

Research on Operation Mechanism of Pharmaceutical Corporate Incubator from the Perspective of Innovation Ecosystem

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Abstract

The coordination and symbiotic development of stakeholders is the guarantee for the healthy operation of pharmaceutical corporate incubator, but the pharmaceutical corporate incubator in China is still in the early exploration stage, and there are still some problems, such as unreasonable operating mechanism, imperfect innovation ecosystem and so on. The perspective of innovation ecosystem has important guiding significance for the operation and development of innovation complex system. So, this paper clarifies the operation mechanism of pharmaceutical corporate incubator innovation ecosystem based on innovation ecosystem theory and the operation practice of corporate incubator. Finally, this paper puts forward some opinions and suggestions for the innovation and development of pharmaceutical corporate incubator in our country.

Keywords

innovative ecosystem, corporate incubators, operation mechanism.

1. Introduction

As an important tool to promote the survival and innovation development of start-ups, business incubator is of great significance to promote the development of national and industrial innovation. Policy documents such as <opinions on vigorously promoting some policies and measures of “widespread entrepreneurship and innovation”> (promulgated by the State Council) and < Administrative Measures for Technology Business Incubator > (promulgated by Ministry of Science and Technology of the People’s Republic of China) emphasize the important position of incubators in innovation and entrepreneurship. And clearly expressed support for conditional leading enterprises and other subjects to build professional incubators, in order to promote the sharing of innovative and entrepreneurial resources, and promote the cooperation and innovation between large, small and medium-sized enterprises[1]. In recent years, in order to achieve rapid and low-cost innovation, some large pharmaceutical companies at home and abroad have begun to set up pharmaceutical corporate incubators, such as Johnson, Novo Nordisk, Fosun Pharma and other well-known pharmaceutical companies. From the practice at home and abroad, the operation mode and system of the foreign pharmaceutical corporate incubator have tended to be stable, while the development of domestic pharmaceutical corporate incubator is still subject to the imperfection of its’ internal governance system and the innovation ecosystem. The specific performance is the macro background of the lack of overall innovation capability of the pharmaceutical industry and the difficulties of domestic pharmaceutical corporate incubators in operation, capital, finance and so on[2].

At present, the research of corporate incubator is mostly based on qualitative research methods such as case study and model construction, and focuses on the analysis of similarities and differences between corporate incubator and other types of incubator, business model of

corporate incubator, corporate incubator network and other topics. The existing research has laid a solid foundation for the innovation and sustainable development of pharmaceutical corporate incubator, but the corporate incubator is not an independent individual or network. Pharmaceutical innovation activities should also be embedded in the innovation ecosystem characterized by the interaction of elements, the coordination of subjects and the close relationship between subjects and the environment. Therefore, combined with the process and characteristics of pharmaceutical innovation, this paper will make an in-depth analysis of the operating mechanism of pharmaceutical corporate incubator from the perspective of innovation ecosystem, in order to provide systematic suggestions for the development and optimization of pharmaceutical corporate incubator.

2. Literature Review

Corporate incubator emerged at the beginning of the 21st century, and the real corporate incubator in China appeared after 2010[3]. The research on the corporate incubator began with Hansen, and he concluded that the resident startups and the parent company have a synergistic effect through the flow of technology and talent to achieve win-win results through the analysis of Ford's innovation cases[4]. While the resident startups obtain the heterogeneous resources of social network, the "entrepreneurial spirit" which is dormant within the parent company will also be activated. Corporate incubator plays an important role in the growth of start-up enterprises, and at the same time, it is also creating value. Different from the direct value creation of start-up enterprises, the incubator creates value indirectly by continuously providing and reallocating resources and providing innovation environment for start-up enterprises[5]. The ways of value creation of different generations of incubators show different characteristics. The three generations of incubators realize value creation mainly through spatial agglomeration, value-added services[6] and social networks[7]. From the perspective of development practice, the development of incubator gradually shows the trend of networking and ecological development.

The theory of innovative ecosystem originated from natural ecosystem. Moore first put forward the concept of "business ecosystem", thinking that the competition between enterprises in the future is no longer limited to individual enterprises, but the competition between their ecological environment[8]. After that, Ander describes the concept of innovation ecosystem more specifically, and believes that the development of innovation activities requires multi-agents to participate in cooperation, at the same time, the external environment will also have a corresponding impact on enterprise innovation behavior[9]. The cooperation between large leading enterprises and small and medium-sized and start-up enterprises in the innovation ecosystem is the choice after strict evaluation based on enterprise strategy, technological strength and other factors[10].

