), is a shift away from conventional master planning in favour of a political covenant. The overall idea of how the city should be in the future replaces morphologically deterministic planning at this meta-level. A more open, process orientated master plan is then implemented at the scale of specific sites, defined by this covenant. The ATP can be seen as such a specific site for development within a larger concept for Sydney, to diversify its centres beyond a single CBD, to repair the under-utilised city structure towards the south (international airport), to emphasise the importance of IT and creative industries within the city, to develop new housing within already urbanised areas, to encourage non-car transportation, etc.

Another aspect is, that master planned entities tend to be "bland", simply due to a lack of diversity and discourse - maybe even disagreement. Places like Melbourne's Docklands exemplify this weakness. The well-meant, but generic "mix" unfortunately did not enable real diversity to emerge so far (fig. 70 and fig. 71). Like in many comparable precincts elsewhere, few developers where involved in the realisation process. Government control was given up too early while private investors had too much say on public space and infrastructure. The project could not grow step by step in agreement with the public, a public that is highly dissatisfied with the outcome and rightly so. These linear, large-scale developments are at best a gamble that might turn out just about passable. In the case of Melbourne's Docklands a "retrofit" is on the table, something that should only be an issue with areas 30 or 40 years old, not amidst construction.

Emerging directions

More than just a question of how the future technology park looks like it is a question of how we deal with big chunks of land, often in prime city locations in general. In many cities abundant railway yards, port areas or factory premises are, or will be redeveloped (fig. 73). They offer chances to increase the range of uses in the inner city, to provide small, young businesses with a good address and to reintroduce housing into office precincts. With the growing significance of high-tech related businesses for a country's economy, the formation of a "creative class" (cl. Florida 2012, *The Joys of Urban Tech*) and a shift of these firms and entrepreneurs towards urban areas, technology precincts are an important element in city development.

While big corporations retreat to internalised citadels, others seek a more heterogeneous mixture of uses and occupants. Campus grounds were in the past often celebrating their difference from the city and more or less self contained. While this notion continues to exist in corporate campuses, progressive schemes increasingly include the attempt, to retrofit urban life within the park-environment and to re-humanise the dullness of open spaces. Technology parks and university campuses, especially in Europe, are now beginning to retrofit liveability, trying to "re-humanise" these areas, but still do not fully engage with their cities. Campuses that did not offer student housing on site for example, are increasingly adding residential units for students or workers. Low density, greenfield campuses are inserting new buildings to form a richer fabric and at least some kind of urban intensity. Public transport, walking and cycling are generally considered the most desirable modes of transport and encouraged on campus and beyond, at best connecting home and workplace (see case study 3.2.2 Delft). Most developments however still maintain the overall park approach, but can at least imitate real urbanity.

Parts of the city and the technology development have to overlap or as Christopher Alexander (1966) would say, they have to form a semi-lattice instead of a tree structure. In "A city is not a tree" he describes the common American form of the isolated campus as mistake, where a conceptualised method of planning does not correspond with the reality of university life. It does not help, to call an open space plaza, even if furniture is nicely arranged in groups, people will not gather there to have coffee and they will not exchange creative ideas. Not a place makes a city work, but cities create places that work because of everything surrounding the place. There is a trend among entrepreneurs and young high-tech companies, to set foot in city centres rather than remote technology parks (cl. Florida 2012, *The Joys of Urban Tech*). In fact a dense urban environment suggests itself to be the place of exchange and collaboration by co-location. Something that the technology park desperately tries to emulate.

Beyond the technology park

> *The balance of power [between investors, politicians, citizens, etc.] has shifted with the increasing competition between cities: of what use is power and money, if citizens leave their city? [...] The everyday experience of citizens defines a city's reputation. It is incorruptible and at the same time has become more relevant, since the willingness to move to another city, has risen significantly. [...] Even city marketing professionals do not believe in medially cultured city profiles any more. That means: Either everyday life of a city is a sensation or there is none at all. (cl. Hüberli 2012, my translation)*

What is true for the city at large, is also true for the development of technology parks. Either an entrepreneurial culture and collaboration as well as competition evolve in an area over time, or there is no innovation and more importantly no marketing and exploitation of new ideas. As Luis Sanz, Director General of the IASP, stated and projects like meetup.com[23] prove, "a Science or Technology Park is a space, physical or cybernetic" - and we could add cultural. What many successful high-tech areas like Silicon Valley, Boston or

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[23] Online platform to organise real-life meetings, which played a significant role in the formation of NYC's Silicon Alley.

Cambridge have in common, is that they are not simply technology parks. They are networks of cities, towns, universities or colleges, different clusters and overlapping communities, that also have built strong virtual networks. It is fundamentally about people and the (entrepreneurial) culture they share, not about the specific site of a technology park or its layout. It is the "diverse populace [which] fuels Silicon Valley", what becomes evident in the fact that "from 1995 to 2005, 52 percent of Silicon Valley's startup founders were born outside the U.S. [...]" (Wadhwa 2013). The goal must therefore be, to foster and enrich this entrepreneurial culture in a certain city or region, not to design purpose-built innovation machines, that have no margins for this culture to emerge. Sydney could built upon an already existing ecosystem of start-up and high-tech activities instead of gathering "[...] public and private sector high technology industrial enterprises involved in research and development" (Redfern Waterloo Authority 2005, 19).

Adaptation and diversity

Conventional technology parks are large, property based developments, planned top-down. To some extend the effort is made, to include a minimum of amenities for workers, sometimes even usable for neighbouring residents. It seems commonly accepted that a certain re-integration of additional functions can foster the innovation process that technology parks strive for (see for example Battelle 2007, 31 and 36). But instead of touting "world-class mixed use precincts", there must be real discourse about the quality of public domain that is created and the level of participation. We have to reintroduce some uncertainty in our cities. Visions of what a place might be able to become, implemented by a process that also leaves open some things - retaining potential throughout the way, potential to still change things. The ATP's location and historic buildings provide the opportunity to create a place, that is used by many actors, embedded in its local history. "You already have an identity as a city — you don't need to be Silicon Alley or Silicon Slopes" (Feld 2012).

Colorado based venture capitalist Brad Feld identifies four key elements of a thriving start-up community (Ibid).

