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Abstract: The preparatory briefing on China is the result of the collection of relevant cluster information in the country, including business and sector trends, cluster policies and programmes, as well as a cluster mapping. This document is intended to provide an overview of the country's opportunities for European cluster organisations and SMEs.

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1 Objective of the report

The aim of this preparatory briefing is to provide up to date information on the cluster landscape in China in order to support European cluster organisations and their SME members to familiarise with the country and explore its potential for collaboration and market opportunities. More specifically, this briefing paper provides an overview of the country's economy and sectoral trends/strengths where clusters contribute. In addition, it outlines the existing cluster community, the cluster policies, local support to clusters and the cluster programmes - including their historical development and internationalisation activity where they apply.

A complementary report, a discussion paper, is available that provides an overview on the existing EU-China cluster cooperation, present related good practices/success stories and opportunities for future exchange, including recommendations for an EU-China cluster policy dialogue (non-public information).

The content of this report is sourced through desk research and confirmed by relevant Chinese stakeholders.

2 China Economy: focus on sectoral trends

2.1 Overview

China has shifted from a centrally-planned to a market-based economy over the course of the late XX century. As a consequence of the reforms promoted by Deng Xiaoping in 1978, the country has experienced a rapid economic and social development mainly driven by the industry and service sectors¹. In fact, China has become the second largest economy in the world with an annual GDP growth around 7%, which despite showing a gradual deceleration in recent years, continues to be impressive by global standards.

The economy of China is described as an upper middle income economy by the World Bank, yet still considered as a developing country due to the low GDP per capita². The economic growth has brought many challenges that the government tries to address through the 13th Five-Year Plan (2016-2020). In this framework, the focus turns from the economic growth to the implementation of measures to reduce pollution, increase energy efficiency, improve the access to education and healthcare, expand social protection and tackle the inequality.

Currently, China is the EU's largest source of imports and its second largest export market behind the United States (accounting for 9.7% of the total share or €170,136 million). The EU is China's largest trading partner (a share equal to 20.2% or €344,642 million)³. EU imports from China mainly consist of industrial and consumer goods: machinery and equipment, footwear and clothing, furniture and lamps, and toys. EU exports to China mostly correspond to machinery and equipment, motor vehicles, aircraft and chemicals. The foreign direct investment (FDI) was valued at €34.9 billion from China to the EU, and €168.4 billion from the EU to China in 2015⁴.

The EU is experiencing a significant trade deficit with China mainly due to the existing market access barriers in China. These barriers include: a lack of transparency, industrial policies and non-tariff measures that discriminate against foreign companies; strong government intervention in the economy, resulting in a dominant position of state-owned firms; unequal access to subsidies and cheap financing; and poor protection and enforcement of intellectual property rights.

The diplomatic ties between the EU and China were established in 1975 but it was in 2003, with the creation of the EU-China Comprehensive Strategic Partnership, that those bonds deepened and broadened the bilateral cooperation. The most recent guiding document of the Sino-European relationship is based on the EU-China Strategic 2020 Agenda for Cooperation adopted by both regions at their 16th Summit in 2014. The main objectives of the Agenda are grouped under five themes: peace and security, prosperity, sustainable development, and people to people exchanges.

¹ CIA Fact Book: www.cia.gov/library/publications/the-world-factbook/geos/ch.html

² World Databank, <http://data.worldbank.org/country/china>

³ http://trade.ec.europa.eu/doclib/docs/2006/september/tradoc_122530.02.2017.pdf

⁴ <http://ec.europa.eu/trade/policy/countries-and-regions/countries/china>

2.2 Opportunities for Europe – investment, trade and science, technology & innovation cooperation

As one would expect, the EU-China Strategic Partnership was established to create mutual benefits for the EU and China. There are many cooperation opportunities to be exploited between both regions in terms of investment and S&T innovation.

China is one of the world's largest economies and an important trading partner for the EU, having a GDP of €10,628 billion in 2016 (39.8% from industry, 51.6% from services and 8.6% from agriculture⁵) and a GDP per capita income of 7,319€⁶ in 2016. The GDP growth rate was 6.78% in 2017 with a forecasted growth of 6.61% in 2018. According to the Global Competitiveness Index 2017-2018, China ranked 27th (out of 140 countries). Its overall performance has barely moved over the past six years. Due to the rising production costs, an aging population, and diminishing returns on the massive capital investments over the past three decades, China is expected to evolve to a model where productivity gains are generated through innovation and an increase in demand due to domestic consumption rising⁷.

Regarding its trade balance, since 2009, China has positioned itself as the number one exporter in the world and the second largest importer. The EU-China Trade Project (EUCTP) is a trade related technical assistance project between the EU and China that started in 2000. The project activities aim at supporting the Chinese government's trade reform and sustainable development agenda, under the EU-China economic and trade dialogues, to promote fair competition and value for consumers in the EU and in China. The project held 400 individual activities organised within five linked components. All the activities have the objective of supporting China's continued integration into the global trading system⁸.

According to the A.T. Kearney's FDI Confidence Index, China ranked as the 3rd most attractive country for investors (2017). Executives from industrial and service sectors as well as from IT firms all rank China as one of the world's top five markets for FDI⁹. However, according to the World Bank, China stands at 78th in the ranking of 190 economies on the ease of starting a business¹⁰. This is mainly because of the bureaucratic and legal steps that an entrepreneur must take to register a new firm in China. Despite this obstacle, the Chinese government welcomes foreign investment. For instance, in 2014, China attracted an FDI amounting to €109 billion. The large amount of FDI allowed China to increase exports on value-added products, shifting from exports on basic products towards production and assembly of electronic equipment¹¹.

Although China maintains a high economic growth rate, foreign investors could meet potential investment uncertainty. The challenges related to investment climate in China include industrial policy

⁵ www.statista.com/statistics/270325/distribution-of-gross-domestic-product-gdp-across-economic-sectors-in-china

⁶ OECD, <https://data.oecd.org/china>

⁷ www.weforum.org/reports/the-global-competitiveness-report-2016-2017-1

⁸ EUCTP: www.euctp.org/index.php/en/project-background.html

⁹ A.T. Kearney's FDI Confidence Index, www.atkearney.com

¹⁰ https://data.worldbank.org/indicator/IC.BUS.EASE.XQ?name_desc=false

¹¹ China Ficha de Mercado, AICEP Portugal Global, 2013

to protect local state-owned firms, equity caps, lack of IPR protection, transparency and an unreliable legal system.

The EU-China 2020 Strategic Agenda for Cooperation includes key initiatives in the area of trade and investment policy, notably the negotiation of a comprehensive EU-China Investment Agreement. It also includes an EU-China cluster cooperation initiative to strengthen collaboration in strategic fields such as sustainable growth and urbanisation which has not fully materialised until now as bilateral cluster cooperation is taking place primarily through a bottom-up approach under the EU COSME programme. Cluster cooperation is by nature a business win-win approach but high-value activity of strategic potential such as business takeovers in emerging fields, i.e. machines learning and Artificial Intelligence (AI) business development, are being looked at cautiously by the EU. AI is in particular an area where more caution to bottom-up will be exerted by the EU in the future given its defence dual-use and potential massive impact on manufacturing systems in global value-chains.

The EU-China Investment Agreement provides a simpler and more secure legal framework to investors of both sides by ensuring predictable long-term access to EU and Chinese markets. Undoubtedly, it was a big step towards a closer cooperation between the regions. However, the EU is increasingly concerned about the possibility of EU SMEs being taken over in strategic industrial sectors.

Nonetheless, the advantages of the bilateral cooperation seem greater than the problems for EU competitiveness. The establishment of the China IPR SME Helpdesk is just another proof of the willingness to collaborate. The centre supports European businesses that wish to internationalise in China offering help in regard to: existing regulations like the protection concerning intellectual property rights, searching for counterparts, or sales and distribution.

In terms of science and technology (S&T) cooperation, the EU and China are working together in strategic areas to promote research and innovation cooperation: food, agriculture, biotechnology, sustainable urbanisation, aviation and aeronautics, environment and climate, non-nuclear energy, peaceful uses of nuclear energy, information and communication technologies, and space.

The EU and China have signed a number of agreements for scientific, research and innovation cooperation, including:

- The Science and Technology Agreement, under joint responsibility of RTD and the Chinese Ministry of Science and Technology (MoST), constitutes the formal framework for S&T cooperation since its signing in December, 1998.
- During the 3rd EU-China Innovation Cooperation Dialogue held in the scope of the 19th EU-China Summit (June 2017), both regions decided to further boost their research and innovation cooperation with a new package of flagship initiatives targeting the areas of Food, Agriculture and Biotechnologies, Environment and Sustainable Urbanisation, Surface Transport, Safer and Greener aviation, and Biotechnologies for Environment and Human Health.

- In addition to an Administrative Arrangement renewing the Co-Funding Mechanism for the period 2018-2020 to support collaborative research and innovation projects, both sides agreed to exchange best practices and promote the principle of reciprocity in access to publications, research data, and science/technology and innovation resources.
- The EURATOM-China Agreement for R&D Cooperation in the Peaceful Uses of Nuclear Energy (R&D-PUNE Agreement) was signed in April 2008. It was implemented by a joint steering committee co-chaired by the DG Research and Innovation representing EURATOM and MoST.

MoST has cooperated with the European Commission Directorate General (DG) for Research and Innovation and established a new co-funding mechanism for research and innovation cooperation. The co-funding mechanism (CFM) is being implemented by both the EU and China from 2016 to 2020.

In order to benefit from joint projects with European partners within Horizon 2020, the Chinese-based entities are providing ¥200 million (€28.57 million) per year. Similarly, to promote the participation of European organisations in joint projects with Chinese partners, the European Commission (EC) is providing more than €100 million per year. Aiming at supporting joint research activities and innovation activities, the co-funding mechanism is focused on key areas of common interest and mutual benefits, including: food, agriculture, biotechnology, and green transport¹².

Key EU-China projects in the S&T field resulting from the aforementioned partnerships are indicated in the Annex¹³.

