Preparatory Briefing on China

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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 the China Preparatory Briefing is to provide up to date information on the cluster landscape in China in order to support European cluster organisations and their members to familiarise themselves 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 when relevant.

A complementary report, "discussion paper", is also available and provides an overview on the existing European Union (EU)-China cluster cooperation, and presents related good practices/success stories and opportunities for future exchange.

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 twentieth century. As a consequence of the reforms promoted by Deng Xiaoping in 1978, the country has experienced rapid economic and social development mainly driven by the industry and service sectors[1].

Over the last 30 years, China has been the world's fastest growing economy with consistent growth rates of around 10%. In 2018, China's gross domestic product (GDP) grew 6.6%, which was the weakest economic growth in nearly three decades. However, this figure is still impressive when compared with the results from the Western economies[2].

The economy of China is described as an upper middle income economy by the World Bank, yet considered as a developing country due to its low GDP per capita[3]. In fact, China's economic growth has led to numerous societal challenges, which the 13th Five-Year Plan (FYP) (2016-2020) is focused on addressing. This plan aims to implement measures to reduce pollution, increase energy efficiency, improve the access to education and healthcare, expand social protection and tackle inequality, which are key issues to improve China's quality of life[4].

The diplomatic ties between the EU and China were established in 1975 and upgraded in 2013 with the creation of the EU-China Comprehensive Strategic Partnership. In addition, in 2018 during the 20th EU-China Summit, the EU and China agreed to further develop the EU-China strategic partnership. Thus, both parties agreed on implementing the 2018-2020 Flagship Initiatives and explore a roadmap for

[1] CIA Fact Book: www.cia.gov/library/publications/the-world-factbook/geos/ch.html
[2] Quartz, https://qz.com/1527008/chinas-final-2018-economic-numbers-will-be-shaky/
[3] World Databank, http://data.worldbank.org/country/china
[4] 13th Five-Year Plan, http://en.ndrc.gov.cn/newsrelease/201612/P020161207645765233498.pdf

further cooperation in areas such as basic research, frontier science and key societal challenges, emphasising the importance of international cooperation on climate change and clean energy[5].

China is the EU's largest source of imports and its second largest export market behind the United States (US), accounting for 9.7% of the total exports or €170,136 million. The EU is also China's largest trading partner with a share equal to 20.2% or €344,642 million[6]. EU imports from China mainly consist of industrial and consumer goods, machinery and equipment, footwear and clothing; while exports to China mostly correspond to machinery and equipment, motor vehicles, aircraft and chemicals. In addition, EU-China trade in services accounts to more than 10% of the total trade in goods[7].

Currently, the EU is experiencing a significant trade deficit with China mainly due to China's market access barriers, which include: 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; cheap financing; and poor protection and enforcement of intellectual property rights (IPR). In this context, the EU aims to open its trading relations with China; however, this open trade partnership must be fair, respect IPR, as well as the World Trade Organisation (WTO) obligations. Thus, in 2016, the EU established a new trade strategy towards China, which defines the EU trade relationship with China for the 2016-2021 period. This strategy promotes reciprocity and fair competition across all areas of cooperation and aims to foster negotiations on a Comprehensive Agreement on Investment[8].

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

The Comprehensive Strategic Partnership was established in 2013 to create mutual benefits for the EU and China. Therefore, there are many cooperation opportunities to be exploited between both regions in terms of investment and international cooperation on science, technology and innovation (STI).

As abovementioned, in 2018, China's GDP growth rate saw a decline compared to earlier years due to weaker growth in investment and exports. In this context, the Chinese Government announced measures to support growth and investor confidence, including increased liquidity provision by the People's Bank of China, infrastructure investment, fiscal incentives for households and firms, as well as additional support to small businesses. In addition, China is expected to shift government spending towards health, education, and social protection[9].

According to the 2018 A.T. Kearney's FDI Confidence Index, China ranked as the 5th most attractive country for investors. Even though China remains in the top five, the country fell to its lowest-ranking

[5] European Commission, Roadmap for EU-China S&T cooperation, https://ec.europa.eu/research/iscp/pdf/policy/cn_roadmap_2018.pdf
[6] http://trade.ec.europa.eu/doclib/docs/2006/september/tradoc_122530.02.2017.pdf
[7] European Commission, http://ec.europa.eu/trade/policy/countries-and-regions/countries/china/
[8] European Commission, http://ec.europa.eu/trade/policy/countries-and-regions/countries/china/
[9] European Commission, China Economic Update - December 2018 www.worldbank.org/en/country/china/publication/china-economic-update-december-2018

in the history of the Index[10]. Moreover, according to the World Bank, China stands at 46th in the ranking of 190 economies on the ease of doing business. China's rank went from 78 in 2017 to 46 in 2018 due to the country's impressive improvements to its business environment, including a decrease in number of the days needed to register a company from 22.9 days to nine[11].

However, the Chinese Government faces several economic challenges including: (i) low domestic household consumption; (ii) high corporate debt burden; (iii) off-balance sheet local government debt; (iv) social inequality; (v) speculative investment in the real estate sector; (vi) industrial overcapacity; and (vii) efficient allocation of capital and state-support for innovation. The environment's deterioration, mainly in the north of the country, is also considered a long-term problem that China aims to tackle. Thus, in 2016, China ratified the Paris Agreement and committed to reach a carbon dioxide emissions upper limit between 2025 and 2030[12].

Investment and trade

In 2013, the EU-China 2020 Strategic Agenda for Cooperation defined key initiatives in the area of trade and investment policy, notably the negotiation of the EU-China Comprehensive Investment Agreement. The Agreement aims to: (i) provide new opportunities and improved conditions for access to the EU and Chinese markets for Chinese and EU investors; (ii) address key challenges of the regulatory environment, including those related to transparency, licensing and authorisation procedures; (iii) establish guarantees regarding the treatment of EU investors in China and of Chinese investors in the EU, including protection against unfair and inequitable treatment, unlawful discrimination and unhindered transfer of capital and payments linked to an investment; (iv) ensure a level playing field by pursuing, *inter alia*, non-discrimination as a general principle subject to a limited number of clearly defined situations; (v) provide support to sustainable development initiatives by encouraging responsible investment and promoting core environmental and labour standards; and (vi) allow for the effective enforcement of commitments through investment dispute settlement mechanisms available to the contracting parties and to investors[13].

Moreover, the EU-China 2020 Strategic Agenda for Cooperation established an EU-China cluster cooperation initiative to strengthen collaboration in fields of strategic interest such as sustainable growth and urbanisation[14]. However, this initiative has not been materialised until now since bilateral cluster cooperation is taking place primarily through a bottom-up approach under the EU COSME programme.[15] In addition, cluster cooperation was considered by both parties as a business win-win

[10] A.T. Kearney's FDI Confidence Index, www.atkearney.com/foreign-direct-investment-confidence-index
[11] World Bank, Doing Business 2019, www.doingbusiness.org/content/dam/doingBusiness/media/Annual-Reports/English/DB2019-report_web-version.pdf
[12] Central Intelligence Agency, China : The World Factbook, www.cia.gov/library/Publications/the-world-factbook/geos/ch.html
[13] European Parliament, EU-China Comprehensive Agreement on Investment (EU-China CAI), www.europarl.europa.eu/legislative-train/theme-a-balanced-and-progressive-trade-policy-to-harness-globalisation/file-eu-china-investment-agreement
[14] European Commission, EU-China 2020 Strategic Agenda for Cooperation, https://eeas.europa.eu/sites/eeas/files/20131123.pdf
[15] Commission Implementing Decision (EU) of 26.10.2018, http://ec.europa.eu/research/participants/data/ref/other_eu_prog/cosme/wp-call/cosme-wp-2018_en.pdf

approach; however, high-value activities of strategic potential areas are being looked at cautiously by the EU. Artificial intelligence (AI) is particularly considered an area in which more caution to bottom-up will be exerted by the EU due to its defence dual-use and potential massive impact on manufacturing systems in global value-chains[16].

Even though, the EU is increasingly concerned about the possibility of EU small and medium-sized enterprises (SMEs) being taken over in strategic industrial sectors, the establishment of the China IPR SME Helpdesk was a proof of the willingness to collaborate with China. The Centre supports European businesses that wish to operate on the international market, including in China and offers help in regard to existing regulations like the protection concerning IPR, as well as the search for counterparts, sales and distribution[17].

Overall, the EU-China 2020 Strategic Agenda for Cooperation and the EU-China Investment Agreement provide a simpler and more secure legal framework to investors of both sides by ensuring predictable long-term access to EU and Chinese markets. These agreements were a big step towards a closer cooperation between the regions.

Science, technology and innovation

In 2015, the Chinese Government launched the Made in China 2025 strategy with the aim of transforming China into an advanced and competitive economy based on highly innovative manufacturing technologies. In this context, Made in China 2025 targets high-tech industries that strongly contribute to economic growth in 10 key priority sectors: 1) New advanced information technology; 2) Automated machine tools & robotics; 3) Aerospace and aeronautical equipment; 4) Maritime equipment and high-tech shipping; 5) Modern rail transport equipment; 6) New-energy vehicles and equipment; 7) Power equipment; 8) Agricultural equipment; 9) New materials; and 10) Biopharma and advanced medical products[18].

The Made in China 2025 strategy's 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 scale[19]. In this context, Made in China 2025 prioritises some aspects such as the production of domestic-origin parts, growing usage of local content and own brands. It also emphasises the expansion of research and development (R&D) capacity since core design centres for products usually remain based in other countries. In the strategy, China outlines 40 new R&D centres to be deployed in order to boost innovations in the manufacturing sector.

In terms of R&D spending, China's total expenditures in 2017 accounted for €222.7 billion. The industry was responsible for 77.5% of the total R&D spending; while universities and government-funded research institutions accounted for 6.8% and 14.4% respectively. Moreover, by 2020, China aims to

[16] Artificial Intelligence, What implications for EU security and defence?, EUISS, https://www.iss.europa.eu/sites/default/files/EUISSFiles/Brief%2010%20AI.pdf
[17] China IPR SME Helpdesk, https://iprhelpdesk.eu/china-helpdesk
[18] Center for Strategic & International Studies, Made in China 2025, www.csis.org/analysis/made-china-2025
[19] Gómez Pérez-Cuadrado, E., Oficina Económica y Comercial de España en Pekín (2016) "Plan Made in China 2025"- www.icex.es

increase its R&D intensity to 2.5% and reach a 60% STI contribution to economic growth. Mass innovation and entrepreneurship are also being strengthened through several measures, including new profit sharing schemes to allow scientists to retain profits from their innovations[20]. Regarding STI cooperation, during the 3rd Innovation Cooperation Dialogue (ICD) the EU and China agreed to strengthen cooperation through 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[21].

