Status, Problems and Solutions Research of Innovative Ecosystem for Advanced Manufacturing Industry in Dongguan City

Yi-Wen ZHANG\textsuperscript{1,2,a} and Jia-Hui LIANG\textsuperscript{3}

\textsuperscript{1}Guangdong University of Science and Technology, Dongguan, Guangdong, China
\textsuperscript{2}Macao University of Science and Technology, Macao, China
\textsuperscript{3}Guangdong University of Science and Technology, Dongguan, Guangdong, China

\textsuperscript{a}yvonnecc07@163.com

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\textbf{Abstract.} Being known as the “world factory”, Dongguan city is in a high speed development period. The city not only upgrading its manufacturing industry, meanwhile, it is building the international advanced manufacturing center, which is the implementation of the "Made in Dongguan 2025". So, with relying on a greater bay area of Guangdong-HongKong-Macao strategic platform of the country, deeply develop from a "manufacturing city" to a world-class advanced manufacturing center with innovative ecosystem in manufacturing.

\textbf{Introduction}

The Outline of the Development Planning of Guangdong-Hong Kong-Macao greater bay area puts forward the idea of “building world-class advanced manufacturing industry clusters with global influence and competitiveness, such as electronic information cluster”, with Shenzhen and Dongguan as the core on the eastern coast of the Pearl River, which points out the direction for the development of Dongguan manufacturing industry.

The root of development industry is the construction of ability. The essentially development of advanced manufacturing industry is the process of gradually forming innovation ability and transforming this ability into innovative product.

As an effective way to improve innovation ability, innovative ecosystem has been discussed and studied in academic field. Therefore, the key to continuous improvement of the innovative capability of advanced manufacturing industry is to build the innovation ecological chain which is relying on the technology chain. Meanwhile, to build the innovative ecosystem chain of advanced manufacturing industry. As an important strategic city, Dongguan has entered the incubation period of advanced manufacturing innovation ecosystem. How to build an advanced manufacturing innovative ecosystem is significant for Dongguan to participate in the construction of GuangDong-HongKong-Macao Greater Bay and gain a leading position in international manufacturing competition.

\textbf{The Development Status of Advanced Manufacturing Industry in Dongguan}

The concept of Advanced manufacturing is an industry that absorbs advanced technological achievements and applies them into the whole process of production to achieve high-quality, efficient and clean production. The main areas of advanced manufacturing industry in Dongguan city are refer to six categories: communication equipment industry, electrical machinery industry, new energy industry, automobile manufacturing industry, shipbuilding industry and petrochemical industry. In 2018, the proportion of advanced manufacturing account for 52.3\% and up to 8.6\% increase compared to 2017.

The advanced manufacturing innovation ecosystem belongs to the middle-level industrial innovation ecosystem. Advanced manufacturing innovative ecosystem refers to an open and complex symbiotic competition and dynamic evolution system formed within the advanced
manufacturing industry through the interaction of material flow, knowledge flow and information flow among different innovative environment. In the process of development and evolution, the system improves the overall innovation performance of advanced manufacturing industry by giving play to the functions of innovation and diffusion, optimizing resource allocation and promoting industrial optimization.

**Innovative Resource**

In 2017, Dongguan launched the "Double program" to promote the pilot enterprises to achieve the double scale and efficiency by providing key support in innovative-oriented intelligent transformation, merger and reorganization, financial leasing and other aspects. In 2018, the plan expanded the number at the municipal level to more than 250 enterprises and municipal finance in Dongguan city also invested more than 500 million Yuan (approximately 83 million USD) in the first phase to set up a parent fund for industries development (Dongguan official, 2013).

In September 2014, by introducing the policy of "Machine-Human replacement", municipal financial department invested 200 million Yuan (approximately 35 million USD) annually to support enterprises to carry out technological transformation and upgrading. At the same time, government has issued policies to construct platforms, like intelligent robot research institutes. The development of industrial robot intelligent equipment can help with the manufacturing industry upgrading in Dongguan City, also it can promote the innovative ecosystem.

**Innovative Environment**

For the social environment, Dongguan has gradually formed a tolerant and receptive social and cultural atmosphere. It is beneficial to encourage innovation and entrepreneurship and build an innovative ecosystem. Especially in recent years, in the process of implementing innovative-oriented development strategy, it has intensified the publicity of innovative and held various forms of innovation and entrepreneurship competitions to strengthen the guidance in Dongguan City.