2.3 Sectoral strengths

In the scope of the 13th Five Year Plan, six strategic emerging industries have been identified in the fields of aerospace, oceanography, information networks, life sciences and nuclear technology:

- Biotechnology
- Next generation information industries
- Intelligent perception of spatial information networks
- Energy storage and distributed energy
- Advanced materials
- New-energy vehicles (NEVs)

Due to its synergies with the EC strategy and the cluster community, the fields that seem to offer more potential for cooperation between the EU and China among the emerging industries listed above are: automotive; biotechnology; renewable energy; and information, communication and technology (ICT).

¹² <http://ec.europa.eu/research/index.cfm?pg=newsalert&year=2015&na=na-070915>

¹³ The Annex contains information about relevant organisations, selected projects and clusters.

2.3.1 Automotive

China is the world's largest car market with 28.8 million vehicles sold in the country in 2017, according to data collected by the China Association of Automobile Manufacturers (CAAM)¹⁴. About 80% of the automobiles were passenger cars, the majority of which were produced in China through wholly owned Chinese manufacturers or Joint Ventures (JV) with leading western automotive manufacturers¹⁵. Moreover, 30 million domestic cars are forecast to be sold annually by 2020.

There is a strong demand in the automotive market from the second and third tier cities. However, these cities have a lower penetration rate and are more price sensitive as proved in 2015, when Chinese consumers forced the international and local car companies to cut prices. However, the declining retail price will increase the willingness of Chinese consumers to buy a car in the near future.

In addition, some of the market potential has been identified such as low carbon vehicle technology, including electric vehicles, and especially new energy vehicles (NEVs), which are expected to reach five million by 2020. In order to promote the production and sales of NEVs, China has implemented various measures and policies, such as subsidies for car purchases, tax exemptions, and a requirement for government departments to buy more new energy cars, i.e. urban public transport and taxi services¹⁶. As a result, sales of NEVs rose 56.8% to 163,000 vehicles in 2017.

The 13th FYP also encourages the development of all-electric vehicles and hybrid electric vehicles with a focus on making advancements in key technological areas, such as: battery energy density and battery temperature adaptability; the development of a network of charging facilities and services that are compatible with each other and come under unified standards; as well as strengthen efforts to recover and dispose of used batteries from NEVs.

The eco-friendly transportation is also key in environmental terms. In this regard, it is important to note that the central government will prioritise the development of public transportation, encourage people to use eco-friendly transportation and support the development of online vehicle booking and other forms of customized transportation services. As a consequence, there are several transportation projects that could be utilised by the automotive sector and related fields to harness this potential.

2.3.2 Biotechnology for human health

China is the second largest pharmaceutical market in the world, forecasted to grow from \$108 billion (€98.8 billion)¹⁷ in 2015 to \$167 billion (€139 billion)¹⁸ by 2020, representing an annual growth rate of 9.1%¹⁹. According to the Chinese State Council, pharmaceuticals are identified as one of the seven

¹⁴ www.reuters.com/article/china-autos-sales/china-dec-vehicle-sales-up-0-1-pct-y-y-industry-association-idUSB9N1DG014

¹⁵ www.gov.uk/government/publications/exporting-to-china/exporting-to-china#opportunities-for-uk-businesses-in-china

¹⁶ Forbes, March 2016. www.forbes.com/sites/jackperkowski/2016/03/04/chinas-auto-industry-alive-and-well/#5301aa8c48e2

¹⁷ Oanda, USD 1 = 0,92 EUR, 31 December 2015

¹⁸ Oanda, USD 1 = 0,83 EUR, 2nd of May 2018

¹⁹ www.trade.gov/topmarkets/pdf/Pharmaceuticals_China.pdf

strategic industries. In accordance with the 12th Five-Year Plan, China spent ¥20 billion (€2.57 billion)²⁰ on innovative medicine, cultivation of new varieties of genetically modified organisms and on the prevention and control of viral hepatitis and other infectious diseases²¹. China's Minister of Health has pledged the country will spend an additional €10 billion to advance biotech innovation from 2015 to 2020.

China's government has been investing in innovative new drug development over recent years. It has spent ¥20 billion on innovative medicine from 2011 to 2015. Now, there are more multinationals partnering with domestic pharmaceutical companies in R&D trading technology transfer in China. Within the 12th FYP period, 30 innovative drugs, 150 diagnostic reagents and 40 new biological drugs were developed, and 10 clinical trials of new drugs were initiated.

The 13th FYP describes the general guidelines and some concrete projects in the Chinese health sector for the period 2016-2020. According to the FYP, the central government will improve the quality of medical services offered by the public healthcare following the principles of disease prevention and treatment more efficiently and in an equitable way for all citizens.

To achieve these objectives, a comprehensive reform of all public hospitals will take place so that they are enabled to serve society without having to make a profit. Some of the initiatives consist in: establishing modern hospital management systems; allowing public hospitals to act as independent legal persons; and establishing staffing and remuneration systems suited to the industry. Non-governmental actors will be invited to provide healthcare services and non-profit private hospitals will enjoy an equal treatment to public hospitals. Furthermore, the government will push for a better quality of the healthcare and the work environment for practitioners through the implementation of mechanisms such as the mediation in disputes between them and patients to facilitate more amicable relations.

As of 2016, China had over 28,500 hospitals with revenues estimated at ¥2,701 billion (€369.8 billion) due to the influx of social capital in the medical industry triggered by the reform. This resulted in an upsurge in the number of private hospitals that account for 55.3% of the total infrastructure and less than 10% of the gains. Nonetheless, the situation is expected to turn around in the forthcoming years so that by 2020 there are 20,262 private hospitals registered with revenues that reach ¥639.6 billion.

As a matter of fact, more than 65% of the specialised hospitals are private. They require low investment but spark higher return, as shown by their figures: 20% growth rate and revenues that exceed ¥300 billion. Among specialised hospitals, ophthalmic, stomachic, orthopaedics and beauty hospitals enjoy the highest profitability, with a profit margin of above 10%²².

Major diseases will receive special attention. In this respect, the government will implement a strategy for the effective prevention and control of chronic diseases such as cardiovascular, brain, and vascular

²⁰ Oanda, 1 CYN=0.14099 EUR, 31st December 2015

²¹ EU SME Centre: The Healthcare Sector in China, 2014

²² China Hospital Industry Report (2016-2020), www.researchandmarkets.com/research/6f3csg/china_hospital

diseases as well as diabetes, malignant tumours, respiratory diseases, and mental illness. The maternal and infant healthcare, including pregnant, postnatal and childbirth care, also occupies a prominent place. The prevention and control of major communicable diseases such as HIV, hepatitis B or tuberculosis will be reinforced; while schistosomiasis, malaria and leprosy are to be eradicated.

Health education will have a significant role to spread awareness on nutrition and physical exercise. Non-governmental initiatives will be encouraged to develop the sports industry. Moreover, smoking will be prohibited in public places and food safety promoted. Additionally, the country will develop family planning services.

The medical services will be optimized to better ensure cooperation, coordination, and complementarity between institutions at different levels. Some initiatives are based on smart healthcare, for example using electronic health records, integrating functions and innovations in services, building the capacity of general practitioners or developing telemedicine. The traditional Chinese medicine (TCM) healthcare service system will be developed by new models, raising capacity for providing community-level services, strengthening TCM clinical research centres and research institutions and creating a database and knowledgebase of ancient writings on TCM.

China is one of the largest medical device markets in the world. The sales of these products have increased rapidly in recent years, reaching a value around €50.89 billion in 2016, an increase of 20.1% compared to 2015. Roughly 73% of this growth is fuelled by hospital procurements²³. According to some studies, the industry is expected to continue its growth tendency supported by the government policy, which encourages investment in R&D.

Thus, there are many opportunities for foreign medical products that can profit from new distribution channels such as the e-commerce, but the competition will gradually increase. In particular, the sub-sectors with the most optimistic projections are: in-vitro diagnostic equipment, implantable and intervention materials, artificial organs, therapeutic products, medical diagnostic and imaging equipment, surgical and emergency appliances, healthcare information technology related equipment, and medical equipment parts and accessories²⁴.

2.3.3 Renewable Energy

China is a world leader in the renewable energy sector, in terms of power generation and energy capacity. In fact, the country has a variety of renewable energy resources with rich reserves yet a high dependency on contaminating energy sources such as coal and petrol that are causing serious problems in the environment and public health. Nonetheless, in order to curb the effects of pollution and turn

²³ www.export.gov/article?id=China-Medical-Devices

²⁴ Source: Flanders Investment and Trade "The Medical Device Market in China", December 2016
www.flandersinvestmentandtrade.com/export/sites/trade/files/market_studies/2016%20-%20Market%20Study%20-%20the%20Chinese%20medical%20device%20market%20_0.pdf

into a more sustainable development, the central government has released several measures with positive outcomes²⁵.

To sustain the so-called “Chinese Green Growth”, the 13th FYP sets several objectives intended to promote the green improvement and upgrade the traditional manufacturing industries through the introduction of new materials and technologies. By 2020, it is expected that the benefit of environmental industry will reach 5% of the national GDP and investments in environmental pollution control will account up to 3% of GDP.

The energy sector is rather regulated by the government, making it difficult for European SMEs to find business opportunities. The establishment of partnerships with Chinese companies constitutes the best route to enter the market since they have realised the importance of introducing engineering solutions. In exchange for know-how, European SMEs that are ahead in R&D and new technologies will be able to access the Chinese market.

In this context, a major emphasis is on clean technology for reducing the use of water and increasing energy efficiency in the industrial sector. One of the key areas in the 13th FYP is water conservation since 70% of the rivers’ water is polluted as well as about 60% of the country’s groundwater. The capital expenditure on industrial water and wastewater treatment in China is set to increase by nearly 25% over the next five years, reaching €5.7 billion in 2020.

Both, the solar and wind markets have a high interest in the European know-how. China hopes to increase its solar capacity to 100 GW by the end of 2020. The Chinese photovoltaic industry is the largest market worldwide and the central government is pushing to support solar distributed generation (DG). The building-integrated photovoltaics and rooftop solar PV are receiving great attention, making it easier for European SMEs to gain market share.