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

- **Science and Technology Cooperation Agreement:** The EU-China STI cooperation is guided by the Science and Technology Cooperation Agreement, which was signed in December 1998 and renewed for the third time in December 2014. The implementation of the Agreement is overseen by a Joint Steering Committee that met last in December 2018.
- **High-Level Innovation Cooperation Dialogue (ICD):** In September 2012, the European Commission (EC) established a High-Level ICD focused on raising the level and intensity of research and innovation (R&I) relations with China by providing a forum for the discussion of innovation policies and systems, addressing framework conditions and launching new joint R&I initiatives.
- **EURATOM-China Agreement for R&D Cooperation in the Peaceful Uses of Nuclear Energy (R&D-PUNE Agreement):** The 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 the Ministry of Science and Technology of the People's Republic of China (MoST).

Regarding cooperation under the EC's Framework Programmes (FP), in 2016, the EC and MoST announced the EU-China Co-Funding Mechanism (CFM) in the context of the Horizon 2020 (H2020). Under this scheme, ¥200 million (€28.57 million) are made available annually by MoST for China-based researchers and companies to participate in H2020. The CFM will continue through the 2018-2020 period due to an agreement signed between the EC and MoST during the 3rd EU-China ICD, which was held in June 2017 in Brussels. On the European side, during the referred period, the EC plans to provide over €100 million per year to fund European entities in joint projects with Chinese participants, which will focus on topics of common interest and mutual benefits, including food, agriculture, biotechnology, and green transport[22].

Until October 2018, Chinese entities have participated in H2020 337 times and signed 158 grants of collaborative actions, Marie Skłodowska-Curie Actions (MSCA) and European Research Council (ERC) actions, receiving €3.1 million of direct EU contribution and €33.8 million from non-EU budgets of Chinese beneficiaries. Regarding H2020 collaborative actions, Chinese applicants have been involved

[20] European Commission, Roadmap for EU-China S&T cooperation, https://ec.europa.eu/research/iscp/pdf/policy/cn_roadmap_2018.pdf

[21] European Commission, Roadmap for EU-China S&T cooperation, https://ec.europa.eu/research/iscp/pdf/policy/cn_roadmap_2018.pdf

[22] http://ec.europa.eu/research/index.cfm?pg=newsalert&year=2015&na=na-070915

1052 times (two times as coordinators) in 441 eligible proposals. Chinese entities have 183 participations (181 times as beneficiaries) in 78 signed grants, receiving €3 million from the EU, while €33.8 million is the non-EU budget of Chinese beneficiaries[23].

Key EU-China projects in STI fields resulting from the aforementioned partnerships are indicated in Annex section A.2 of this document.

2.3 Sectoral strengths

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

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

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

2.3.1 Automotive

China is the world largest automobile market, both in terms of demand and supply[24]. In 2018, China produced 27.8 million vehicles, while sales totalled 28 million units. More precisely, the production of passenger vehicles accounted for 23.5 million units and sales reached 23.7 million units. In addition, the production of commercial vehicles reached 4.2 million units, while sales totalled 4.3 million units. The production of NEVs accounted for 1.2 million units, reflecting a 59.9% increase when compared to 2017; while sales accounted for 1.2 units, reflecting a 61.7% increase. Furthermore, exports from China accounted for 1 million vehicles, which represented an increase of 16.8% when compared to previous year[25].

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 proven in 2015, when Chinese

[23] European Commission, Roadmap for EU-China S&T cooperation, https://ec.europa.eu/research/iscp/pdf/policy/cn_roadmap_2018.pdf

[24] The Statistics Portal, Largest automobile markets worldwide between January and December 2018, based on new car registrations (in 1,000s), www.statista.com/statistics/269872/largest-automobile-markets-worldwide-based-on-new-car-registrations/

[25] Automotive Industry Portal, China - Flash report, Production volume, 2018, www.marklines.com/en/statistics/flash_prod/productionfig_china_2018

consumers forced the international and local car companies to cut prices[26]. Nevertheless, the declining retail price is expected to increase the willingness of Chinese consumers to buy a car in the near future.

Moreover, according to the China Association of Automobile Manufacturers' (CAAM) predictions, China is expected to sell about 28.1 million vehicles in 2019, more precisely 23.7 million passenger vehicles and 4.4 million commercial vehicles. When accounting for import and export forecasts, the annual demand of China's automotive market is expected to be 28.2 million vehicles[27].

Currently, low carbon vehicle technology, including electric vehicles, and especially NEVs, are considered the vehicle segments with the highest potential. Therefore, China has implemented various measures and policies to promote the production and sales of NEVs, such as subsidies for car purchases, tax exemptions, and a requirement for government departments to buy more new energy cars for urban public transport and taxi services[28]. In fact, the 13th FYP also encourages the development of all-electric vehicles and hybrid electric vehicles with the aim of (i) advancing key technological areas (e.g. battery energy density and battery temperature adaptability); (ii) developing a network of charging facilities and services that are compatible with each other and come under unified standards; and (iii) strengthening efforts to recover and dispose of used batteries from NEVs.

The eco-friendly transportation is also key in environmental terms, which is an issue highlighted in the 13th FYP. In this regard, the China 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 customised 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 Human Health

The Chinese Government's Healthy China 2030 policy places public health at the centre of the country's decision-making, and recognises that multisector collaboration and innovation play a key role in China's development. Thus, the Healthy China 2030 aims to foster technological advances and improvements to the health insurance system in order to overcome the country's main health challenges, which include increasing rates of cancer and cardiovascular diseases. In addition, Healthy China 2030 states China's political commitment to participate in the Global Health Governance, and comply with the United Nations Sustainable Development Goals agenda[29].

Considering China's major health challenges, Healthy China 2030 aims to promote healthy lifestyles and physical fitness. This plan includes the development of Healthy Cities to guarantee a focus on prevention,

[26] Forbes, March 2016 https://www.forbes.com/sites/jackperkowski/2016/03/04/chinas-auto-industry-alive-and-well/#3415b0a45389
[27] Automotive Industry Portal, China - Flash report, Production volume, 2018, www.marklines.com/en/statistics/flash_prod/productionfig_china_2018
[28] Forbes, March 2016. www.forbes.com/sites/jackperkowski/2016/03/04/chinas-auto-industry-alive-and-well/#5301aa8c48e2
[29] World Health Organization, Healthy China 2030 (from vision to action), www.who.int/healthpromotion/conferences/9gchp/healthy-china/en/

instead of treatment. Moreover, Healthy China 2030 promotes Primary Health Care and Traditional Chinese Medicine (TCM) to prevent chronic diseases[30].

The Chinese Government strategy for health also includes: establishing guidelines focused on strengthening health education; increasing regulatory capacity in health services, food safety and health products and technologies; addressing the impact of the environment and climate change on health; and enhancing China's contribution to global health[31]. Furthermore, Healthy China 2030 includes the optimisation of medical services, which will contribute 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.

China is the second largest pharmaceutical market in the world, forecasted to reach €154.1 billion in 2020[32]. According to Made in China 2025, biopharma and advanced medical products are one of China's 10 priority sectors[33]. Moreover, promoting innovation in the healthcare sector is a key target for the Chinese government, as innovation in the pharmaceutical industry is included as a goal in the 13th FYP.

In this context, in 2015, the Chinese Government promoted the reform of the China Food and Drug Administration (CFDA), which aims to accelerate China's pharmaceutical development[34]. This reform led to important changes in China's pharmaceutical industry, including the reduction of the time it takes to approve a drug from five years to just six months, and a decrease in the number of requirements needed to conduct local clinical trials before being granted access to the Chinese market[35]. Thus, this reform has led to important opportunities for pharmaceutical companies, which are allowed to develop more robust, harmonised and de-risked drug development programmes[36].

Furthermore, in order to comply with the objectives of Healthy China 2030 a comprehensive reform of the public hospitals have been taking place. This reform includes measures to adjust pricing policies, modernise health insurance payments, establish modern hospital management systems, and define the power of the government in public hospital administration[37].

[30] World Health Organization, Healthy China 2030 (from vision to action), www.who.int/healthpromotion/conferences/9gchp/healthy-china/en/

[31] China – World Health Organisation, Country Cooperation Strategy 2016-2020, https://apps.who.int/iris/bitstream/handle/10665/206614/WPRO_2016_DPM_003_eng.pdf;jsessionid=27E8F7C62DF30FD431DC5ED072BF6025?sequence=1

[32] Pharma Technology Focus, Is China the next great hope for the Pharma Industry?, http://pharma.nridigital.com/pharma_dec18/is_china_the_next_great_hope_for_the_pharma_industry

[33] Center for Strategic & International Studies, Made in China 2025, www.csis.org/analysis/made-china-2025

[34] McKinsey & Company, What's next for pharma innovation in China, www.mckinsey.com/industries/pharmaceuticals-and-medical-products/our-insights/whats-next-for-pharma-innovation-in-china

[35] PMLive, Is China ready for a pharmaceutical gold rush?, www.pmlive.com/pharma_intelligence/Is_China_ready_for_a_pharmaceutical_gold_rush_1269996

[36] Outsourcing Pharma, Once significantly behind, China begins to close the drug development gap, www.outsourcing-pharma.com/Article/2018/11/20/China-begins-to-close-the-drug-development-gap

[37] BMC Health Services Research, Public hospital reforms in China: the perspective of hospital directors, www.researchgate.net/publication/331425131_Public_hospital_reforms_in_China_the_perspective_of_hospital_directors

In recent years, the privatisation of medical hospitals and clinics has been increasing due to consumer wishes for a more patient-centred system and government initiatives aiming to reduce the burden of care from public hospitals. In 2017, the compound annual growth (CAGR) for private hospital beds was 31%, compared to 6% for public hospitals. During the period 2011-2017, the number of private hospitals in China doubled to a total of 16,900 hospitals, representing 57.2% of all Chinese hospitals. However, private hospitals generate lower revenues than public hospitals. Private hospitals are often smaller and more specialised; while public hospitals are more likely to have higher capacity rates[38].