1. entrepreneurs must lead the startup community
2. the leaders must have a long-term commitment, at least 20 years
3. the startup community must be inclusive of anyone who wants to participate in it
4. it must have continual activities that engage the entire entrepreneurial stack

This implies that the organisation is non-hierarchical, there are leaders but they are part of the entrepreneurial community. Such an innovation model could be combined with a kind of curated guidance by the city or a publicly mandated body, responsible for the spatial implementation of plans. There is also a place for universities in this process, but Feld (2012) points out a fundamental difference, "Startup communities are networks [...] Universities are hierarchies". They should participate "[...] as conveners for entrepreneurial activity, attracting smart new people to the community, spinning off research into companies, and building bridges between students and the startup community."

This stands in stark contrast to the patterns of ownership and decision making in technology parks. The network mentioned above has many authors and retains the quality of the "unplanned". Not because

entrepreneurs are disorganised, but because the variety of individuals suggests ideas, a single handed master plan could have never taken into account. Collaboration should already start with the creation of a collaborative innovation ecosystem.

The Open City

> *"Open city" is a somewhat utopian term: it refers to efforts by architects and urban designers to translate the ideals of an "open society" — a society with a tolerant and inclusive government, where diverse groups develop flexible mechanisms for resolving inevitable differences — into physical spaces. It refers to places where people of different backgrounds can coexist, where interaction leads to cultural enrichment and innovation, and where the market flourishes. (The Design Observer Group, 2009)*

What do the findings about technology parks, innovation and entrepreneurship imply for planning? The idea of the Open City might point in the right direction an can act as source of inspiration. Central to this concept is an issue, that already Jane Jacobs (1964) denominated as "[...] the self destruction of diversity, a process where whatever is successful, will be repeated and displace everything else". Hence the entire district becomes more and more monolithic. Christiaanse (2009) addressed a similar problem when sating, that "[...] today there is the tendency, to produce mono functional units; islands that do not talk with each other and therefore require an enormous amount of transportation infrastructure. There are however ways to work against this process and planners have to reconcile these mono functional parts and work with them."

"The Open City is not a real city, but a set of values or instruments, that creates a mix of uses and people who will exchange ideas and goods and thereby create a certain economic intensity. It is only found in fragments or parts of the city and there is a fragile balance between integrating and disintegrating forces. They constantly change the city, that can therefore never be a whole city" (Christiaanse, 2009). Jane Jacobs (1964) already described this issue as the self destruction of diversity, a process where whatever is successful, will be repeated and displace everything else.

In practice that means that the master plan has to be a gradual system of rules. Instead of a (conventional) master plan that is subdivided into realisation phases and implemented with planning regulations. This is exemplified by the HafenCity project in Hamburg. Already in the conceptual phase, different structures for each quarter are planned, based on the surrounding of each specific location. The first layer of this system of rules consists of a rough description of each quarter in order to map the status quo, followed by a refinement in three steps. Step one is a progressive qualification of the master plan; step two the urban development of the quarters via test-designs; step three is the allocation of properties to investors who are requested to invited competitions. The two most important issues of the master plan were the connections with the surrounding and the meta-structure, that aims at the integration of small-scale, urban structures. Since it was formally decided by the senate that this is the official planning document, many details were intentionally left out because it would be difficult to change them afterwards. All these details should be discussed later, in the qualification phase by means of workshops with all stakeholders present. The centre stage was taken by the distribution of usages and their typological realisation. It is a master plan whose strengths lie in stimulation, that does not seek to enforce a once fixed image through pressure and restrictions. (cf. Christiaanse and Neppl 2008, my translation)

At the Urban Age (2009) conference in Istanbul, Kees Christiaanse was talking about the concept of the Open City more generally and gave a short insight, what it means on the level of town planning or urban design. He referred to his recent publication Urban Reports, "a quick scan of six European middle-size cities", from which a general process of operation can be derived. Four major tendencies, Christiaanse very realistically called a "workable methodology of dealing with cities and implementing schemes".

1. The city creates a structural vision, an overall idea of how the city should be and look like as a political covenant.
2. "Theoretical plans" like zoning plans or detailed planning applications become more reduced and are less meaningful because the political covenant is getting more important.
3. The city defines specific sites, in order to develop compact projects with effect on the local scale within the umbrella of large scale visions.
4. The city creates mandated development agencies; they get a democratic mandate, are mostly public private partnerships and are able to execute projects in a comprehensive and quick way.

Sydney & the Australian Technology Park

> *Wonderful Sydney. It's a city, very good for parties, for Olympics and for summits. But it's not so glorious for the everyday life. It could be much, much better. (Jan Gehl, City Talks)*

While Europe developed a dense Network of medium sized cities, that sometimes form continuous regions, this is not the case in Australia. With a size comparable to the USA, China or Brazil but only above 20 million inhabitants, there is simply a lot a space available. More than half the population lives in the five big cities[24]. Generally these metropolitan regions are vast, rather comparable with sovereign states in Europe. The biggest of these five, Sydney, reaches form the Pacific coastline in the east all the way to the Blue Mountains, a good two hours journey by train.

As reflected in current planning policies, the largeness and structure of Sydney should be understood as polycentric conglomerate. The Australian Technology Park (ATP) could be one specialised node in this network and act as hub on different scales and layers. While there are general urban planning issues like public transport and affordable housing, there is also the need for strategic planning goals for the ATP. To promote innovation and risk taking, to foster a local, entrepreneurial culture and fascinate the youth for jobs related to the wide field of high-tech.

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[24] Sydney 4,6 mio - Melbourne 4,2 - Brisbane 2,1 - Perth 1,8 - Adelaide 1,3 - together account for 14 mio inhabitants out of 22 in all of Australia

The ATP occupies an spot, that can be transformed into a prime inner city location. While current plans stipulate a suburban campus, there is far bigger potential for this area and the chance to provide benefits for a wider public. I will approach the subject geographically from big to small scale, followed by an analysis of the ATP and its surrounding.

Sydney

> *The city of cities concept describes a compact, multi-centred and connected city structure enabling people and businesses to spend less time travelling to access work, services, markets or regional facilities. This promotes productivity and better infrastructure utilisation, reduces car use, energy use and emissions, and supports a more active lifestyle. (Sydney Metropolitan Plan 2036, 26, "City of Cities")*

The Metropolitan Plan (MP) identifies five global and regional centres (fig. 78): Sydney CBD, North Sydney, Parramatta, Liverpool and Penrith. This concept of a compact and expanded agglomeration, but how are these cities connected? They are (at best) decentralised sub-centres within the City of Cities scheme but do not form a distributed network, even beyond 2036 (fig. 81). That would include a much better network of connections, a more diverse mobility concept, including rail lines, underground and trams. Every city or part needs several access points, that are connected with several other parts.