The National Development and Reform Commission (NDRC) began providing generous financial incentives for solar equipment manufacturers in 2012, which led to a boom in large-scale solar projects. By the end of 2016, total PV capacity had increased to over 77.4 GW, but the expected contribution to the total electric energy production remains modest. In spite of this, the interest in building integrated photovoltaics and rooftop solar PV together with the efforts of the government to go greener, make it easier for European SMEs to gain market share.

Regarding the wind industry, in 2017 the country ranked first in new installed capacity with the addition of 19.7 MW wind power generation, totalling a cumulative installed capacity of 188.4 MW. China currently takes up 35% of the global sum and the total wind power energy technically exploitable is estimated to be 1400 GW onshore and 600 GW offshore by the United Nations Environment Programme (UNEP)²⁶. However, the obstacles for building an effective grid that allows to fully use the energy generated is a problem yet to be solved.

²⁵ EU SME Centre: The Green Tech Market in China, 2014.

²⁶ Global Wind Energy Council (GWEC), <http://gwec.net/global-figures/graphs/>

The biogas-biomass sectors as well as the waste to energy/heating sectors are worth mentioning too. Waste to energy can provide significant opportunities for European SMEs through helping Chinese companies to acquire better technology and equipment. Moreover, China is investing in nuclear energy, which is expected to reach 150 GW by 2030, relying on international cooperation for transferring technology²⁷.

Under the renewable energy high penetration scenario, by 2050 China's end-use energy consumption is forecasted to be 3.2 billion Tonnes Coal Equivalent (TCE) and electricity will account for 62%²⁸. According to the China National Renewable Energy Centre, the programme “Boosting Renewable Energy as part of China’s energy system revolution” aims at maximising renewable energy reserves, enabling China to implement international best-practice solutions for the transformation of the Chinese energy system. The programme is funded by the London based charity, the Children’s Investment Fund Foundation, as part of its climate mitigation activities²⁹.

2.3.4 Information Communication and Technology (ICT)

According to International Data Corporation (IDC) research, China will become the world leader by 2025 in several areas, including manufacturing added value, scale of online shopping and scale of the middle-class. This indicates that more industries, including Internet of Things (IoT), big data, cloud services, mobility and consumer IT products will be the main drivers of the Chinese ICT market growth. Over 80% of organisations in China will have become technological organisations, and each Chinese consumer will have five digital smart devices on average by 2025³⁰.

To achieve the objectives abovementioned, the strategy “Made in China 2025” provides a series of incentives and specific plans for many sectors including education, agriculture, software and information services, manufacturing, forest management, and land resources, to cope with the country’s deteriorating competitive strength due to the lack of innovation or the rising labour costs, among other factors. The main goal is to stimulate and restructure the industry to move from quantity to a quality and efficiency principle in production, so that the country becomes a leader in technology at an international scale³¹.

The strategy prioritises aspects such as the production of domestic-origin parts, growing usage of local content and own brands. It also emphasizes the expansion of the R&D Chinese capacity since core design centres for products the country manufactures usually remain based in developed countries. In the strategy, China outlines 40 new R&D centres to be deployed in order to boost innovations in the manufacturing sector. Finally, China will build a digitalised production structure with the aim to keep

²⁷ Webinar- “Tapping into China’s Green Tech Market: Business Opportunities and Challenges for SMEs” (February 2017)
www.eusmecentre.org.cn

²⁸ China 2050 High Renewable Energy Penetration Scenario and Roadmap Study
www.cnrec.org.cn/english/publication/2014-12-29-463.html

²⁹ www.chinadaily.com.cn/business/tech/2015-11/13/content_22450012.htm

³¹ Gómez Pérez-Cuadrado, E., Oficina Económica y Comercial de España en Pekín (2016) “Plan Made in China 2025”-
www.icex.es

foreign companies in the country, as labour costs would play a lesser role, and they would retain local production facilities in order to achieve overall costs efficiency, promoted by the Industry 4.0.

The Chinese strategy includes prioritisation of domestic products, which is causing some second thoughts among foreign investors that may eventually impact FDI. For instance, the European Union Chamber of Commerce in China already expressed its concerns. Even more important, the strategy might hurt the economy on the short term as it removes low value-added operations, where a significant part of the population is employed.

Finally, data protection, cyber security, net neutrality and related topics will have to be resolved in China, if it is to implement Industry 4.0. The 4.0 industrial revolution includes massive amounts of data, which buyers, suppliers, manufacturers, logistics service providers and others agree to share in order to achieve high efficiency. However, the country manages this poorly and lags in most ratings regarding areas like cloud computing readiness.

Aware of its importance to maintain its leading position, China has prompted the implementation of measures to overcome the current situation and adopt the key technologies abovementioned, especially concerning AI and data mining. The aim is to achieve a leading role if not outright supremacy by 2030. For this purpose, a State Council document issued in July 2017, states it is a priority to position China as the world's foremost practitioner of AI in both research and application within the next 12 years. No other country has elaborated such a concrete strategy and enjoys such a favourable environment for a rapid development.

Among the favourable conditions, the enormous amount of data, the lack of social discussion concerning the use of that data, both due to the acquaintance of the government and the society's preference of convenience and security over privacy, as well as the talent pool are to be highlighted. The size and homogeneity of the market, the economic support and the eagerness of the citizens to adopt new technologies are also important advantages³².

Thus, the nation is betting heavily on AI. Money is pouring in from Chinese investors, big internet companies and the government, driven by a belief that the technology can rebuild entire sectors of the economy, as well as further ensure national security, where China hopes to achieve a bigger integration of civilian, academic and military development of AI.

With respect to IoT, China is the largest machine-to-machine (M2M) market in the world. It is expected that by 2020 the country will have more than 336 million M2M connections across multiple sectors. The M2M devices will provide Chinese organisations with real-time information to support their decision making, thus increasing the efficiency levels, lowering costs and improving infrastructure management. The most impacted sectors are transportation (cut on costs and delays), energy (manage energy supply), retail (improved customer service), consumer goods (smart goods) and agriculture (food safety and origin tracking).

³² www.wired.co.uk/article/why-china-will-win-the-global-battle-for-ai-dominance

The most important government agencies in China with respect to ICT policy are the National Development and Reform Commission (NDRC), the Ministry of Industry and Information Technology (MIIT), and the Ministry of Science and Technology (MOST). NDRC leads in the development of plans and public investment. MIIT is responsible for the policy and operational action in the ICT industry, while MoST supports R&D³³.

³³ Atkinson, R.D., (July, 2014) "ICT Innovation Policy in China: A Review"

3 Cluster community in China

3.1. Cluster mapping

China is home to an important cluster community since the Reform & Open-door policy in the 1980s. At the same time, China established special economic zones and since then has also developed many important science parks. Local industrial agglomerations are frequently adopted as development tools in China, driving growth in wide areas. Therefore, this framework makes it necessary to distinguish between special economic zones (SEZs), science parks and industrial clusters.

According to the World Bank, SEZs are defined as geographically delimited areas with a single management or administration and a separate customs area (often duty free), where streamlined business procedures are applied and where firms physically located within the zone are eligible for certain benefits. These benefits include access to better infrastructure and services, as well as laws and regulations that are more market friendly.

In contrast, science parks are agglomerations of physical infrastructures in the high-technological domain. Physical and functional components such as specific knowledge, services and financial providers, are combined creating new business opportunities and adding value to mature companies, fostering entrepreneurship, incubating new innovative companies, generating knowledge-based jobs, and building attractive spaces for knowledge workers.

Clusters are geographic concentrations of interconnected companies and institutions in a particular field that can generate second-best market solutions conditioning the regional development paths. For example, the disaggregation into many steps of an integrated production process so that a large number of SMEs intervene in the production, has been one of the key features of the industrial clusters to become the most important drivers of the country's rapid development.

Other distinctive features are that SEZs operate in more technology and capital-intensive sectors and enjoy greater government support, more FDI, and stronger links to the global market. Clusters, instead, operate in low technology and labour-intensive industries but have an industrial specialization that SEZs and sciences parks do not have. Moreover, clusters' development is not necessarily related to an urban one as in the case of science parks. There is no physical infrastructure qualifying an industrial cluster, and they do not follow any technology or fiscal-driven development trajectory.

Finally, SEZs and science parks are top-down industrial policy initiatives driven by the central government, designed and implemented in order to achieve broad development goals. On one hand, SEZs are mainly aimed at attracting FDI creating new industrial and employment opportunities, but they can also generate indirect benefits such as upgrading the skills of the workforce and management, technology transfer, export diversification that enhances the trade efficiency of the domestic firms, and knowledge of international markets. On the other hand, science parks are created for developing local capacity for innovation and for creating employment. Nevertheless, industrial clusters are generally considered a bottom-up process where the intervention of local and central institutions take place in

order to support growth, to increase productivity and to help firms in specific and strategic issues like the skill-upgrade of the workforce, R&D activities, and market access. However, policy interventions often occur only after a cluster has been formed³⁴.

SEZs, science parks and clusters offer a wide range of opportunities for European businesses. All three have great potential for bilateral cluster cooperation, however, some barriers are also present. The clusters make the best choice to enter the Chinese market due to market demand that drives their creation and development, but their focus on low technology and labour-intensive industries may not fit the EU innovation agenda. Both the SEZ and science parks provide a very innovative and high-tech ecosystem driven by FDI, government policy and incentives, yet the political control is higher. The EU clusters must opt between high-tech but policy dependent partners (SEZs and science parks) or more cooperation oriented but low-tech partners (clusters).

SEZs, science parks and clusters offer a wide range of opportunities for European businesses. However, the nature of the Chinese clusters and the huge market demand that drive their creation and development (bottom-up policy) make them the best choice to enter the Chinese market. The SEZs and science parks have opportunities for European businesses; nevertheless, the political control and political influences in these environments can overshadow the potential benefits provided to European businesses.

The major sectors of the Chinese clusters are: agriculture, high-tech industry, and manufacturing³⁵. As stated by the OECD, the clusters development in China are characterised by the promotion of network structures, service support for entrepreneurs, and cluster co-ordination³⁶.

