

FROM KNOW-HOW TO KNOW-WHO



1. EXECUTIVE SUMMARY

China is in the midst of moving from an export economy mainly depending on production to a partly science based society where innovation plays a vital role in transforming the knowledge to commercial successes that can create higher value and margins. The transformation is needed to maintain the relatively high growth rates; the volume of the middle class must grow in parallel with the urbanisation and create a larger mass market.

For this to happen the Chinese government has initiated a number of projects and policies related to everything from building science and innovation parks to tax incentives for filing patents.

Whereas the quality has yet to follow the quantity of most of these initiatives the trend is clear: the past and current investments into education and research must translate into valuable products and the demand calls for technology transfer, and input of knowledge from leading companies and societies. This should be seen as an opportunity for Danish entities with advanced technological capabilities and know-how. Many multi-national companies are already performing R&D in China – for the Chinese market but also for the rest of the world.

The Chinese market is in no way easy. Many aspects are more difficult in the Chinese markets than elsewhere. A lot of homework has to be done; be it IPR, set-up, understanding of needs and behaviour, and much more.

This report is an attempt to outline where some of the more interesting areas and entities for innovation in China are, within selected segments and technologies. It is in no way a final or concluding list but should be seen only as a tool to show what types of entities are available, what they e.g. focus on and how they work.

It is our hope that the report can serve as inspiration for Danish based companies, networks and institutions as a parameter of considering potential innovation in, with and for China.

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2. INTRODUCTION

While China has been known as the production hall of everything from cheap toys to clothes and simple white goods, the future for China's growth looks different: China has been investing heavily into education and research, and the next step is to get science transformed into innovation and hence commercialisation. China's leaders are prioritising innovation heavily as the increasing value in Chinese products is needed to sustain the growth model and the raising group of domestic customers' requirements. It is the explicit ambition of the Chinese government to drive the country into being one of the most innovative countries in the world.

A number of initiatives are being implemented across the country, in many of the provinces, as an answer to the wish for innovation. The initiatives are far from all solid and their success is not obvious. However, some of these initiatives could well support the work of turning knowledge into growth, and hence the efforts of Innovation Centre Denmark, Shanghai when looking for Chinese partners to the internationalisation of Danish growth initiatives: privately and publically.

2.1 CHINA IN A BETA VERSION

China is on a move from a relatively wealthy and prosperous country to more wealthy people. With weakened demand for goods from especially Europe and the US the demand has to be propelled by internal growth; a mounting middle class is essential. And being the production hall for cheap good does not create sufficient value per head. The government has therefore put innovation high on the agenda, driving and giving incentive to a higher number of patents, constructing science and incubation parks, establishing special development zones, etc.

Urbanization is an overall megatrend in China. It is a mission and a need to keep the growth at a steady level. By 2030 China is estimated to have an added population of 350 million people in China's cities leading to about 220 cities with more than 1 million inhabitants; in comparison Europe has 35 cities of equivalent size today.¹ Bringing this many people together creates both immense opportunities and challenges – how to get sufficient and safe, traffic and infrastructure in general, control of rising pollution levels, efficiency in construction, clean and sufficient water, waste management, clean energy, etc. With fewer resources it is clear that clever technologies will be needed to solve the tasks at hand.

The Chinese government is opening the business body somewhat; foreign private companies are invited to partner with local players to tap into the primary opportunities especially within the seven 'strategic sectors' that have been designated as key industries by the government in Beijing.²

¹ Preparing for China's urban billion, McKinsey 2009.

² China Releases Blueprint to Promote Seven Emerging Industries, China-Briefing, 2012
<http://www.china-briefing.com/news/2012/06/01/china-releases-blueprint-to-promote-seven-emerging-industries.html#more-16509>

The seven strategic industries are:

1. Environmental protection
2. Information technology
3. Biology (life sciences)
4. High-end equipment manufacturing
5. New energy
6. New materials
7. New energy automobiles

QUANTITY & QUALITY

Another important component to the discussion on innovation is the fact that an increasing number of foreign multinational companies (MNCs) are performing a growing share of their innovation in China. 2/3 of the MNCs perform R&D in China, for non-Chinese markets. This clearly indicates that the MNCs find the available talent, knowledge and market interesting for developing products to the world. The Chinese market is e.g. well-known for providing instant feed-back, and having early adapters, especially within ICT.

The number of MNCs doing global R&D in China has increased with 29% in the recent twelve months. Even more astonishing is, however, the increase in Chinese companies performing R&D: it has gone up by 66% and surpassing the volume of MNCs performing R&D in China. So the Chinese companies are doing what the government has hoped; they are researching, developing and innovating.

During the past 12 months the number of Chinese companies conducting R&D for the world markets has increased by 66%, and the corresponding increase for MNC's in China was 29%.

2/3 of the MNCs in China are now – in China – developing products for non-Chinese markets.³

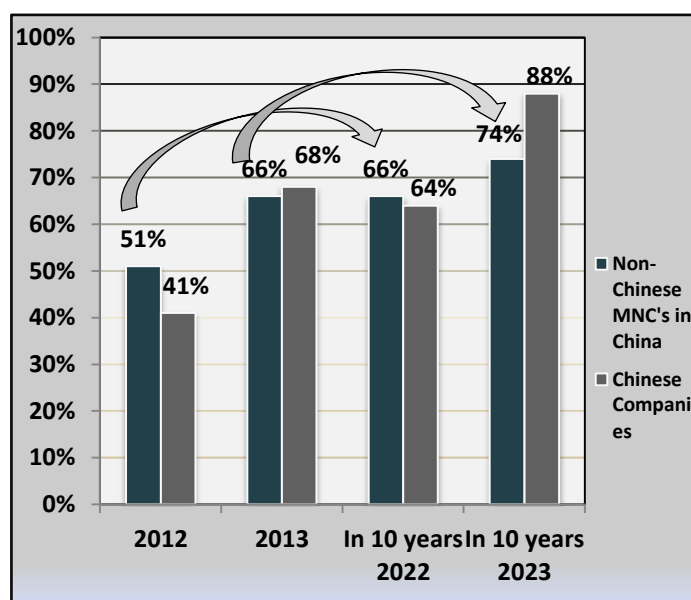


Figure 2.1 – Global R&D in China

³ China Innovation Survey 2013, Booz & Co., 2013

Whether the outcome of these R&D efforts is sufficiently impressive is another question. There is little doubt that e.g. the steep increase in the number of Chinese patents is closely linked to the tax incentive that comes with a registration and the quality of the patents hence seems to suffer under this mass-registration.

Moreover, the title of some of higher education graduates can be hard to compare to other countries' standards and the otherwise impressive number of engineers graduating every year is somewhat misleading; some

"engineers" are auto mechanics or technicians, for instance.⁴ However, the quality of the science and patents seems on a rise, and the trend is hard to ignore. So where as we are still to see the mega break-throughs related to new technologies the refinement of incremental innovation is very much taking place already.

According to the Royal Society(see fig. 2.2) the share of scientific articles published by China has increased from around 5pct in 2002 to around 8 pct in 2012; an increase of around 37 pct over ten years. If the trend was to be extrapolated liniary it would mean that China would publish more articles than the US in the next coming years. It is doubtful that this picture is true, but the trend is however clear – the quality of the Chinese science is on the rise.

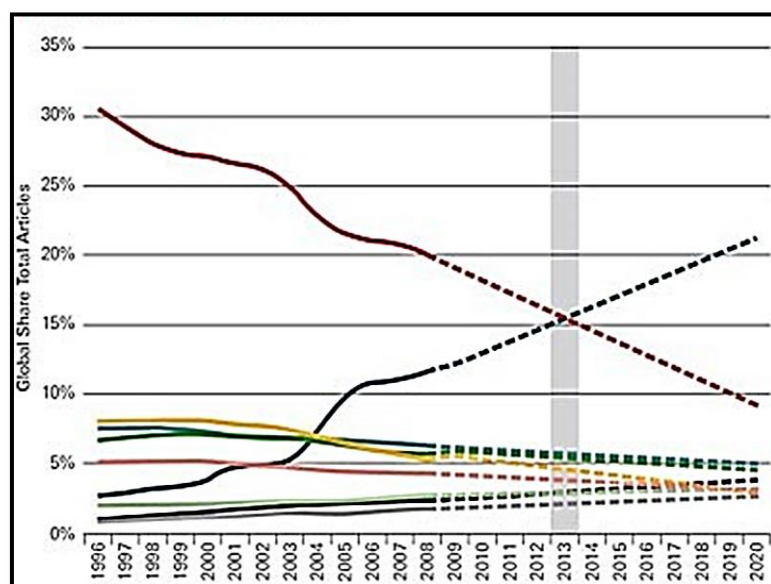


Figure 2.2 - Linear extrapolation of future publication trends

CAN INNOVATION BE MANUFACTURED

Chinese are innovative. This report is not trying to say how much or how little. When e.g. looking to Silicon Valley the figures indicate that Chinese immi-

⁴ *Chinese Can Innovate - But China Can't*, Vivek Wadhwa, Nov 2013

<http://www.linkedin.com/today/post/article/20131114180931-8451-chinese-can-innovate-but-china-can-t>

grants have founded 12 pct of Silicon Valley's start-ups and contributed to 17 pct of America's global patents.⁵

Innovation Centre Denmark, Shanghai, has researched the on-going Chinese efforts to make innovation happen *in China* and found a large variety of models and an even larger variance within their success. Asking people to be innovative is normally not the way to create new breakthroughs. But accepting that innovation can be the result of well-structured processes we set out to analyse some of the parks and other entities that are the relative recent results of the governmental drive on science and innovation and selected industries and technology areas; to take a closer look at which work, and which don't.

What the parks/ entities can deliver in infrastructure and facilities they cannot automatically produce in creativity, risk-taking, challenging of the norm and experimenting with the unknown. Networks, exchange of ideas, and a strong legal framework to protect the new; without these the parks will be more production halls, offices and real estate investments than cradles of new technology and applications.

The role of the state-owned companies (SOEs) also play a role. Several foreign companies – especially the younger and more entrepreneurial of the kind – have mentioned the challenge of working in a space and market place where the SOEs are dominant. The SOEs get clear prioritisation from the government and it is reflected in the market forces. Either because competition is not welcomed, or because it as a supplier to these SOEs can be hard to see though the political organisation that such a SOEs also is; who makes decisions, how are decisions influenced, what drives the agenda, etc. And without knowing what a customer really will buy a development is hard to drive for a small company. The SOEs are not inviting to creativity.