The MP further describes a hierarchy of centres: Existing major centres like Bondi Junction, also a big transport hub, or mixed use renewal projects like Green Square, specialised centres like Macquarie Park (see 3.1.3), town centres, villages and finally neighbourhood centres, consisting of a small group of shops and services with a walking catchment of up to 200 metres. What is however essential, are the interconnections between these parts, on a big and small scale. Likewise this is important for technology parks, since they are significant concentrations of workers, who normally do not live close by but commute every day. The park has to be easily reachable by public transport, this reduces traffic congestions and the necessity for huge parking garages on site.

Transport is of major concern in Sydney, since the public systems relies mainly on buses and the car has a modal share of above two thirds of all journeys and mass transit constitutes for 11%, while cycling just reaches the one percent mark[25]. By comparison, in Paris or Seoul, that are both very large, almost two thirds rely on mass transit. Sydney has to catch up in this regards, a problem that can only be approached on a big scale.

The City of Sydney

The City of Sydney (CoS) is the innermost local government area of Sydney, lying south of its famous harbour (fig. 79). It counts 180,000 residents and a total of 430,000 jobs (360,000 in the CBD alone) and thereby accounts for a quarter of the Gross State Product, which is also visible in building mass. There is an extreme concentration of floor space (FS) combined with business use in the CBD (fig. 80). Its adjacent

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[25] refenence

districts have a more diverse distribution of FS and high residential densities between 56 and 246 persons per hectare in Ultimo and Kings Cross respectively. The southern half of the CoS in contrast has a low FS ratio trough out and much bigger city "blocks", resulting in a coarse road pattern, and far lower building and residential densities (fig. 80).

Like on the scale of Sydney as a whole, there are several centres within the CoS, commercial high streets that act as village hubs, mostly for several districts (fig. 82). Understandably there are far more of these hubs in the northern districts of the CoS, while a few of them are currently developing in the south. The rail lines leading towards central station, are a distinct, physical barrier between north and south, partly cutting through the city. The southern part of the CoS has an industrial history and still there are many warehouses and big commercial structures. The ATP lies south of the rail corridor too, in one of the city's renewal areas (fig. 83) around Eveleigh, Redfern and Waterloo. It is so to speak a missing link between north and south.

Especially the urban renewal project of Green Square (GS), some 1,5 km from the ATP, will offer new impulses for the area. It is planned to house 40,000 residents and 22,000 workers, with an improved transport hub and town centre around the existing GS Station. Also a new light rail is proposed, connecting it to the CBD, all the way to Barangaroo. The ATP would definitely benefit from this route, since it runs along Regent Street, that together with Redfern Street, forms the commercial centre of the area. Furthermore the accessibility from the international airport, via GS Station would be improved significantly.

Overall the ATP lies amidst a part of town, undergoing major transformation. An opportunity for the site to participate in this process rather than to retreat to a car dominated office enclave.

The Digital Precinct

> *We should not try to replicate Silicon Valley. It cannot be done. There are cultural things unique to the States, but there are things that the States do not have, that Australia has. [...] Australia's version will look different than Silicon Valley [...] The core argument it that Australia is a lucky country, sitting on all these natural recourses, but it needs to invest aggressively to build technology based industries in parallel to fully capitalise on the commodities. If it does not, it is going to be left behind globally in a way, that is irreversible because of the underlying shifts in Australia's core industries. Services based industries, like retail, like education, like health care, like financial services. All of those industries are information centric and tech based at their core. (Adrian Turner, 2012)*

Amidst Sydney's global economic corridor[26], an arc shaped portion of the city of concentrated jobs and activities (fig. 77), just south of the CBD, there is an area, now dubbed the Digital Precinct (DP). It includes suburbs like Surry Hills - sometimes even called Silicon Hills - with a very fine grain urban pattern, lots of small restaurants, cafes and bars, a mix of housing and office use and also one of the city's most expensive

[26] Including Parramatta, North Sydney, Macquarie Park, the CBD and the area around the international airport in the south, containing 40 % of Sydney's jobs.

neighbourhoods. As well as Redfern and Eveleigh, suburbs, where technology and design companies are still rather few and far between, popular with students, since rent is still a bit cheaper. The ATP should extend the DP to the south, across the rail lines, that cuts off this part of the CoS from commercial centres in the north.

> *[The aim is] To create, foster and grow the digital precinct which has emerged in Sydney's inner south [which] will support the growth of an innovation ecosystem across NSW that will leverage multi-disciplinary teams from government, business, academia and community including universities and established media and technology companies – to produce pioneering digital research and industry-applied solutions.*
>
> *[The precinct is] Bridging the area stretching from Surry Hills through Redfern, Ultimo and Pyrmont in Sydney's inner south, this digital precinct is becoming the epicentre of NSW's digital culture. [...] a precinct specifically focused on the research, development and commercialisation of new digital products and services [...] has the potential to generate a substantial new source of economic activity. This precinct should exist both physically and virtually, allowing regional communities to participate, collaborate and innovate, regardless of their physical location.*
>
> *Today ATP is isolated from the digital precinct. Connecting ATP to the rest of the precinct via Carriageworks will provide an important physical link and aid precinct development. Longer term, the entire railway yards from ATP through to Central Station should be covered and developed as an open and vibrant digital community space. (NSW Government 2012, 24-25)*

Matt Barrie, Freelancer.com chief, and part of the taskforce that worked on the NSW Digital Economy Industry Action Plan, cited above, commented the following on the idea of making the ATP a technology hub:

> *[...] build a building in a terrible area of town that has always been earmarked for technology, but always been a white elephant because it's a disused rail yard out the back of Redfern. (Moses 2012)*

The Digital Precinct - given that it exists in the way described above - is mainly spread across well established Sydney neighbourhoods for a good reason. Because entrepreneurs, knowledge workers and artists chose to set up a business there, to live and work in this area. There was no top-down planning to create this precinct, it emerged from a lot of small actions.

Pyrmont, Ultimo, Surry Hills and increasingly Redfern are diverse residential neighbourhoods, that include commercial and office functions. They offer an urban lifestyle, good public transport (for Sydney's standards) and you have an abundance of places to go for lunch. There is choice, a wide range of activities within walking distance (fig. 85). Eveleigh now lacks of all these qualities and connections to other districts, it really is "out the back" of urban life.