The clusters are mainly located in the Eastern area of the country and their concentration grows, moving towards Southeast. The biggest agglomerations of clusters are mainly located in the Pearl River Delta (PRD), Yangtze River Delta (YRD) and Bohai Rim (Beijing-Tianjin-Liaoning) regions, where the GDP per capita is generally higher than the national average (Figure 1). Following the “Go West” policy that aims at favouring the development of the central provinces of China, some clusters are also developing in these areas.

³⁴ Fratini, F., Proni, G., “Industrial clusters in China: Policy tools for further and more balanced development”
<http://revel.unice.fr/eriep/?id=3476>

³⁵ European Cluster Collaboration Platform: www.clustercollaboration.eu/international-cooperation/china

³⁶ OECD: www.oecd.org/sti/outlook/e-outlook/stipolicyprofiles/interactionsforinnovation/clusterpolicyandsmartspecialisation.htm



FIGURE 1 - MAP OF THE THREE MAIN CLUSTER REGIONS³⁷

The Pearl River Delta (PRD) is the first economic zone in China since the economic reform was launched in the 1980s. During the last decades, it has become one of the fastest growing regions in the country with an average annual GDP growth rate over 11%. Located in the Guangdong province, the PRD is specialised in the production of electronic goods, electrical products, electrical and electronic components, watches and clocks, toys, garments and textiles, plastic products, and a range of other goods. In many sectors, the region sets cost and price standards globally and its manufacturing base is also deepening and diversifying into the automotive, chemical, advanced materials and environmental technologies sectors.

Per capita incomes and consumer spending in the PRD region have grown rapidly in recent years and cities like Shenzhen, Guangzhou, and Foshan are among the wealthiest in the Chinese Mainland. The region (with 108,500,000 inhabitants) is considered an evolving megalopolis due to its rapid urbanisation that have created demand for infrastructure, building materials, food, entertainment and leisure, transportation services, housing, and a variety of other goods and services.

The European clusters offer quality services and products, which meet the needs of the rising middle class associated with urban development. The wide range of opportunities can be summarised in the following fields: export-oriented production facilities in traditional and in higher value-added and higher technology industries (such as automobiles, auto parts, advanced materials, and chemicals); the increase in residential, industrial, and infrastructure construction has created opportunities in materials, construction equipment, transportation equipment, telecommunications equipment, and in related services such as construction, design, architecture, engineering, and financial services; and increasing concern for the environment has made the region an interesting market for environmental, pollution-

³⁷ Source: www.wedoimport.com

control, and clean technologies and financial and business services. Of course, the special role of Hong Kong is not to forget³⁸.

The Yangtze River Delta (YRD) is one of the largest and most sophisticated consumer markets in China. In fact, the region accounts for 20% of the national GDP and is responsible for one third of its imports and exports. The YRD cluster is mainly formed by local industrial parks focused on heavy industries such as machinery, chemicals and other upstream industries such as the production of raw materials, intermediate goods and capital goods including electronic parts, textile and chemical fibre. For example, parks in Suzhou and Ningbo serve the market around Shanghai, mainland China's financial and logistics centre, and have developed many market-oriented and competitive clusters such as: chemicals in Jinshan; electric wires and cables, environmental protection equipment in Wuxi; IT, circuit board, apparel, silk textile in Suzhou; eyewear in Zhenjiang; ship building, energy equipment in Taizhou; and moulds, household electronic appliances, stationery in Ningbo³⁹.

The high income level in the YRD, combined with a large inflow of tourists, resulted in strong consumer demand whose pattern is gradually moving towards services. The relative share of urban household expenditure on items like transportation and communications, education, cultural and recreation services have increased. The trend for rising expenditure on new types of durable goods, such as cars and computers, is also noticeable⁴⁰. As a consequence, European clusters could find a niche in the efforts of the region to boost the quality of urban development (infrastructures, transport, smart cities or environmental services) and the quality of living.

The higher local purchasing power and the new lifestyle associated to it, has changed the consumption patterns with more sophisticated costumers. For example, many shops in smaller county-level cities focus on mid-range brands and special design products to cater to middle-class consumers looking for mid-range, fashionable and high-quality products; while avoiding the intense price competition from online shopping websites. Meanwhile, some county-level cities advocate leisure pastimes, and their consumption is more focused on lifestyle and leisure experiences.

The rising concerns about healthcare are another important factor since they have resulted in increased spending in medical, wellness and healthcare services, especially among the middle and upper classes. For example, in addition to improving basic retirement and healthcare systems, Jiangsu is also developing the high-end services market by combining the elements of wellness, medical services and recreation, in order to meet the demand from the middle class for services catering to their physical and mental wellbeing, as well as a balanced lifestyle⁴¹.

Finally, the Bohai Rim covers Beijing, Tianjin, part of Hebei, part of Liaoning and part of Shandong. The Bohai Rim is rising as the Northern economic powerhouse. The region has consumers with relatively

³⁸ www.ucer.camcom.it/Internazionalizzazione/news/pdf-2012/GPRDReport.pdf

³⁹ Business and economic distribution and clusters, ActiveUKChina, last accessed in November 2016

⁴⁰ <http://info.hktdc.com/mktprof/china/yrtd.htm>

⁴¹ <http://economists-pick-research.hktdc.com/business-news/article/Research-Articles/New-Style-Urbanisation-in-Yangtze-River-Delta-Boosts-Service-Sector-Demand/rp/en/1/1X000000/1X0A1H2J.htm>

high purchasing power, especially those in Beijing, which has been the traditional backbone for companies to lobby with government agencies and policy makers. Among the industrial clusters in the Bohai Rim, traditionally involved in heavy industries and manufacturing, the most competitive ones include: aviation, logistics and shipping in Tianjin; insulation materials and metal casting in Cangzhou; furniture in Langfang; petrochemical, educational and R&D industries in Beijing; fasteners in Handan; and high-end pharmaceutical industry in Shijiazhuang⁴². The area is becoming a significant growth cluster for the automobile, electronics, petrochemical sectors.

In addition, the central government has prioritised the integration of all the cities in the Bohai Rim and the economic development of the region, including the construction of an advanced communications network, better highways, expanded education and scientific activities as well as exploiting natural resources such as the petroleum and natural gas deposits discovered.

Most clusters are not represented by a formal cluster organisation, but some belong to relevant associations in their specific sector (see Table 1). No Chinese cluster organisations are registered on the ECCP. However, the Chinese Pharmaceutical Manufacture and Development Association (CPMDA) and the Chinese National Federation of Industries (CNFI) are registered in Taiwan.

⁴² Overview of China's Regional Development 2010 Part I: Three major city clusters, Li & Fung Research Centre, December 2010, last accessed in October 2012

TABLE 1 - SAMPLE OF CLUSTER ORGANISATIONS BY SECTOR

SECTOR	ORGANISATION	WEBSITE
Agriculture	Yangling Agricultural Demonstration Zone	www.ylagri.gov.cn
	China Agricultural Association for International Exchange	www.cicos.agri.gov.cn/sites/caaie
Automotive	China Automotive Technology & Research Centre (CATARC)	www.catarc.ac.cn/ac/index.html
	The National Engineering Laboratory for Electric Vehicles (NELEV)	http://english.bit.edu.cn/Research/scientificResearch/95179.htm
High-tech	Zhongguancun Science Park	www.zpark.com.cn
	Shanghai Zhangjiang High-tech Park	www.zhangjiang.net
	Beijing Municipal Science & Technology Commission	www.bjkw.gov.cn
Biotechnology	China Medicinal Biotech Association	www.cmba.org.cn
	Chinese Society of Biotechnology	www.biotechchina.org
Renewable Energy	China Renewable Energy Society	www.cres.org.cn/index.html
	Chinese Renewable Energy Industries Association	www.creia.net/CreiaEn.html

3.2. Clusters in Automotive, Biotechnology, Renewable Energy and ICT

As mentioned in Section 2.3 Sectoral strengths, Chinese clusters in the automotive, biotechnology, energy, especially renewable energy and ICT sectors are considered among the most interesting for the European Union. This section analyses some clusters supported by formal organisations.

Automotive clusters

Guangzhou Huadu Automobile City

Guangdong is not only a major automotive manufacturing base, but it also has the largest automotive owner ratio, with possession of civil vehicles hitting 4.29 million units in 2006, accounting for 11.6% of the country's total possession of civil vehicles. The province's new registration of civil vehicles and possession of private vehicles were also ranked first in China.

There are three large Japanese car manufacturers in Guangzhou: Honda, Nissan and Toyota. It is the local government that manages the industrial zones, promotes joint ventures between state-owned enterprises and foreign investors as well as joint ventures between Guangzhou Automobile and foreign investors such as Honda, Nissan, and Toyota. To illustrate the importance of the local authorities, Guangzhou municipality built the infrastructures and conditions of the industrial zone and then invited Honda to locate there, gradually attracting suppliers related to the firm and other anchor companies

www.clustercollaboration.eu

creating a “snow-ball” effect. Moreover, it plays an active role solving capacity problems, providing human resources and even dealing with Japanese-Chinese translation issues.

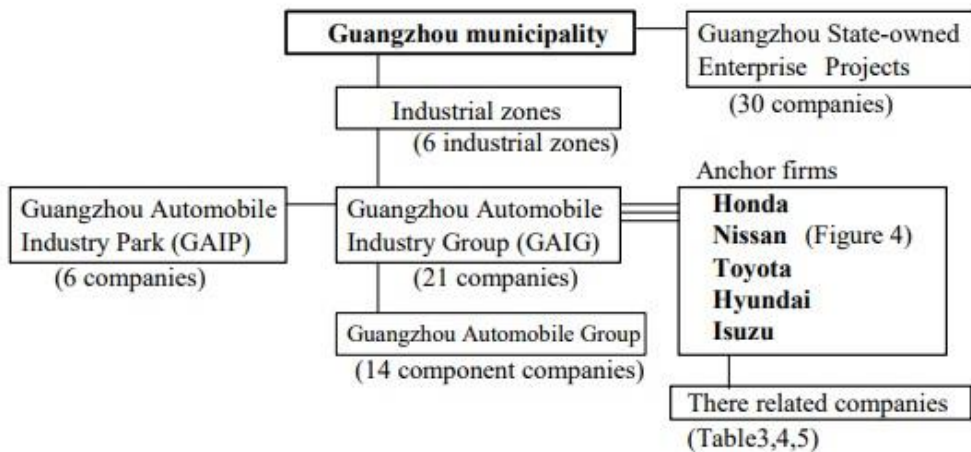


FIGURE 2 - GUANGZHOU MUNICIPALITY'S CLUSTER POLICY (SOURCE: AKIFUMI, K.)