With the continuous maturity of innovative ecosystem theory and the rapid development of incubators, some scholars try to conduct in-depth research on incubators from the perspective of innovative ecosystem. Incubator innovation ecosystem is an innovation ecosystem, which emphasizes the research on incubator elements, subject composition and operating mechanism from the perspective of innovation ecosystem, with more emphasis on the interaction between stakeholders and the environment [11]. At present, the research on incubator innovation ecosystem still stays at the relatively simple level, such as concept definition, characteristic analysis, system composition [12] and so on. There are few articles to study the operating mechanism of incubator or even corporate incubator from the perspective of innovation ecosystem. Therefore, based on the perspective of innovation ecosystem, combined with the characteristics and process of pharmaceutical industry

innovation, this paper will elaborate on the stakeholders, model construction and operation mechanism of pharmaceutical corporate incubator innovation ecosystem.

3. The Model Construction and Operation Mechanism Analysis of the Pharmaceutical Corporate Incubator Innovation Ecosystem

3.1. The Whole Process of R & D and Listing of New Drug

The pharmaceutical industry is famous for its high-risk, high-return, high-tech, long-cycle and other characteristics, in which R & D and innovation is the basis to maintain the vitality of the industry. From the initial laboratory research to the final listing and sales, pharmaceutical industry innovation activities need to go through a number of links and involve a number of stakeholders. Among them, universities and scientific research institutes mainly carry out basic research such as new drug discovery (some large pharmaceutical enterprises also carry out basic research activities), while R & D pharmaceutical enterprises mainly transform basic research results, and carry out preclinical research, clinical research, New Drug Application and other activities. Government departments such as FDA, intellectual property office, medical insurance bureau and other departments supervise the research and development, production, circulation and sale of new drugs based on their respective responsibilities. The characteristics of new drug R & D activities, such as multi-disciplinary intersection, high risk, high investment and long period, make it impossible for a single agent to complete a series of activities from new drug research and development to sales. So, it is necessary for venture capital institutions, intermediary institutions, contract research organization (CRO) to provide funds, technology and information timely and effectively, so as to speed up the progress of innovation output. The new drug R & D and marketing process is shown in [Figure 1](#).

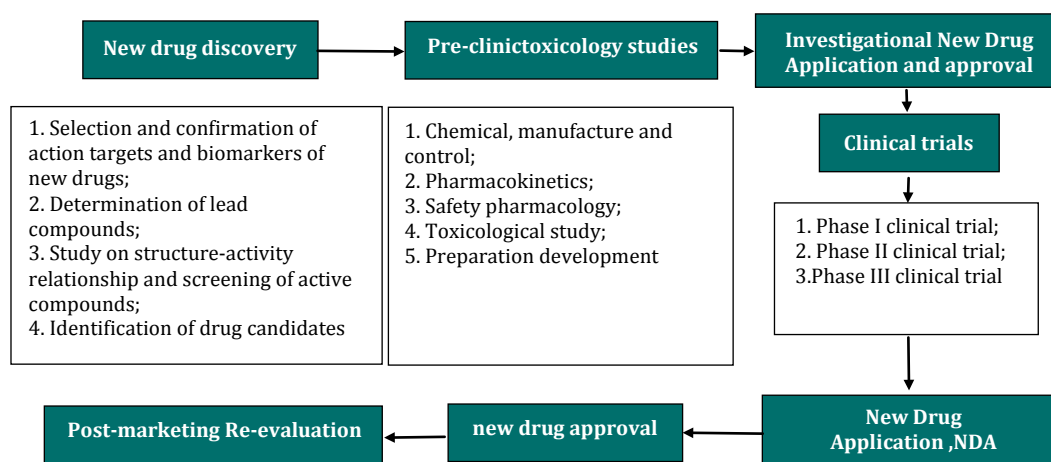


Figure 1: The whole process of new drug R & D and marketing

3.2. Connotation Analysis and Model Construction of Pharmaceutical Corporate Incubator Innovation Ecosystem

3.2.1. Connotation Analysis of Pharmaceutical Corporate Incubator Innovation Ecosystem

The corporate incubator, also known as the innovation center, is an operating platform for large enterprises (parent companies) to provide resources and services for start-up enterprises by making use of their own and network resources advantages based on the concept of open innovation. The main purpose of its operation is to activate the innovative and entrepreneurial spirit within the parent company through cooperation with start-ups [3]. The system presents the characteristics of resource flowing, close cooperation and

environmental dependence. Innovation ecosystem refers to a dynamic and complex system characterized by competition and cooperation among stakeholders, communities and innovation environment in the flowing and sharing of knowledge, information, capital, talents and other resources [13]. The system has the characteristics of collaborative symbiosis[14, 15], continuous innovation and development, self-organization and so on [16].

Therefore, this paper holds that the pharmaceutical corporate incubator innovation ecosystem refers to the self-organizing, dynamic and complex system composed of various stakeholders and innovation environment of pharmaceutical corporate incubator. In this system, mutually beneficial symbiosis and collaborative innovation are realized through the flowing and sharing of key resources such as capital, information, talents and so on.