We chose to divide our work into three areas as these also match the seven strategic industries well: CleanTech, ICT, and LifeScience.

In order for Danish players to capitalize on China's development, either by exploiting the market potential or partnership establishment, it is imperative to approach with a strong and competitive network. This goes for RD&I as well as for commercial objectives. It is ICDK's ambition, and one of our core competencies, to identify and unify new alliances that can turn into partnerships.

This report is in no way a complete ranking of parks/ entities. It is a tool that should be used as one source of input among many when considering the

⁵ *Chinese Can Innovate - But China Can't*, Vivek Wadhwa, Nov 2013
<http://www.linkedin.com/today/post/article/20131114180931-8451-chinese-can-innovate-but-china-can-t>

route potential partnership or own innovation in China. It should be used as a simplification tool when navigating and assessing the innovation landscape and identifying corresponding Chinese innovation entities within the three sectors; Cleantech, Life Science, Information Communication Technologies.

And as a final comment it should be noted that while the parks identified as being most promising work great, there can be challenges for foreign companies settling. These challenges are not related to the individual parks and hence not included in the evaluation of them. As an illustration of the challenges we have included a case-story on a foreign start-up based in Shanghai.

2.2 CLEANTECH

The combination China's manufacture history and the urbanization's current and future effects increases the country's challenges within green infrastructure, energy and water sources, energy reduction and general sustainable solutions, to name just some.

With the government in Beijing appointing 'Energy Savings' as one of the country's seven strategic industry sectors, and simultaneously sourcing development through market activity, energy & environmental issues reach a peak level on the political agenda.

The ambition of the current 12th five-year-plan is to reduce energy consumption by 16% in China's five Tier-1 cities by 2015. It is an ambition that is trying to be met by lowering the massive coal incineration. (See figure 1.1)

Moreover, with the large Chinese companies facing tighter environmental rules as they become global players they too have to revamp assets and retrofit their existing solutions to deliver to the required standards. 'Brown-field' might well be a term more have to work with in China, going forward.

In the industrial sector's manufacturing sites, the incentive for clean tech solutions has increased to retain competitiveness. It is not only an issue of being green and environmentally friendly to meet standards, but very much also a need to secure cost-effective solutions.

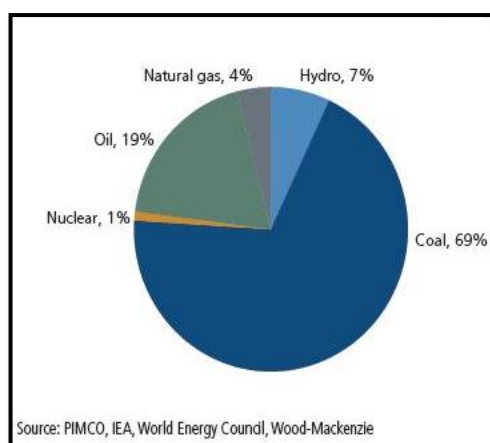


Figure 2.3 - Total energy consumption in China 2010

50% of China's energy consumption is rooted in the industries, whereas 25% of China's energy use is related to construction which converts to 20% of the total coal incineration.⁶ The Ministry of Finance and the Ministry of Housing

⁶ Energy-efficiency retrofits ramp up in China, GreenBiz, <http://www.greenbiz.com/blog/2013/06/04/energy-efficiency-retrofits-ramp-up-china>

and Urban-Rural Development are working on improving sustainable construction processes and buildings, by endeavouring green buildings to account for 30% of the country's new constructions by 2020.⁷

This could translate into a demand for science, technology, and know-how. Danish companies and experts are among the leaders within several areas of the energy and environment industries – especially in a holistic societal perspective – e.g., enabling to document and showcase energy reductions, return on investments, and efficiency improvements. Lack of transparency within beneficial energy-efficient investments has been of the main reasons for the often short termed solutions in China, but with an improved approach to e.g. consultancy Danish expertise could come into play.

2.3 LIFE SCIENCE

With the ambition of securing and improving an effective, safe and low-cost Health Care sector the Chinese government has through the 12th FYP designated the area as a strategic industry, encouraging for a higher degree of innovation. Hereby, the sector should be a 'hot spot' for its related industries. It is estimated that approximately US\$ 1 trillion will be spent on healthcare by 2020 and 95% of the total population are somewhat covered by healthcare insurance.⁸

The emphasis within the healthcare sector can be divided into in to five focus areas, or subsectors, here listed with each there aim for improvement.⁹

- Medical insurance – *to expand basic medical-insurance programs*
- Drug supply security – *to establish national essential drug system*
- Medical service provision – *to develop primary healthcare service system*
- Public health service – *to provide equal access to urban and rural areas*
- Operating environment – *to accelerate public hospital reform*

The 12th FYP also includes an increased emphasizes on the pharmaceutical industry to upgrade:

- Technology – *Innovation through R&D*
- Standards – *manufacturing and quality control standards*
- Capability – *industry integration and going global*

These governmental initiatives are correlated to challenges of an aging labour force, increasing lifestyle diseases and a growing middleclass with related increase of qualitative and quantitative requirements. With 35 years of the so-called one-child policy in China, the volume of working generations to lift this burden and care for the elder is brought to a minimum.

This is opening new market areas in China, e.g. Welfare tech.

⁷ China set to construct more green buildings, China.org.cn

⁸ Healthcare in China - Entering uncharted waters, McKinsey&Co., 2012

⁹ Healthcare in China - Entering uncharted waters, McKinsey&Co., 2012

On a more practical level the challenge calls for e.g. 5000 hospitalities needed to be built within the next 30 years, together with a complete health sector expansion of about 50%.¹⁰

Besides from securing sufficient infrastructure, the healthcare system is also in need of regaining patient trust. Random samples made at 3-A hospitals show that more than 30% of the treated patients are not ill to the extent they needed treatment from a big hospital.¹¹ This tendency is directly rooted to the distrust of the primary care providers, creating misuse of precious healthcare resources, hence a massive need for utilizing solutions/ management expertise from established healthcare systems, e.g. as known in Denmark.

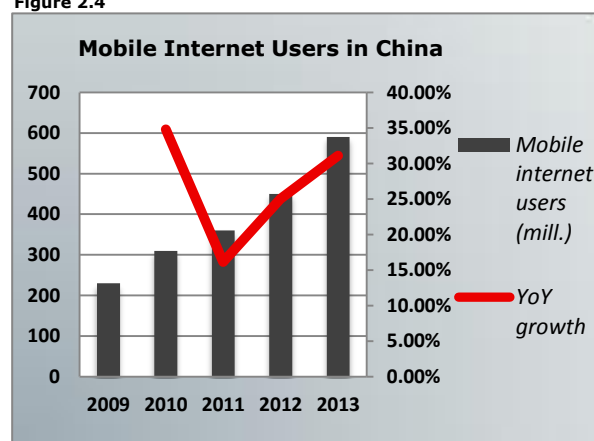
2.4 INFORMATION & COMMUNICATION TECHNOLOGIES

The Chinese ICT industry is exceeding most people's expectation when it comes to the development of numbers of mobile internet users.

The Chinese central government, provinces, municipalities and industrial parks are investing heavily into both technology development and political support to further speed up the development. Pilot cities have been identified to run different projects, and they are recruiting highly competent foreign technologies and enterprises for specific joint projects or joint venture activities. Several emerging technology clusters formed up in the regions such as the Bohai economic rim, the Yangtze River delta area, the Pearl River delta area, and the central and west regions in China.

OptoElectronics is a high-tech industry of world strategic importance. Its application finds in a broad range includes fiber optical communications, precision optics, optoelectronic displays, LED lighting, laser infrared technologies, and photovoltaics, etc. Amongst the up mentioned, fiber optic communications, LED, laser manufacturing and novel display of on high agenda in Chinas national strategic new industrial plans. Take semiconductor lighting as an example, its national total output value reached 300 billion in 2012, with volume of export rise against tendency of up to 34%, with half of the revenue generated in Guangdong province. As an emerging industry cluster, it is considered an rather promising

Figure 2.4



¹⁰ China builds 5,000 more public hospitals in 30 years: ministry, English.news.cn, 2010

¹¹ Going private in healthcare 'is the future', By Chen Yingqun, Cecily Liu and Ren Qi, China Daily, 2013, http://usa.chinadaily.com.cn/business/2013-07/15/content_16774954.htm

achievement.

The telecommunication market consists of 1.18 billion¹² mobile phone subscribers and among these the number of smartphone subscribers has exploded. China has leap frogged into the mobile age: by the end of 2013, the Chinese smartphone market is predicted to consist of 570 million users (see fig. 2.4), which verges on the number of PC internet users - approximately 600 million¹³ - and it is estimated to surpass this within the first quarter of 2014.

The smartphone boom is followed by an exponential increase within the m-commerce market. China's mobile internet market reached 165.04 billion yuan (USD 26.92 billion) with a year-on-year increase of 94.1% in 2013.¹⁴

Online communication has its many Chinese platforms and social media providers are experiencing massive growth rates. A representative indicator of the size and potential within this field, is the story of Tencent's mobile application WeChat. WeChat is based on instant-messaging functions of earlier platforms and social media components, but in one single app, and adding new functions. The app was launched in January 2011 and by October 2013 it reached more than 500 mill users.¹⁵

The opportunities within Big Data, Internet-of-Things, Cloud Computing, Gaming, development of E & M-Commerce platforms are superior in numbers, compared to other ICT-markets of the world.

¹² *China's mobile subscribers up 1 pct at 1.18 bln in June*, Reuters, 2013

¹³ *China Now Has 591 Million Internet Users, 460 Million Mobile Netizens (And More New Stats)*,

¹⁴ China Mobile Internet 2013 Development Report, China Internet Watch, 2013,
<http://www.chinainternetwatch.com/4869/china-mobile-internet-2013-development-report/#more-4869>

¹⁵ WeChat Reportedly Surpassed 600 million Users, Technode Oct 2013
<http://technode.com/2013/10/24/wechat-reportedly-surpassed-600-million-users/>

3. THE DIFFERENT SCIENCE CLUSTERS

3.1 CHINA NATIONAL HIGH-TECH INDUSTRIAL DEVELOPMENT ZONES

China High-Tech Industrial Development Zone (hereinafter referred to as "High-Tech Zone") is a science and technology industrial park established at national level with the approval from the PRC State Council.