Moreover, China is one of the largest medical device markets in the world. In recent years, this industry has been experiencing rapid growth due to its complete product categories, increasing innovation capability and strong market demand. New insurance policies have also been contributing to the growth of the Chinese medical device market since an expanding patient pool leads to new opportunities for medical device manufacturers. Furthermore, the improved accessibility of healthcare services, the increased demand for medical services, as well as the increase in the number of hospitals are expected to lead to national and international market opportunities[39].

Overall, Healthy China 2030 provides several opportunities for European companies. In particular, the sub-sectors that provide more opportunities 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 accessories[40].

2.3.3 Renewable Energy

China is a world leader in the renewable energy sector, in terms of power generation and energy capacity. The country has a large variety of renewable energy resources; however, the continuous high dependency on contaminating energy sources has a negative impact on the environment and causes serious problems to public health. Therefore, to curb the effects of pollution and comply with the United Nations Sustainable Development Goals, the China Central Government released several measures with positive outcomes[41].

In 2017, China made high-profile commitments to replace coal as the main source for heating by enacting a coal ban for 28 cities and emphasising an enhanced role for renewables. The 13th FYP also provides detailed guidelines aiming to build a clean, low-carbon, safe and efficient energy system[42]. In this context, the 13th FYP sets several objectives to promote the green improvement and upgrade of the traditional manufacturing industries through the introduction of new materials and technologies. By

[38] Collective Responsibility, Chinese Healthcare Trends: Rising Hospital Privatization, www.coresponsibility.com/chinese-healthcare-trends-rising-hospital-privatization/

[39] Global Business Intelligence Research, Medical Devices Market in China to 2018, www.marketresearch.com/product/sample-7224005.pdf

[40] 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

[41] EU SME Centre: The Green Tech Market in China, 2014.

[42] China Renewable Energy Outlook 2018, http://boostre.cnrec.org.cn/wp-content/uploads/2018/11/China-Renewable-Energy-Outlook-2018-Folder_ENG.pdf

2020, the benefit of the environmental industry is expected to reach 5% of the national GDP and investments in environmental pollution control are forecasted to account for up to 3% of the GDP.

Furthermore, in 2017, China's National Development and Reform Commission (NDRC) and the National Energy Administration (NEA) launched a guideline on the country's clean energy consumption for the 2018-2020 period. According to the Guideline, by 2019, wind power utilisation rate should surpass 90%, while the utilisation rates of photovoltaic and hydropower should be over 95%[43].

In 2018, China renewable capacity increased 12% when compared to 2017. In the same year, China's installed capacity of hydropower stations, wind power stations, photovoltaic (solar) power stations and biomass power stations totalled 352,000 MW, 184,000 MW, 174,000 MW, and 17,810 MW respectively. The power generated by renewable energy accounted for 1.87 trillion kilowatt-hours (kWh), 170 billion kWh higher than in 2017. Thus, in 2018, renewable energy generated 26.7% of China's total power[44].

Moreover, the 13th FYP emphasises the development and utilisation of clean technology for reducing the use of water and increasing energy efficiency in the industrial sector. Water conservation is considered one of the 13th FYP key areas since 70% of China's rivers and 60% of the groundwater is polluted. Therefore, the capital expenditure on industrial water and wastewater treatment is expected to reach €5.7 billion in 2020.

The NDRC is focused on promoting China's photovoltaic (PV) industry. Thus, in 2012, the NDRC started providing financial incentives for solar equipment manufacturers, which led to an increase in large-scale solar projects. In 2017, the newly installed capacity of the global PV market accounted for 102 GW, representing an increase of over 37% when compared with 2016. In 2017, China exported around 37.9 GW of PV modules, with an increase of 77.9% year-over-year. In this context, the fast growth of China's PV power generation directly led to the development of the sectors along the PV industry chain and created new market opportunities. Moreover, the demand in the PV market and PV export volume is expected to continue increasing until 2022, which represents an opportunity for investors[45].

Regarding the wind industry, favourable policies helped tackling the wind power curtailment issue that was particularly relevant in some provinces and regions across China, such as Jilin, Gansu, Heilongjiang and Shanxi. This combined with a number of recently approved wind power projects, has led to an increase in China's newly installed capacity. In 2017, China's newly installed capacity accounted for 22 GW. In addition, China's newly installed capacity is expected to continue growing until 2020; while the proportion of the country's total wind power is also expected to continue increasing in the years to come[46].

[43] China's renewable energy output leaps, www.straitstimes.com/asia/east-asia/chinas-renewable-energy-output-leaps
[44] China's renewable energy output leaps, www.straitstimes.com/asia/east-asia/chinas-renewable-energy-output-leaps
[45] China Photovoltaic Industry Research Report, 2018-2022 - ResearchAndMarkets.com, https://newsok.com/article/feed/3177305/china-photovoltaic-industry-research-report-2018-2022-researchandmarketscom
[46] Renewable Energy World, China's Wind Industry Installs More than 20 GW of Capacity in 2018 and Curtailment Decreases, www.renewableenergyworld.com/articles/2019/02/chinas-wind-industry-installs-more-than-20-gw-of-capacity-in-2018-and-curtailment-decreases.html

Under the renewable energy high penetration scenario, by 2050 China's end-use energy consumption is forecasted to reach 3.2 billion Tonnes Coal Equivalent (TCE) and electricity will account for 62%[47]. 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 activities[48].

2.3.4 Information Communication and Technology (ICT)

In 2017, the production growth of the Chinese ICT sector surpassed China's GDP expansion due to technological innovations in areas such as cloud computing, Big Data, Internet of Things (IoT), AI and advanced manufacturing[49]. According to the Ministry of Industry and Information Technology (MIIT), in 2017, the total output of the Chinese ICT sector exceeded €2.3 trillion.

According to the International Data Corporation (IDC), the Chinese ICT market is expected to reach a CAGR of 8.6% from 2016 to 2021. Moreover, by 2025, China is forecasted to become a world leader in several fields, including manufacturing added value and scale of online shopping. In this context, the ICT market is expected to contribute to the growth of China's digital economy, which is estimated to represent 55% of China's GDP by 2021[50].

Furthermore, the transformation of traditional industries through ICT technologies aligned with the Chinese enterprises' participation in 'Belt and Road' initiatives to enter foreign markets are expected to become the main driving forces for the development of China's domestic ICT market. In this sense, the technological development of the Chinese traditional industries is expected to foster the application and development of production technologies, such as mobile Internet, cloud computing, Big Data, and IoT[51]. This is in line with the objectives of Made in China 2025, which aims to transform the country into a technological leader.

According to IDC, smart cities are also expected to play a leading role in the deployment of IoT, Big Data and cloud services, as well as mobility and consumer IT products. Currently, there are more than 300 smart city pilot sites across China, including the 193 local governments and economic development zones that the Ministry of Housing and Urban and Rural Development (MOHURD) selected as official smart city pilot project sites. These pilots have been fostering the deployment of many technologies related with several industries, such as transportation and utility infrastructure, network equipment, telecom and wireless, data analytics, electronics equipment, and software applications[52].

[47] China 2050 High Renewable Energy Penetration Scenario and Roadmap Study
[48] www.cnrec.org.cn/english/publication/2014-12-29-463.html
[49] Market Monitor ICT China 2018, https://tradesecurely.ca/market-monitor-ict-china-2018/
[50] China Daily, China's ICT market expected to grow fast by 2021: IDC, www.chinadaily.com.cn/a/201806/07/WS5b18f4c2a31001b82571eb97.html
[51] Export.gov, China - Technology and ICT, www.export.gov/article?id=China-Technology-and-ICT
[52] Export.gov, China - Technology and ICT, www.export.gov/article?id=China-Technology-and-ICT

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 [53].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)[54].

Moreover, in recent years, the Chinese Government has been committed to fostering the development of a strong internet industry sector. In 2016, the number of 4G subscribers exceeded 734 million and is expected to continue to increase in the years to come. In this context, the development of 5G has also become a priority for the Chinese Government and, therefore, the country has been highly active in the development of 5G international standards[55].

Considering China's industrial sectors, industrial big data and industrial internet have become two of the pillars of Made in China 2025. In addition, China is a leading market for semiconductors and semiconductor manufacturing equipment. Internet of vehicles (IoV) is also expected to become one of China's leading subsectors due to the development and integration of smart platform/vehicle operating systems, AI and 5G.

However, it is important to highlight that China has strict national security policies focused on ensuring security regarding foreign companies. In this context, the most important government agencies in China with respect to ICT policy are NDRC, MIIT, and 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&D [56].

[53] Here's what happened in internet of things this week, Business Insider https://www.businessinsider.com/heres-what-happened-in-internet-of-things-this-week-2015-7-19?international=true&r=US&IR=T

[54] How China is Scaling the Internet of Things, GSMA https://www.gsma.com/newsroom/wp-content/uploads/16531-China-IoT-Report-LR.pdf

[55] Export.gov, China - Technology and ICT, www.export.gov/article?id=China-Technology-and-ICT

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

3 Cluster community in China

3.1 Cluster mapping

In 1978, China began its process of economic growth through globalisation with the implementation of the Reform & Open-door Policy. This made private competition in certain sectors legal and allowed the establishment of areas for foreign investment. Thus, the increasing market demand for different industry products led to the establishment of numerous clusters in a short period of time, mainly in the coastal regions of South and East China.

Since their inception, the Chinese clusters have been attracting considerable investment, giving rise to associated industries, and boosting the development of manufacturing, commercial and logistics sectors. Moreover, some clusters have succeeded due to the presence of abundant resources and labour skills, such as the clusters in the Guangdong Province and Wenzhou[57].

Coastal clusters have also benefited from their proximity to international transport infrastructures, which promotes the attraction of foreign investment and fosters export-oriented trade. Thus, Chinese coastal regions have also become home to export-oriented sourcing and manufacturing clusters, such as the IT cluster in Guangdong Dongguan. In addition, other clusters have been established around large state enterprises, which has attracted smaller enterprises providing products and services to these large state enterprises or spin-offs of the large state enterprises. The clusters of Haier in Qingdao and the Yiqi in Changchun are leading examples of clusters that have been formed around large state enterprises.

Since the early-1980s, the Chinese Government has been providing special support to cluster creation and development. In this context, the Special Economic Zones (SEZs) were established to promote China's economic development[58]. All SEZs take advantage from financial, investment and trade benefits in order to attract foreign investments and technology, stimulate employment, support capital formation, and promote the use of Chinese and imported resources[59].