In this respect, the Guangzhou Municipality has positioned the Guangzhou Automobile Industry Group (GAIG) at the centre of the industrial cluster promoting joint ventures between GAIG and Honda, Honda and Dongfeng Automobile, Toyota and Hyundai. The automotive centres include: the Guangzhou Development Zone, which is an assembly producing area with about 70 foreign parts suppliers settled there and with a total investment of one billion USD, out of which 30% are Japanese companies that provide parts for Guangzhou Honda; and Huadu Automobile City that integrates a modern production base, which combines automotive manufacturing with auto R&D, auto parts production, auto trade services, auto logistics, auto fair, auto science, technology and IT services, auto culture and tourism and the Nansha Development Zone⁴³.

The automobile cluster in Guangzhou City is expanding not only to the nearby cities of Foshan and Shunde, but also to Dongguan, and now covers almost the entire Guangdong Province in southern China. The Sumitomo Corporation is planning to link its industrial zone in Hanoi, Vietnam, to the automobile cluster in Guangzhou City through logistics.

Chongqing automobile cluster

According to city government statistics from 2006, Chongqing's automobile industry (including vehicles and parts) produced a value of ¥ 133.1 billion, an increase of 35% compared to the same period in the previous year and a value accounting for 31.7% of the city's total GDP. In addition to the increasing production, the government has also put in place incentives which are encouraging producers to enhance research and development of new technology, particularly in the areas of clean energy and

⁴³ www.conquer-china.com/chinas-automotive-clusters

energy efficient vehicles. The overall goal is to attain an industry that can rely 80% on domestically developed technology⁴³.

In the automotive sector, there are a number of areas around the city which have become home to important industry clusters: the Dezu and Hechuan districts integrate automobile production, R&D, trade and tourism functions; Jiulong Industrial Park and Shapingba District present a dominant number of auto part and component suppliers; and Ba’Nan District and ChaYuan New Area are home to Suzuki and have recently attracted a growing number of parts suppliers.

As per requirements of the Chongqing Municipality, Chang’an Kuayue Automobile will organize a Chongqing Automobile Industrial Cluster with production scale of 300,000 light vehicles to boost industry and economic development of the Three Gorges reservoir area. Multiple automobile parts (or assembly) manufacturers of motor, axle, compartment, seat, glass, plastic, inner decoration and car frame have been settled in Wanzhou Tianzi Park formally initiating an industrial cluster⁴⁴.

In the Dazu district, three major traditional industries (automobile & parts, equipment and hardware) continue to play a key role, accumulating 41.65 billion industrial outputs, accounting for 80.1% of the gross value, and contributed nearly 80% of industrial growth, especially the automobile & parts. Up to June 2015, the Dazu district has formed an automobile and motorcycle cluster of 412 companies. It will develop a heavy vehicle industry, and increase the expansion of the automobile and motorcycle parts industry. Convenient transportation is considered as the most important factor for settling in the Dazu district.

Biotechnology clusters

Shanghai Zhangjiang Hi-Tech Park

Zhangjiang Hi-Tech Park was established in 1992 and is one of China's first state-level high-tech zones approved by the State Council as well as the core park of Zhangjiang National Innovation Demonstration Zone. Shanghai’s Zhangjiang Park states that the majority of resident biotech organisations are concentrating on R&D activities of some sort (Zhangjiang Hi-Tech Park 2009). This division of labour is reinforced by the strategies of those cities. Based on the initial spin-off activities from universities (and public research institutes), university parks were set up to provide such fledgling firms with a range of services. Furthermore, potential entrepreneurs are lured to the city to start innovative projects.

Tonghua Pharmaceutical Cluster

The pharmaceutical cluster is located in Tonghua, Jilin province. It has been selected as the Chinese Herbal Medicine Demonstration Base under the “National Torch Program”, the National Biological Industry Base, and one of the first batch National Biopharmaceutical Industry Bases for export innovation. As of 2011, there were about 95 pharmaceutical enterprises in the cluster, but most of them were private SMEs and no leading firms have emerged. The Tonghua cluster has a large amount of plant

⁴⁴ www.kuayuegroup.com

bases for Chinese herbals, all of which have the good agriculture practices (GAP) certification. In addition, the cluster also has 26 R&D institutions and 34 medical wholesale enterprises. The pharmaceutical enterprises in the cluster cover almost the whole industrial chain of traditional Chinese medicine (TCM)⁴⁵.

There is a strong networking among companies within the cluster, from herb planting, processing, to manufacturing and they have invested greatly to build networks with many sales companies outside the cluster. Since Tonghua City implemented the strategy of "China Pharmaceutical City", the pharmaceutical industry has gathered a number of high-tech pharmaceutical companies with an important influence in the industry, such as Jilin Xiuzheng Pharmaceutical, Tonghua Dongbao Pharmaceutical and Tonghua Wantong Pharmaceutical.

Renewable energy clusters

Wuhan East Lake High-tech Zone

Wuhan East Lake High-tech Zone was established in 1988 when the State Council approved the first batch of high-tech industrial development zones. The zone was initially launched the "Optics Valley of China", which is the largest optical fibre and cable manufacturing base in China. The zone represents the highest development level in China in optical communications, laser, renewable energy and environmental protection. The industrial strengths of the zone focus on photoelectric information, bio medicine, new energy, and energy saving (solar, wind, biomass and nuclear energy). One of the parks in the zone, named Wuhan Future Science and Technology Town focuses on photonics, energy, environmental protection, high-end equipment manufacturing and other strategic emerging industries and high-tech services. The park also hosts well-known private technology enterprises, research institutes, and universities. The park had 21 contracted projects representing ¥24.564 billion of contracted investment from Deutsche Telekom AG, Huawei, China Mobile, China Telecom, National Power Grid and another 5 Fortune 500 enterprises⁴⁶.

Information Technology and Communication (ICT) clusters

Zhongguancun Science Park

In 1988, the State Council approved the establishment of the Beijing New Technology Industrial Development Trial Zone (predecessor of the Zhongguancun Science and Technology Park). Thus Zhongguancun became the first high-tech park in China. Zhongguancun is one of the innovation and entrepreneurial locations for overseas talents conferred by the Central Personnel Work Coordination Group. During the 12th Five-Year Plan period, Zhongguancun will further improve its Science and Future S&T Cities, promote the development of the northern R&D service and high-tech industrial belt, which are located in North Haidian, South Changping, as well as the southern high-tech manufacturing and

⁴⁵ www.researchgate.net/publication/263178332_Local_government_policies_and_pharmaceutical_clusters_in_China

⁴⁶ www.wehdz.gov.cn

emerging industrial belt consisting of the Beijing Economic-Technological Development Area and partial areas of Daxing, Tongzhou and Fangshan districts⁴⁷.

Chengdu Hi-tech Zone

Chengdu Hi-tech Zone (CDHT) was established in 1991 and is one of the earliest state-level hi-tech industrial development zones, an ISO14000 National Model District and one of the six pilot zones established under the project of "The World's First-class Park Initiatives" sponsored by the Ministry of Science and Technology. CDHT has gathered a group of new generation communications companies represented by Siemens, Motorola, Nokia, Ericsson, Alcatel, Huawei and ZTE, and has become one of the largest R&D centres for new generation mobile communications in China. The sales revenue achieved ¥13.4 billion in 2012⁴⁸.

⁴⁷ http://en.zhongguancun.gov.cn/2013-12/04/content_17148863.htm

⁴⁸ www.chengduhitech.co.uk/Default.asp

4 Cluster policies and programmes in China

4.1. The cluster policy in China

China's public cluster policy is developed by both the central and provincial governments. Being aware of the importance of industrial clusters for social and economic development, the Chinese central government seeks continuous cluster development according to the guidelines on facilitating the development of industrial clusters announced by the National Development and Reform Commission (NDRC). The most notable programme regarding cluster development is the TORCH Programme, approved in 1988 by the national government⁴⁹. The TORCH Programme is based on an initiative to develop and internationalise China's new and high-tech industries. The Programme was implemented in response to the global technology revolution and the economic reform.

The TORCH Programme is responsible for much of the cluster development as well as the internationalisation of the high-tech industries. Moreover MoST, the umbrella organisation of the TORCH Programme, and DG Internal Market, Industry, Entrepreneurship and SMEs of the European Commission have been discussing to explore future cooperation in support of SME internationalisation through clusters. Although there were no formal conclusions made, it is expected that closer international cluster cooperation between the EU and China would have the potential to benefit both parties⁵⁰.

MoST announced administrative practices to identify and certify innovative industrial clusters in 2013. The practices include a set of indicators to identify and measure innovative industrial clusters based on: the innovative environment (local policy, industry chain, facility, etc.), development of industry (number of companies, income, market share, investment into R&D, patents, standard, etc.), and service providers (incubator, R&D institute, angel & VC, etc.). The Torch Centre under MoST is in charge of the certification process and the local governments take the lead on implementing the practices in the various regions⁵¹.

In China, cluster development is primarily managed by the NDRC but the Ministry of Industry and Information Technology and MoST are also involved. In 2015, the first announced a guideline to further promote cluster development in order to support the development of SMEs. The guideline indicated that the local government should establish plans to develop clusters together with other regional development plans. It is encouraged to establish SME industrial parks and incubators for start-ups⁵².