Previously the High Tech Zones were called Economic Zones, because the earlier focus was more industrialized in terms of pure trade, where today R&D is of greater importance.

The object with the High-Tech Zones is to create an environment for domestic technology to learn from foreign advanced technology resources. The environment is also utilized to implement political measures and reforms to achieve scientific and technological results.

After the Torch Program was implemented in 1988, more efforts have been put to the establishment of High-Tech Zone. The first zone was founded in the same year (Beijing Zhongguancun Science Park), and the State Council has today approved the establishment of 105 national high-tech industrial development zones in total.

High-Tech Zone focus areas include:

- Electronics and Information Technology
- Bioengineering and New Medicine Technologies
- New Materials and Application Technology
- Advanced Manufacturing Technology
- Aerospace Technology
- Marine Engineering
- Nuclear Application Technology
- New Energy and Energy-efficient Technology
- Environmental Protection Technology
- Modern Agricultural Technology
- Other new technology in the transformation of traditional industries.

3.2 SCIENCE PARKS

Science Parks are integrated sector-focused divisions of the High Tech Zones, which can also be regarded as the operating entities of the zone.

Science parks often provide favourable policies to support R&D organizations, or start-ups. Enterprises are encouraged to build joint R&D platforms with higher education and research institutions, and approved projects will be sponsored with funding from the park. Newly joined members and SME's – also foreign – certified to be 'High-Tech' are able to get subsidies from the park or special programme funding by the government. SME's in growth also have the opportunity to apply for special financial support such as no-interest loans.

Detailed regulations vary from park to park, as different parks design and execute individual support policies for SME's.

3.3 NATIONAL UNIVERSITY SCIENCE PARKS

On the basis of higher education institutions with strong research capabilities, National University Science Parks (hereinafter University Science Parks) are missions to provide support and services for scientific and technological achievements, high-tech business incubators, innovation and entrepreneurship training.

Ministry of Science and Technology (MOST) and Ministry of Education (MOE) collaborate to facilitate the construction of University Science Parks and are responsible for the macro management and guidance to the parks.

Since incubation is one of the main focus areas of the National University Science Park, the cluster offers favourable policies and resources for high-tech start-ups to cut down the operation cost and get access to larger networks. Also, for those individuals or groups who have core technologies, University Science Parks can utilize financial and human resources to help build up new enterprises.

3.4 INDUSTRY TECHNOLOGY INNOVATION ALLIANCES

Industry Technology Innovation Alliances (hereinafter referred to as Innovation Alliance) are co-operating organizations consisting of enterprises, universities, research institutions and others. The aim is to promote innovation ability of certain industries by virtue of joint innovation efforts and complementary competencies from all parties in a legally binding contract.

Main tasks include: organizing enterprises, universities and research institutions around an industry to carry out technical co-operation on key problems and to form industrial technical standards. This creates public technology platforms for efficient allocation of resources and sharing of IPR, hence implementing technology transfer and accelerating the commercialization of scientific achievements. The alliances also conduct joint talent training.

Banks and venture capitalists are encouraged to join alliances to provide diversified financial support and services.

The platform of an innovation alliance encourages the members with relatively more mature development to drive the innovation progress of SME's by increased R&D knowledge sharing.

3.5 NATIONAL TECHNOLOGY TRANSMISSION CENTRE

Torch Centre under Ministry of Science and Technology (MOST) is responsible for the establishment and management of Technology Transmission Centres.

Technology Transmission Centres mainly refer to service organizations providing brokerage, technology integration and management, investment and financial services.

The main function is to facilitate a knowledge flow and technology transfer. The work includes:

- Collection, screening, analysis and processing of technical information
- Technology transfer and agency
- Technology integration and secondary development
- Pilot testing, engineering and analysis
- Technical advisory
- IPR transaction, bidding agent,
- Investment and financial services
- Technology trading service platform and network.

The Technology Transmission centres primarily focus on the following industries:

- Farming
- Manufacturing
- Energy resources
- Marine
- Traffic development
- Modern service
- Medicine, health care and environmental protection.

Technology Transmission Centre serves SME's mainly in relation to creating public service platform/ technology support systems in highly developed areas.

About the Torch Plan and Torch Centre

In August 1988, the State Council of China officially approved the implementation of the Torch Program -- China National Hi-Tech Industrial Development Plan was implemented where the establishment of high-tech industrial development zones and high-tech innovation service centre has explicitly included as an important part. As the executor of the program, Torch High Technology Industry Development Centre (Torch Centre) was founded in October 1989, as an independent legal entity, funded by the Ministry of Science and Technology (MOST).

4. METHODOLOGY

4.1 DESK RESEARCH

Since science clusters are one of the main triggers of China's hi-tech and innovation development, the focus of the report is to highlight the various types of official organizations facilitate this development. These include:

- High-Tech Zones
 - with sub Science Parks integrated
- National University Science Parks,
- Technology Transmission Centres
- Innovation Alliances

The research starts from the entire map of China and is narrowed down by virtue of statistics displaying the individual innovation level for the different levels of regions:

1. Provinces,
2. Autonomous regions
3. Municipalities directly under the central government

Based on official statistics¹⁶ about performance measurements released by the Ministry of Science and Technology of China, the scope of the science clusters within these geographical areas was further downsized to a category A-ranking.

All A-ranked science clusters were hereafter delivered to ICDK-consultants with industry specific professional knowledge to conduct a qualitative screening and selection of the targeted clusters, including on-site investigations of selected clusters to undertake in depth analysis.

Both a screening timeline and a geographical map have been conducted to visualize the complete research/ screening process and to highlight the A-ranked science clusters. (Please see section 4.3 & 4.4)

Data Collection

The gross collected data includes:

- 31 Regions in China in terms of R&D competence with the reference to the China Statistical Yearbook 2013 compiled by National Bureau of Statistics of China
- 105 State-level high-tech industrial development zones approved by the State Council with the reference to the China Statistical Yearbook 2013 compiled by National Bureau of Statistics of China as well as relevant online resources

¹⁶ China Statistical Yearbook 2013

- 98 National university science parks approved by Ministry of Science and Technology and Ministry of Education
- 275 National technology transmission centres approved by Ministry of Science and Technology
- 58 Industry technology innovation alliances approved and evaluated by Ministry of Science and Technology

A-ranked Clusters

Individual clusters with relatively higher innovation level.

- 15 Regions of strong innovation competence
- 12 High-tech development zones based on the general structure of one zone- several sub-parks' (usually divided according to industries)
- 17 National university science parks
- 58 National technology transmission centres
- 18 Industry technology innovation alliances

4.2 FIELD RESEARCH

Science Cluster Assessment Tool: Performance Matrix

A matrix scoreboard has been conducted to assess the chosen clusters in a comparable and holistic vision.¹⁷

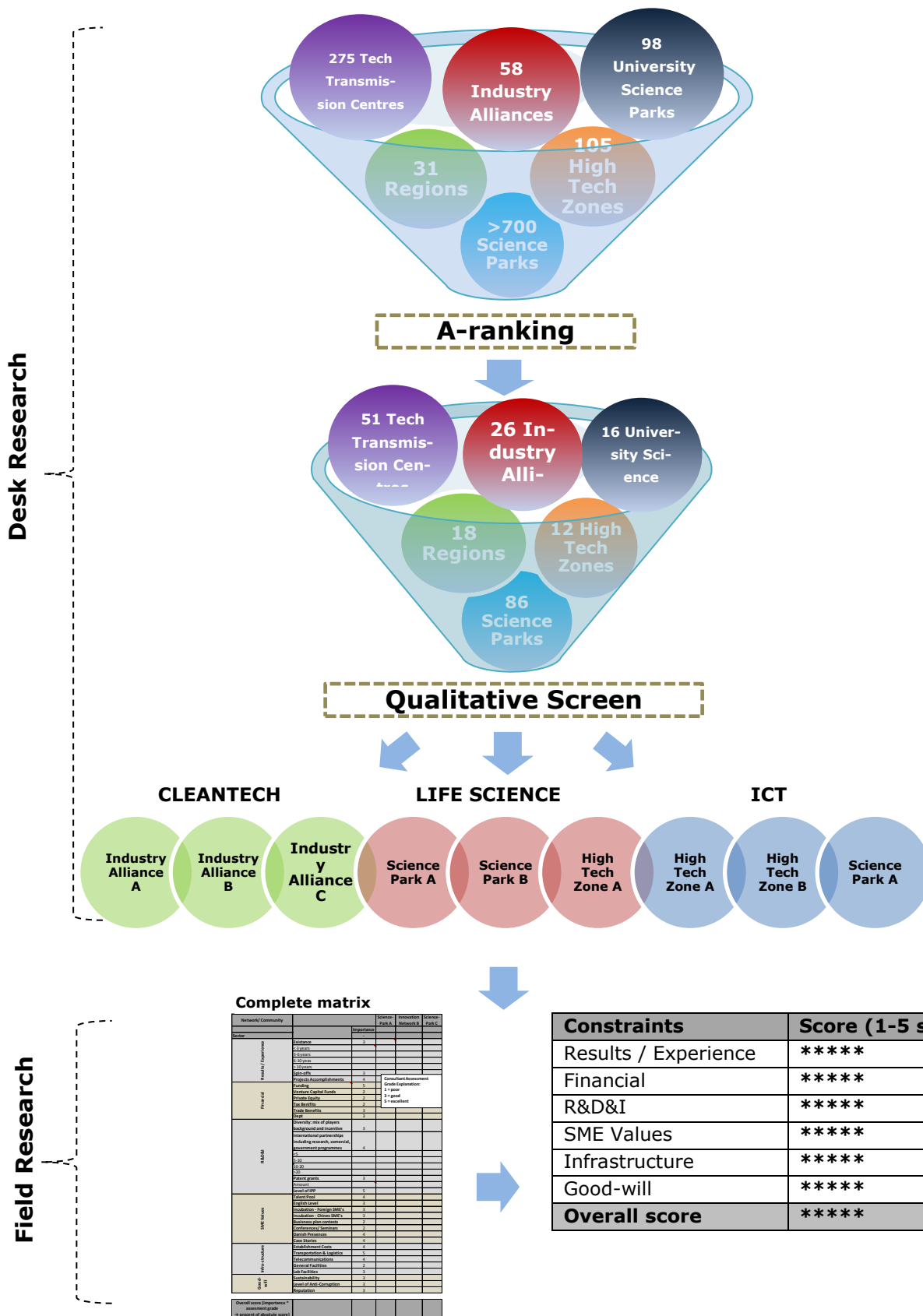
There are four objects of the matrix:

- To clarify which constraints and elements the individual networks/parks/communities should be assessed from.
- To ensure a uniform exploration method within the project team across the three sectors.
- To rate and assess the individual networks/parks/communities in an easy-to-read/digestible format.
- To compare the networks/parks/communities uniformly.