According to the World Bank, Chinese SEZs vary in scope and function. Thus, some SEZs are designated geographical spaces where special policies and measures are aimed to support specific economic functions; while others include free-trade areas, industry parks, technical innovation parks and bonded zones that facilitate experimentation and innovation over a wide range of industries[60]. Considering the importance of SEZs to the Chinese economy, some clusters have emerged from SEZs, such as those in Beijing, Shanghai, and Shenzhen[61].

Furthermore, considering the importance of innovation to the Chinese economy, the Chinese Government has been promoting the development of Science and Technology Industrial Parks (STIPs)

[57] How Do Special Economic Zones and Industrial Clusters Drive China's Rapid Development, World Bank, March 2011
[58] ThoughtCo., Special Economic Zones in China, www.thoughtco.com/chinas-special-economic-zones-sez-687417
[59] China's Special Economic Zones, https://transportgeography.org/?page_id=4103
[60] World Bank Group, China's Special Economic Zones, https://www.worldbank.org/content/dam/Worldbank/Event/Africa/Investing%20in%20Africa%20Forum/2015/investing-in-africa-forum-chinas-special-economic-zone.pdf
[61] How Do Special Economic Zones and Industrial Clusters Drive China's Rapid Development, World Bank

and High-Tech Zones (HTZs). These are key players of the Chinese national innovation system (NIS) since their physical and functional components can create new business opportunities, add value to mature companies, foster entrepreneurship, generate knowledge-based jobs, and build attractive spaces for knowledge workers[62].

In recent years, STIPs have become one of the greatest achievements of China's economic reform and paved the way for the creation of new high-tech clusters across China. In this sense, STIPs have developed a successful model for nurturing the growth of businesses and industry clusters through continuous R&D investment, technology transfer and industrial clustering. Moreover, STIPs have been fostering enterprise creation and innovation through the provision of technical support for industrial cluster innovation[63].

In this context, innovation clusters have emerged from STIPs and HTZs and improved China's innovation capacity. Some of China's most successful innovation clusters include the IC design cluster in Beijing Z-park, IC & Biopharmacy cluster in Shanghai Zhangjiang, fibre optical cable cluster in Wuhan East-lake, communications cluster in Shenzhen, software outsourcing cluster in Dalian, and IoT and photovoltaic clusters in Wuxi[64].

China's City Clusters

The Chinese Government plans to transform the country into 19 super-regions thanks to its city-cluster policy, which is focused on regional specialisation. Thus, this policy aims to gather in the same city companies, research and development institutions, and universities to boost innovation.

Of the 19 city clusters, the China Central Government has prioritised three of them to become world-class clusters by 2020, namely the Pearl River Delta (PRD), the Yangtze River Delta (YRD), and Beijing-Tianjin-Hebei. These three clusters are expected to become the most innovative and internationally competitive of all the clusters and, therefore, to drive national economic development. In addition, the other 16 clusters are either medium or small size clusters and are expected to generate a smaller economic impact. **Error! Reference source not found.** provides an overview of China's City Cluster Plan[65].

[62] Fostering Innovation in Hi-Tech Clusters, APCTT 2010
[63] Fostering Innovation in Hi-Tech Clusters, APCTT 2010
[64] Overview of China's Regional Development 2010 Part I: Three major city clusters, Li & Fung Research Centre
[65] China Briefing, China's City Clusters: The Plan to Develop 19 Super-regions, www.china-briefing.com/news/chinas-city-clusters-plan-to-transform-into-19-super-regions/

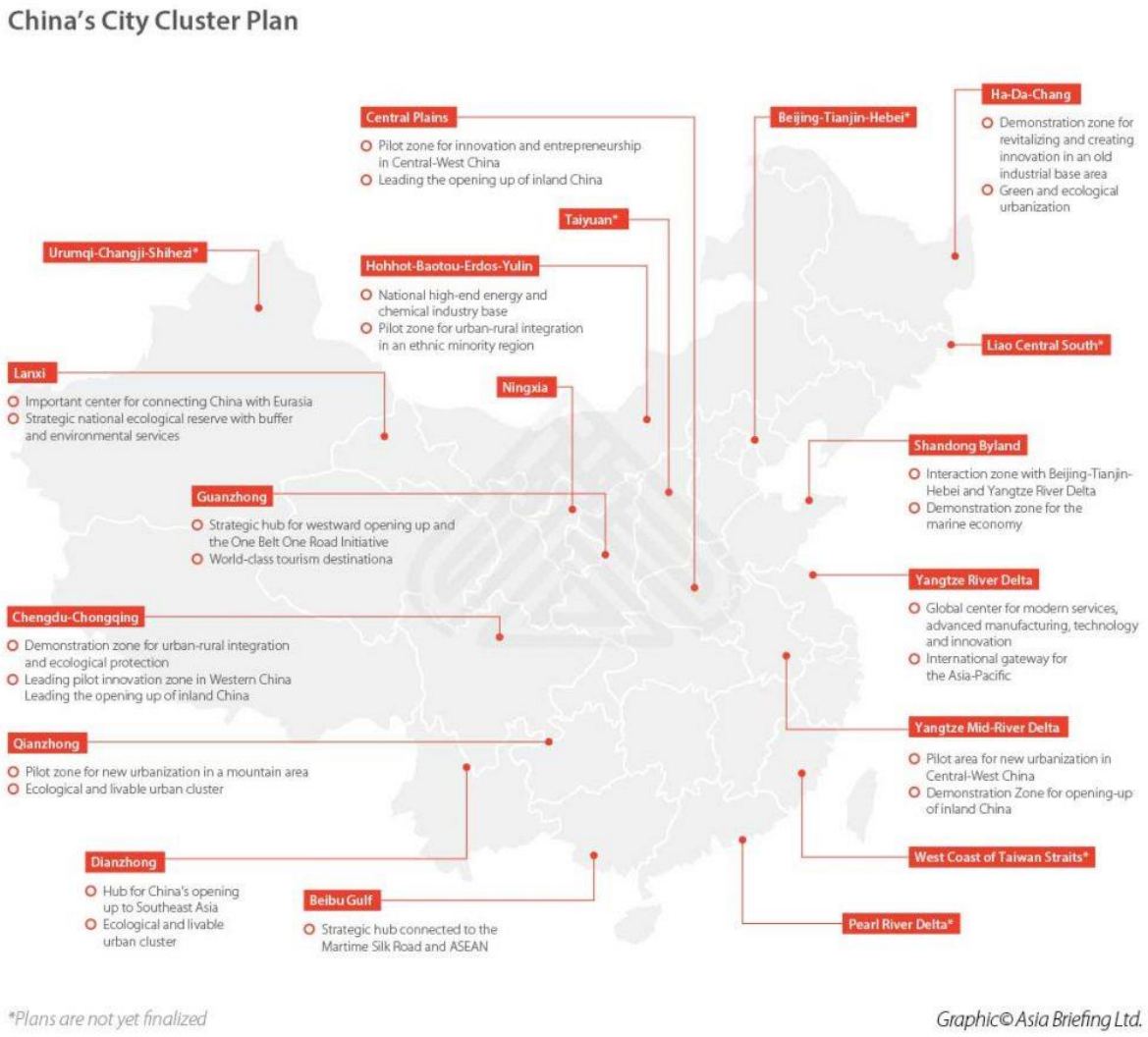

FIGURE 1 - CHINA'S CITY CLUSTER PLAN[66]

Pearl River Delta (PRD)

The PRD is located in the Guangdong Province, covering major cities such as Guangzhou, Shenzen, Dongguan, Foshan, Zhongshan, Zhuhai and Huizhou. The PRD was the first SEZ in China and during the last decades has become one of the fastest growing regions in the country. Located close to the South China Sea, Hong Kong, Macau and Taiwan, the PRD is also very attractive to foreign investment. Currently, the PRD has eight cities in the top 200 of the global Economic Competitive Index[67].

[66] Source : China Briefing, China's City Clusters: The Plan to Develop 19 Super-regions, www.china-briefing.com/news/chinas-city-clusters-plan-to-transform-into-19-super-regions/

[67] China Briefing, China's Mega City Clusters: Jing-Jin-Ji, Yangzte River Delta, Pearl River Delta, www.china-briefing.com/news/chinas-mega-city-clusters-jing-jin-ji-yangzte-river-delta-pearl-river-delta/

Moreover, the PRD is one of mainland China's largest and most sophisticated consumer markets. Even though PRD's population only represents 5% of China, it produces more than 10% of its economic output[68]. 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[69].

In this context, PRD's wide range of industries has promoted the development of clusters. Thus, the two PRD Banks present different industry profiles. The East Bank focuses on electronics and IT products, while the West Bank is recognised for the production of household appliance products[70]. The most famous industrial clusters in the PRD include: machinery, electronics, packaging, lighting, and casual wear in Zhongshan; electronic products in Dongguan and Shenzhen; denim clothing and automobile in Guangzhou; and shoes in Huizhou[71].

Moreover, the PRD offers a wide range of opportunities to European clusters mainly: in export-oriented production facilities in traditional, higher value-added and higher technology industries such as automobiles, auto parts, advanced materials, and chemicals; in materials, construction equipment, transportation equipment, telecommunications equipment; in related services such as construction, design, architecture, engineering, and financial services; in environmental, pollution-control, and clean technologies; as well as in financial and business services[72].

Yangtze River Delta (YRD)

The YRD is represented by the municipality of Shanghai and the provinces of Jiangsu, Zhejiang and Anhui. The YRD is China's richest region per capita and accounts for one-third of the country's imports and exports. Moreover, the YRD is one of the largest and most sophisticated consumer markets in China. In this context, in 2010, China's State Council established a plan to transform the YRD region into a world-class city cluster by 2030[73].