3.2.2. Analysis of Stakeholders and Structure of Pharmaceutical Corporate Incubator Innovation Ecosystem

On the basis of the definition of stakeholders by American economist Freeman[17], and according to the different supply and demand subjects of incubation services, the stakeholders of incubators can be divided into two categories: incubator service providers and incubator service consumers, the former includes government, incubator, universities and scientific research institutions, intermediary institutions and financial service institutions, and the latter refers to the resident startups in the incubation stage[18]. The parent company is not only one of the important factors that make the difference between the traditional incubator and the corporate incubator, but also the founder of the corporate incubator and the supplier of important incubation resources and services. In addition, this paper believes that the graduated startups and other large pharmaceutical enterprises are also important stakeholders in the pharmaceutical corporate incubator system.

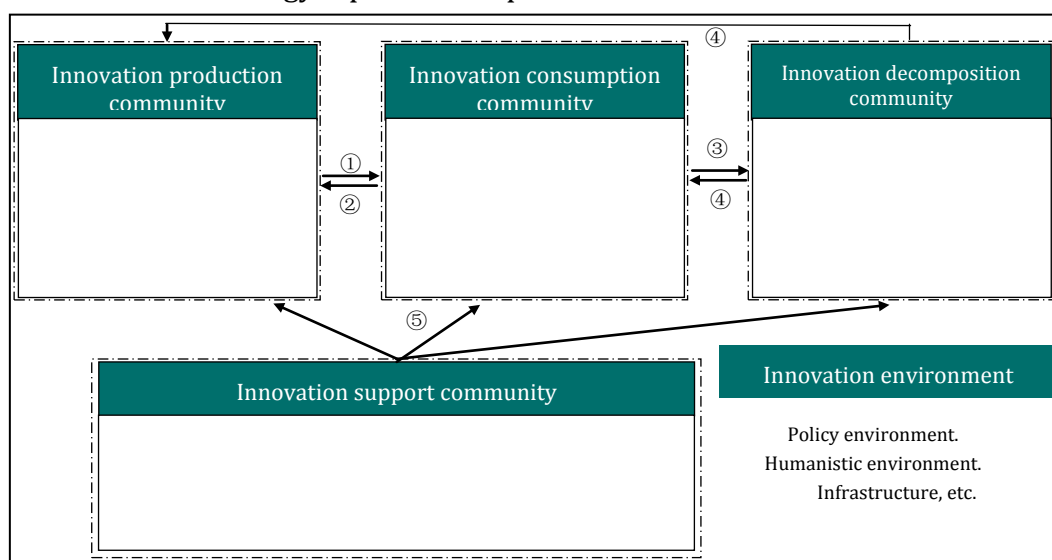
At present, the academic circles have reached a consensus that the innovation ecosystem is composed of two parts: subjects and the inorganic environment (innovation environment). In the study of national innovation ecosystem, Judy Estrin believes that subjects of innovation ecosystem can be divided into innovation research community, innovation development community and innovation application community[19]. The environment is a collection of all subjects, and the interaction between the two promotes the development and change of both sides[20]. Innovation environment provides innovation subjects with excellent policies, capital, infrastructure and other necessary elements of innovation. Innovation population and innovation environment realize systematic coordination and symbiosis through the flow of material, energy, information and other resources[21].

Combined with the whole process of new drug R & D and listing, this paper thinks that the pharmaceutical corporate incubator innovation ecosystem is composed of innovation production community, innovation consumption community, innovation decomposition community, innovation support community and innovation environment. Among them, resident startups and graduated startups constitute the innovation production community, carry out innovation activities through the resources provided by themselves and the pharmaceutical corporate incubator platform, and provide innovation technology, information and other important resources for the innovation consumption community. The innovation consumption community is composed of parent companies and other pharmaceutical manufacturing enterprises. On the basis of the innovative achievements provided by the innovative production community, these enterprises carry out activities such as preclinical research, clinical research, new drug application and product promotion, and finally transform the innovative achievements into innovative products. Innovation support community refers to the main bodies that provide incubation services for resident startups, including universities and scientific research institutes, pharmaceutical corporate incubators, as well as the government, pharmaceutical industry associations, intermediary service

agencies, financial institutions, Contract Manufacture Organization (CMO), CRO and so on. This community can provide resident startups with a variety of resources, including capital, technology, innovative talents, physical space, instruments and equipment, and plays an important role in the system of pharmaceutical corporate incubator. The innovation decomposition community is composed of pharmaceutical circulation enterprises, medical institutions, pharmacies and patients. Through the full "decomposition" of innovative products, the innovation decomposition community realizes the value of innovative products and provides funds and innovation demand information for the next stage of innovation activities. While the innovation environment provides resource support in the process of enterprise innovation and entrepreneurship, it will also be affected by enterprise behavior. The innovation environment mainly includes soft elements such as laws and regulations, social and cultural atmosphere, investment and financing environment, and hard elements such as geographical location, infrastructure, labor structure, natural environment and so on.

