Research on the New R&D Institutions in Wuhan

Shi Ge* and Huang Taoa
School of Wuhan University of Science and Technology, Wuhan, China
*Corresponding author e-mail: 604666276@qq.com, 1514216035@qq.com

Abstract. As a powerful organizational driving force to promote innovation and development of the international community, the new R&D institutions are increasingly becoming a new entry point for achieving double breakthroughs in technological innovation and economic development. Based on the definition and the cause of formation of the new R&D institutions, this paper analyses the characteristics and operation mode of the new R&D institutions in Wuhan. Then, this paper puts forward some suggestions and prospects on the problems of Wuhan's new R&D institutions.

1. Introduction
How to improve social productivity and promote economic development with scientific and technological innovation is always the focus of attention in China. In the related research of Chinese scholars, the process of innovation is divided into three stages: knowledge innovation, research and development (R&D) design innovation and product innovation. [1] The new R&D institutions are closely related to these three stages and together constitute an innovation entirety. At present, the new R&D institutions have become important organizations that attract talents, achieve breakthroughs in innovation, and promote popularization of research.

In recent years, Wuhan has been continuously valued by the country and has a series of shining titles because of its superior advantages in scientific and educational resources and an important economic center in the central China. [2] In order to maintain Wuhan's competitive advantages and exploit its own advantages, the government has provided relevant support in various aspects such as industrial adjustment, talent attraction and financial assistance. However, there is no direct policy for the new R&D institutions in Wuhan, and the development of new R&D institutions has not caused adequate attention of the Wuhan Municipal Government. Therefore, this paper combines relevant domestic and international experience to effectively explore new R&D institutions in Wuhan, which is of great significance. It can not only enrich the theoretical research of the new R&D institutions, but also provide suggestions for Wuhan's innovational pattern and the construction of new economic growth points to promote the long-term development of the city.

2. The definition and cause of formation of new R&D institutions

2.1. Definition of the new R&D institution
The new R&D institution is an independent legal organization that combines multiple investment entities, adopts both an enterprise management model and a market-oriented R&D model, and combines incubation and innovation with entrepreneurship. Essentially, it is a deepening cooperation
between production, education and research. By integrating those in a corporate framework, R&D institutions, universities, innovative enterprises, government support and social capital are combined. It uses market mechanisms to allocate innovative resources, and conducts basic research and directly targets the market demand for the industrialization of scientific and technological achievements.

2.2. The cause of formation of the new R&D institution

The formation of new R&D institutions is the result of a combination of internal and external factors. Internally, the new R&D institutions have fully mobilized the various elements of participation to complement each other. On the basis of fully analyzing the strengths and shortcomings of the company, a good interaction is formed to achieve complementary advantages and effective allocation of resources. Reduce R&D costs based on shared resources and promote the formation of a risk sharing mechanism. Externally, it is mainly driven by the market competition environment and government policies. As the degree of marketization continues to deepen, the competitive pressure of modern enterprises is gradually increasing. In order to maintain the existing competitive advantages, it is necessary to increase the investment in scientific and technological innovation and improve the ability of technological innovation. [3] But relying on the company's own resources is often unable to support the related R&D. Therefore, the new R&D institutions established by enterprises, universities and scientific research institutions have emerged, and they have completed technological breakthroughs and innovations in cooperation, achieving a win-win situation.

3. Characteristics of Wuhan’s new R&D institutions

Wuhan's new R&D institutions are in the development stage and gradually become important innovation subjects with a series of policy guidance. In its continuous exploration, Wuhan has emerged a large number of new R&D institutions such as Wuhan Institute of New Energy, Wuhan Intelligent Equipment Industrial Institute and Wuhan Institute of Biotechnology. These institutions have gradually identified their own positions with unique advantages and policy supports, and also have come out of a different way of others.

3.1. Innovative investment and construction

Wuhan’s new R&D institutions are not limited to a single individual, but are mostly built by different social entities such as the government, universities, enterprises, research institutes, and so on. Many enterprises aim at Wuhan's rich scientific and educational resources. Under the guidance of the government, they have established cooperative relations with Wuhan’s universities and used their scientific research capabilities to promote the upgrading of their products and improve their own market competitiveness. “Private funding, official support” is the most distinctive system feature of the new R&D institutions. [4] Their subjects of investment and construction are more flexible, independent and diversified. Participating parties adopt risk sharing methods to distribute benefits, which makes up for the problem that traditional scientific research institutions do not have strong risk awareness.