The abovementioned plan takes into account YRD's regional strengthens and promotes the cooperation among provinces and cities in the region. Thus, Shanghai is a logistics centre and mainland China's financial centre, while Zhejiang and Jiangsu provinces have strong manufacturing industries. Moreover, the provinces of Zhejiang and Jiangsu are home to a large number of industrial parks, which are located

[68] Forbes, China's Crown Jewel: The Pearl River Delta, www.forbes.com/sites/edfuller/2017/10/02/chinas-crown-jewel-the-pearl-river-delta/#3251f80c5047

[69] The Greater Pearl River Delta, Invest Hong Kong, https://www.ucer.camcom.it/Internazionalizzazione/news/pdf-2012/GPRDReport.pdf

[70] HKTC Research, PRD Economic Profile, http://china-trade-research.hktdc.com/business-news/article/Facts-and-Figures/PRD-Economic-Profile/ff/en/1/1X000000/1X06BW84.htm

[71] Business and economic distribution and clusters, ActiveUKChina

[72] www.ucer.camcom.it/Internazionalizzazione/news/pdf-2012/GPRDReport.pdf

[73] China Briefing, The Yangtze River Delta Integration Plan, www.china-briefing.com/news/yangtze-river-delta-integration-plan/

in cities such as Hangzhou and Suzhou. The Anhui province is recognised by its abundant natural resources, being a large provider of energy and coal to eastern China[74].

In 2018, authorities from Shanghai, Zhejiang, Jiangsu, and Anhui launched a three-year action plan (2018-2020) to promote a strategic roadmap, which includes around 12 collaborative projects to increase YRD's competitiveness on the global scenario. The action plan is also focused on developing the region's comparative advantages in the modern service industry, as well as on advancing the manufacturing industry[75].

Furthermore, the three-year action plan for the YRD cluster is aligned with the industrial priorities defined in Made in China 2025. Thus, the cluster will be mainly focused on marine and high-tech ships, new energy vehicles, power equipment, advanced rail, medical technology, aviation and aerospace, and ICT. In addition, the Shanghai tourism authorities plan to transform the YRD region into a world-famous tourist destination.

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 lifestyle[76].

Moreover, the YRD region is highly focused on attracting foreign technology to boost the development of the abovementioned priority industries. In this context, the region's industrial parks and two free trade zones (FTZs) are expected to act as catalysts of foreign investment, which may represent an opportunity to European investors[77].

Beijing-Tianjin-Hebei

The Beijing-Tianjin-Hebei region covers Beijing, Tianjin, part of Hebei, part of Liaoning and part of Shandong. The Beijing-Tianjin-Hebei region is rising as the northern economic powerhouse. Beijing-Tianjin-Hebei combined account for around 10% of China's GDP. In addition, the region represents 8% of China's population[78].

The city cluster development project of Beijing-Tianjin-Hebei was first presented over 10 years ago by NDRC; however, it was only approved as part of China's plan to develop 19 super regions. Thus, the

[74] China Briefing, The Yangtze River Delta Integration Plan, www.china-briefing.com/news/yangtze-river-delta-integration-plan/
[75] China Briefing, The Yangtze River Delta Integration Plan, www.china-briefing.com/news/yangtze-river-delta-integration-plan/
[76] 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
[77] China Briefing, The Yangtze River Delta Integration Plan, www.china-briefing.com/news/yangtze-river-delta-integration-plan/
[78] China Briefing, The Beijing-Tianjin-Hebei Integration Plan, www.china-briefing.com/news/the-beijing-tianjin-hebei-integration-plan/

Beijing-Tianjin-Hebei plan is focused on accelerating the development of the region by taking advantage of local assets and developing synergies[79].

The Beijing-Tianjin-Hebei city cluster will be deeply grounded in the strengths of specific areas. Beijing is an internationally recognised political, educational, cultural, and R&D centre. Tianjin is northern China's logistics centre, with one of the busiest ports in the world; while Hebei province is known for its heavy industries. The region is also home to manufacturing and industry activities, more precisely: aviation, logistics and shipping in Tianjin; insulation materials and metal casting in Cangzhou; furniture in Langfang; fasteners in Handan; and high-end pharmaceutical industry in Shijiazhuang[80].

However, the Beijing-Tianjin-Hebei project requires important changes in order to be successful. In this context, the Hebei province will need to move away from heavy polluting industries; while Tianjin is expected to become an R&D centre for manufacturing and a pilot area for financial innovation and reform. In order to ensure the success of these changes, the Tianjin FTZ is expected to support Tianjin since the region benefits from policy experimentation and looser restrictions[81].

3.2 Clusters in Automotive, Human Health, Renewable Energy and ICT

As mentioned in Section 2.3 Sectoral strengths, Chinese clusters in the automotive, human health, renewable energy and ICT sectors are considered among the most interesting for the EU. This section analyses some of the leading clusters related to these sectors.

Automotive clusters

Guangzhou automobile city cluster

Guangzhou is a major automotive manufacturing base. The cluster is home to three large Japanese car manufacturers, Honda, Nissan and Toyota. Moreover, the Guangzhou Municipality has positioned the Guanzhou Automobile Industry Group (GAIG) at the centre of the cluster by promoting joint ventures between GAIG and Honda, Honda and Dongfeng Automobile, and Toyota[82].

Furthermore, Guangzhou is home to two automotive centres, namely Guangzhou Development Zone and Huadu Automobile City. Guangzhou Development Zone is an assembly producing area with about 70 foreign parts suppliers, out of which 30% are Japanese companies that provide parts for Guangzhou

[79] China Briefing, The Beijing-Tianjin-Hebei Integration Plan, www.china-briefing.com/news/the-beijing-tianjin-hebei-integration-plan/

[80] Overview of China's Regional Development 2010 Part I: Three major city clusters, Li & Fung Research Centre, December 2010

[81] China Briefing, The Beijing-Tianjin-Hebei Integration Plan, www.china-briefing.com/news/the-beijing-tianjin-hebei-integration-plan/

82 The Flowchart Model of Cluster Policy: The Automobile Industry Cluster in China, IDE-JETRO https://ir.ide.go.jp/?action=repository_action_common_download&item_id=38067&item_no=1&attribute_id=22&file_no=1

Honda. The Huadu Automobile City integrates a modern production base, which combines automotive manufacturing with auto R&D and auto parts production[83].

In 2018, the Guangzhou municipal government launched the Guangzhou Automobile Industry 2025 Strategic Plan. The Plan aims to upgrade Guangzhou to a world recognised manufacturing cluster by 2025 in terms of production and sales. Moreover, the plan details the strategy for the city's auto industry and emphasises the importance of developing national brands, intelligent vehicles, and upgrading its system for innovation[84].

Furthermore, the city aims for its auto industry to build "Two Zones, One Highland". In this context, the "Two Zones" refer to the pilot zone for Chinese auto brands and the pilot zone for the industrialisation of intelligent and new energy vehicles; while the "One Highland" refers to the highland for innovation, openness, and sharing. Thus, Guangzhou is focused on encouraging cooperation between traditional auto enterprises, emerging auto enterprises, and internet companies, as well as on building an international innovation centre for the auto industry by promoting new cooperation modules with foreign investors in regard to new energy and intelligent vehicles[85].

In addition, the plan is in line with the "breed Chinese brands" strategy, which aims to have two internationally-renowned Chinese brands by 2025. In this context, the international promotion of Trumpchi, a car brand owned by Guangzhou Automobile Group (GAC Group), will be highly supported by the Guangzhou Automobile Industry 2025 Strategic Plan[86].

Chongqing automobile cluster

The region of Chongqing is a leading automotive region. More precisely, the districts of Hechuan and Dazu are home to important automobile, motorcycle and accessories industries, which contribute to the region's economic growth. In 2018, Chongqing's automotive industry produced over 200,000 new energy automobiles and 800,000 smart network automobiles[87].

In recent years, Chongqing has become a major automobile production base in China. Chongqing has been incubating numerous famous brands including Chongqing Chang'an, Chang'an Ford, and Lifan. The auto products produced in Chongqing vary from passenger cars to trucks and special vehicles. The city is also China's biggest motorcycle producer and exporter[88].

Even though the districts of Hechuan and Dazu are home to the city's biggest automotive component companies, there are other areas around the city which are highly important for the Chongqing cluster.

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[83] China's Automotive Clusters, Conquer China, http://www.conquer-china.com/chinas-automotive-clusters/
[84] Life of Guangzhou, Guangzhou sets out auto industry strategy, www.lifeofguangzhou.com/knowGZ/content.do?contextId=7454&frontParentCatalogId=175
[85] Life of Guangzhou, Guangzhou sets out auto industry strategy, www.lifeofguangzhou.com/knowGZ/content.do?contextId=7454&frontParentCatalogId=175
[86] Life of Guangzhou, Guangzhou sets out auto industry strategy, www.lifeofguangzhou.com/knowGZ/content.do?contextId=7454&frontParentCatalogId=175
[87] Chongqing, Chongqing's Auto Industry Achieves Transformation and Upgrading, www.ichongqing.info/business/chongqings-auto-industry-achieves-transformation-and-upgrading/
[88] China Daily, Industries of Chengdu-Chongqing City Cluster, http://govt.chinadaily.com.cn/a/201902/18/WS5c6a0e6a498e27e3380387ee.html

In this context, the Jiulong Industrial Park and Shapingba District present a dominant number of auto part and component suppliers; while Ba'Nan District and ChaYuan New Area are home to Suzuki and have recently attracted a growing number of parts suppliers[89].

Human Health 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. Zhangjiang is home to numerous high-end industries, including the bio-pharmaceutical and bio-medical industries. The biomedicine manufacturing industries of Zhangjiang are mainly focused on chemical medicine manufacturing, biomedicine manufacturing, modern traditional Chinese medicine and medical equipment[90].

In 2001, the Zhangjiang Biomedicine Base Development Co Ltd was established under the joint agreement signed in 1996 by MoST, the Ministry of Health, the Chinese Academy of Science (CAS), the Chinese Food and Drug Administration, together with the Shanghai Municipal Government. Since then, biotechnological companies in Zhangjiang Hi-Tech Park have been concentrated in a particular industry cluster known as "Zhangjiang Drug Valley[91].

Zhangjiang Drug Valley includes an industry cluster, R&D, incubation, education and training activities, professional services and risk investment for biomedical industry in Zhangjiang Hi-Tech Park. There are over 130 organisations and companies established at Zhangjiang Drug Valley, including some of the world's leading biomedical companies' R&D centres, such as Dupont, Roche, Hutchison Whampoa, Amway China, Honeywell, National Biological Chip Center, Rohm and Haas Electronic Materials[92].

Tonghua Pharmaceutical Hi-tech Industrial Development Zone

The Tonghua Pharmaceutical Hi-tech Industrial Development Zone was established in 2005. In 2013, the Tonghua Pharmaceutical Hi-tech Industrial Development Zone was upgraded into a national pharmaceutical high-tech zone approved by the State Council. This Zone follows the industrial orientation of "one main body with two wings" and "one master and multi auxiliaries".