It is important to note that neither the NDRC nor the Ministry of Industry and Information Technology provide direct financial support for the development of Chinese industrial clusters. In spite of the absence of government financial support, the industrial development of the country has been impressive. This might be partially motivated by the fact that the division into small steps of integrated

⁴⁹ D3.1 Initial Report

⁵⁰ www.eca-tactics.eu/eca/newsroom/eu-china-discussion-clusters

⁵¹ Ministry of Science and Technology, www.most.gov.cn/tztg/201303/t20130321_100310.htm

⁵² Ministry of Industry and Information Technology, www.miit.gov.cn

processes eases the access of funds for small companies by other means. Within clusters, companies can: acquire credits, enjoy tax incentives, and even receive informal financing from friends and relatives. Besides this, local governments can provide the necessary public goods and stimulate the cluster growth⁵³.

The MoST and DG Growth (EC) have been actively discussing how to explore future cooperation in support of SME internationalisation through clusters. Many of European clusters registered in the ECCP show interest in cooperating with China. Presently, eight ESCP-4i supported under COSME programme (out of a total of 23) are targeting China for bilateral cooperation and 36 % of EU clusters indicated their priority in targeting China via survey responses (representing 93 clusters in a survey where 400 clusters failed to respond). Although no formal conclusions have been made, it is expected that closer international cluster cooperation between the EU and China, confirmed by the ESCP-4i projects' interest in China, would have the potential to benefit both parties⁵⁴.

4.2 Automotive policies and programmes

The Chinese government supports domestic automotive and parts producers by restraining the exportation of key raw materials. The export restraints benefit China's domestic producers by guaranteeing supplies and lowering input prices within China. In addition, domestic automotive producers in China also benefit from domestic content and technology transfer requirements that have helped the industry develop the capacity to produce key components with advanced technologies. Several plans formulated by the Chinese government are listed below⁵⁵:

- The Automotive Industry Development Policy (2004) that requires foreign investors in automotive manufacturing to also produce complete engine sets in China. Foreign investors cannot produce complete automobiles in China unless they have joint ventures with Chinese partners. The Chinese partners must have a majority interest in the ventures.
- The Automotive Industry Restructuring and Revitalization Plan (2009) also contains specific policies and measures intended to expand domestic automotive demand and promote the development of the automotive industry, including the parts industry.
- The 13th Five Years Plan (2016-2010) focuses on intelligent transportation. For this purpose, it promotes: the internet-based operation of transportation infrastructure and means of transportation and the digitalization of operation information; the development of the Internet of Vehicles and Vessels; the improvement of early warning systems for failures and systems for operational maintenance and intelligent scheduling; vehicle automation; the digitalization of facilities, and the increasing use of smart operations.

⁵³ www.jstor.org/stable/10.1086/605208?seq=1#page_scan_tab_contents

⁵⁴ www.eca-tactics.eu/eca/newsroom/eu-china-discussion-clusters

⁵⁵ www.stewartlaw.com/Content/Documents/S%20and%20S%20China%20Auto%20Parts%20Subsidies%20Report.pdf

Since Europe dominates the global automotive market not only because of the engineering capability but also the added value of the world-known brands, the Chinese automotive industry tries to leverage the increasing purchasing power of the population, the openness of the country to new technologies and environmental friendly developments and the demography itself to its advantage.

4.3 Biotechnology policies and programmes

This section will focus on the human health area where China and the EU share significant potential for cooperation, since the Chinese government is undergoing a massive modernisation of the national healthcare system.

In 2009, the Chinese government announced its healthcare reform. The government designed a framework that covers a number of key reform areas, including public hospital reform, primary care, pricing and payment structure, drug quality supervision, and information system improvement. During the first stage of China's healthcare reform, between 2009 and 2011, the plan focused on expanding coverage. The Chinese leadership called for deepening medical reform by strengthening the national healthcare network, improving the essential drug system and promoting the reform of public hospitals.

In 2013, China set up the National Health and Family Planning Commission (NHFPC) through merging the existing Health Ministry (MOH) with the National Population and Family Planning Commission. The merger can be seen as a consistent effort by the Chinese government continuing its focus on improving healthcare for the overall population⁵⁶.

In the 13th FYP China emphasises the importance of prevention as a basis for establishing a basic healthcare system so that all citizens have access to basic healthcare services. It includes the so-called Poverty Alleviation Programme, which addresses some areas of healthcare where people are affected by poverty, through the implementation of new measures. The profound reforms to be implemented and the governmental support to the participation of non-governmental capital in the operation of public hospitals open a wide range of opportunities for clusters. Some opportunities to be taken into account are: care and service systems for women, children and elderly people in rural areas; regional systems for referring patients, in both directions, between major hospitals and community health service facilities; and promoting universal recognition of medical examination results or coordinated development of social insurance.

4.4 Renewable Energy policies and programmes

The impact of the economy, the environment and the energy are of great importance for the sustainable development of China. The country has already implemented several national programmes and policies in order to improve the development of China's renewable energy but it will continue to face a lot of challenges in the short and medium-term.

For instance, China's Energy Development Strategy Action Plan (2014–2020) published by the State Council aims at reducing China's high energy consumption per unit GDP ratio through a set of measures

⁵⁶ EU SME Centre : Healthcare Sector in China

and mandatory targets, promoting a more efficient, self-sufficient, green and innovative energy production and consumption⁵⁷.

The 13th FYP describes several projects for energy development. In terms of renewable energy, China aims to: build 60 GW of regular hydropower capacity, giving priority to hydropower development in the southwest; coordinate the development of end-use markets and power transmission routes; take ordered steps to optimize the development of wind energy and photovoltaic energy in the northern, northeaster, and north-western regions and in coastal areas; accelerate the development of dispersed wind power and distributed photovoltaic power in the central, eastern, and southern regions; carry out solar thermal energy demonstration projects; build the national new energy integrated demonstration zone in Ningxia; and actively move forward with the development of demonstration zones for renewable energy such as those in Qinghai and Zhangjiakou.

Overall, China needs to balance its economic growth with a more sustainable development to continue improving the quality of life of the population as well as its economy. However and in spite of the progresses made, the country still profits from the foreign know-how and technologies to fully exploit the renewable energies field. European clusters still enjoy a competitive advantage as they already have significant experience in the sector and more developed technologies. Nevertheless, as China is very committed and investing great efforts in this aspect, the timing is essential to access the market as delayed entrance might increase the difficulty for foreign companies to do business in this field.

4.5 Information and Communication Technology policy and programmes

The ICT sector is strongly promoted in China and has received support from the central government, which also encourages foreign companies to invest in the country.

In 2006, MIIT published the “National Information Development Strategy 2006-2020”⁵⁸. This strategy outlines the overarching goals for the Chinese ICT industry by 2020. The key points are as follows: to grow the economy through high technology rather than capital investment by fully utilising the ICT industry; to develop indigenous innovative core technologies rather than imitating or introducing them from abroad; to establish a world-class reliable, and safe information system; and to make government and military affairs paperless.

The 13th FYP further supports the vision abovementioned by emphasising the need to cultivate integrated circuit industrial systems and to foster artificial intelligence, intelligent hardware, new display technologies, smart mobile terminals, 5G mobile communications, advanced sensors, and wearable devices into becoming new areas of growth.

The 13th FYP also enhances AI as a very important industry to the economy. Following 2015, AI was included multiple national economic initiatives: Made in China 2025, Robotics Industry Development

⁵⁷ www.lse.ac.uk/GranthamInstitute/law/energy-development-strategy-action-plan-2014-2020

⁵⁸ www.china-embassy.org/eng/xw/t251756.htm

Plan, and the Three Year Guidance for Internet Plus Artificial Intelligence Plan. In 2017 the Chinese government formalised its position to prioritise the AI industry as an engine to support the country's growth. The Chinese market has big advantages in AI that include talented scientists and engineers and a rich data source with few obstacles to data collection^{59, 60}.

Naturally, the information and communication technologies are widely spread along the six strategic emerging industries listed in the 13th FYP. For example, ICT plays a big role in the cyber economy development strategy. As a consequence of ICT's role in various sectors and applications, there are many available opportunities for European clusters to enter the Chinese market and take advantage of offering the latest trends in ICT.

⁵⁹ <http://www.china-briefing.com/news/2017/03/14/china-world-leader-artificial-intelligence.html>

⁶⁰ <https://www.technologyreview.com/s/609038/chinas-ai-awakening/>

5. Conclusion

After more than 20 years of development, Chinese clusters including in the formats of SEZs and science parks have become an important driving force for economic growth and international competitiveness of different regions. Driven by market demand and government support, the Chinese clusters are shifting from a development phase to a more mature stage and are gradually becoming market-oriented, professional, and global.

The business model of clusters in China slightly differs from the European one; however, they also share many characteristics. The Chinese clusters are agglomerations of companies, including big firms, limited to geographic areas and that often do not have an organisation of reference that acts as a representative. On the contrary, the EU clusters are formal organisations that represent and manage a joint strategy for their members that are mostly SMEs. The political influence is also bigger in China than in the EU, since the former understands the concept of clusters as an effective means to encourage the development of a certain sector, or especially, a particular region.

In recent years, because of industrial upgrade, rising costs, limited land, and strict environmental requirements, many coastal clusters have begun to move inland. Some clusters in the middle and western regions were formed through such transfer. In some cases, the migrations were highly influenced by deliberate government policies; however, such transfer is still based largely on market choice, where government plays mainly a facilitating role.

Even though the visions of EU and Chinese clusters may differ in certain ways, it is necessary to emphasise the importance of public policies for the development of Chinese clusters. The implication of local authorities has proved to be very useful in order to provide the infrastructural conditions for settling a cluster, the guidelines and objectives to follow as well as for acting as a mediator to attract businesses.

China has a cluster community, including SEZs and science parks, of great relevance that has achieved many accomplishments and still shows significant potential for growth. Moreover, the Chinese cluster model is quite structured, which would allow the entrance of EU clusters quite easily as long as the cultural differences are overcome and the political factor is taken into account when designing the internationalisation strategy. Furthermore, the EU and Chinese cluster communities share in the value given to continuous innovation for the development of the clusters and the Chinese central government is open to foreign investment, particularly through joint ventures.

Another optimistic aspect is the main emerging industries for China, which are already rather developed in Europe. The country has strategically focused on four primary sectors: automotive, biotechnology, renewable energy and ICT that present several opportunities for the EU to cooperate with China in S&T innovation, trade and business development.