Each constraint will be weighed (1-5) of importance for the target group(s) and afterwards multiplied with the overall assessment grade (1,3 or 5) given by the individual commercial advisor. The total sum of the networks/parks/communities individual constraint scores will equal an overall score and hereafter converted into an overall simplified star-rating.

¹⁷ See complete matrix in appendix

4.3 SCREENING PROCESS



Hubei
Key Cities: Wuhan
High Tech Zones: 1
Innovation Alliances: 1
Science Parks: 9
University Science Parks: 1
Tech Transmission Centres: 2

Shaanxi
Key Cities: Xi'an
High Tech Zones: 1
Innovation Alliances: 0
Science Parks: 7
University Science Parks: 1
Tech Transmission Centres: 2

Jilin
Key Cities: Changchun
High Tech Zones: 1
Innovation Alliances: 0
Science Parks: 5
University Science Parks: 0
Tech Transmission Centres: 0

Shandong
Key Cities: Qingdao, Jinan, Linshu
High Tech Zones: 0
Innovation Alliances: 1
Science Parks: 0
University Science Parks: 0
Tech Transmission Centres: 4

Heilongjiang
Key Cities: Harbin
High Tech Zones: 0
Innovation Alliances: 1
Science Parks: 0
University Science Parks: 1
Tech Transmission Centres: 0

Sichuan
Key Cities: Chengdu, Mianyang
High Tech Zones: 1
Innovation Alliances: 0
Science Parks: 5
University Science Parks: 1
Tech Transmission Centres: 3

Liaoning
Key Cities: Anshan, Shenyang
High Tech Zones: 0
Innovation Alliances: 0
Science Parks: 0
University Science Parks: 0
Tech Transmission Centres: 3

Jiangsu
Key Cities: Suzhou, Wuxi, Nanjing, Changshu, Zhenjiang
High Tech Zones: 2
Innovation Alliances: 2
Science Parks: 9
University Science Parks: 0
Tech Transmission Centres: 5

Beijing
High Tech Zones: 1
Innovation Alliances: 18
Science Parks: 16
University Science Parks: 4
Tech Transmission Centres: 7

Tianjin
High Tech Zones: 1
Innovation Alliances: 1
Science Parks: 6
University Science Parks: 0
Tech Transmission Centres: 2

Shanghai
High Tech Zones: 1
Innovation Alliances: 0
Science Parks: 12
University Science Parks: 4
Tech Transmission Centres: 5

Zhejiang
Key Cities: Hangzhou, Ningbo, Xuzhou, Wenzhou
High Tech Zones: 0
Innovation Alliances: 0
Science Parks: 0
University Science Parks: 2
Tech Transmission Centres: 5

Fujian
Key Cities: Fuzhou, Xiamen
High Tech Zones: 0
Innovation Alliances: 0
Science Parks: 0
University Science Parks: 0
Tech Transmission Centres: 2

Guangdong
Key Cities: Guangzhou, Shenzhen
High Tech Zones: 2
Innovation Alliances: 0
Science Parks: 13
University Science Parks: 1
Tech Transmission Centres: 2

Chongqing
High Tech Zones: 0
Innovation Alliances: 0
Science Parks: 0
University Science Parks: 0
Tech Transmission Centres: 1

Hunan
Key Cities: Changsha
High Tech Zones: 1
Innovation Alliances: 2
Science Parks: 4
University Science Parks: 0
Tech Transmission Centres: 2

Anhui
Key Cities: Hefei, Bengbu
High Tech Zones: 0
Innovation Alliances: 0
Science Parks: 0
University Science Parks: 0
Tech Transmission Centres: 4

Xinjiang

Gansu

Inner Mongolia

Ningxia

Shanxi

Shandong

Jiangsu

Shanghai

Zhejiang

Jiangxi

Hubei

Henan

Shaanxi

Sichuan

Chongqing

Guizhou

Yunnan

Guangxi

Guangdong

Hainan

Tibet

Qinghai

Heilongjiang

Jilin

Liaoning

Beijing

Hebei

Tianjin

Shandong

Jiangsu

Shanghai

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5. TARGETED SCIENCE CLUSTERS

5.1 CLEANTECH

Overview

The Chinese cleantech industry includes a number of distinct sub industries, which could be broadly classified into two categories:

- 1) Comprehensive resource utilization.
E.g. renewable energy; waste management; material recycling and re-use; energy efficiency; intelligent energy; etc.
- 2) Environmental technology.
E.g. emission control; water treatment; waste treatment; etc.

These industries have gone through quite a development within the past two decades. They are however still at their infancy as compared to other traditional industries. They share common characteristics of:

1. Close dependency on policy and government strategy
2. High capital investment
3. High technology content

All three elements are considered important for a project within the cleantech industry to succeed.

The innovation cleantech clusters in China include innovation associations & alliances, science incubating networks (high-tech zones, science parks), technology transmission centres, etc. The entities are spread out all over China, however with a tendency that more of the clusters are based in economic and academically advanced provinces/ cities.

The qualitative assessment of the A-ranked clusters is based on following:

- 1) Support from government offices
- 2) Connection with capital resources
- 1) Academic, research and development resources
- 2) Network size
- 3) Access to public funding
- 4) Knowledge of technology, industry and policy intelligence
- 5) Clear and easy industry networking platform

The three innovation alliances shown below are leaders within their segment.

China Technology Innovation Strategic Alliance for Resources Recycling Industry (CIAR) 中国再生资源产业技术创新战略联盟

Score

Constraints	Score (1-5 stars)
Results / Experience	****
Financial	***
R&D&I	*****
SME Values	****
Infrastructure	*****
Good-will	****
Overall score	*****

Summary

Administrated by China Association of Circular Economy (中国循环经济协会) CARCU.

China Technology Innovation Strategic Alliance for Resources Recycling Industry (CIAR) established on 27 October, 2009. It is among the most experienced A-ranked innovation alliances, certified by the China Ministry of Science and Technology. CIAR is the innovation organisation within the China Association of Resource Comprehensive Utilization(CARCU).¹⁸

CIAR supports innovation development for its 69 member organizations, including universities (e.g. Peking University, Nankai University, etc.), research institutes (e.g. China National Electric Apparatus Research Institute), science parks and high-tech zones (e.g. Ziya Circular Economy Area) and a number public and private technology companies (e.g. Aluminium Corporation of China). The members are leaders and advocates in resource recovering and material reuse industries, especially industry waste treatment and utilization. CIAR conducts several aspects of works:

- 1) Providing political and regulative assistance.
- 2) Support for networks to apply and utilize public research funding programs, for example National technology supportive programs, e.g. program 863¹⁹, consolidate industry by organizing academic seminars and technology workshops.

¹⁸ CARCU has a broad industry focus and consist of 600 group members and 140 individual members.

¹⁹ Program 863: public funding program for development of technology based industries.

- 3) Support technology pilot test environments by actively engaging connection between research institutes, incubating facilities and commercial companies.
- 4) Engaging international collaborations.

Core Competencies

Comprehensive resource utilization, environmental protection and energy conservation

Comment

CIAR, together with CARCU is recommended as an outstanding innovation network mainly due to its competence in assisting advanced research and development projects to connect with necessary external resources, including public funding, supporting policy information, project developer information, etc. The network covers majority of the academic and business players and is in direct work connection with the administrative authorities. Both organization entities mainly work in paths of their registered members. But they are open for collaboration with foreign counterparts.

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Case story - Tianjin Ziya National Circular Economy Area

Ziya Circular Economy Area is a state level high-tech zone, a national pioneer in fostering material recycling entities. The Ziya Circular Economy Area is directly governed by Tianjin Ziya Municipality, with more than 10 years development experience in supporting this sector. It currently has 231 companies in its industrial park, with an annual processing capacity of 1.5 million ton recycle of waste materials (including wasted vehicles, electronics, equipment and appliances etc). The park produces recovered metals, plastics, and other materials towards north China market. Aside from providing public subsidy and resources, commercial support towards the sit in companies, the Circular Economy Area is also home or partners with a number of national research centers, including Renewable Resources Research Institutes etc., providing pilot-scale test ground for advanced technology in resource-recovering technologies.

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Energy Efficient Water Treatment Equipment Industry Innovation Alliance (WEA) 节能降耗水处理装备产业技术创新战略联盟 (China Yixing Industrial Park for Environmental Science & Technology (ES&TP) 中国宜兴环保科技工业园, 江苏省环保产业技术研究院)

Score

Constraints	Score (1-5 stars)
Results / Experience	****
Financial	****
R&D&I	*****
SME Values	*****
Infrastructure	*****
Good-will	****
Overall score	*****

Summary

The Energy Efficient Water Treatment Equipment Industry Innovation Alliance (WEA) is administrated by Jiangsu (Yixing) Institute of Environmental Industry (JIEI). It is the first Chinese innovation industry alliance focused on energy efficient water equipment industry.

WEA has more than 20 active member organizations including: CECEP Assets Management Co., Ltd, Research Center for Eco-Environmental Science, Chinese Academy of Science, Tsinghua University and other industrial leaders in energy efficient water equipment industries.

WEA mainly focuses on several aspects of work:

- 1) Investment and financial guidelines for entrepreneurs.
- 2) Provide political support for R&D, demo and pilot-scale production.
- 3) Management of technology collaboration platform and assists in technology transfer and match-making projects.
- 4) Organizing industrial and academic information network events;

WEA works closely with China Yixing Industrial Park for Environmental Science and Technology (ES&TP), a national hi-tech zone. It provides multiple research and commercial support towards its member companies, including entrepreneur support in finance and policy introduction and partner suggestions etc. Both WEA and ES&TP maintain active international collaborations. They have worked with industry partners from Australia, Finland, U.S, Korea and Denmark.

