

Research on Fostering and Upgrading IotF-Oriented World-Class Industrial Clusters in the Yangtze River Delta

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ABSTRACT

Industries of the Future (IotF) have become a new focus in international competition as the information technology (IT) revolution and industrial transformation accelerated the iteration, substitution and accumulation of impetus to global economic growth. Western developed countries have raced to plan their IotF, seeking to capture first-mover advantages in the new round of economic growth. China likewise remained reluctant to be outdone in the great power competition, committed to upgrading its world-class industrial clusters in the Yangtze River Delta. It intended to build a high-level industrial innovation ecosystem by facilitating cross-regional collaboration among industries on innovation and policymaking, aiming to help transform industrial clusters into innovation clusters and foster and incubate IotF. At the time when the global innovation system and industrial structure were considerably reshaped, these strategic measures proved crucial for China to build growth poles for the pioneer area of IotF in the Yangtze River Delta, shift from an industry follower to a rival and ultimately to a leader, and “overtake by changing the track” within the new window of opportunity. Meanwhile, these efforts also provide strong impetus for China’s modernization initiatives and its endeavor to shift from a manufacturing giant to a world manufacturing power.

Keywords: *Industry of the Future; World-Class Industrial Cluster; the Yangtze River Delta; Regional Integration; High-Quality Development*

1. INTRODUCTION

The new round of IT revolution and industrial transformation has expedited the surge in new technologies, paradigms, forms of business, and industries. As “deglobalization, unilateralism and technological hegemony” increasingly grew in Western developed countries and the world experienced recurrent Covid-19 outbreaks, the global industrial structure has been significantly reshaped, while strategic games played by major powers and science and technology (S&T) competition among them have fully intensified. Conducting independent innovation in S&T and keeping industrial chains secure and controllable have come into

the worldwide spotlight. The entire history of industrial transformation indicated that any change in scientific and technological innovation paradigms invariably led to the development of emerging industries, a period during which seizing new technologies and fostering new industries constituted vital measures for a certain country to shape new areas of economic growth and enhance its international competitiveness. IotF has attracted a great deal of international attention since it represents the future trends in S&T and industries and is composed of innovative, pioneering and cutting-edge industries that can enormously stimulate the development of surrounding areas. Currently many countries worldwide are scrambling to foster disruptive technologies and to

plan their IotF with foresight, among which countries and regions like Europe, America, Japan and South Korea have issued various policy plans and reports on IotF, aiming to capture preemptive advantages in the new round of industrial transformation. The theory of “two windows of opportunity” proposed by Pérez (2003) suggests that the current new round of IT revolution has provided China and Western developed countries with equal opportunity for their development. China could seize the historical chance to accelerate its IotF layout, which would help itself “overtake by changing the track” and transform from an industrial follower to a rival and ultimately to a leader.^[1] Due to the Covid-19 pandemic and the “technology nationalism” preached by Western developed countries, global industrial chains tended to be shorter and cluster together regionally. Consequently, industrial clusters have become the major entities engaged in international trade competition, reflecting the international competitiveness of a certain country’s industry. Fostering internationally competitive industrial clusters exemplified by world-class advanced manufacturing clusters has become a pivotal strategic approach for each country to attain global competitiveness, hold a place in the new round of industrial transformation and control the industrial high ground.^[2]

The Yangtze River Delta, the pioneer area of reform and opening up strategically positioned as “a globally important advanced manufacturing base” by the Chinese government, is one of China’s most innovative and economically dynamic regions that boast the most solid industrial foundation and also play the greatest role in leading other areas. It remained a national strategic mission of importance for the Yangtze River Delta Region to build world-class advanced manufacturing clusters. To this end, the three provinces (i.e. Anhui, Jiangsu and Zhejiang) and Shanghai Municipality need to fixate on the national strategy of regional integration and identify their respective industrial foundation and resource advantages. They should make an overall plan and propose a rational division of labor accordingly to enhance cross-regional cooperation among industries and collaboration in innovation.^[3] China has been undergoing a profound change unseen in a century, during which it had to cope with the S&T blockade imposed by Western countries to create new momentum for national economic growth and make its industries internationally more competitive. Therefore, it was a pressing, vital strategic agenda to foster and upgrade world-class industrial clusters at a faster pace by maintaining focus on several advanced manufacturing sectors and remaining oriented towards IotF.^[4]