In this context, "two wings" refer to the Zone's high-tech sector and high-end services[93]. Moreover, TCM is the Zone's main industry, which is supported by a wide range of related industries. Thus, the Zone includes industrial parks in the areas of TCM, biopharmaceutics, medical devices, medical packaging, and pharmaceutical logistics[94].

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[89] China's Automotive Clusters, Conquer China, http://www.conquer-china.com/chinas-automotive-clusters/
[90] Asia Biotech, China Invests in Biotechnology and Biomedical Sciences, www.asiabiotech.com/11/1114/0967_0968.pdf
[91] Asia Biotech, China Invests in Biotechnology and Biomedical Sciences, www.asiabiotech.com/11/1114/0967_0968.pdf
[92] Asia Biotech, China Invests in Biotechnology and Biomedical Sciences, www.asiabiotech.com/11/1114/0967_0968.pdf
[93] Invest in China, Tonghua Pharmaceutical Hi-tech Industrial Development Zone, http://investinchina.chinadaily.com.cn/2019-01/18/c_317653.html
[94] China Jilin, Tonghua Pharmaceutical Hi-Tech Industrial Development Zone Was Promoted to a National Development Zone, http://english.jl.gov.cn/News/GeneralNews/201401/t20140111_1603528.html

Furthermore, the Tonghua Pharmaceutical Hi-tech Industrial Development Zone is home to 44 pharmaceutical enterprises, out of which seven companies have developed into group enterprises, including: Tonghua Dongbao and Xiuzheng Pharmaceutical; Tonghua Dongbao and Tonghua Jinma Pharmaceutical have become listed companies; and nine pharmaceutical companies were re-identified as national high-tech enterprises. This zone also owns five Chinese well-known trademarks and created the province's first development zone-based academic workstation. In this context, this zone has been known as the "national innovative pharmaceutical industry cluster pilot"[95].

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. This zone was initially launched as the “Optics Valley of China”, which is the largest optical fibre and cable manufacturing base in China. It represents the highest development level in China in optical communications, laser, renewable energy and environmental protection. The industrial strengths of this zone focus on photoelectric information, bio medicine, new energy, and energy saving (solar, wind, biomass and nuclear energy)[96].

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. This park also hosts well-known private technology enterprises, research institutes, and universities. The park already had 21 contracted projects from Deutsche Telekom AG, Huawei, China Mobile, China Telecom, National Power Grid and another 5 Fortune 500 enterprises[97].

Information Technology and Communication (ICT) clusters

Zhongguancun Science Park

Zhongguancun Science Park is one of the leading technology centres in the world. Currently, the Park is home to nearly 20,000 high- and new-tech enterprises, such as Lenovo and Baidu. In recent years, the Park has turned into a high and new-tech industrial cluster featuring sectors such as ICT.

In addition, the Park includes extensive educational resources, such as 40 higher educational institutions, 206 national and provincial research institutions, and numerous members of the CAS and the Chinese Academy of Engineering. There are also more than 15,000 repatriates in Zhungguancun, who have established more than 6,000 enterprises in the park. In this context, the Park also includes a Northern

[95] China Jilin, Tonghua Pharmaceutical Hi-Tech Industrial Development Zone Was Promoted to a National Development Zone, http://english.jl.gov.cn/News/GeneralNews/201401/t20140111_1603528.html

[96] Wuhan Eastlake Hi-tech Development Zone https://www.belspo.be/belspo/coordination/doc/events/20170330ChinaInnovation/01%20Plenary%20China-Belgium%20Final/5-ScienceParks-LI%20Jing-WuhanEast%20Lake%20-e.pdf

[97] www.wehdz.gov.cn

Development Belt for R&D services and high and new-tech industries, which boosts R&D and information services and facilitates the commercialisation of high and new-tech achievements[98].

Chengdu Hi-Tech Industrial Development Zone (CDHT)

The CDHT was established in 1988 and is one of the first state-level hi-tech industrial development zones in China. The CDHT ranks 4th among all Chinese state-level hi-tech zones and is highly supported by national, provincial and municipal authorities. In addition, CDHT includes a south and a west technology park.

The CDHT provides services and support to investors and has set up two government service centres in both the south and west parks. The parks' incentive policies allow it to provide financial support to enterprises in sectors such as ICT. Currently, the CDHT is home to 33237 companies, out of which 1115 companies are foreign invested enterprises including world renowned companies[99].

Moreover, in 2017, the CDHT announced its plan to increase the intensity of its talent-recruitment effort. Thus, the CDHT aims to attract talent from around the globe to promote the competitiveness of its STI system. The China Central Government has recently also upgraded the city of Chengdu to the status of "national central city" with a goal of turning the city into the "science and technology centre of western China"[100].

4 Cluster policies and programmes in China

4.1 The cluster policy in China

China's cluster policy is developed by both the central and the provincial governments. Being aware of the importance of industrial clusters for social and economic development, the China Central Government seeks continuous cluster development according to the guidelines on facilitating the development of industrial clusters announced by NDRC[101].

The most notable programme regarding cluster development is the TORCH Programme, which was approved in 1988 by the national government[102]. The TORCH Programme was implemented in response

[98] UKSPA, Zhongguancun Science Park, www.ukspa.org.uk/members/zsp
[99] AMCHAM, Chengdu Hi-Tech Industrial Development Zone, www.amcham-shanghai.org/en/industrial-park/chengdu-hi-tech-industrial-development-zone
[100] PR Newswire, Chengdu Hi-tech Industrial Development Zone (Chengdu Hi-tech Zone) : Investing USD 730 Million to Attract Global Talent, www.prnewswire.com/news-releases/chengdu-hi-tech-industrial-development-zone-chengdu-hi-tech-zone--investing-usd-730-million-to-attract-global-talent-300405495.html
[101] Cluster community in the country, European Cluster Collaboration Platform: https://www.clustercollaboration.eu/international-cooperation/china?order=field_escp_sme&sort=asc&page=2
[102] D3.1 Initial Report

to the global technology revolution and economic reform, with the aim to develop and internationalise China's new and high-tech industries[103].

In China, cluster development is primarily managed by the NDRC, but MIIT and MoST are also involved. In 2015, they announced a guideline to further promote cluster development in order to support SMEs. The guideline indicated the local governments should establish plans to develop clusters together with other regional development plans. Thus, this guideline encouraged the establishment of SME industrial parks and incubators for start-ups[104].

Moreover, it is important to highlight that neither the NDRC nor MIIT provide direct financial support for the development of Chinese industrial clusters. In spite of the absence of government financial support, the progress has been impressive. This might be partially motivated by the fact that the division into small steps of integrated 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 growth[105].

Furthermore, 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:

i. The innovative environment (local policy, industry chain, facility, etc.);
ii. Level of development of industry (number of companies, income, market share, investment into R&D, patents, standard, etc.); and
iii. Number of 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 abovementioned indicators in the various regions[106].

Regarding EU and China cluster cooperation, MoST and DG GROW have been actively discussing how to explore future cooperation in support of SME internationalisation through clusters. Many European clusters registered in the ECCP show interest in cooperating with China. Currently, 271 clusters registered in the ECCP target China for the development of international activities. In addition, there are nine second generation European Strategic Cluster Partnerships for Going International (ESCP-4i) targeting China:

- European Digital Industry Alliance (DIA) – ICT sector;
- Europe Leading Blue Energy (ELBE) – Energy sector;
- Food In Eco Network (FoodNet) - Transportation and Logistics sector;
- Green Ict development (GIVE) – Automotive sector;

[103] China Torch, Torch High Technology Industry Development Center Ministry of Science and Technology, www.chinatorch.gov.cn/english/
[104] Ministry of Industry and Information Technology, www.miit.gov.cn
[105] www.jstor.org/stable/10.1086/605208?seq=1#page_scan_tab_contents
[106] Ministry of Science and Technology, www.most.gov.cn/tztg/201303/t20130321_100310.htm

- European Strategic Cluster Partnership for Advanced Smart Packaging (AdPack²) - Paper and Packaging sectors;
- European Cleantech Internationalization Initiative (EC2i) - Environmental Services;
- Mobility Goes International - In Action (MobiGoIn-Action) - Transportation and Logistics sector;
- New Frontiers in Food Fast Forward (NF4) – Food sector; and
- Space Clusters International Industrial Diversification (SPACE2IDGO) – ICT sector.

4.2 Automotive policies and programmes

Since 2004, the Chinese government has been supporting domestic automotive and parts producers by limiting the exportation of key raw materials. According to the Automotive Industry Development Policy (2004), foreign investors in automotive manufacturing are required to also produce complete engine sets in China. Thus, foreign investors cannot produce complete automobiles in China unless they have joint ventures with Chinese partners and Chinese partners must have a majority interest in the ventures[107].

Furthermore, export restraints have been benefiting China's domestic producers by guaranteeing supplies and lowering input prices within China. In addition, domestic automotive producers in China have benefitted from domestic content and technology transfer requirements that have helped the industry developing the capacity to produce key components with advanced technologies[108].

However, in May 2018, the NDRC released the draft Administrative Rules on Auto Industry Investment ("Draft Rules"), which aim to reshape China's auto industry. When approved, these rules will change China's approval system for auto investment projects by delegating more authority to local governments, eliminating any new production capacity for fossil-fuelled vehicles and raising the threshold for establishing electric vehicle manufacturing companies.

Moreover, the Draft Rules aim to improve entry standards for auto industry investment projects, guide reasonable investment towards social funds, strongly control any increase in new production capacity for traditional fossil-fuel burning autos, promote the development of NEVs, and establish an innovation system for intelligent vehicles. The Draft Rules also establish that the production capacity for fossil-fuelled cars will be tightly controlled. Thus, when approved, the Draft Rules will replace the abovementioned car industry development policy that has been in place since 2004 and reshape China's auto industry policy[109].

Regarding foreign investment, foreign ownership restrictions on special-purpose vehicles and NEVs are expected to be removed, which will be followed by the liberalisation for commercial vehicles and passenger cars in 2022. Moreover, the current rule that forbids foreign automakers from setting up more than two joint ventures in China will be removed in 2022 and, after the 5-year transition period,

[107]China's automobile industry: development, policies, internationalization, E-Journals, http://www.ejournals.eu/pliki/art/5930/pl

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

[109] China Law Insight, China is Re-shaping its Auto Industry, www.chinalawinsight.com/2018/06/articles/corporate-ma/china-is-re-shaping-its-auto-industry/

all restrictions on foreign investment in the auto sector will be eliminated. These changes are expected to make it easier for foreign companies to produce and sell cars in China, as well as to facilitate foreign investment in the Chinese automotive sector[110].