Core Competencies

Water treatment, Water saving technology, environmental protection and energy conservation

Comment

It is evident that WEA, together with its affiliated Jiangsu Yixiang Industrial Park for Environmental Science and Technology possess notable industrial experience in fostering advanced technology research and development projects, especially as industrial pilot testing ground for research scale projects. The network also has an active international collaboration profile, including its exposure to a number of Danish cleantech organizations, including Invest in Denmark, Copenhagen Cleantech Cluster, etc. This established mutual engagement would provide positive value in assisting Danish cleantech company connecting with potential partners in innovation project.

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Case story - Lingzhi Group Cooperates with American Key Industrial Laboratory in Yixing ES&TP

On May 24, 2013, American company PARC reached intent with Lingzhi Environmental Group and Chongqing University to establish a new technology transfer company in ES&TP. The registered capital of the new company reached 30 million RMB.

The strategic Alliance on Technological Innovation of Urban Biomass Gas Industry 城市生物质燃气产业技术创新战略联盟

Score

Constraints	Score (1-5 stars)
Results / Experience	*****
Financial	****
R&D&I	*****
SME Values	***
Infrastructure	**
Good-will	*****
Overall score	*****

Summary

The strategic Alliance on Technological Innovation of Urban Biomass Gas Industry is administrated by Tsinghua University, School of Environment. It was initiated in 2010 and led by Tsinghua University together with more than 20 Chinese leading research institutes and engineering companies, Tongji Universities, Institute of Process Engineering, Chinese Academy of Sciences, China Datang Corporation, etc.

The alliance maintains a direct and active dialogue with Ministry of Science and Technology project offices and is supported financially by Beijing Science and Technology committee. The alliance aims to build an active platform for industry innovators to dialogue and collaborate on advanced technology projects. The alliance is also closely engaged with local incubating leader Zhongguancun Science Park in terms of supporting entrepreneur development within its industry expertise.

The Alliance works with several aspects:

- 1) Active engagement as industry knowledge for governmental assignment. Research projects for national biomass gas industry planning, technology development guidelines and standards.
- 2) Facilitate innovative capabilities for industry members, manage technology research sharing platform, promote pilot scale technology transfer and industrial applications.
- 3) Operate information sharing and academic events in the form of seminars and workshops;
- 4) Assist member organizations in participating into public research programs
- 5) Manages international collaborations for industries

Core Competencies

Municipal Solid Waste treatment, biogas production, complex environmental solutions

Comment

As the biomass gas industry is still in its infancy in China, one key criterion in assisting project implementation is to get engaged with government recognized expert partnership, which should be competent in employing new technologies into demo or pilot industrial project. The Strategic Alliance on Technological Innovation of Urban Biomass Gas Industry is an acknowledged innovation network due to its involvement with key organisations. The cluster also possess good lobbying capabilities to advice the authorities future trends, thus potential benefitting collaboration outcome.

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Case story

Alliance network companies got awarded with National R&D funding 2012-07-11 The alliance facilitated research proposals for 2013 "China Technology Planning Projects" got successfully approved. The projects awarded to two engineering companies, Shanghai Environmental Industry and Hangzhou Puda renewable energy equipment Co. Ltd, under the projects of "Technology development and demo on municipal solid waste landfill fast utilization and contamination control", and "Key technology development and demo on municipal kitchen and food waste efficient transformation into biogas".

5.2 LIFE SCIENCE SECTOR

Overview

Currently, there are on all levels over 100 pharmaceutical and life science parks across China. Among them, about one third of the parks are established within existing national economic development zone or high-tech development zone, and the rest two thirds are solely designated biopharmaceutical parks. In terms of funding sources, the majority of them are government funded (i.e. funding from central, provincial and local government). However there is

also an increasing number of privately invested life science parks in the past years.

In terms of geographic locations, over 60% of life science parks are situated around more economically advanced areas in China, including Bohai Economic Rim (e.g. Beijing Zhongguancun Life Science Park, Tianjin TEDA and etc.), Yangtze River Delta (Shanghai Zhangjiang Hi-Tech Park, Nanjing Life Science Park, Suzhou Biobay, Taizhou China Medical City and etc.) and Pearl River Delta (Guangzhou International Biology Island, Shenzhen Nanshan Medical Device Industrial Park and etc.) With China's "Go West" policy, there are also tremendous development in parks like Wuhan Biolake and Chengdu Tianfu Life Science Park, which are located in central/western part of China.

Majority of the life science parks in China have modern setting and infrastructure, diversified investment structure and clear goals and themes. The life science and health industry of China is entering a golden age, as biopharmaceutical and biotechnology emerge as one of the 7 strategic industries in China's most recent five year plan. The establishment of modern life science parks, together with research and development from universities, research institutions and companies, is an ideal way to accelerate the transformation and commercialization and promote the rapid development of the industry. Popular themes range from modern applications for traditional Chinese medicine, to synthetic drug formulation, pharmaceutical research and development and service, biotechnology and bioagriculture, medical development and health care and so on. Nevertheless, some of them are still suffering from lack of funding support, management skills, innovation capability and far from specialization and functions in a dynamic industrial value chain.

Methodology

In the following session, we have selected three case stories from Beijing Zhongguancun Life Science Park, Tianjin TEDA and Shanghai Zhangjiang Hi-Tech Park. These parks represent one of the best innovative ecosystems and successful life science clusters in China. They encompass three common features: universities and research institute to drive innovation and provide talent pool and scientific workforce, financing mechanisms to support companies founded on innovation, and infrastructure such laboratories and space for business to grow.

Beijing National Bio-Industrial Bases (Daxing Biomedicine Industrial Base)

Score

Constraints	Score (1-5 stars)
Results / Experience	*****
Financial	****
R&D&I	*****
SME Values	****
Infrastructure	****
Good-will	*****
Overall score	*****

Summary

Founded in 2002, Daxing Biomedicine Industrial Base joined the Zhongguancun Science and Technology Park and was appointed by China's National Development and Reform Commission as the core industrial development area of "Beijing National Bio-industrial Base" in 2006. It was incorporated in the Beijing Economic-Technological Development Area in 2010. It is a biotechnology industrialization base built by the Beijing Municipal Government to revitalize its modern manufacturing industry.

As a bio-industry cluster area for the Bohai Economic Zone and the entire northern region, the base holds industrial functions such as biotechnology indigenous innovation, product R&D, industrialization of technical achievements, R&D and producer services in Beijing.

As one of the three core areas of Beijing National Bio-industrial Bases, Daxing Biomedicine Industrial Base has taken full advantage of Beijing's industrial resources in terms of scientific research and administration to build an industrial park of R&D, manufacturing, sales and services.

The base has four development and support priorities – biopharmaceutical projects centering on vaccine and protein drugs; the import of modernized and internationalized TCM enterprises to drive the growth of medicine, health care products; the introduction of medical instrument programs to consolidate the leading position of Beijing in the field of instrument and diagnosis; and last but not least is to bring in innovative drugs and high-end generic drug industrialization projects to form preparation products that meet international certification standards.

Serving as a critical platform of China's biomedicine industry, Daxing Biomedicine Industrial Base enjoys policies related to industrial support, financial support and intellectual resources from China's ministries and commissions such as the Ministry of Science and Technology, National Development and Reform Commission, the Beijing municipality, Daxing district, Zhongguancun National Innovation Demonstration Zone and Beijing Economic-Technological Development Area.

Core competences

- Convenient location
- Favourable benefit and support from central and Beijing municipality government
- Surrounded by great talents in Beijing Areas

Other parks affiliated with Beijing National Bio-industrial Bases include Beijing Yizhuang Biomedical Park and Changping Life Science.

Danish relevance: Novo Nordisk and Novozymes are located in Beijing National Bio-Industrial Bases.

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Tianjin TEDA Biopharmaceutical Innovation Park (Tianjin International Joint Academy of Biotechnology and Medicine)

Score

Constraints	Score (1-5 stars)
Results / Experience	****
Financial	****
R&D&I	****
SME Values	***
Infrastructure	****
Good-will	****
Overall score	****

Summary

Tianjin National Biopharmaceutical Innovation Park is situated in Tianjin Binhai New Area and is jointly established by Ministry of science and technology, department of commerce, former Ministry of Health, CFDA and Tianjin municipality government in July 2008. The core and landmark of the Innovation Park is the Tianjin International Joint Academy of Biotechnology and Medicine (TJAB).

TJAB's founding cooperation organizations include China National Center for Biotechnology Development, Chinese Academy of Sciences, Academy of Military Medical Sciences, Chinese Academy of Medical Sciences, Chinese PLA General Hospital (301 Hospital), Tianjin Municipal Science and Technology Commission, Nankai University, Tianjin University of Traditional Chinese Medicine, Tianjin Economic-Technological Development Area (TEDA).

TJAB aims to build a superior comprehensive platform for drug innovation and brought together high quality domestic and international resources, creatively promoted the Binhai Model, i.e. to operate by market mechanism with government setting up the stage; to operate with the state-own assets; to open and collaborate without setting up fence, to obtain internationalization certifications and to create win-win and mutual benefits. As a world-class biopharmaceutical industry chain platform, as well as a complete and comprehensive new drug development technical platform, TJAB innovatively provides the entrepreneurs and research team with one-stop, comprehensive and thoughtful services, which resulted in accumulation of large group of top bio pharmaceutical talents, and successful incubation of large number of innovative companies.

The innovation park initiative has led to the successful construction of Binhai New Area Bio pharmaceutical industry cluster.

Structure and other related entities in TEDA

- Tianjin University Science Park
- ALEXANDRIA Center for Science & Technology
- TEDA SME Park Incubation Center

Core competences

- International collaboration
- Integrated platform of drug discovery (i.e. pharmaceutical R&D information platform, analytical center, Bio-GMP facility, clinical research platform)
- A cluster of Danish companies in life science and clean tech sectors

Danish relevance

Novo Nordisk, Novozymes and NNE Pharma are located in Tianjin TEDA.