2. INTEGRATION OF YANGTZE RIVER DELTA REGION UNDERLYING THE FOSTERING AND UPGRADING OF WORLD-CLASS INDUSTRIAL CLUSTERS

A world-class industrial cluster refers to a relatively competitive and internationally influential world-leading industrial network in a region, which features a rational layout, a clear-cut division of labor, collaborative innovation and full industrial chains. It forms in a specific area with the guidance of international concepts about scientific and technological innovation as well as the development of advanced industries. Its formation also rests on advanced technologies, a specialized division of labor and regional comparative advantages. The Yangtze River Delta Region, the world’s sixth-largest megalopolis centering around Shanghai Municipality, boasts extensive hinterland, prosperous economy and strong research and innovation capabilities. It abounds with development zones, comprising 146 national-level and 320 provincial-level ones, which have created a favorable condition for industrial agglomeration and development.^[5] This region, situated at the intersection of the Yangtze River Economic Belt and “One Belt, One Road” (currently called the Belt and Road Initiative), plays a pivotal role in connecting internal and external markets and in opening up to both of them. It is one of China’s regions that have the highest level of openness, the most convenient condition for factor mobility, the best industrial system and the most vibrant innovation in S&T. General Secretary Xi Jinping, a leader attaching great importance to the practice of integrated development in the Yangtze River Delta Region, proposed to pursue high-quality integrated development in the new round of IT revolution and industrial transformation. He proclaimed faster action to construct a regional community of shared innovation, industry, interests and ecology, and further build the Yangtze River Delta into a demonstration and pioneer area for China’s coordinated regional development. The Yangtze Delta encompasses three provinces and one municipality (i.e. Jiangsu, Zhejiang, Anhui and Shanghai) which are economically distinctive but industrially complementary. Shanghai, the forerunner of that region, ranks as an international financial, shipping and technological innovation center playing an increasingly notable role in spearheading independent innovation. Moreover, Jiangsu is a province with a well-developed collective economy and apparent advantages in manufacturing clusters. Zhejiang is home to a remarkably dynamic private economy and boasts a strong foundation for innovation in the digital economy, while Anhui has achieved further economic growth thanks to industrial transfer from Jiangsu, Zhejiang and Shanghai. Guided and propelled by the strategy of integrated development, the Yangtze Delta highlighted differentiated development, complementary advantages and synergy between industries and cities. It possessed

an increasingly reasonable industrial structure and led the entire country in its comprehensive strength of manufacturing industry.

Fostering and upgrading world-class industrial clusters in the Yangtze Delta remained a must for promoting high-quality integrated development of the Yangtze Delta as proposed in *the Outline Development Plan for Regional Integration of the Yangtze River Delta*. They also served as a major strategic initiative for this region to pioneer technological and industrial innovation, strengthen its endogenous forces behind economic growth, function as a hub for both internal and external markets, and build strong growth poles to spearhead the high-quality development of manufacturing industry nationwide at the time when the new development pattern of “dual circulation” composed of internal and external markets has been introduced. Over four decades of reform and opening up and the considerable advancements in regional integration have yielded substantial gains for the manufacturing in the Yangtze Delta, generating a large number of manufacturing clusters. In 2019, manufacturing enterprises above designated size in Jiangsu, Zhejiang, Anhui and Shanghai (three provinces and one municipality in the Yangtze Delta) achieved an operating revenue of 21.5 trillion yuan, accounting for 23.2% of China’s total. In the Yangtze Delta, a total of seven competitive industrial clusters worth at least one trillion yuan have come into existence, namely, electronic information (5,068.989 billion yuan), equipment manufacturing (3565.548 billion yuan), metallurgical industry (2313.765 billion yuan), textile and garment (2,220.357 billion yuan), petrochemical (2190.135 billion yuan), automobile manufacturing (1446.596 billion yuan) and non-metallic products (1041.84 billion yuan). Moreover, three industrial clusters worth 500 billion yuan or above have also emerged, comprising food processing (570.688 billion yuan), rubber and plastics (716.932 billion yuan) and pharmaceutical manufacturing (558.681 billion yuan). Among them, textile and garment, equipment manufacturing, rubber and plastic products, electronic information and pharmaceutical manufacturing were five industrial clusters in the region each of which accounted for over 20% of their respective industries in China. The output value of one trillion yuan or above has laid a solid foundation for fostering and upgrading world-class industrial clusters, making the advantages of the Yangtze Delta as an industrial base more notable.