Furthermore, it is important to highlight that the 13th FYP focuses on intelligent transportation. Therefore, the Plan promotes: (i) the internet-based operation of transportation infrastructure and means of transportation and the digitalisation of operation information; (ii) the development of the Internet of Vehicles and Vessels; (iii) the improvement of early warning systems for failures and systems for operational maintenance and intelligent scheduling, vehicle automation; (iv) the digitalisation of facilities; and (v) the increasing use of smart operations.

4.3 Human Health policies and programmes

In 2009, the Chinese government announced its healthcare reform. The government designed a framework that covered a number of key reform areas, including public hospital reform, primary care, pricing and payment structure, drug quality supervision, and information systems 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 the medical reform by strengthening the national healthcare network, improving the essential drug system and promoting the reform of public hospitals[111].

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 to continue improving healthcare for the overall population[112].

Furthermore, in 2016, the Chinese Government launched the Healthy China 2030 plan, which set the basis for the new healthcare reform. Healthy China 2030 aims to achieve certain key goals by 2030, namely: ensure a continuous improvement of people's health conditions, raise life expectancy to 79 years-old, promote an effective control regarding the main health-endangering factors, foster the improvement of China's health service, and guarantee the establishment of inclusive health-improving regulatory systems. Specific actions under Healthy China 2030 include enhancing health education, promoting healthy lifestyle, increasing universal healthcare access, improving service quality of healthcare providers, and promoting reforms in health insurance, pharmaceutical and medical instruments systems[113].

The 13th FYP China also 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

[110] KWM, Impact of China Removal of Restrictions in Auto Sector, www.kwm.com/en/knowledge/insights/impact-of-china-removal-of-restrictions-in-auto-sector-20180724

[111] Key Issues in China's Health Care: Payment System Reform, the CSIS, https://csis-prod.s3.amazonaws.com/s3fs-public/legacy_files/files/publication/121207_Boynton_KeyIssuesChinaHealth_Web.pdf

[112] EU SME Centre : Healthcare Sector in China

[113] World Health Organization, Healthy China 2030 (from vision to action), www.who.int/healthpromotion/conferences/9gchp/healthy-china/en/

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 include: care and service systems for women, children and elderly people in rural areas; regional systems for referring patients between major hospitals and community health service facilities; and promoting universal recognition of medical examination results or coordinated development of social insurance[114].

4.4 Renewable Energy policies and programmes

China's commitment to renewable energy development was firstly shown by the establishment of the Renewable Energy Law (REL) in 2005, which was amended in 2019. The REL aims to promote the development and utilisation of renewable energy, improve the structure of energy, ensure the safety of energy, protect the environment, and foster sustainable economic and social development. Thus, the REL can be considered a milestone of China's promotion of renewable energy[115].

Furthermore, in 2014, China's Energy Development Strategy Action Plan (2014–2020) was published by the State Council. The Plan aims at reducing China's high energy consumption per unit GDP ratio through a set of measures and mandatory targets, and promoting a more efficient, self-sufficient, green and innovative energy production and consumption[116].

The 13th FYP also defines specific targets for renewable energy deployment by 2020. These targets are aligned with the 13th FYP goals on National Economy and Social Development. The main objectives of the 13th FYP regarding renewable energies are the following:

- To increase the share of non-fossil energy in total primary energy consumption to 15% by 2020 and to 20% by 2030;
- To grow the installed renewable power capacity to 680 GW by 2020;
- To increase the installed wind capacity to 210 GW;
- To promote offshore wind and ocean power development;
- To lead renewable energy technology innovation;
- To further support the development of the renewable energy industry in China and decrease reliance on foreign companies in the domain; and
- To solve the renewable power curtailment issue problem[117].

[114] The 13th Five-Year Plan for Economic and Social. Development of the People's Republic of China, CCTB, http://en.ndrc.gov.cn/newsrelease/201612/P020161207645765233498.pdf

[115] Ministry of Commerce of People's Republic of China, Renewable Energy Law of the People's Republic of China, NIH/NLM, http://english.mofcom.gov.cn/article/policyrelease/Businessregulations/201312/20131200432160.shtml

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

[117] International Energy Agency, China 13th Renewable Energy Development Five Year Plan (2016-2020), https://www.iea.org/policiesandmeasures/pams/china/name-161254-en.php?s=dHlwZT1yZSZzdGF0dXM9T2s,&return=PG5hdiBpZD0iYnJlYWRjcnVtYiI-PGEgaHJlZj0iLyI-SG9tZTwvYT4gJnJhcXVvOyA8YSBocmVmPSIvcG9saWNpZXNhbmRtZWFzdXJlcy8iPlBvbGljaWVzIGFuZCBNZWFzdXJlczwvYT4gJn

In 2016, NEA issued the "Guidance on the Establishment of the Target System for the Development and Utilisation of Renewable Energy Sources", in which the renewable energy proportion in the total energy consumption of each province is recommended. In the same year, the NDRC launched the "Management Measures for the Full Guaranteed Purchase of Renewable Energy Power Generation" in order to foster the consumption of renewable energy power through the guaranteed purchase of renewable energy power generation[118].

Moreover, in 2017, the NDRC, the MOF and the NEA jointly issued the "Notice on the Certification and Voluntary Subscription of Renewable Energy Green Electricity Certificates", which encourages government agencies, enterprises, institutions, social institutions and individuals to voluntarily subscribe green electricity certificates from the national green electricity certification and subscription platform as proof of the consumption of green electricity. This is expected to increase the renewable energy electricity quota[119].

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"[120]. 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.

Furthermore, the 13th FYP supports the abovementioned key points by emphasising the need to foster integrated circuit industrial systems and promote AI, 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 Chinese economy. Thus, since 2015, AI has been included in multiple national economic initiatives, such as Made in China 2025, Robotics Industry Development Plan, and the Three Year Guidance for Internet

JhcXVvOyA8YSBocmVmPSIvcG9saWNpZXNhbmRtZWFzdXJlcy9yZW5ld2FibGVlbmVyZ3kvIj5SZW5ld2FibGUgRW5lcmd5PC9hPjwvbmF2Pg

[118] IOP Conference Series: Materials Science and Engineering, The Development of China's Renewable Energy Policy and Implications to Africa, https://iopscience.iop.org/article/10.1088/1757-899X/394/4/042034/pdf

[119] IOP Conference Series: Materials Science and Engineering, The Development of China's Renewable Energy Policy and Implications to Africa, https://iopscience.iop.org/article/10.1088/1757-899X/394/4/042034/pdf

[120] www.china-embassy.org/eng/xw/t251756.htm

Plus Artificial Intelligence Plan. Moreover, in 2017, the Chinese government formalised its position to prioritise the AI industry as an engine to support the country's growth[121, 122].

In 2016, the Chinese Government launched China's first Cybersecurity Law (CSL). This Law determines how companies should approach security and privacy in China. It also includes strict controls regarding online activities and provisions around storing data locally, having joint venture partners, and registering network assets. In addition, the CSL has mandatory requirements regarding breach notification, appointment of a head of cybersecurity, and incident response plans. In 2018, additional provisions, known as the Regulations on Internet Security Supervision and Inspection by Public Security Organs, were established to define how the Ministry of Public Security (MPS) can conduct both onsite and remote inspection of computer networks[123].

Moreover, in 2016, China's Telecom Services Catalogue was launched to provide licenses to all telecoms services, i.e. either basic or value-added telecom services. Under this catalogue, foreign firms are prohibited from operating numerous services outside the structure of a joint venture partnership with a Chinese company. In 2017, the MIIT released Telecom Service Licensing Requirement to reinforce the Catalogue[124].

5 Conclusion

After more than 20 years of economic growth, Chinese clusters have become important driving forces for economic development and international competitiveness in different Chinese regions. Driven by market demand and governmental support, the Chinese clusters have shifted from a development phase to a more mature stage and are progressively becoming more specialised, market-oriented, and global.

The Chinese cluster ecosystem comprises different types of clusters, including coastal clusters, clusters focused on taking advantage of abundant natural resources and labour skills, clusters mainly linked to exports, as well as clusters formed around large state enterprises. The different types of clusters have distinct aims, ways of operating, as well as regulations. Therefore, European stakeholders should take this into account when looking for cooperation opportunities in China.

Furthermore, the Chinese cluster ecosystem is highly decentralised and comprised of different entities such as STIPs, HTZs, and SEZs. In this context, in recent years, STIPs and HTZs have been playing a role in China's innovation ecosystem. These entities highly promote innovation, foster the development of R&D activities, and boost entrepreneurship. On the other hand, SEZs can be considered as milestones of China's economic growth, providing important opportunities for EU-China cluster cooperation.

[121] http://www.china-briefing.com/news/2017/03/14/china-world-leader-artificial-intelligence.html
[122] https://www.technologyreview.com/s/609038/chinas-ai-awakening/
[123] CSO, What are the new China Cybersecurity Law provisions? And how CISOs should respond, www.csoonline.com/article/3359236/what-is-the-china-cybersecurity-law-how-cisos-should-respond.html
[124] Export.Gov, China - Technology and ICT, www.export.gov/article?id=China-Technology-and-ICT

Currently, the China Central Government is highly focused on promoting the development of a strong and innovative cluster ecosystem. Thus, the plan to transform China into 19 super-regions can be considered as an opportunity for international cooperation. According to this plan, the regions of PRD, YRD, and Beijing-Tianjin-Hebei are expected to become global clusters, which will facilitate international cooperation and foreign investment.

Moreover, it is important to highlight that in recent years the China Central Government has been establishing new rules to facilitate international cooperation and foreign investment in key sectors, such as the automotive sector. Thus, the decrease of the constraints imposed since the beginning of this century is expected to create new opportunities for EU-China cluster cooperation.

In this context, several sectors present opportunities for European stakeholders, including sectors in which both the EU and China are leaders, such as the automotive, human health, renewable energy and ICT sectors. These sectors are deeply grounded on STI, which enhances the appearance of a wide range of cooperation opportunities for European and Chinese clusters regarding STI fields.