Australian Technology Park analysis

Location	suburb of Eveleigh, Sydney, NSW
Size	13.89 ha
Public recreation space	2.86 ha (21%)

Target figures 2005 master plan

Employees	6,500 (raised to 8 - 9,000)
Residents	0
Floor space	166,680 m^2 (raised to 200,000)
FSR (gross)	1.2
Parking spaces	1,600

Dates of planning	first master plan 1994 revised version 2005
Current planning framework	Built Environment Plan (BEP) Stage 2

Links:
www.atp.com.au
www.smda.nsw.gov.au/precincts/redfern-waterloo-precinct

The site

The ATP was created by the Government of NSW, the University of Sydney, University of Technology Sydney and University of NSW in the 1980s with the intention to foster collaboration and innovation. It is now operated under the control of the Sydney Metropolitan Development Authority.

It is located on a 14 hectare site (fig. 86), located in the inner-city suburb of Eveleigh on the brownfield of a former railway yard, 5 km from Sydney's CBD and 8 km from the international airport. "It is bounded by the railway corridor and Redfern Railway Station to the north, Henderson Road to the South, Garden and Cornwallis Streets to the east, housing owned by the Department of Housing and RailCorp operational facilities to the west" (RedWatch, *ATP - Final*).

Redfern Railway Station is within short walking distance and the University of Sydney is a 20-minute-walk away. Although its proximity to the centre, it is cut off from the inner city by the rail tracks that lead to central station in the north-east of the site. The already revised master plan from 2005 still seems incapable to deal with the specific issues of this place, especially the relationship of the ATP to its surrounding. Since 2007, two new buildings have been completed, NICTA research facility and Channel Seven Media City, a eleven storey complex with 42,000 square metres of floor space, now visually dominating the site. Apart from that, there are two buildings form the 1990s on site, adjacent to the Oval park (fig. 88), which also severs as storm water detention and covers a rail tunnel that runs along the edge of the site towards Henderson Road. The rest of the ATP is a waste land of car parks with some mediocre attempts to improve the amenity of a under developed public realm.

History

The largest heritage item on site are the Locomotive Workshops, partly dating back to the 1880s. The super structure is made up of 16 bays measuring 16,25 by 90 metres each. Across the rail lines, in North Eveleigh, the Carriage Workshops form another hall comprising ten bays. "By the 1930s, more than 500 locomotives were being run through the site each year. But with the decline of the locomotive in the 1960s, the workshop's active days were numbered, and it closed in 1989. At its peak, it was the biggest industrial complex in the country and employed 3000 people." (RedWatch, *A brief History of the Site*) The idea to create the ATP (back than called Advanced Technology Park) was first proposed in 1988.

The 2005 master plan

The ATP's second, improved master plan (fig. 90), was prepared by Nettleton Tribe Architects and Mike George Planning. A short description on their home page illustrates the vast gap between intention and reality of the site.

> *The ATP Master Plan is set to build on ATP's emerging reputation as a* [1] *world-class facility for technological research and development, as well as* [2] *adding value to the community through* [3] *accessible open space, high-quality social and recreational facilities, and* [4] *access to historically significant sites. (Nettletontribe)*

Unfortunately neither of the four features mentioned is true. The ATP has (1) no world-class reputation of any kind, as comments like the one by entrepreneur Matt Barrie confirm (see p. 156). There is (2) virtually little to none added value for neighbours and (3) the quality and usability of open spaces and the tennis and basketball courts that existed before the master plan already are the only amenity of the ATP. Finally the heritage buildings are for sure the most interesting feature of the site but (4) the big railway workshop is more cluttered by unrefined implants rather than accessible and exciting.

This master plan was so far unable to nurture the emergence of these qualities to and by now seems to be rather outdated anyway. The low FSR limit of 1.2, roughly calculated over the entire site including streets and public realm, is already used up to 60 percent, although only two new buildings have been added since the master plan has been approved. A reason why the estimate final floor space has already been raised to 200,000 square metres in 2006 by the RWA.

The two new buildings, Channel 7 and NICTA, basically follow the master plan. However, now that Channel 7 exploited permitted floor space to the maximum[27], it becomes clear, that the overall west-east orientation of the master plan results in unfavourable overshadowing. This devalues the site south of the eleven storey building. At build out the master plan would not make use of the site's potential and lack of interfaces towards surrounding streets and buildings. Especially towards the south, it is extremely undifferentiated (fig. 30). At large the scheme lacks of an articulated public domain, different scales and uses as well as permeability.

West Eveleigh

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[27] Without the extended car parking site, the building effectively has a FSR of 3.3 instead of 1.2.

The area adjoining the ATP to the west is a public housing site comprising almost 100 dwellings. There is also a recently completed privately owned apartment development. South Sydney Rotary Park continues here along Henderson Road, forming a rather unusable, strip of greenery. Since there the existing one and two storey townhouses provide significant opportunities for renewal, this area is included in the extended ATP site for analysis. An upgrade of this precinct is also foreseen by the city[28]. Only by approaching a future development together with the Large Erecting Shed (fig. 88), which is now on Sydney RailCorp land but also declared business zone, can a better result be achieved.

North Eveleigh

The 2008 master plan (fig. 92) for North Eveleigh proposes a mixed use area, however it fails to relate to the surrounding urban pattern or grain. The scheme consists mainly of four to eight storey blocks, that create a rather diffuse, unvaried public domain, typical for office and technology parks. At the same time, the railway heritage of the site is - except by the already existing Carriage Works Theatre - not addressed by the design.

Size	10.7 ha
Public recreation space	1 ha (9%)

Target figures 2008 master plan	
Employees	3,200
Residential	1,250 dwellings / 95,000 m^2
Floor space	177,530 m^2 (1.7 FSR)
Parking spaces	1,800

A blind spot

The ATP is operated under control of the Sydney Metropolitan Development Authority[29] (SMDA), embedded in a bigger regeneration scheme for the area of Redfern and Waterloo. Not only is the ATP located on a difficult spot because of the massive railway infrastructure, it is also treated like an island by planning authorities. Main concerns of this regeneration area are public housing projects that date back to the 1960s and 70s. Current planning documents are more or less limited to the future of these housing estates and leave planners without guidance for the ATP site (fig. 94). A recent draft introduces a Digital Precinct, which acknowledges the need to think of the ATP beyond its confined site but jurisdictional boundaries seem to work against this idea. The main problems cannot be solved at the site scale alone, since connections towards the north, public transport and reintegration are of essential importance for the ATP's future. Currently the ATP is also a white spot for pedestrians and cyclists, routes are scarce and interrupted. At large, steered by

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[28] For details consult Redfern-Waterloo Built Environment Plan Stage 2.

[29] The SMDA is planning authority for the site since 1 January 2012, prior to this the Redfern Waterloo Authority (RWA) was responsible.

overlapping and sometimes competing interests, the ATP seems to be left at the mercy of some lucky happenstance, that did not present itself so far.