In fact, the EU and China have selected a number of areas for joint interest and mutual benefit, which are represented by several key industrial clusters. For example, in the automotive sector, electric

vehicles and new energy vehicle are both developing and growing sectors in clusters located in the area of Guangzhou. In the case of the biotechnology sector, the cluster in Shanghai, Zhangjiang, is focused in the pharmaceutical and healthcare areas. For the renewable energy sector, more enterprises in green technologies have been established in order to solve the pollution problems in China. Finally, in the ICT sector, clusters in Dongguan that were originally manufacturing-based have gradually turned into specialised clusters in different industry sub-sectors such as IoT, big data and cloud services.

In brief, the opportunities for EU clusters in China cover a wide range of sectors. The formal model of the cluster organisations and the support of the European Commission also help to facilitate the cooperation with Chinese organisations, especially now that the Chinese government is rather open to foreign investment and collaboration.

6. Annex

6.1 EU-China Flagship Initiative

The EU and China will boost their research and innovation cooperation with a new package of flagship initiatives targeting the areas of Food, Agriculture and Biotechnologies, Environment and Sustainable Urbanisation, Surface Transport, Safer and Greener aviation, and Biotechnologies for Environment and Human Health.

This is one of the outcomes of the **3rd EU-China Innovation Co-operation Dialogue**, organised today in the margins of the 19th EU-China Summit. These flagship initiatives will translate into a number of topics dedicated to cooperation with China under the EU's funding programme for research and innovation. The emphasis will be on green initiatives with actions on ecological quality of water in cities, nature-based solutions for restoration and rehabilitation of urban ecosystem, reduction of transport impact on air quality, aviation operations impact on climate change or biotechnologies for environmental remediation.

Both sides also signed an administrative arrangement renewing the **EU-China co-funding mechanism for research and innovation**. For the period 2018-2020, the Chinese side will reserve an annual budget of 200 Million RMB (more than €25 million per year) for the benefit of China-based entities that will participate in projects with European partners under Horizon 2020. The EU expects to continue spending over €100 million per year for the benefit of Europe-based entities in Horizon 2020 projects with Chinese participants.

This round of the Innovation Co-operation Dialogue also discussed progress on framework conditions and innovation cooperation. In particular, the two sides have agreed to promote open science and to exchange best practices in open access to publications and research data, and have confirmed the principle of reciprocity in access to Science Technology and Innovation resources. They agreed also to jointly promote innovation and entrepreneurship and to develop new ways of promoting EU-China innovation cooperation, for example by strengthening the links between innovation cooperation platforms, applying the co-funding mechanism to future SME cooperation and encouraging and supporting start-ups and start-up services.

In addition, the Commission's science and knowledge service, the Joint Research Centre (JRC), and the Chinese Academy of Sciences signed an overarching Research Framework Arrangement building on their longstanding cooperation in the field of remote sensing and earth observation. The objective of the agreement is to expand their collaboration and develop new scientific approaches in key areas, such as air quality, renewable energy, climate, environmental protection, digital economy, regional innovation policy and smart specialisation⁶¹.

⁶¹ <http://ec.europa.eu/research/index.cfm?pg=newsalert&year=2017&na=na-020617>

6.2 EU-China R&DI projects

TABLE 2 - EU-CHINA RESEARCH, DEVELOPMENT AND INNOVATION SELECTED PROJECTS⁶²

PROJECT	DESCRIPTION
ENRICH (former ERICENA) 01/2017-12/2020	ENRICH is a global network (China, USA, Brazil) of centres and hubs that encourages the internationalisation of European science, technology and innovation (STI). Promoted by the European Commission through Horizon 2020, the service portfolio of ENRICH intends to be comprehensive and diverse, aiming to address the needs and interests of its European innovative businesses in the Chinese market and to maximize the benefits of their activities and presence in China. Website: http://china.enrichcentres.eu
DRAGON STAR PLUS 02/2015-01/2018	The project aims at raising the EU's science and technology profile in China by a series of promotional activities to disseminate the EU's research policies and actions among Chinese scientists and research institutions. A partnership between EU countries and China is promoted through collaboration schemes and identification of new activities. Dragon Star identifies and determines mutual interest and benefit in the cooperation between the EU and China sharing best practices via workshops and presenting the state of the art and the prospects for cooperation in particular fields. Website: www.dragon-star.eu
CHINAACCESS4EU 01/2010-08/2012	The project aims at increasing the awareness and dissemination in the Member States and Associated Countries of access opportunities for European researchers and research organisations in Chinese national research and/or innovation programmes. The overriding purpose of the proposed project is to help develop the reciprocity aspect of the EU-China Science and Technology agreement by identifying the Chinese programmes open to EU researchers and promote their participation, and to provide outputs useful in the context of the Joint Committee meetings of the EU-China Science and Technology agreement. Website: www.access4.eu/China
INCO LAB 01/2003-12/2006	INCO LAB is a European Commission Subsidized International Scientific Cooperation Program, with Chinese and European Academic Laboratories. It aims at increasing the translational medical research cooperation between European countries and China, and more particularly at conducting research to identify immunological characteristics in Chinese cancer patients as medical biomarkers for the personalized prognosis of patients. It aims also at enhancing the research capacity and the technological transfer to the joint institute by providing adequate human resources and equipment to conduct beyond the state-of-the-art oncology research and promoting a reference Euro-Asian centre on Chinese cancer prognosis by spreading the knowledge and by raising awareness in China and European Union. Website: www.transgene.fr

⁶²<http://ec.europa.eu/research/iscp/index.cfm?pg=china>

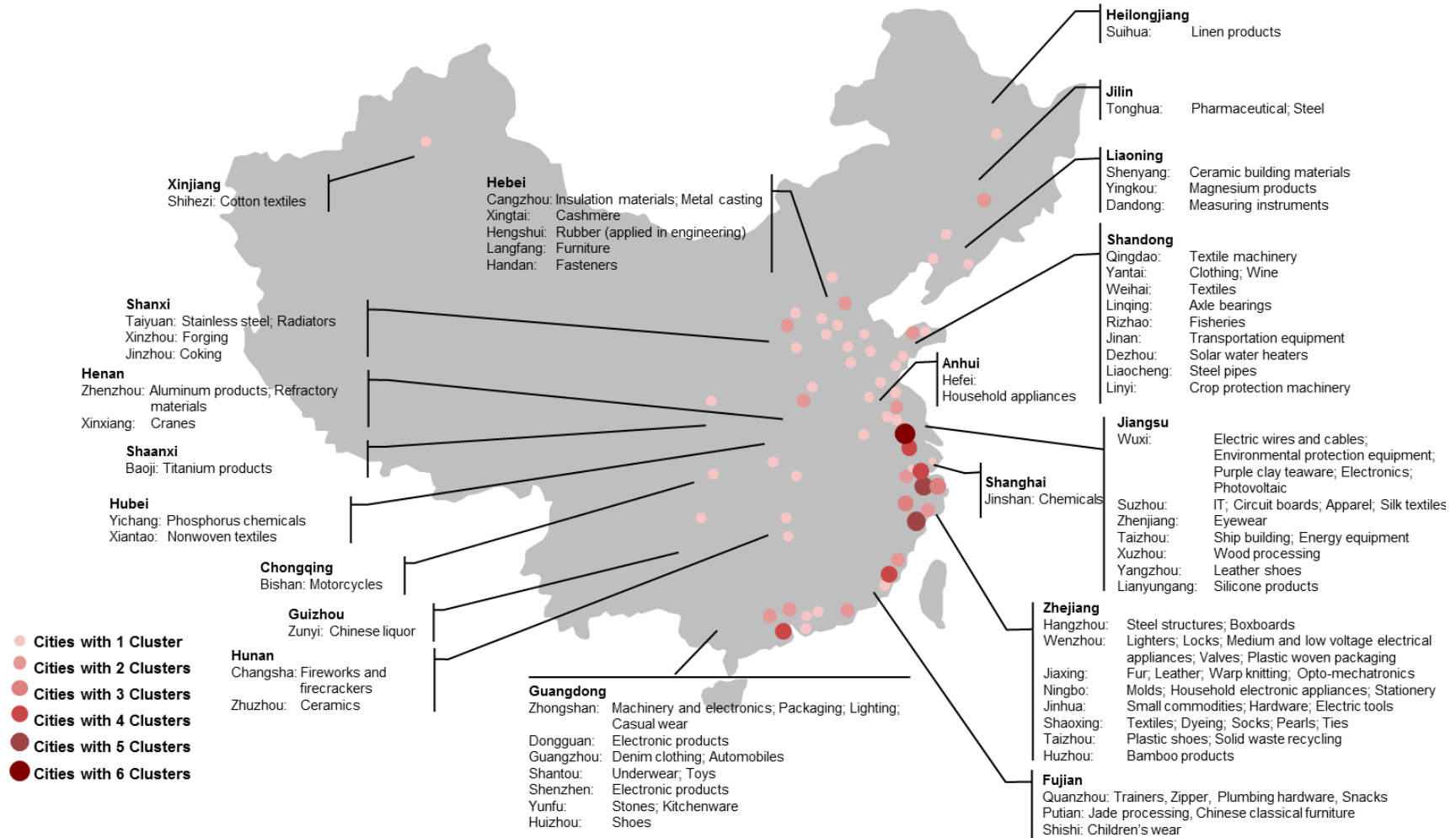
6.3 Relevant organisations in China

TABLE 3 - RELEVANT ORGANISATIONS IN CHINA FOR CLUSTER COOPERATION AND BUSINESS SUPPORT

SECTOR	ORGANISATION	WEBSITE
All	Ministry of Industry and Information Technology	www.miit.gov.cn
	Ministry of Science and Technology	www.most.gov.cn
	National Development and Reform Commission (NDRC)	http://en.ndrc.gov.cn
	China-EU Regional Economic Cooperation Centre,	http://cereco.org
	Beijing Municipal Science & Technology Commission	www.bjkw.gov.cn
	China IPR Helpdesk,	www.china-iprhelpdesk.eu
	Chongqing Science & Technology Commission,	www.cstc.gov.cn
	EU SME Centre	www.eusmecentre.org
	European Union Chamber of Commerce in China	www.eurochamber.com.cn
	Guangdong Provincial Department of S&T	www.gdstc.gov.cn
	Jiangsu Provincial Department of Science and Technology	www.jstd.gov.cn
	Ministry of Industry and Information Technology	www.miit.gov.cn
	Ministry of Science and Technology, MoST	www.most.gov.cn
	National Development and Reform Commission, NDRC	www.ndrc.gov.cn
	Science Technology Department of Zhejiang Province	www.zjkjt.gov.cn
	Shanghai Science and Technology Committee	www.stcsm.gov.cn
	Tianjin Municipal Science & Technology Commission	www.tstc.gov.cn
	TORCH Centre, Ministry of Science and Technology	www.chinatorch.gov.cn
Automotive	China Association of Automotive Manufacturers	www.caam.org.cn
	China Auto Info	www.autoinfo.org.cn
	China Auto Statistic	http://auto-stats.org.cn
	Society of Automotive Engineering of China	www.sae-china.org
Biotechnology	China Medicinal Biotech Association	www.cmba.org.cn
	Shanghai Bio Industry Association	http://sbia.org.cn