3. IOTF CULTIVATION REMAINED THE PRIORITY OF FOSTERING AND UPGRADING WORLD-CLASS INDUSTRIAL CLUSTERS IN THE YANGTZE RIVER DELTA

Currently China has ushered in the mid-to-late period of industrialization and is striding towards the post-

industrial era. Advanced experience from developed countries indicated that, to successfully make the leap, China would have to seize opportunities that could be harnessed to develop strategic emerging industries, plan its IotF with foresight and then strategically substitute its dominant industries. The new round of IT revolution and industrial transformation is well underway at the current time when changes are more profound than ever in a century. Scientific and technological innovation has thrived ubiquitously and deeply integrated with multiple socio-economic aspects, functioning as the dominant force reshaping the global economic landscape and industrial ecology. Western developed countries and regions fixated on the first-mover advantages and the right to make international standards for IotF, which was covered in various reports and policy documents they outlined or issued. They have also accelerated the layout in “zero consumption” and “strategic vacuum” sectors. For instance, America has released various documents centering around advanced manufacturing, artificial intelligence (AI), 5G and quantum information science, proposing to shift the focus of great power competition to the layout of IotF. Three of such documents were *America Will Dominate the Industries of the Future* (issued in 2019), *Recommendations for Strengthening American Leadership in Industries of the Future* (2020) and *Industries of the Future Institutes: A New Model for American Science and Technology Leadership* (2021). European Union (EU) also released a similar strategic research report titled *Strengthening Strategic Value Chains for a Future-Ready EU Industry*, urging a focus on improving the global competitiveness of the future-ready EU industry.

China likewise was not resigned to playing second fiddle in that great power competition, having explicitly put IotF development on its national strategic agenda. The purpose was to avoid being stuck in the lower end of global value chains, break the S&T blockade imposed by Western developed countries, and effectively address the adverse effects “unilateralism, trade protectionism and de-Sinicization” exerted on global economy. *The Outline for the 14th Five-Year Plan for National Economic and Social Development and the Long-Range Objectives Through to the Year 2035* proposed to prioritize cutting-edge S&T and those sectors undergoing industrial transformation, which comprised quantum information, brain-inspired intelligence, future network, gene technology, hydrogen energy and energy storage, and deep sea and space development. That document also suggested implementing plans for IotF incubation and acceleration and developing an array of IotF in a forward-looking manner. The National Development and Reform Commission (NDRC) soon afterwards elaborated the target domains of IotF that would be high on the upcoming agenda. During his inspection in Zhejiang Province in April 2020, General Secretary Xi Jinping urged faster action on the layout of strategic

emerging industries and IotF, such as the digital economy, new materials, and life and health. He reiterated that request when convening the Standing Committee of the Political Bureau of the CPC Central Committee in May of the same year, asking to further upgrade industrial foundation and modernize industrial chains. China should consciously grasp the new trends in the global economy and seize the new window of opportunity whereby it could optimize industrial foundation and independently create secure and controllable industrial chains. Those were vital strategic initiatives for China to attain new strategic advantages and “overtake on the bend” in the new era. The Yangtze Delta has lain at the heart of China’s industrial development pattern and served as an essential base for its advanced manufacturing. It was imperative to foster and develop high-level IotF based on world-class industrial clusters, which was a breakthrough point for the Yangtze Delta and even the entire nation to tackle “stranglehold” problems and make industrial and supply chains more independently controllable. Bringing innovation elements together would enormously boost innovation vitality, sparking breakthroughs “from 0 to 1” (creating something out of nothing) and then “from 1 to 100” (increasing the quantity and improving the quality). Fostering high-level IotF was unfeasible without the support of world-class industrial clusters. The solution to start was to optimize industrial ecosystems and maximize the cluster effect through enhancing the coordinated and integrated development of competitive industrial chains in the Yangtze Delta. The subsequent step was to renovate and extend industrial chains and promote their deep integration with innovation chains. Those were intended to help control the industrial high ground in the future, have a say in making international standards for IotF and enhance international influence.