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Shanghai Zhangjiang Hi-Tech Park (Zhangjiang Medicine Valley) - "From rice paddles to a vibrant innovation park"

Score

Constraints	Score (1-5 stars)
Results / Experience	*****
Financial	*****
R&D&I	*****
SME Values	****
Infrastructure	****
Good-will	*****
Overall score	*****

Summary

In 1996, the Ministry of Science and Technology, the former Ministry of Health, CFDA, Chinese Academy of Sciences together with Shanghai municipality government established the State Biotech & Pharmaceutical Industrial Base in Zhangjiang Hi-Tech Park, today recognized as Zhangjiang Medicine Valley or Zhangjiang Life Science Cluster.

As one of China's most advanced biopharma innovation clusters, the companies in Zhangjiang cover the entire value chain, with special focus on biotechnology, modernization of traditional Chinese medicine, chemical drugs, medical devices and diagnostics and speciality chemicals.

The park has gathered more than 500 institution and enterprises, covering R&D headquarters of multinational pharmaceutical companies (e.g. Roche, Novartis, Astra Zeneca and GSK), research institutes, major Chinese pharmaceutical companies (Henrui, Shanghai Pharma, Sinopharm, Desano, Fosun Pharma, Yangtze River Pharma, Tasly and etc.), small to medium sized R&D companies, CROs, public service platforms. Together the R&D activities attract local high value manufacturing.

Moreover, the keys to the success for Zhangjiang Hi-Tech Park are the funding & support, its market/location, local and global talents and governmental support & policies. The park has a special interest in encouraging and supporting innovative entrepreneurs and companies, disseminate innovation from Zhangjiang to the Chinese and global market and foster a great balance between local and global R&D capability and strength. It has become one of the landmark biopharma park and life science cluster with the most concentrated R&D institution, the strongest innovation capacity and most fruitful of research and industrialization in Shanghai and in China.

Zhangjiang Biopharmaceutical Base will further expand to the central and southern part of Zhangjiang Hi-Tech Park, and will continue to work closely with the modern medical device park on the east side and Sunqiao modern agricultural zone on the south side to promote biotechnology and bioagriculture development. The overall goal is to further improve its multi-functional biomedical and life science research and innovation systems.

Core competences

- Sound environment for investment and start-up
- Unique biopharma cluster with global and local R&D center
- State level biopharmaceutical base with favourable policies (tax, customs, IPR, talents, innovation incubator and commercialization)
- Concentration of highly educated, high-level and high-qualified talents

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Comments

1. One important factor that seems to be lacking in the majority of the life science parks in China is the incubator service or business model for foreign SMEs. Majority of existing incubator services are for SMEs founded by Chinese entrepreneurs, especially those educated abroad and returned to China to start their own business. In addition to that, the benefits and funding support are also primarily targeting Chinese entrepreneurs and their SMEs. All the Danish companies that are situated in Chinese life science park, either conducting R&D or producing, are big names such as Novo Nordisk and Novozymes. There is no clear business model available for Danish or foreign SMEs at the moment.
2. Nevertheless, international collaboration is promoted in most of the parks with funding available in this direction, e.g. Tianjin TEDA. Danish life science companies, especially SMEs, could likely enter Chinese market and get access to life science clusters, through strategic business partnership with local Chinese companies.

One possible incubator business model, proposed by Dr. Shi from TJAB during the visit, is that the parks could provide affordable office space for foreign SMEs, recommend suitable talents for the company to hire in China, and the company could conduct research in China using the common research and analytical laboratory facility and platform within the parks.

3. Another challenge within the life science parks in China is the bureaucracy style from the management team, which also contribute to the poor management skills in a lot of parks. It can be in many different ways. For example, different parks under the same cluster or base do not communicate horizontally and therefore not efficiently. And since most of the parks are government funded and run by governmental officials, it is rather difficult to get access to, even for fact finding trips.

5.3 INFORMATION & COMMUNICATION TECHNOLOGIES

Overview

For the study carried out for this report, there were initially 18 entities with that have been chosen in the ICT industrial sector.

Thereafter, systematic filtering scheme was carried out using the key elements of the assessment matrix. Four out of the eighteen entities emerge to be the most promising ones, they are the:

- Beijing Zhongguancun Science Park (Z-park);
- Wuhan East Lake National Innovation Model Zone (WEHDZ – Optics Valley);
- Shenzhen High-Tech Industrial Park Shenzhen Bay Park (SHIP-park);
- Wuxi Sensing China Center – SensingNet Innovation Park (WSN-Park).

Beijing Z-park, Wuhan WEHDZ-Optics Valley, and Shenzhen SHIP-park reside in the first group of national level high-tech zones, all of them has been through more than two decades of development, and have generated outstanding outcomes in (and not limited to) the fields of information technologies, optoelectronic communications technologies, electronics R&D and manufacturing, respectively. The Wuxi WSN-Park was approved as national sensing net demonstration park in 2009, with the aim to promote the development and application of the Internet-of-Things. All four chosen clusters are of the most competent entities in the Chinese ICT industry sector, with each of them shouldering key development projects that are in-line with the seven national strategic new industries in China's 12th five year plan. All parks are facilitated with modern infrastructures, in adjacent to top universities with large talent pool, have access to diversified financing structures, with a good international co-operation platform, and are backed up with political support to reach their respective development goals. Detailed elaboration and description to each of the four parks can be found in the following sections.



Figure 5.1

Beijing Zhongguancun Science Park (Z-Park)

Representative industry: Information Technology

Score

Constraints	Score (1-5 stars)
Results / Experience	*****
Financial	*****
R&D&I	****
SME Values	*****
Infrastructure	****
Good-will	*****
Overall score	*****

Summary

Through two decades of development, Zhongguancun park has created and accumulated innovation experiences in various aspects. It has created excellence in the ICT sectors in next generation internet technologies, mobile internet and next generation mobile communications, and satellite applications; and has potential industrial clusters in integrated circuits and high-end equipment and general aviation. Zhongguancun park has 16 subsidiary parks throughout Beijing city, composed of the northern and the southern regions. The northern region focuses mainly on research and development services and high technology industrial cluster district, composed of the following subsidiary parks related to ICT:

- Future Technology City
- National Engineering Technology Innovation Base
- Zhongguancun Software Park
- Zhongguancun Yongfeng Hi-Tech Technology Industrial Base

The southern region focuses mainly on high-tech manufacturing and emerging industries of strategic importance, with the following ICT related parks:

- Beijing Economic and Technological Development Zone
- Electronics and Information

Core Competences

Zhongguancun is an area with a good pool of human resources; it provides a talent base with high science intelligence level. There are more than 40 university institutions, including the top two ranking Peking University and Tsinghua University; 206 national (provincial) research institutions, includes institutions belonging to Chinese Academy of Science and Chinese Academy of

Engineering; 67 National Key Laboratories; 27 National Engineering Research Centres; more than 80 multinational R&D institutions; 28 national engineering technology research centers; 26 University Science Parks; and 34 Overseas Chinese High-Tech Venture Parks. Z-park has received more than 15,000 overseas returnees, and generated more than 6,000 enterprises.

One third of China's Nasdaq-listed companies resides in Zhongguancun area. The annual venture capital investment cases and the amount of investment account for about one third of the country total.

Zhongguancun park puts an effort into expanding channels for international development; accelerate integration into the global research and innovation systems, attract domestic and foreign large enterprises and attract internationally renowned research institutions to set up laboratories in the demonstration zones. The park supports enterprises and new industrial organizations in the demonstration zones to take part in international science and technology cooperation programs, to promote the development and application of international standards; and encourage native competent enterprises to set up R&D institutions abroad to enhance the ability to integrate the use of global resources in research and innovation.

In regard to significant demand around major state projects, key projects, strategic emerging industries and urban modernization, Zhongguancun (also for foreign enterprises):

- Improves the platform for international exchange and communication.
- Supports international academic organizations, industrial organizations, and public organizations to build a platform for exchanges and cooperation in innovation.
- Explores new model of international cooperation between global entities and the Zhongguancun area.
- Attract international industrial alliances to locate in the demonstration zone.
- Deepen the collaboration between Zhongguancun area and the renowned international science parks, and international cities with intensive innovation resources.
- Use the Beijing Science and Technology Industry Expo, Zhongguancun Forum as an important platform to showcase independent innovation, and to enhance the level of international cooperation.

Conclusion

Zhongguancun Science Park with its distinctive 16 subsidiary parks forms the high-end industrial functional area across different administrative districts in the greater Beijing Area, and drives the growth of the Northern China region. Z-park plays an important role also to strengthening the innovation development cooperation mechanisms between the major cities, particularly its neighbouring Tianjin and Hebei regions, and radiate to the Bohai economic rim.

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Wuhan East Lake National Innovation Model Zone (Optics Valley)

Representative industry: Optical communications, Photonics, OptoElectronics

Score

Constraints	Score (1-5 stars)
Results / Experience	*****
Financial	*****
R&D&I	****
SME Values	*****
Infrastructure	****
Good-will	*****
Overall score	*****

Summary

The East Lake New Technology Industrial Development Zone started construction in 1988. It was approved by the state council as National High-Tech Zone in 1991. After 20 years of construction and development, East Lake National Innovation Model Zone has become an important area of scientific and technological resource-intensive and high-tech industrial base. It has an important strategic position in the innovation and development of high-tech industrial clusters represented in the fields of OptoElectronics information. In 2009, the national independent innovation demonstration zone started its construction. Wuhan East Lake National Innovation Model Zone has successfully created the "Wuhan – Optics Valley of China (OVC)" brand. In 2010, the east lake demonstration zone achieved total income of 291.8 billion CNY, and gross industrial output of 250.3 billion CNY.

Core competences

Adhere to industry specialization and high-end development, the east lake demonstration zone has formed a leading optoelectronics information high-tech industrial cluster. It has built China's largest optical fibre and cable man-

ufacturing base, and an important research and development base in the field of optical communications. The production scale in fiber optic cables rank number two in the world, with domestic market share of 50% and global market share of 12%. Market share for optoelectronic devices is 60% domestically and 6% in the global market. The development zone gave birth to a number of leading technologies, including China's first piece of optical fiber, the first optical transmission system, and the first red light high-definition video disk device with independent intellectual property rights. Seven international standards have been formulated and created in the zone.