Implications & Propositions for the ATP

> *Make no little plans; they have no magic to stir men's blood and probably will not themselves be realized. Make big plans; aim high in hope and work* [...]
>
> *(Daniel Burnham[30])*

> *A creative city is not goal oriented. Not only does it make little plans, it makes millions of little plans. It is adrift looking for its next opportunity. It is not made by an architect, but cultivated by its people.*
>
> *Make millions of little plans.*
>
> *(Mathieu Helie, 2009)*

It the goal for the ATP is to facilitate innovation or more specifically innovative people, there must be a radical change in its planning approach. As argued before it must get rid of any morphological determinism, the ATP does not need to be a clear-cut, identifiable precinct. Instead, it can mingle with the city and let things happen to some extend. Since there is no final shape, that has to be implemented, we can also get rid of a rigid master plan. Instead a curational authority of planners is combined with a creative openness for individual projects - there is no maximum floor space to develop - no style. Planning is required as enabler of many authors and must only be deterministic in so far, as to circumvent undesirable development. Namely over scaled open spaces and the formation of big boxes exclusively.

The ATP together with North Eveleigh[31], the area across the rail tracks, is chosen to become the hub of the "Digital Precinct" (NSW Government). Regardless of the conceptual maturity of this idea, it is the right way to expand the view and realise Sydney's innovation ecosystem as metropolitan or regional undertaking. However, this is not reflected in any current planning schemes in the surrounding area. In order for the ATP to become such a tech-scene and start-up hub, it must be very inclusive of the entrepreneurial community. The agenda for a broader vision therefore has to be:

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[30] There is little or no documented evidence that Burnham actually said these famous words frequently conceded to him, but they capture the essence of his legacy.

[31] In the NSW Digital Economy Industry Action Plan (see references) Carriage Works is mentioned as hub for the Digital Precinct.

1. create an environment that is supportive to the self-determination and collaboration of entrepreneurs and stays flexible to react to rather fast changes in high-tech and creative industries
2. transform the dull "suburban nerdistan office park model" (Florida 2012, *Strategies for increasing diversity ...*) into an environment, in which young entrepreneurs actually want to work (and live), this also adds value for the city
3. create a live/work environment, which is attractive especially for migrants and entrepreneurs, who stay in Sydney temporary, this has wider benefits such as reduction of car dependency or security (because the place is not empty at night)
4. utilise the historic buildings to create a unique identity, make the railway workshops accessible, make use of the openness and resilience of this super structure

The technology park model will certainly continue to exist and might be appropriate for specific usages or locations, but it is definitely not the way to go for developments like Sydney's emerging Digital Precinct. This area south of the CBD is characterised by a partially dense residential environment, hosting many additional functions. It is imperative to utilise and amend this condition as much as possible. In this location an anti-urban phenomenon like a technology park, would contradict the aims of Sydney to become more "green, global and connected[32]". This is not a plea to abandon all campus style office parks, but against locking the organic process of innovation into a rigid planning structure of spatial and organisational constraints. Technology parks are not the silver bullet of innovativeness - there is no royal path to follow.

Supplement and utilise the existing

Start with the real status quo, that is then transformed according to a certain process along an overall idea or vision and not by looking at abstract planning schemes. Capture the status quo by a process of mapping on different scales to receive a multi-layered reading of the site, this can only be done by physically experiencing it. Be very aware of traces and identities of the specific place, design is always enmeshed in a community. The context of the site is always spatial, social, economic and cultural, hence always unique. Spaces of special interest, of architectural or functional distinctiveness can be defined in advance and then be emphasised, but there must be enough freedom for these focal points to emerge "by chance". The site of special buildings (fig. 115) in prominent locations can be defined in advance to initiate the transformation. These buildings do not necessarily have to be very large, their quality and meaning for the community is crucial.

The technology district should benefit from its surrounding area and also contribute to it, by providing functions, that can be used by the whole community. Take advantage of the location and what exists already. In case of the ATP, make use of the urban surrounding of Redfern, Darlington, Erskinville, Alexandria. Each of these neighbourhoods has existent qualities and can contribute to a new development. At the same time,

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[32] Future plans for Sydney: http://www.sydney2030.com.au

complementary and shared facilities for the surrounding area can provide what is missing in these neighbourhoods. When we think of a bigger area as a supplementing conglomerate of neighbourhoods, we can start to address topics like energy, mobility or recreation in a comprehensive way. There should be precinct wide energy water and waste systems, also for adjoining areas to plug-in. A mobility concept must be worked out for the ATP and its surrounding and pressing issues like parking must be addressed by the whole area.

> *Today many cities are adopting neighbourhood revitalization policies that encourage or even mandate social and functional diversity. Look at the Paraisópolis favela, in São Paulo. There the authorities, instead of bulldozing these slums as in earlier eras, send in teams of sociologists, technicians, urban designers and architects to develop renewal plans with the local communities. These plans result in the construction of sewer systems, public transit and sports facilities, in the creation of social clubs and libraries. They stimulate micro-economic activity and help to produce new, sturdier housing, with shacks being torn down to create public spaces. (Interview with K. Christiaanse - The Design Observer Group 2009)*

The point of departure is of course a different one than in Sáo Paulo, nevertheless we can learn from this approach. Some of the most progressive urban planning is happening in South America nowadays. We need to respect the identity of the place, let things happen to some extend and repair what is undesirable instead of imposing a grand vision

The city as technology "park"

> *The question is not just where great universities are located, but where entrepreneurial talent wants to be. Entrepreneurs are highly mobile, as is scientific and technical talent more generally. And there is growing evidence that an increasing share of such talent is growing tired of the nerdistan model and beginning to prefer bigger cities and more urban environments. (Florida 2011, Start-Up New York?)*

The big prototypes of innovative places are large city regions, not single technology parks (fig. 99) and therefore have vast catchments of talent. Sydney is well put - "startup genome", a project measuring and mapping start-up activity in cities, listed it 12th in the world[33] (cl. Empson, 2012). What it mainly lacks is funding and related to this, successful execution, but not entrepreneurs and ideas - and this does not include the many Australians who go abroad but might otherwise stay. The country has a strong but small economy (only 22 mio inhabitants). However, the less competitive market and welcoming atmosphere, due to its strong immigration history, might appeal to many. So in order to grow this ecosystem, we should start from there.