SECTOR	ORGANISATION	WEBSITE
	China Society of Biotechnology	www.biotechchina.org
	Shanghai Society of Biotechnology	www.ssbtt.org.cn
	China Biotech	www.biotech.org.cn
Renewable energy	China Energy Society	www.zgny.org.cn
	China Renewable Energy Society	www.cres.org.cn/index.html
	Beijing New Energy Association	www.bjxnyxh.com
	Beijing Energy Network	www.bjnyw.com.cn
	China Wind Energy Association	www.cwea.org.cn
	Energy Research Institute National Development and Reform Commission	www.eri.org.cn
ICT	China Academy of Information and Communications Technology (CAICT)	www.caict.com
	Institute of Computing Technology, Chinese Academy of Sciences	www.ict.ac.cn
	China Information	www.ciia.org.cn
	China Information Technology Industry Association	www.citif.org.cn/citif
	China Institute of Electronic	http://cie-info.org.cn
	China Electronics and Information Technology Industries Association	www.ceitia.org.cn

6.4 China cluster mapping



Source: Li & Funq Research Centre: The Beijing Axis Analysis

FIGURE 3 - MAP OF TOP 100 INDUSTRIAL CLUSTERS IN CHINA

TABLE 4 - LIST OF TOP 100 INDUSTRIAL CLUSTERS IN CHINA, 2010

Provinces/Municipalities/ Regions (number of clusters)	City/County	Industrial Clusters
Zhejiang province (25)	Xiaoshan, Hangzhou 杭州蕭山	Steel structures industrial cluster
	Fuyang, Hangzhou 杭州富陽	Boxboard industrial cluster
	Lucheng, Wenzhou 溫州鹿城	Lighter industrial cluster
	Ouhai, Wenzhou 溫州瓊海	Locks industrial cluster
	Leqing, Wenzhou 溫州樂清	Medium and low voltage electrical appliances industrial cluster
	Longwan, Wenzhou 溫州龍灣	Valves industrial cluster
	Pingyang, Wenzhou 溫州平陽	Plastic woven packaging industrial cluster
	Chongfu, Tongxiang, Jiaxing 嘉興桐鄉崇福	Fur industrial cluster
	Haining, Jiaxing 嘉興海寧	Leather industrial cluster
		Warp knitting industrial cluster
	Pinghu, Jiaxing 嘉興平湖	Opto-mechatronics industrial cluster
	Yuyao, Ningbo 寧波餘姚	Mold industrial cluster
	Cixi, Ningbo 寧波慈溪	Household electronic appliances industrial cluster
	Ninghai, Ningbo 寧波寧海	Stationery industrial cluster
	Yiwu, Jinhua 金華義烏	Small commodities industrial cluster
	Yongkang, Jinhua 金華永康	Hardware industrial cluster
		Electric tools industrial cluster
	Shaoxing 紹興	Textile industrial cluster
		Dyeing industrial cluster
	Zhuji, Shaoxing 紹興諸暨	Socks industrial cluster
		Pearls industrial cluster
	Shengzhou, Shaoxing 紹興嵊州	Ties industrial cluster
	Wenling, Taizhou 台州溫嶺	Plastic shoes industrial cluster
	Luqiao, Taizhou 台州路橋	Solid waste recycling industrial cluster
	Anji, Huzhou 湖州安吉	Bamboo products industrial cluster
Jiangsu province (16)	Yixing, Wuxi 無錫宜興	Electric wires and cables industrial cluster
		Environmental protection equipment industrial cluster
		Purple clay teaware industrial cluster
	Xishan, Wuxi 無錫錫山	Electric car industrial cluster
	New district of Wuxi 無錫新區	Electronics industrial cluster
		Photovoltaic industrial cluster
	Kunshan, Suzhou 蘇州昆山	IT industrial cluster
		Circuit board industrial cluster
	Changshu, Suzhou 蘇州常熟	Apparel industrial cluster
	Shengze, Wujiang, Suzhou 蘇州吳江盛澤	Silk textile industrial cluster
	Danyang, Zhenjiang 鎮江丹陽	Eyewear industrial cluster
	Jingjiang, Taizhou 泰州靖江	Ship building industrial cluster
	Jiangyan, Taizhou 泰州薑堰	Energy equipment industrial cluster
	Pizhou, Xuzhou 徐州邳州	Wood processing industrial cluster
	Jiangdu, Yangzhou 揚州江都	Leather shoes industrial cluster
Donghai, Lianyungang 連雲港東海	Silicone products industrial cluster	
Guangdong province (13)	Zhongshan 中山	Machinery and electronics industrial cluster
		Packaging industrial cluster
	Guzhen, Zhongshan 中山古鎮	Lighting industrial cluster
	Shaxi, Zhongshan 中山沙溪	Casual wear industrial cluster
	Dongguan 東莞	Electronic products industrial cluster
	Xintang, Zengcheng, Guangzhou 廣州增城新塘	Denim clothing industrial cluster
	Huadu, Guangzhou 廣州花都	Automobile industrial cluster
Shantou 汕頭	Underclothing industrial cluster	



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	Chenghai, Shantou 汕頭澄海	Toys industrial cluster
	Shenzhen 深圳	Electronic products industrial cluster
	Yuncheng, Yunfu 雲浮雲城	Stone industrial cluster
	Xinxing, Yunfu 雲浮新興	Kitchenware industrial cluster
	Huidong, Huizhou 惠州惠東	Shoes industrial cluster
Shandong province (10)	Jiaonan, Qingdao 青島膠南	Textile machinery industrial cluster
	Haiyang, Yantai 煙臺海陽	Sweater industrial cluster
	Penglai, Yantai 煙臺蓬萊	Wine industrial cluster
	Wendeng, Weihai 威海文登	Textile industrial cluster
	Linqing 臨清	Axle bearing industrial cluster
	Rizhao 日照	Fisheries industrial cluster
	Zhangqiu, Jinan 濟南章丘	Transport equipment industrial cluster
	Dezhou 德州	Solar water heater industrial cluster
	Liaocheng 聊城	Steel pipe industrial cluster
	Linyi 臨沂	Crop protection machinery industrial cluster
Fujian province (7)	Jinjiang, Quanzhou 泉州晉江	Trainers industrial cluster
		Zipper industrial cluster
	Nan'an, Quanzhou 泉州南安	Plumbing hardware industrial cluster
	Hui'an, Quanzhou 泉州惠安	Snacks industrial cluster
	Putian 莆田	Jade processing industrial cluster
	Xianyou, Putian 莆田仙遊	Chinese classical furniture industrial cluster
	Fengli, Shishi 石獅鳳裏	Children's wear industrial cluster
Hebei province (6)	Hejian, Cangzhou 滄州河間	Insulation materials industrial cluster
	Botou, Cangzhou 滄州泊頭	Metal casting industrial cluster
	Qinghe, Xingtai 邢臺清河	Cashmere industrial cluster
	Taocheng, Hengshui 衡水桃城	Rubber (applied in engineering) industrial cluster
	Xianghe, Langfang 廊坊香河	Furniture industrial cluster
	Yongnian, Handan 邯鄲永年	Fasteners industrial cluster
Shanxi province (4)	Taiyuan 太原	Stainless steel industrial cluster
	Qingxu, Taiyuan 太原清徐	Radiator industrial cluster
	Dingxiang, Xinzhou 忻州定襄	Forging industrial cluster
	Taigu, Jinzhong 晉中太谷	Coking industrial cluster
Henan province (3)	Gongyi, Zhengzhou 鄭州鞏義	Aluminum products industrial cluster
		Refractory materials industrial cluster
	Changyuan, Xinxiang 新鄉長垣	Cranes industrial cluster
Liaoning province (3)	Faku, Shenyang 瀋陽法庫	Ceramic building materials industrial cluster
	Dashiqiao, Yingkou 營口大石橋	Magnesium products industrial cluster
	Dandong 丹東	Measuring instruments industrial cluster
Hubei province (2)	Yichang 宜昌	Phosphorus chemicals industrial cluster
	Xiantao 仙桃	Nonwoven textile industrial cluster
Hunan province (2)	Liuyang, Changsha 長沙瀏陽	Fireworks and firecrackers industrial cluster
	Liling, Zhuzhou 株洲醴陵	Ceramics industrial cluster
Jilin province (2)	Tonghua 通化	Pharmaceutical industrial cluster
		Steel industrial cluster
Shanghai (1)	Jinshan 金山	Chemicals industrial cluster
Chongqing (1)	Bishan 璧山	Motorcycle industrial cluster
Anhui province (1)	Hefei 合肥	Household appliances industrial cluster
Heilongjiang province (1)	Lanxi, Suihua 綏化蘭西	Linen products industrial cluster
Guizhou province (1)	Renhuai, Zunyi 遵義仁懷	Chinese liquor industrial cluster
Shaanxi province (1)	Baoji 寶雞	Titanium products industrial cluster
Xinjiang Uygur Autonomous Region (1)	Shihezi 石河子	Cotton textile industrial cluster