4. MEASURES TO ACCELERATE THE OPTIMIZATION OF IOTF-ORIENTED WORLD-CLASS INDUSTRIAL CLUSTERS IN THE YANGTZE RIVER DELTA

China has been undergoing the critical transition from a manufacturer of quantity to one of quality, requiring faster action on fostering and upgrading an array of world-class advanced manufacturing clusters. That has been a vital strategic measure for removing impediments to the dual circulation comprising internal and external markets and keeping the industrial, innovation and supply chains secure and stable. It has also been a crucial underpinning for the high-quality integrated development of the Yangtze River Delta Region. IotF refers to future-oriented, forward-looking industries that rest on major innovations in cutting-edge S&T, typifying the scientific and technological innovation capabilities and industrial competitiveness of a certain country or region. Fostering world-class industrial clusters in the Yangtze Delta would end in

failure if attention was solely paid to mature pillar industries. Instead, it must focus on cultivating a new generation of IotF, leverage high-level industrial platforms to pool resources and boost scientific and technological innovation to generate endogenous forces behind growth. Meanwhile, emphasis should be placed on promoting factor mobility and the transfer of growth momentum among Jiangsu, Zhejiang, Anhui and Shanghai and on mobilizing multiple entities (e.g., government, industry and enterprise) to make collective efforts. The purpose was to create an advantageously complementary, high-quality and efficient innovation ecosystem featuring a clear division of labor in industry chains and a reasonable functional layout geographically.^[6] Specifically, the measures below could be taken to expedite the optimization and upgrading of world-class industrial clusters in the Yangtze Delta.

4.1. The government level

Optimizing world-class advanced manufacturing clusters in the Yangtze Delta has been a long-lasting and systemic project of strategic importance. It required strengthening the high-level coordination mechanism in compliance with both national strategic plans and the sub-action plans of each province and municipality in the region, a measure which aimed to enable the regional cooperation office to maximize its function of overall planning and top-level design. The region’s governments at all levels were supposed to fixate on high-quality integrated development and gain a deeper understanding of the relationship between fostering IotF and upgrading world-class advanced manufacturing clusters. They should enhance the top-level design and optimize the layout of key industries. Additionally, they need to make overall plans with a holistic view at the time when global industrial, innovation and value chains have been undergoing restructuring, while determining the division of labor in industry chains according to the difference in resource endowment, industrial foundation, comparative advantages and industrial structure of each sub-region in the Yangtze Delta. Those measures were intended to form an orderly, coordinated and internally differentiated pattern concerning the spatial division of labor in world-class industrial clusters, a pattern primarily composed of cluster area around the central headquarter, major industrial base, and complementary and supporting area for industries. Optimizing and upgrading world-class industrial clusters, the underpinning for cultivating IotF, also rested on more standardized, international, and high-end modern markets of specialization. Hence governments in the Yangtze Delta should also enhance high-level coordination whereby they could build a common market for the region and integrate the supply of factors of production. Any market, policy and institutional barriers impeding free factor mobility must be removed at a faster pace to facilitate the free movement of such factors as labor, capital, technology,

information and data across areas. That would regionally maximize the efficiency of resource allocation and create new impetus for innovation in upgrading world-class industrial clusters and fostering IotF.^[7]