Alternative models to the suburban technology park are possible as Manhattan's vast start-up scene, Barcelona's 22@ district and others exemplify. Instead of a TP's greenery, the city grid and its urban intensity form the background for the companies. Even if the ideal of many, diverse clients, building for an existing demand instead of speculative purposes, is only a noble goal, there must be mechanisms in place to break down large, mono functional units. Such entities must be subdivided into manageable portions that are then

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[33] #1 Silicon Valley, #2 Tel Aviv, #3 LA, #18 Melbourne (Nov 2012)

designed by different planners under a curated scheme, opening up opportunities to a wider group of players. Critical mass can be achieved by joint effort instead of a single body. Only in special cases, at strategic points or where the programme requires large floor plates, should bigger units be permitted. There is a place for them, but it must be an exception, that can be absorbed by the rest of the city.

Phillimore and Joseph (2003, 756) suggest to encourage "[...] science parks to integrate more closely with their civic, urban and regional environments so that they actively use their spatial characteristics to promote interaction and networking possibilities, rather than cutting themselves off from their surrounding innovative milieu through maintaining an 'elitist' image." At the same time it is important to create "[...] new science parks with a more specific focus, such as particular technologies [which] enables more distinctive park developments to emerge and should make it easier to encourage closer links between park tenants themselves as well as between the tenants and relevant university and government researchers" (Ibid, 756). I cannot fully agree with the second part, but do assent in so far, as we want a low-threshold and inclusive milieu. Let SMEs and start-ups decide their own focus, distinction sure eases exchange, but it follows the logic of a specialised corporation. True however is, that the ATP's current definition of anticipated tenants needs some reassessment.

Issues & Objectives

Starting with the status quo, there are some issues the ATP has to resolve:

- the morphological determinism of the "park"
- a lack of activity
- a prescriptive development approach
- the definition of is tech-focus
- its attitude towards the re-use of heritage

The ATP's improved 2005 master plan at least acknowledges, that better connections with the surrounding are a missed opportunity. "The ATP is currently somewhat remote from its local setting. There is a need to better define the interface and connections between the Site and surrounding areas [...]" (Redfern Waterloo Authority, 11). I suggest no to create such an exclusive technology zone in form of an implanted, single-use precinct at all, but instead to extend the diverse surrounding. Problems are already visible, since the location's specific constraints and opportunities have not been met. Heavy traffic volumes at peak hours are increased further, although parking at the ATP is rather expensive for the area. "Larger building floor plates in response to market demand" (Ibid, 8) are another point of critique. Buildings of greater physical bulk are not necessarily more efficient and definitely do not create "a better streetscape relationship with the historic Locomotive Workshops" or "a more permeable street pattern on the site" (Ibid, 8). Several crucial issues are identified in the master plan but contradicted by the design.

The gross FSR of the entire site is defined with 1.2 and big patches of land would remain undeveloped in between the buildings. Nevertheless the FSR of specific plots does exceed 3.0 (e.g.: Channel 7 has 3.3 and NICTA has 3.1). The "true" maximum FSR however, excluding streets and public spaces, reaches just under 2.0. The problem is, that the public domain is not defined in advance and subtracted form the total area to be

developed, but rather the space that will be left over, however this space might look like. The most obvious step, starting to define this public domain, is to extend surrounding streets (fig. 109) or at least plan buildings in such a way, that connections remain possible.

Generally there is the problem of too much or superfluous open space combined with low building density. "Venture capital icon Paul Graham notes that, for all its advantages and power, Silicon Valley has a great weakness. The high-tech 'paradise' created in the 1950s and 1960s 'is now one giant parking lot' [...]" (Florida 2012, *The Joys of Urban Tech*). One could say, that there is plenty of public and semi-public space, but the usability and quality is an issue. Exactly 50 % of the ATP's land are built up space in the 2005 master plan, an unusually high proportion for the conventional technology park, but its distribution is rather unfavourable. Simultaneously 14 % would be green space, but mainly consisting of a long, narrow park along Henderson Road. The indicated "activity strips" are now either parking lots or a continuous facade with a single entrance. In order to activate the ATP a set of values must replace the master plan. In contrast to the a conventional master plan, the actual shape must be as unspecific as possible - it is not about ingenious city layouts. This set of values is not static but always renegotiable, there is the inherent need even to constantly question and challenge them. It is the main advantage in comparison to a master plan, specific instruments can be added, altered, sharpened or abandoned but the set of values as a whole remains valid. Within this framework site specific projects like one bay of the Locomotive Workshops, a small plot along Henderson Road or other fragments of the Digital Precinct can be defined and developed. Activities will thereby cluster wherever they happen to do so, not along some previously defined strip.

Implications for planning

The main topics are:

- more physical connections
- few but quality open and green spaces
- fine grain development structure
- coherent infrastructure & parking scheme
- integration of affordable housing
- more suitable usages for heritage buildings

A network of connections

Extend the existing street pattern wherever possible. Connect the technology district to surrounding areas and make use of the central, urban location. The ATP and North Eveleigh should be accessible as one precinct, combining its historic buildings and modern interventions. Physical connections are important for re-integration into the city, the aim is random movement through the place, neighbours using common facilities on the weekend.

Create a multidirectional street network for communication between parts of the city. Avoid a hierarchical division into main connecting streets and side streets in form of culs-de-sac. It should be possible to reach almost any point from any other point via several routes with different qualities. Quality public transport,

facilities within walking distance and buildings that relate to the street are beneficial for a wider public. The car is only one option of many and ideally public transport is more convenient than to drive. It makes sense from an ecological point of view and provides everybody, irrespective of income, with the opportunity of choice. The traffic congestion around the ATP on weekdays is already a problem for the area and the number of employees (now 3,000) is likely to triple over the next 15 to 20 years. These connections must work on different scales and for different modes of transport. There should be an emphasis on high quality public transport and walkability. Now the ATP lacks of these essential connections. New bridges for pedestrians and cyclists must connect the ATP with North Eveleigh and the inner city. One of them can also act as western entrance to Redfern Station and allow easier access to the area.

Open and green spaces

Technology parks have a lot of "excess open space", left over in between the buildings rather than defined by them. Open and green space has to be concentrated and intensified. There has to be a mix of few neighbourhood parks with several hectares and a variety of pocket parks within short walking distance of every single household and office. These small islands have to be reachable safely and conveniently by every one (fig. 108). Sydney luckily is a city with lots of parks from large to small throughout most suburbs. Also within walking distance of the ATP there are some (fig. 107), therefore planning can concentrate on small, high quality open spaces on site.

Innovation Plaza has recently been redesigned bona fide but lacks of activation. A fair amount of people crosses this square every day, but there is no incentive to dwell on the ATP's spaces, no coffee to grab or train ticket to buy. William H. Whyte (1980) identified important ingredients to make a public space work during his study about places in Manhattan.