The development zone has created its distinctive innovative industrial clusters, give high priority to the development of the optoelectronics information industry. Amongst the professional parks there are the optoelectronics innovation park, the semiconductor industrial park and the optoelectronics industrial high-tech zone. There is also a nationwide influential creative industry base – optics valley creative, its industry clusters include animation and gaming, sound, lighting, and 3D printing in creative cultural applications. Wuhan as a prosperous city along the Yangtze River plays the role of an important engine to drive the growth of central China region with its radiation to neighbouring cities.

The east lake development zone has gathered a wealth base of human resources. There are 42 colleges and universities, more than 30 national key scientific research institutions, and more than 400 enterprise R&D institutions gathered in the zone. There is a large number of high-end talent and scientific and technology personnel, including 60 academicians, 20,000 active technology personnel, more than 200,000 professional technicians, and 800,000 college students. Since 2000, more than 16,000 patents have been applied, which takes 50% of the total in Wuhan.

The development zone provides intensive policy support to promote international cooperation and aim at accelerating the formation of new industrial clusters with global competitiveness. For global partners, the development zone puts emphasis on introducing international business organizations, chambers of commerce, industrial organization, international cooperation, and exchanges to build bridges and channels; encourage foreign universities and research institutions to establish joint laboratories or research bases; encourage multinational corporations to set up independent R&D institutions and R&D headquarters in the zone; promote international scientific and technological cooperation and exchanges; develop R&D outsourcing, promote cross-border trade; create "Optics Valley - China" international optoelectronics exposition and forum, fairs and other overseas Chinese entrepreneurs to develop and influential international exhibition brand; expand cooperation and exchanges with the world-renowned science and technology parks; establish strategic partnerships with international cooperation in science and technology parks with a common basis; integration of domestic and international resources for innovation, with the focus on optoelectronics, bio-photonics and other fields; establish international innovation park; optimize the international business environment; create a fair competition and policy environment for domestic and foreign enterprises and entrepreneurs; improve both soft- and hard-ware conditions for international business development; establish East Lake bonded zone / tariff-free area / free-trade zone; strengthen the linkage

with Wuhan new port, Sky-river (Tianhe) airport, railway central station and other portal areas.

Conclusion

The construction of the east lake demonstration zone led to local industrial reconstructing, and the promotion of economic and social development. It has become one of the most important centres in China for independent innovation. It houses facilities of multiple Chinese and foreign photonics and telecoms players, such as FiberHome, YOFC, Chutian Laser, Accelink, China Mobile, China Telecom, China Unicom, Ericsson, and France Telecom, etc. By 2020, the industrial scale of Optics Valley of China is expected to reach 3 trillion.

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Case story - Wuhan

Deutsche Telekom (DT) continued efforts to strengthen ties with China by initiating the creation of a global development centre in Wuhan East Lake High-Tech Park in mid-2012. DT intends to deliver ICT services to its multinational customers in China. DT's expansion to China offsets other European rivals' better-established ties locally, such as Telefonica Group's shareholding in number-two mobile operator China Unicom, and Vodafone's strategic relationship with market leader China Mobile. The new centre supports a push for additional ties with Chinese players, including recent alliances with Beyondsoft and Huawei Technologies on IT services. The facility of the centre will take four years to build, and focuses on cloud computing, internet of cars, and smart-grid, etc. The ultimate total investment is expected to exceed 40 million euros – starting with the development of the first phase construction which involves an initial investment of around 5.6 million euros. Approximately 1000 employees will work at the centre by 2014.

Wuxi Sensing China Center and SensingNet Innovation Park (WSN-Park)

Representative industry: Sensing, Mobile Internet, Internet of Things

Score

Constraints	Score (1-5 stars)
Results / Experience	****
Financial	*****
R&D&I	****
SME Values	****
Infrastructure	***
Good-will	****
Overall score	****

Summary

Wuxi was approved as national SensingNet innovation demonstration park by the state council of PRC in 2009. The WSN-park aims at leading the innovation of Internet of Things (IoT) on the aspects of technology, industrialization, implementation, and international communication.

Core Competences

The city Wuxi has high level of urbanization and modernization with strong comprehensive strength and good industrial bases. The manufacturing technology and scale of integrated circuits ranked top nation-wide. The core industries of development in Wuxi includes IoT related hardware, software, information services, integration, and operational services, with particular focuses to improve the design and manufacturing of sensors, chips, instrumentations, M2M devices, to improve the research and industrialization competence on embedded systems, devices, application software and various security software.

Wuxi takes the role to carry out national key and typical application demonstration project, to form comprehensive integrated solutions for IoT applications, and to drive the scalability of IoT applications, and the development of the IoT industry.

The WSN industry service platform is built up by a union of 15 Chinese leading universities for researching talents and developing the industry, such as Peking University, Tsinghua University, Beijing university of posts and telecommunications (BUST), etc.

Wuxi government has released a series of policies to improve the cooperation between the government, industry, universities and research institutions, and policies to attract native and foreign talents to join the innovative and entrepreneurial environment in Wuxi. Cooperation mechanisms has been practiced to attract foreign companies to establish R&D headquarters; to encourage

enterprises and research institutions to participate the formulation and creation of international standardizations; to improve cooperation on enterprise and products' international certification; to implement export credit policies, insurance policies, and overseas promotion policies, etc.

Conclusion

By 2011, the industrial scale of IoT exceeded 230 billion Chinese Yuan, with more than 20 million M2M application terminal unites. Both the software and integration service has reached to considerable scales. The market size of IoT in China is predicted to be 750 billion by 2015.

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<http://en.wuxi.gov.cn>

Shenzhen High-Tech Industrial Park – Shenzhen Bay Park (SHIP)

Representative industry: Information Technology, Electronics, Acoustics, manufacturing

Score

Constraints	Score (1-5 stars)
Results / Experience	****
Financial	*****
R&D&I	****
SME Values	****
Infrastructure	***
Good-will	****
Overall score	****

Summary

Shenzhen High-Tech Industrial Park (SHIP) Shenzhen Bay Park was founded in 1996. SHIP adheres to independent innovation and harmonious development, and advocates the innovation culture of daring to venture, striving to innovate, tolerating failure and pursuing success, open to tolerating, competitive, energetic and voiding fickleness.

Core competences

In 2012, patents' application volume was 15,420, out of which 12,390 were patents of invention. The PCT application volume passed 5000 which is at the first place of all national high-tech parks for several consecutive years. Quite a few industrial chains have taken shape in SHIP Bay Park, such as communication, computers and software. Some of the key industrial areas in SHIP Bay Park related to ICT include electronics and information technology, next generation internet, and next generation mobile communication. The park has developed diversified, specific and interactive incubation groups with venture and investment services square to provide financing and start-up services.

With 12 years of development, Shenzhen virtual university park (SVU) of 53 famous domestic and foreign universities, has become a base for cultivation of high-caliber personnel, key labs construction, transformation and industrialization of universities' research achievements, and has cultivated over 31,422 postgraduates, and 72 postdoctoral students have been ushered in, incubated 648 companies, cooperated with companies on 1099 projects. SVU key lab platform consisting of 109 national-level research organizations is helping with enterprises' technological innovation.

To enforce the exchange, cooperation and oversea market exploitation between the companies in Shenzhen and Hong Kong, an interactive base of Shenzhen-Hong Kong Innovation Zone was set up by SHIP and Hong Kong Science & Technology Parks jointly in 2009. As a member of the international association of technology parks and a technology park of APEC, Shenzhen municipal government has set up a Shenzhen international science and technology business platform. There are up till now more than 30 foreign organizations from more than 40 countries and regions that have joined the platform.

Conclusion

SHIP Shenzhen Bay Park has developed an innovation system with enhanced synergy amongst the government, industries, universities, research institutions, capital and intermediary services. It has been honoured as one of the six national key science parks, with the ambition of becoming one of the world leading high-tech zones.

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6. CASE STORIES – AND HOW TO PICK THE RIGHT LOCATION: CONCLUSION

In order to validate the results from the desk research and the interviews with the different parks we interviewed a dozen of foreign/ primarily Danish companies in China. We spoke about their initial settlement, how they had chosen location, what they had benefitted from, challenges they met, etc.

In summary, the most important findings were the following:

Bureaucracy. For a foreign SME in China what might be normal administration and information to public authorities can become tedious and time consuming: the language difficulties and the rigid systems can pose a challenge for an entrepreneurial soul.

E.g. getting foreign capital into China requires a large amount of correct documentation.

Corruption. Still a factor that is present within business relations and can be difficult for a start-up to identify without in-depth knowledge of China.

Network. It means everything, and you need to create it from scratch. Network to reach out to potential partners, customers, authorities, institutions, etc.

Talent. Recruiting the right personnel is vital when being a start-up and even though the well educated workforce is growing, it can still be challenging to recruit the best qualified, because of competition from the larger players/ corporations.

HQ. For one company the main challenge had been to make the organisation back in Denmark understand the difference in running businesses in the two different countries; that things had to be done in a different way.

Value Pricing, consulting. A company that has consulting as the key part of their service have had to spend a lot of time educating the Chinese customers on how time and value and hence price go together.

Getting tax reductions and low rent. A company manufacturing electronic products for industrial use obtained a technology certificate that gave them access to a "software park" with low rent in the early days. They also received tax reduction due to the SME's export and technology focus. For full insights into this company's story please see Appendix on One Sail.

Alliances. A large German company established a 'global development centre' in the park that had their technology as a focus area. The company delivers ITC solutions to international clients in China and has found a way into the market by getting close to the local players by building alliances.

Local government support. A Danish entity settling in a high tech park found that the close connections between the park and the local government could work to his advantage. The entity had assistance from a local organisation

when doing the necessary registrations, visa, obtaining relevant information on whom to go to for different issues, etc.

R&D centre. When a by now large Danish company should pick the initial location for their R&D centre they looked at parameters such as rent, tax benefits due to IPR status, the research environment (talent and knowledge), geography and fit with regional admin office.

In conclusion, when looking at all our findings we believe that making the decision on a location in China – or where to find a suitable partner - depends on a number of factors. Some are very practical, other more diffuse and with cultural aspects.

It should also be made clear that what is available to a Chinese company in the different entities is not likely available to a Danish entity. Some form of partnership could be needed to enjoy the same benefits: be it access to R&D funding, etc.