The high number of European clusters interested in cooperating with China can also be considered as an important indicator of the potential for EU-China cluster cooperation. Thus, currently, 271 clusters registered in the ECCP target China for the development of international activities. In addition, there are nine second generation European Strategic Cluster Partnerships for Going International (ESCP-4i) targeting China:

- European Digital Industry Alliance (DIA) – ICT sector;
- Europe Leading Blue Energy (ELBE) – Energy sector;
- Food In Eco Network (FoodNet) - Transportation and Logistics sector;
- Green Ict development (GIVE) – Automotive sector; and
- European Strategic Cluster Partnership for Advanced Smart Packaging (AdPack²) - Paper and Packaging sectors;
- European Cleantech Internationalization Initiative (EC2i) - Environmental Services;
- Mobility Goes International - In Action (MobiGoIn-Action) - Transportation and Logistics sector;
- New Frontiers in Food Fast Forward (NF4) – Food sector; and
- Space Clusters International Industrial Diversification (SPACE2IDGO) – ICT sector.

Since R&D and innovation have an important role in the Chinese cluster ecosystem, ENRICH in China represents a key opportunity for EU innovation stakeholders to enter/cooperate with Chinese organisations. Thus, ENRICH in China offers services to European research, technology and business organisations to connect them with relevant stakeholders in the Chinese market. ENRICH in China has its headquarters in Beijing, hosted by the EU SME Centre, and a first regional Hub in Chengdu, hosted by EUPIC.

Annex A.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 specialisation[125].

[125] http://ec.europa.eu/research/index.cfm?pg=newsalert&year=2017&na=na-020617

Annex A.2 EU-China R&DI projects

TABLE 1 - EU-CHINA RESEARCH, DEVELOPMENT AND INNOVATION SELECTED PROJECTS[126]

PROJECT	DESCRIPTION
Strengthening international R&I cooperations between China and the EU (SENET) – 2019 - 2021	The overall objectives of the Sino-European Health Networking Hub (SENET) are (1) to create a sustainable health networking and knowledge hub which facilitates favourable conditions for a constant and constructive dialogue between Chinese and EU research and innovation entities and (2) increase collaborative efforts addressing common health research and innovation challenges. SENET's objectives are in line with the expected impacts of the call. It intends to enhance bi-lateral and multi-lateral cooperation between EU and China on health research and innovation topics. It is determined to increase higher participation of Chinese researchers in SC1 and future EU and Chinese joint health research programmes and consequently strengthen R&I cooperation in health research and innovation. Website: http://senet-hub.eu/
5G HarmoniseD Research and TrIals for serVice Evolution between EU and China (5G-DRIVE) - 2018-2021	The objective of 5G Drive is to increase harmonisation and R&I cooperation between the EU and China in 5G through linked trials and research activities by cooperating with the Chinese twin project "5G Large-Scale Trial". 5G Drive will trial and validate interoperability solutions between EU and Chinese 5G networks. The project activities are structured into three pillars: (1) testing and demonstrating the latest 5G technologies for enhanced Mobile Broadband (eMBB) and vehicle-to-everything (V2X) scenarios in pre-commercial 5G networks; (2) researching and addressing gaps in the deployment of network slicing, network virtualisation, 5G transport networks and edge coomputing; and (3) increasing EU-China collaboration through dissemination and exploitation actions. Website: https://5g-drive.eu/
Sino-European innovative green and smart cities (SiEUGreen) - 2018-2021	SiEUGreen aspires to enhance the EU-China cooperation in promoting urban agriculture for food security, resource efficiency and smart, resilient cities. Building on the model of zero-waste and circular economy, it will demonstrate how technological and societal innovation in urban agriculture can have a positive impact on society and economy, by applying novel resource-efficient agricultural techniques in urban and peri-urban areas, developing innovative approaches for social engagement and empowerment and investigating the economic, environmental and social benefits of urban agriculture. Website: www.sieugreen.eu/
Transition towards urban sustainability through socially integrative cities in the EU and in China (TRANS-URBAN-EU-CHINA) - 2018-2020	The key objective of TRANS-URBAN-EU-CHINA is to help policy makers, urban authorities, real estate developers, public service providers and citizens in China to create socially inte-grative cities in an environmentally friendly and financially viable way. Moreover, it will help urban stakeholders in Europe to reflect and eventually reconsider their approaches towards sustainable ur-banisation. Website: http://transurbaneuchina.eu/

[126] http://ec.europa.eu/research/iscp/index.cfm?pg=china

EU-China Innovation Platform on Sustainable Urbanisation (URBAN-EU-CHINA) – 2017 -2019	The key objective of URBAN-EU-CHINA is to develop a robust, evidence-driven bottom-up approach to complement the existing top-down EU-China strategic approach to sustainable urbanisation. This will be accomplished via a coordinated series of actions including: a strategic R&I agenda, scoping and assessment, networking events, peer-to-peer exchanges, benchmarking and monitoring, and joint demonstration projects. Website: www.urban-eu-china.eu/en/
ENRICH in China (powered by ERICENA H2020 project) - 2017-2020	ENRICH in China offers unique services to European research, technology and business organisations, connecting them to the Chinese market. ENRICH was launched in October 2017 in China and it aims to trigger all the scientific and technology collaborative potential of the Chinese market for the benefit of European research organisations and technology based companies including start-ups and SMEs. ENRICH in China has its headquarters in the economically vibrant city of Beijing, hosted by the EU SME Centre, and a first regional Hub in Chengdu, hosted by EUPIC. The ENRICH European Office is located in Brussels, hosted by EBN. Website: http://china.enrichcentres.eu
EU-China study on IoT and 5G (EXCITING) – 2016-2019	EXCITING analysed the research and innovation ecosystem for IoT and 5G in China and compared it with the European model. The main purpose of the project was to support the creation of favourable conditions for cooperation between the European and Chinese research and innovation ecosystems, mainly related to the key strategic domains of Internet of Things (IoT) and 5G. Website: www.euchina-iot5g.eu/

Annex A.3 Relevant organisations in China

TABLE 2 - 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.europeanchamber.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
	China Society of Biotechnology	www.biotechchina.org

SECTOR	ORGANISATION	WEBSITE
	Shanghai Society of Biotechnology	www.ssbt.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

Annex A.4 China cluster mapping

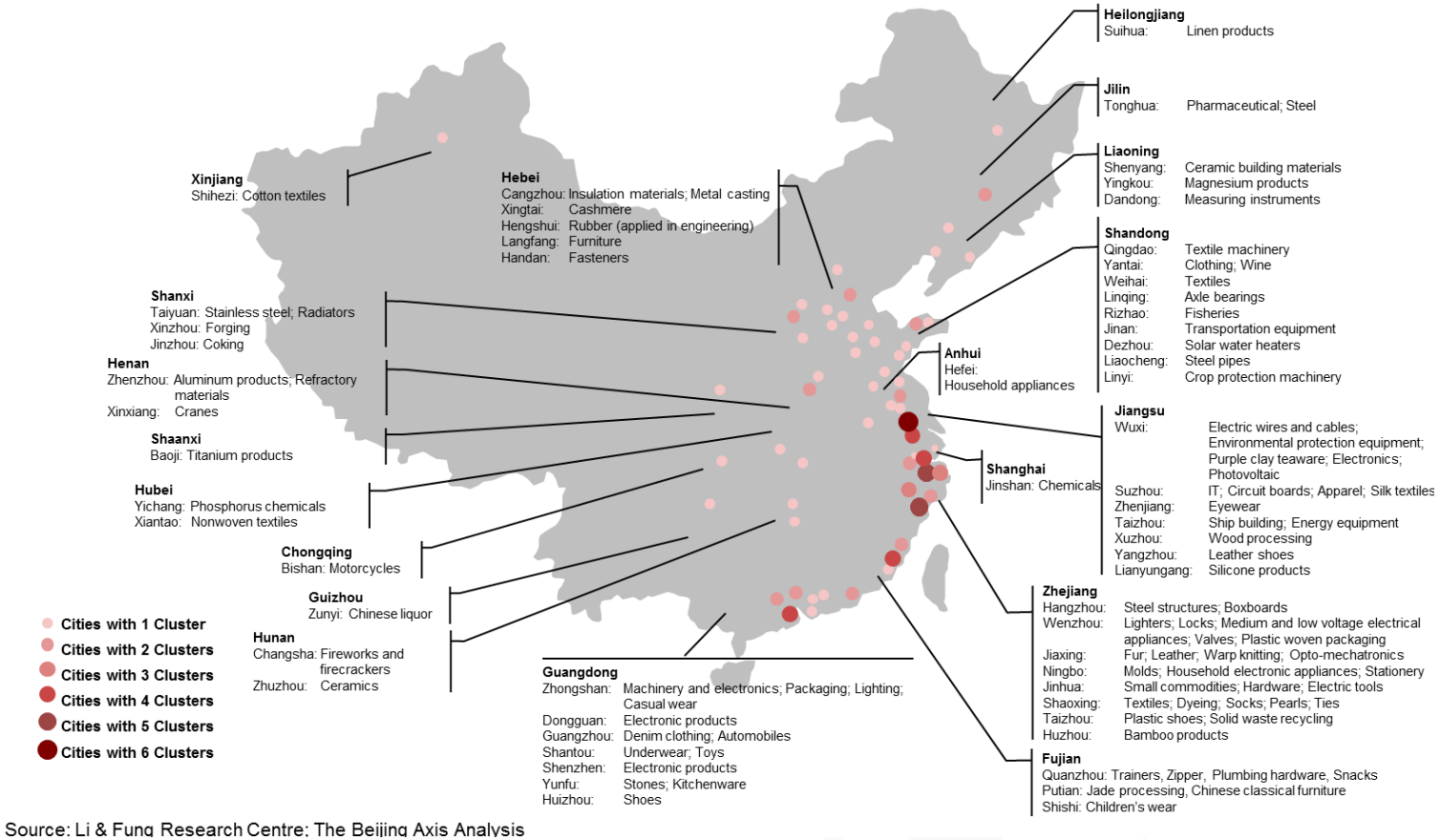

FIGURE 2 - MAP OF TOP 100 INDUSTRIAL CLUSTERS IN CHINA[127]

[127] Map: China's Top 100 Industrial Clusters, The China Sourcing Blog, http://www.chinasourcingblog.org/2011/11/chinas-industrial-clusters.html

TABLE 3 - LIST OF TOP 100 INDUSTRIAL CLUSTERS IN CHINA, 2010[128]

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 溫州甌海	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

	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 石獅鳳裡	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

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