Also, for political environment, it has introduced a series of policies to encourage scientific and technological innovation in Dongguan city. Some measures for the implementation of enterprise research and so on, covers technology services, new research and development institutions, and so on policies on relevant policies.

In addition, for technological environment, various technologies provide more directions and improve the innovative efficiency for the advanced manufacturing innovation ecosystem. It has implemented achievements in intellectual property rights with patented technology as the core in Dongguan City. According to the data in 2017, the number of patent applications and authorizations in dongguan was ranking third in Guangdong province (the first prefecture-level city). Among them, the number of invention patent applications were doubled in 2018. Also, the PCT of international patent applications was 1,829 pieces, doubled the same period in 2017.

Lastly, the economic environment is also optimistic for the innovative ecosystem development. In August 2019, China customs rank a list of "Top 100 foreign trade cities in China", Dongguan was ranked in the third place. Also, Dongguan ranked the first of The Four little Tiger in Guangdong province, known as the "world factory", and an important transportation hub and trade port. In 2018, GDP of Dongguan city has reached 827 billion Yuan (approximately 120 billion USD), as an increase of more than 7% over the past 5 years. The rapidly economic environment is beneficial for the advanced manufacturing industry in Dongguan.

**Problems of Advanced Manufacturing Innovation Ecosystem in Dongguan City**

**Industrial Competitive Force and Heavy Industry Needs to be Improved**

Manufacturing industry of Dongguan is in a large scale but not power enough, some companies give priority to assembly process, OEM, primary additional value. Meanwhile, because part of the key and core technology and components are imported, so the industry core competitiveness is...
weak. By that, it is relatively lack of the major equipment of high technology, high added value products and key components, especially complete sets of heavy equipment.

The Service Carrier of Technology Innovation Lags Behind

The technology service institutions in Dongguan city are in the primarily stage, and the development is relatively backward. Government-based innovative public service platforms and civilian-funded business incubators are generally relied on government support in the operational process, so they reluctant to take initiative action to connect and service customers. The majority of those service institutions are limited on service capacity, low market recognition and lack of self-function.

Lack of Systematic Innovative Policies

Although Dongguan government has launched a series of technology innovation policies to promote enterprises innovation. However, these innovation policies are often formulated by centralized units, which leads to multiple policies and overlapping policy, even conflicts in policy plans. As a result, the innovation policies are failed to form a system, so the policy implementation are difficult.

Measures to Improve Advanced Manufacturing Innovation Ecosystem in Dongguan City

Promote Open Innovation

In order to improve the industrial innovation, developing new manufacturing models such as network collaborative manufacturing Integrate development with "Internet+". We will accelerate the promotion of internet-based customized manufacturing. Combined with personalized service demand and Internet application to speed up the development of web-based manufacturing customized production, such as clothing, furniture, hardware, mechanical mould industry, even service and business model innovation, on the basis of flexible, rapid response, customized production mode.

Intensify Smart Manufacturing

It is important for manufacturing equipment more intelligence to meet the needs of the industry, such as industrial robots, artificial intelligence industry, intelligent equipment controllers which are the foundation of intelligent manufacturing. In key industries, industrial interconnection can be made to start the construction of physical devices and virtual devices. Realize the interaction between equipment and fusion, so that intelligent manufacturing can be digital, network and smart.

Promote Innovation Culture Surroundings

The innovative ecosystem is characterized by freedom and openness. The experience of regions and cities who are active innovation shows that the innovative system is closely related to the atmosphere of openness, inclusiveness and freedom. Innovation will cause highly possibility of failure, however, innovation activities cannot be sustained without humanistic environment. So, government and enterprises should combine to cultivate innovation culture, for example, enterprise should create a loose cultural atmosphere for innovation for employees or to cultivate employees innovative consciousness and innovative thinking. What’s more, employees enthusiasm stimulate their innovative vitality. The innovation development platform provides the space for talents and knowledge gathering, and also provides the development space for cultivating the innovative ecosystem.

Conclusion

To sum up, in order to build an advanced manufacturing innovation ecosystem, Dongguan need to create an open environment and form a new pattern of all-round opening. We will accelerate the development of platforms to open for the outside world. It should take the development of the bay
area as an opportunity to connect all cities in the Guangdong-Hong Kong-Macao greater bay area, to establish broader connections and form deeper industrial interactions. To utilize the advanced experience effectively and advantages of other cities, with further optimize industrial layout of Dongguan city. It will accomplish building an advanced manufacturing ecosystem in Dongguan city.

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