3.2. Innovative management model

The R&D teams have no administrative relationships with the institutions. According to the operation mode of enterprises, Wuhan’s new R&D institutions encourage members to provide high-tech achievements and services to the market for survival and development. Institutions regularly evaluate the R&D teams. And they take the incubation results, technical services and product sales revenue as the core quantitative assessment indicators. In addition, according to different natures, the new R&D institutions can be divided into three types: enterprises, private non-enterprises and institutions. The institutions implement the president's responsibility system under the leadership of the board of directors or the board of directors.
3.3. Innovative strategic positioning
Since their establishment, Wuhan's new R&D institutions have been aiming at the international frontier and developing high-tech, which is forward-looking. They cooperate with the international and domestic, actively become the vanguard and leader of the industry. They are committed to industrialization and marketization of scientific and technological achievements. For example, Wuhan National Library Laboratory for Optoelectronics focuses on integrated photonics, photon radiation and detection, photovoltaic information storage, etc., and conducts basic, forward-looking, multidisciplinary and cross-innovative research, and strives to have vital international influence in the field of optoelectronics.

3.4. Innovative talent team
The talent team of Wuhan's new R&D institutions has gradually become internationalized, attracting talents from all over the country and even the world through a series of policies. For example, the Wuhan Institute of Biotechnology attracts more than 130 high-end talents including academicians at home and abroad. The assessment criteria for talents have also changed. It is not limited to the number of papers published, but also focuses on the results of incubation results, providing technical services and product sales services.

3.5. Innovative interaction
The development process of Wuhan's new R&D institutions is a process of interaction. A major feature of the new R&D institutions is “collaborative innovation”. This collaboration includes not only internal cooperation but also positive interaction with the government and related industries.

Interaction with the government. In the initial stage of establishment and operation, the Wuhan Municipal Government gave certain funds and policy support to the new R&D institutions, including construction costs, operating funds, talent introduction and tax preferential policies. The government's protective and stimulant support for the new R&D institutions can encourage them to actively participate in the market and have more funds to invest in research.

Interaction with industry. Wuhan's new R&D institutions actively participate in industrial technique planning and exploiting and promote industrial agglomeration and development. The new R&D institutions turn knowledge into capital to promote development, which shortens the time from technology research and development to industrialization and improves industrial efficiency.

4. Problems and development suggestions of new R&D institutions in Wuhan
Wuhan has a wealth of scientific and educational resources, unique location advantages and national policy support, providing sufficient internal and external conditions for the formation of the new R&D institutions. However, Wuhan's new R&D institutions as a rising star are still in the preliminary exploration stage, which has caused many problems and severely restricted development. Therefore, the government needs to strengthen guidance and increase support in terms of policies, funds and talents.

4.1. Strengthen the relevance of policies
The municipal government has issued a series of policies to encourage technological innovation, but the actual effect is not obvious. The areas involved in the relevant policies are fragmented and the objectives are ambiguous. On the macro level, attention to the development of the new R&D institutions is few. And there is no strategic thinking that takes the new R&D institutions as the core to drive overall development. The supervision of the implementation of the policy after the introduction of the policy is weak, and the implementation status of the policy has not been fully examined.

Therefore, it is necessary for the government to introduce targeted policies for the development of the new R&D institutions to change the policy guidance and decentralization. Clearly position it and encourage its development with clear material rewards or preferential policies. Finally, establish and
improve the supervision system and increase inspection efforts. Coordinate the integration of departmental functions under a strong unified leadership department.

4.2. Strengthen financial support
Although the municipal government has given certain financial support to the development of new R&D institutions, it is not adequate and has not attracted enough talents. The development of new R&D institutions still has great risks and fails to form a complete guarantee system. At the same time, institutions also have problems with relatively narrow funds support channels, and their ability to attract social capital is weak.

The government should establish a sound risk guarantee mechanism. If the R&D fails, the government could provide certain risk compensation according to the proportion of losses. The government should reform the fund-supporting management model and set up an innovative R&D fund to provide financial support for the new R&D institutions in the form of government participation. [5] Introduce social venture capital, conduct venture capital and private equity investment and expand the funds support channels of the new R&D institutions to provide sufficient funds to promote stable and long-term development.

4.3. Strengthen financial support
At present, Wuhan has a low level of attraction for talents and few high-level talents. Talents are mainly introduced and borrowed, and their cultivating ability is weak. They cannot rely on themselves to achieve long-term development.

If Wuhan wants to keep on advancing on the road of innovation, it must strengthen the attention and fostering high-level talents. First, make more liberal policies. The government should make measures to attract talents and provide adequate research support and life support for high-level talents. Second, strengthen talents’ training. Make full use of Wuhan’s scientific and educational resources. Exploit the advantages of colleges, provide talents with a development platform, and promote the development of local talents. Third, make the talents’ incentive policies. They can be included in the new R&D institutions’ management system through technology shareholding and share awards.

5. Conclusion
Although the new R&D institutions in Wuhan have a late start and insufficient policies, they still show a rapid development trend. With the support of relevant policies, the number of institutions has been significantly improved in terms of quantity and quality. They have gradually grown into a significant part for Wuhan to implement an innovation-driven development strategy and build a nation-wide innovative city. Under the current trend of the times, Wuhan must seize opportunities, deepen understanding of the new R&D institutions, and build a new R&D institution model with Wuhan characteristics. Construct a batch of high-quality new R&D institutions, and utilize innovation to drive Wuhan to take off.

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