1. sittable space
2. street
3. sun
4. food
5. water
6. trees
7. triangulation

Triangulation (7) is used, as Whyte puts it, for the lack of a better term. It really is about all types of activation, that attract people to gather, chat, look around, and simply use a space (fig. 114). These findings have lost nothing of their relevance for urban design. The ATP has the main problem that there is nothing to do except walking to ones office. Open spaces in Manhattan or Sydney's inner city are of course much more frequented than at the ATP, a reason to gather on few, small squares and concentrate commercial activity there. A crowd of 6,500 to 9,000 walking by every day, topped up with local residents will very well support a commercial micro cluster.

Development structure

Generally government must keep ownership and control of the development (= land), what has a number of long term benefits, mainly the possibility for change over time. Always retain the opportunity to influence private developments on this land, to ensure each project fits to the overall covenant of Sydney's Digital Precinct. Big development units (1 ha and more) should be an exception, the standard is small scale to enable diversity. This is valid for the division of plots and for buildings but does not exclude big boxes completely. They can exist right next to fine grain, if they are not planned as free standing, campus style blocks. While big corporations depend less on external know-how and prefer such office complexes, the building specific requirements for emergent firms are entirely different, in fact any building fitted with high speed Internet can work. This means such an office space can be housed in the same typology as a residential unit or a more conventional open plan office, on any floor, in an old warehouse or a transformed parking garage. Biomedical laboratories might require large, continuous floor plates, sealed off to the outside - and there is a place for "A-grade" interiors and antiseptic labs, but not exclusively.

Infrastructure and parking

It is essential to allow for a multitude of transport options, of course with the goal to reduce car dependency. Since a technology precinct will accumulate thousands of workers, with most of them living elsewhere, transportation is a key issue. The district must have various access points, at best be embedded in a network of connections, where the car is just one option. The ATP has huge potential to reduce car parking and traffic congestion, given that a survey of staff from 2002 "established that some 45% were car drivers for the journey to work" (ARAG 2012, 16). This was years before Channel 7 and the NICTA have been built. Now there are some 3,000 workers and 1,800 paring spaces, what suggests, that car usage increased further. At the moment more than 1,000 of them occupy 20,000 m^2 of land for future development. Of course cars cannot be banned from the site but car parking spaces should take up a smaller proportion of the total surface area. If the modal share remains unchanged and the ATP really houses anticipated 6,500 to 9,000 employees by 2020, 3,000 to 4,000 parking spaces would be needed. This would require 2 to 3 multi-storey car parks the scale of Channel 7, just for parking. It is therefore absolutely necessary to gradually half car use. Supply the ATP with attractive amount of parking spaces medium term, but wind back over time.

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7, just for parking. It is therefore absolutely necessary to gradually half car use. Supply the ATP with attractive amount of parking spaces medium term, but wind back over time.

Affordable housing

Housing forms the basis of every urban district, encourages better distributed usage throughout the day, supplementary functions and so forth, while technology parks are only used during office hours. This inclusion of residential buildings can also be attractive for commercial developers. There should be as much affordable housing of all types as possible. That can be shared houses and social housing, but also accommodation for back packers and students, in order to mix working and living environments and prevent the formation of self-contained entities. Students are generally the social group, most willing to engage in urban activities and enliven a neighbourhood, furthermore they are far less car dependent, student housing will get by with little parking. This mixture of university life, affordable housing and office use can create an attractive environment for young professionals and residents alike.

Furthermore the minimisation of overall costs of living and proximity or the possibility of a live-work environment is an advantage in the case of the ATP, especially if entrepreneurs come from another city or even from overseas. In Sydney, the overall cost of living and affordability of apartments is an issue, one that is not addressed in currently planning schemes although there is significant potential.

University links

Today's technological innovation is obviously not a linear process but rather the result of a dispersed team effort. Universities play a significant role in this process, but that does not demand an office park right next to campus, as mentioned earlier (see chapter 4.3.2), universities can participate in many other ways. Access to universities is important but not for the reasons that have been associated with science and technology parks in the past. This has less to do with the commercialisation of research but rather with the pool of students and liveliness of university (fig. 111). A big advantage is, that student culture is very inclusive of new (foreign) people, something that perfectly fits with the entrepreneurial community. And as the findings of startup-genome (2012, 71) show, the average Sydney entrepreneur is 33 years young and one in three has a university degree - quite a natural match with university.

Demographic mix

"Economists frequently note the importance of industries having low entry barriers, so that new firms can easily enter and keep the industry vital. Similarly, a place can benefit from *low entry barriers for people* - where newcomers from different backgrounds are accepted quickly into all sorts of social and economic arrangements. All else being equal, such communities have an advantage in attracting and retaining the diverse and different types of people who power innovation and growth" (Florida, 2012, *The Geography of Tolerance*).

A mix of age and ethnic diversity are important - an open environment that cuts through spatial and social privilege. In the Netherlands of the 1970s, this idea was called "the makeable society", a society that all citizens could collectively shape, and in which different racial, ethnic and social groups would mix into a multicultural society. 1960s and 70s town planning was maybe naive to believe that a designer can create a "good" community, we know that they have to evolve on their own, but design can, as we see at the ATP, also repress

this process completely. A site like the ATP, although diverse, might form quite homogeneous fragments on a small scale, with many young professionals and workers, who leave in the afternoon. There has to be a balance between a fine grain sameness, that allows people to make friends, and heterogeneity on a larger scale. Within one city block, the majority of residents might be quite like minded, whereas more diversity is possible on the scale of a small neighbourhood like Eveleigh.

Neighbourhoods

Create or define neighbourhoods that divide the big site into smaller pieces of a few hectares. The "ecology" of neighbourhoods like Surry Hills or Ultimo is comprised of a diverse range of sizes and a mix of activities. Ideally there is large variety of densities, uses, typologies and scales. The aim is to create fine grain and mix of development parcel sizes (see case study 3.1.4 Surry Hills). Likewise there should be a small-scale mix of uses, for example dwellings, workplace, leisure, retail, etc. within a few city blocks. It must be a design principle, to think of a building typology that suits its main use but can also house supplementary functions. A certain amount of ground floor activities can meet local demands in a neighbourhood.

Functions should not only be mixed horizontally but also vertically. The general aim is, in comparison to the existing pattern of the ATP, smaller units and more connection points - more addresses. Create typologies that activate public and semi-public. This has a lot to do with a building's geometry, point of access, ground floor layout, facade, general openness towards the street and the street scape itself. Channel 7 is the exact opposite of this proposal, its ground floor and delivery entrance must be retrofitted as the surrounding development grows.