All situations will vary, and not two companies are alike. There will be different reasons for looking into the innovation community in China; development, research, innovation, partnerships, future production, etc. Our recommendation is therefore only to be seen as a suggestive starting point. But in general terms, the following could be the factors you could include into your search and criteria:

1. Local Government/ Authorities / Parks – they are linked:

If you bring something to China that is in demand – ref the strategic industries etc. mentioned earlier in this report – there is a good chance that the local authorities are interested in your company settling in the area. As many of the parks/ entities are driven by local government the approval/ welcome from the government could be key to a good negotiation process,

By making it clear to the Chinese host the value of what you bring of technology, IPR, export, exchange of knowledge, training of talent, etc there is likely to be more open doors.

2. Facilities:

For R&D and manufacturing certain facilities might be needed. The different parks/ entities offer very different ranges of facilities; some are more focused on the science parts, others cater to production

3. Infrastructure & Logistics:

In certain industries large volume of material, waste, resources, etc. must be transported. Logistics can quickly become a burden if this is not taken into account. Many parks are situated around natural means of transportation, but some are closer to e.g. ports and important rail and road systems than others.

4. Cultural Aspects:

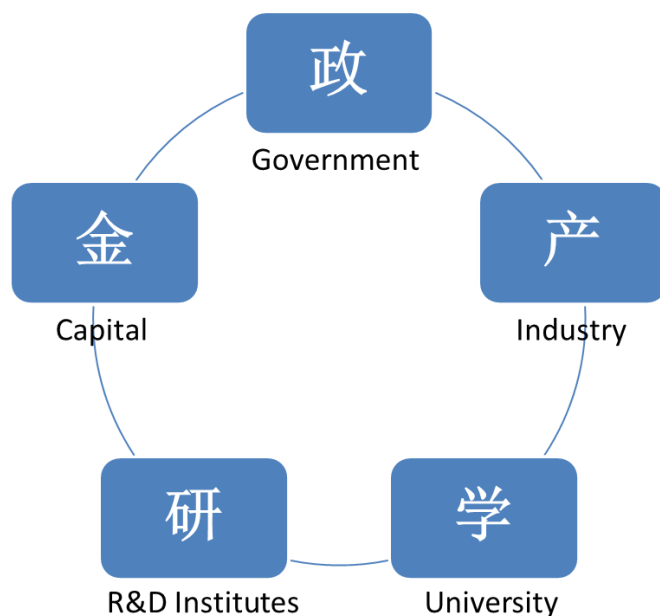
No report, email or telephone conversation can replace a face-to-face meeting. This is especially true in China. Personal connections are crucial and they can only be established in real time. Several parks might seem to offer more or less the same benefits, and so it is encouraged to meet with the potential entities and get a better understanding of their needs and drivers for welcoming a foreign company. Due to cultural differences it would be recommended to include Chinese nationalities/ speakers on such meetings.

Parks with Focus and Clear Governmental Objectives/ Pilots:

The in this report listed parks/ entities are good places to start when trying to identify areas for relevant innovation and location in China. Most of them are explicitly focusing on specific areas of strategic interest and are centres for knowledge, science and hence talent.

Whereas the entities 'only' represent the Chinese version of what the world looks like it gives a good indication of where the development is, what is in focus, which technologies are defined as interesting, - and hence also gives a hint as to where potential partners might be found. And the location that holds the clever technologies and companies could believably also be potential location for a Danish SME looking for a partner. So perhaps the right location for innovation is in proximity of one of these parks?

Put in relatively simple terms the optimal eco-system for innovation entities could be summarised as follows:



Note: the characters 政·产·学·研·金 writes [zhèng]· [chǎn]· [xué]· [yán]· [jīn]

When all of the above factors are found in one place there should be good reason to expect a relatively good base for innovation. How the frames are filled must then be tested.

Innovation Centre Denmark, Shanghai, would welcome any questions on innovation, partnerships and any other matters related to a desire to innovate in and with China.

7. APPENDIX

7.1 MATRIX SCOREBOARD

Network/ Community		Science-Park A	Innovation Alliance B	Science-Park C
Sector	Importance			
	-			
Results / Experience	Existence	3		
	< 3 years			
	3-6 years			
	6-10 years			
	> 10 years			
	Spin-offs	3		
Financial	Projects Accomplishments	4		
	Funding	5		
	Venture Capital Funds	2		
	Private Equity	2		
	Tax Benifits	2		
	Trade Benefits	3		
R&D&I	Dept	3		
	Diversity: mix of players background and incentive	3		
	International partnerships including research, comercial, government programmes	4		
	<5			
	5-10			
	10-20			
	>20			
	Patent grants	3		
	Amount			
SME Values	Level of IPP	5		
	Talent Pool	4		
	English Level	3		
	Incubation - Foreign SME's	3		
	Incubation - Chines SME's	3		
	Busisness plan contests	2		
	Conferences/ Seminars	2		
	Danish Presences	4		
Infra-structure	Case Stories	4		
	Establishment Costs	4		
	Transportation & Logistics	5		
	Telecommunications	4		
	General Facilities	2		
Good-will	Lab Facilities	3		
	Sustainability	3		
	Level of Anti-Corruption	3		
	Reputation	3		
Overall score (importance * assessment grade → percent of absolute score)				

7.2 ONESAIL CASE STORY

Setting up business in China –the story of Onesail:

An accurate description of what Onesail does:

OneSail develops and manufactures electronic products for industrial use. That includes hardware, software and complete “box-build”.

Why China/ why move/ why start up and why this city/ place? –what was your incentive to come to China (the entrepreneurial angle):

I was headhunted in 1997 by a large Hong Kong company to lead the development of a new generation of machine control and factory automation. I started an EMBA (MMT from DTU with focus on innovation and management of technology) in 2001.

Guangzhou was chosen as it is an area with long history and many universities, many factories for electronic components and excellent place with good infrastructure and shipping facilities through HK or international airport.

Financing the project:

I used my own funds and share options as initial capital. Around 2003-2004 I had spent the first million and I therefore teamed up with an investor (business angel). In that given period I also acquired an employee to work with marketing of Onesail in Denmark.

Has OneSail visited any parks prior to choice of location, received incentives to come and place the organisation where it is? (tax reductions etc.):

We obtained a technology certificate that gave us entry to a “software park” with low rent in the beginning. We have also received tax reduction due to our export and technology focus.

Human Capital:

One of the largest challenges in China is to obtain qualified workforce. However it should be said that it is much easier to find qualified workforce today than it was 10 years ago. But it is still difficult to anticipate what one can expect of ones workforce. One day you can be impressed by what has been completed while you the next day can be surprised by why things were not done differently.

The fastest and best way to gain success in China, is to bring a star with you from home and then buy the water carriers out here. Also I try to hold on to my Chinese

employees for longer than usual here in China where it is normal to change jobs often. Gradually your water carriers then become stars.

The positions I wish to occupy are advertised on Chinese online job portals. After a year or two of in-house training the employees have the set of qualifications I need.

Since Onesail's establishment it has been a demand that all of my employees should be able to speak English. This is a criteria which can be difficult to fulfil in China especially for hardware/electronic engineers. Within software engineering the workforce seems to be more linguistically orientated.

Organisational Culture:

What characterises Onesail is that we are a learning organisation. We have a strong focus on development and if we don't know how to do something we strive toward learning how to do it. I really try to implement this spirit among my employees.

Suppliers and sub-contractors:

The way in which we find the right suppliers is simply by giving them a try. In addition you must be willing to enter compromise –the smaller suppliers can deliver quickly but often with a doubtful and fluctuating quality while the larger suppliers have a longer delivery time but a more stable level of quality. One must be aware that companies, and thereby suppliers, might come and go fast as they swift their product focus and move factories much more frequently than in Europe.

Development and production in-house:

We moved all PCB assembly in-house in the beginning of 2013. Now we have development and production closely integrated and that gives us a significant competitive advantage. We moved production in-house 4 years ago to produce prototypes quickly and give the engineers hands-on within the production technology. We have gone stepwise from prototyping to small and medium sized batches. Should a customer demand high volume then we collaborate with sub-contractors. In-sourcing in China should happen more often than at home in Denmark. Not because of price but because of control. It's a question of putting quality control into the product design, ensuring that what is made can't go wrong, and then closely control the production.

Small and medium sized series in a low labour cost country:

In the beginning I did not understand why Danish companies didn't come to China to produce small and medium sized batches and thereby take advantage of the low wages. However, I soon came to understand why and part of the answer to this question is that it demands a very large degree of documentation work and

degree of detail (how should the work be done , quality assurance , supplier follow-up , and so on) in order to be able to do anything at all. The prior preparation to produce even a small batch can be rather comprehensive.

I therefore believe that one should standardize and make the product documentation more efficient for new products. In-sourcing has for Onesail been part of the solution as to how we have made production of middle-sized batches work.

What makes Onesail competitive on the Chinese market:

A major competitive advantage is that development and manufacturing is closely integrated. A one-stop-shop! Furthermore we have a very high flow in our stock as we only manufacture what we have developed our self. That ensures same parts are used in multiple products.

Onesail differs from other Chinese companies by using datalog that is on-line available. The test data can be accessed by our customers via the internet. This is not an unknown way of doing things at home in Denmark but rather unknown for suppliers doing small and medium batch in China.

What makes being a "start up from scratch" different from being a larger company in China?

It differs in that it has no support from the parent company on how to handle an area whether it be human resource, financial or in a third area. Additionally when you start off with your own capital it probably influences the scale of financial risks one may choose to run. Large companies can offer financial capital and human resources in difficult times. This sort of assistance, small start-ups, of course not do not have. The positive side is that "being your own" makes you more agile and saves overhead.

As an entrepreneur how is China different to Denmark?

It does not cost an arm and a leg to try and experiment with something new!

In hindsight we should have done this differently:

Seen in hindsight I have not invested enough and that way Onesail has had a very slow organic growth. If the financial crisis had not come the organic growth had been higher.

Through the initial low entry barrier in China, OneSail has been able to build a company from "0" to a business that today serves top 100 companies with R&D and manufacturing. The core competence has been the ability to deliver the full package with both design and manufacturing services.

Conclusion

Through the initial low entry barrier in China, OneSail have been able to build a company from “0” to a business that today serve top 100 companies with R&D and manufacturing. The core competence have been the ability to deliver the full package with both design and manufacturing services.

7.3 RESEARCH GROSS LIST

Separate separate appendix. Available on demand!