4.2. The industry level

Innovation clusters, reputed as an advanced form of industrial clusters, internally possessed full innovation and value chains and highly aggregated innovation factors. Those were favorable for entities to effectively integrate internal and external innovation resources and to collaborate on innovation while keeping the uncertainty surrounding innovation activities to a minimum.^[8] Fostering and upgrading world-class industrial clusters remained a process of strengthening emerging industries, expanding basic industries and planning IotF. The process not only required building innovation clusters and enabling such cradle of industrial innovation to maximize its energy efficiency, but more importantly, integrating innovation chains involved in the entire process from foundational research to applied research and to commercialization of future technologies. Furthermore, IotF along with cutting-edge S&T should be deeply integrated with each economic and societal aspect. The ultimate purpose was to build a modern industry ecosystem collectively supported by the environment, system and talent and steer industrial clusters towards the low-carbon, knowledge-based, intelligent and high-end direction. To jointly foster and upgrade world-class industrial clusters and build cluster areas for the cultivation of IotF, the Yangtze Delta had to meet international standards for industrial clusters, follow the philosophy of green development, and boost scientific and technological innovation to generate core driving forces. It must ensure major cities like Shanghai, Hangzhou and Nanjing maximize their industrial advantages and role in facilitating the development of surrounding areas, while enhancing the synergy of industries geographically scattered in large, medium-sized and small cities and small towns. The intention was to create an industrial pattern that vertically facilitated collaboration based on the division of labor and horizontally took a differentiated approach to development and to match the industrial distribution with the urban layout.^[9]

4.3. The enterprise level

Independent innovation capabilities of local enterprises played an indispensable role in fostering and upgrading world-class industrial clusters that were oriented towards cultivating a number of IotF.^[10] During the process of fostering enterprises, both quality and quantity should be highlighted while attention must also be paid to promisingly growing, high-value and high-tech “little giant” enterprises that specialized in niche and emerging sectors. For one thing, the Yangtze Delta was

required to introduce preferential policies and pool resources available, whereby it could cultivate an array of large flagship enterprises that exceeded in innovation and led their international counterparts, and build them into competitive top-notch firms having a say worldwide. For another, special emphasis should be placed on the cultivation of cutting-edge tech companies and new species-related firms, while an accelerated pace must be maintained to develop a group of hidden champions, singles champions and unicorn companies in high-level IotF through preferential policies and resources. Additionally, fostering IotF would suffer failures without a multi-level, state-of-the-art talent pool, the priority of which was to cultivate a crowd of entrepreneurial and innovative business talents that aspired to be worldwide pioneers. They need to remain at the frontier of innovation and mobilize enterprises to establish innovation alliances together with higher-educational institutions, scientific institutions, investors and financial institutions. Such alliances must be committed to exploring long-lasting, stable mechanisms for cooperation among enterprises, universities and research institutes. It proved essential to boost the principal role of enterprises in innovation and to conduct collaborative innovation in key generic technologies. The focus was to resolve “stranglehold” technical problems and strive to spur breakthroughs in the development and application of a range of advanced, sophisticated and cutting-edge technologies. The aforementioned measures were aimed at addressing the weaknesses in core technologies and helping industrial clusters enhance their competitiveness and innovation capabilities, which eventually would effectively maintain China’s independence and stability in industrial development.

5. CONCLUSION

Industries have played a pivotal role in China’s economic development and remained an essential underpinning for transforming China into a manufacturing power as specified in the “Made in China 2025” blueprint. The report General Secretary Xi Jinping delivered at the 19th National Congress of the Communist Party of China explicitly proclaimed that “we will move Chinese industries up to the medium-high end of the global value chain, and foster a number of world-class advanced manufacturing clusters.” The Yangtze Delta, an advantageous geographical region situated on the lower Yangtze Plain, has served as a crucial growth pole for the development of China’s economy and as a leading area in the growth of China’s manufacturing industry, possessing apparent advantages in industrial clusters. It boasted the first-mover advantages and a solid foundation for the upgrading of world-class advanced manufacturing clusters and IotF cultivation and incubation. Rapid advances in the new round of IT revolution and industrial transformation have spawned new innovation paradigms, and many countries

worldwide have been in fierce competition with each other in their exploration of IotF. To “overtake by changing the track” rather than being stuck in the lower end of the global value chain, China should, in its efforts to foster IotF, think outside the box about the translation of research outcomes into applications, update its mindset and explore new approaches in the process of fostering IotF. Specifically, China should optimize and upgrade its world-class industrial clusters in the Yangtze Delta, enhance cross-regional collaborations among industries on innovation and policymaking, integrate the factor market, replace old growth drivers with new ones, and create a high-level industrial innovation ecosystem so as to transform industrial clusters into innovation clusters and build the pioneer area of IotF, and finally create new growth poles for China.

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