Re-use and heritage

Including the Large Erecting Shop, there are some 60,000 m^2 GFA in heritage buildings at the ATP. The historic superstructure of the Locomotive Workshops (LW) is an ideal space to offer scalable, short term office space (fig. 104). Among other uses, the National Innovation Centre (NIC) now houses biomedical laboratories, what completely contradicts the layout of the historic structure (fig. 105). Such uses can be transferred to new buildings, the NIC should be used as open plan and semi-public. Also the LW is not utilised to its potential regarding the kind of usage, not the amount. The university for example, would be a less disruptive user of such large, continuous spaces. Carriage Works, on the North Eveleigh site, is a perfect example of the right user for the right building. Understandably we do not need exhibition and performance spaces everywhere, but also start-up office space or a conference centre could be such a user. Bay 10 to 14 of the LW are now reserved as exhibition hall, a good usage to retain the flexibility of the structure, since it can be used by different groups in different ways. The planning approach for this building must be a temporary one, tenants of bays can always be newly arranged.

Take advantage of the heritage buildings but leave them rough. The Eveleigh Workshops already give the ATP a sense of identity and historic significance. In order to provide affordable office space for start-ups, the goal is to transform these workshops with the minimal intervention necessary. Old buildings generally need less revenue and can add to the typological and financial mix.

Recommendations

1. extend all surrounding streets onto the ATP
2. create streets and lanes with different sections and form a fine grain network (no culs-de-sac)
3. concentrate on few but high quality open spaces and pocket parks
4. divide the individual building plots into smaller parts, starting with a size, that suits a single terrace house
5. provide central, common car parking to cover the "base load" of the total demand
6. introduce affordable and student housing at the ATP
7. re-use historic buildings more flexible, open-plan to preserve / restore their unique spatial quality
8. keep all land in public ownership
9. plan some plots / buildings more prescriptive (e.g. car parking) and leave others completely open for individual development

A design approach beyond the ATP

The Australian Technology Park will not be a technology park but an entrepreneurial meeting point, an employment centre, a residential neighbourhood, home to high specification office “big boxes” and part of a significant heritage ensemble. A central theme is the quality of public domain in order to facilitate dialogue between the different users. Since the ATP will develop demand-orientated over a longer period of time, spatial development should be curated to empower many different authors. Simultaneously architectural freedom must be maintained for the individual buildings, that are then determined by each user, in cooperation with the curating instance. Planning only “interferes” to discourage a suburban campus style and enable many, small developments adjacent to the big boxes.

Extend the idea of the Digital Precinct (DP), embedded in a bigger vision of the City of Sydney. This vision addresses conceptual and spatial aspects. Strategic directions are more important at this meta-level than specific planning regulations. The vision must remain flexible enough to react to future changes, without becoming obsolete. In parallel, conventional plans like the 2005 master plan, are gradually reduced. These regulations are now replaced by the political covenant. The ATP is not a “business zone” and not developed to a maximum amount of floor space.

The Digital Precinct is led by the entrepreneurial community and architecturally curated by a mandated development agency or committee created by the city. This agency is “only” responsible for the DP compared to the SMDA that has a wide range of duties. It is planning supervisor and central point of information regarding the DP. The agency has a physical representation at the DP HUB, which is a kind of town hall for the entrepreneurial community. It is not so much their function to decide what is built where, but if something is going to be built, they accompany this development from start to finish, gradually winding back their influence along the way. All plots finally remain in public ownership and the city can also alter a development after its completion, if agreements are not met.

While the building development of the ATP is mainly left open for (small scale) private investors, compact projects, with immediate effect on the local scale are chosen to lead the way of the ATP's transformation. Every design proposal is based on a constantly updated analysis of the status quo, not on proprietary site regulations. Planners suggest a spatial and programmatic implementation in response to the overall vision.

Quality control

Quality is reviewed on three different scales:

1. network - different sites, buildings, institutions, companies, etc. across several city districts, each new project must be physically well connected with other parts nearby
2. spatial strategy - concerned with the public realm, a network of streets, places and green spaces which fosters the usage of the public domain and is added value for a wider public
3. individual building - selection of designer by invitation to tender, clients may ask for advice concerning the selection of an architect, planning has to be approved by the committee

Network

The Digital Precinct forms a spatial, virtual and organisational network, it is made up of complementing parts, not one exclusive zone. Its physical hub will be established at the ATP, close to Redfern Station. Facilities within this network consist of old, reused buildings, mainly for start-ups and SMEs, used short to medium term and demand-orientated, new developments. Companies of the "quaternary" industry help the city to retain older structures that would otherwise be demolished.

A unified online presence informs the public about current projects and coordinates regular meet-ups. A brand for locally made technology "made in Sydney" will be established as a joint image to the outside world. This is also a platform for Australians overseas and other international partners, to get or stay in touch with the local community. It is essential to build legitimacy for the development of the DP by constant engagement with the entrepreneurial community. The entrepreneurs leading the DP as well as the curating agency must be made up of people with a long term commitment to the development. This is not about quick revenue and success is not measured monetarily.

Spatial strategy

The spatial strategy is a framework to transfer the network into built space. Contrary to most technology parks the focus lies on public space, which is not a by-product, left over in between the buildings. An overall rule for the ATP is: less open space but of higher quality, no landscaped buffer zones or extensive car parking sites. The most important topics are:

- A multidirectional access network
- A fine grain block and street structure
- Street character that relates to surrounding districts
- Building typologies that enable ground floor activities
- Neighbourhoods with specific character

Make people walk across the street instead of wandering through their office complex - the ATP is not a corporate campus.

Individual buildings

Compared to the current division, plots are made much smaller, streets and lanes are defined, and everybody has to design in such a way, that all neighbours can build towards the border of the plot. As the case may be, there are one to three open facades towards the street and one to three closed ones towards the neighbouring plots. Theoretically these small plots can be 100% built-up. The relation of each building to public space is essential to ensure a better outcome than a conventional technology park. There is generally architectural freedom, planners must be able to deal with a complex, dense environment. Clients may ask the DP committee for advice regarding the choice of an architect prior to the invited competition. Some buildings are more regulated in advance due to parking requirements or specific connections, that must remain permeable, but many plots are left open.

(The last part of this chapter consists of explanatory notes, related to diagrams and plans and is not included here, since it would be out of context and unintelligible without the illustrations.)

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