3.2.3. Model Construction of Pharmaceutical Corporate Incubator Innovation Ecosystem

The model of pharmaceutical corporate incubator innovation ecosystem based on the above understanding is shown in Figure 2. Each community carries out collaborative innovation activities in the form of energy input and output.



- ① Innovative technology; ② Capital, technology, talents, etc.;
- ③ Innovative products
- ④ Funds, market demand information; ⑤ Policy, capital, technology, consulting services, etc.

Figure 2: Structure model of pharmaceutical corporate incubator innovation ecosystem

3.3. Analysis on the Operation Mechanism of Pharmaceutical Corporate Incubator Innovation Ecosystem

From the perspective of innovation ecosystem, the ultimate goal of pharmaceutical corporate incubator is collaborative innovation and sustainable development. On the other hand, the realization of the ultimate goal lies in such specific issues as whether the key resources such as talent, capital and technology can be allocated reasonably, whether the demands of stakeholders can be met, whether the division of labor of the subject is clear and reasonable, and whether the way of interaction between the subjects and the environment is mature. This paper argues that the operating mechanism of pharmaceutical corporate incubator includes dynamic selection mechanism, synergistic symbiosis mechanism, resource flowing and sharing mechanism and environment matching mechanism.

3.3.1. Dynamic Selection Mechanism

Start-ups and external resource holders such as universities, scientific research institutes, intermediary service institutions and corporate incubators reach a consensus of cooperation and collaborative innovation based on their respective interests. The sufficient resources and mature management mode of the parent company also corporate incubator, and the number of successful graduated startups are the key indicators to attract start-ups to enter the pharmaceutical corporate incubator system. Factors such as the technological innovation capability, development potential and coordination with the development strategy of the parent company are important indicators for the parent company to select start-up enterprises. In addition, factors such as the quantity and quality of resources provided by external resource holders and its' reputation are important criteria for the establishment of corporate incubator partnerships. At the same time, the overall strength of corporate incubators and the quality of resident startups are also the basis for external resource holder to judge.

3.3.2. Resource Flowing and Sharing Mechanism

The main resources in the pharmaceutical corporate incubator innovation ecosystem include talent, capital, knowledge and so on[3]. First of all, the corporate incubator plays an important role in the introduction and cultivation of innovative talents[22, 23], and introducing internal experts into this system to provide professional innovation and entrepreneurial guidance for resident enterprises. Secondly, corporate incubators can provide financial support for resident startups through a variety of forms, including direct equity investment[24], and build a communication platform for resident startups and financial institutions[23]. In terms of knowledge flow, entrepreneurial guidance obtained by resident startups is an important driving force for their rapid growth[25]. At the same time, the communication between resident startups can also play a role in knowledge transfer and innovation.

3.3.3. Synergetic Symbiosis Mechanism

The incubation process is a link to the innovation elements in the entrepreneurial ecosystem and produces synergy in the process[26]. At the same time, whether the partners trust or not will also affect the synergy[27]. The sustainable development of incubator system is based on the coordination of incubators, resident startups, universities and scientific research institutes, government, financial institutions and other organizations[28]. It should be noted that stakeholders in the pharmaceutical company incubator innovation ecosystem should also include exiting startups (successful graduates and early exit startups). The continuous cooperation and communication between the incubator and the exiting startups are of great significance for obtaining heterogeneous resources and expanding the incubation network [29]. The effective interaction between innovation community and innovation environment will also further promote the coordination and symbiosis of the system[21].

3.3.4. Environment Matching Mechanism

Innovation environment refers to the macro environment of stakeholders, including policy environment, humanistic environment, infrastructure environment, etc [13]. A good innovation environment plays an important role in the growth and successful graduation of resident startups. The specific manifestations are as follows: the corresponding policies issued by government departments to promote the industrial innovation development will directly or indirectly affect the behavior choices of stakeholders; the good innovation and entrepreneurial atmosphere and fault-tolerant mechanism inside and outside the corporate incubator are of great significance for the development of enterprise innovation; in addition, high-level talents and perfect supporting measures are also a strong guarantee for the operation quality of the corporate incubator. Therefore, the corporate incubator should

actively pay attention to the changes of the external environment and form a positive interaction with the external environment.

4. Conclusion and Suggestion

The competition among enterprises has gradually upgraded to the competition of innovation ecosystem. The mode that relying solely on capital, technology, talent and other innovation elements to achieve a simple aggregation and coordination has been unable to meet the needs of innovation and development of pharmaceutical enterprises. Therefore, the stakeholders in pharmaceutical corporate incubators system must change their concepts and carry out pharmaceutical research and development, production, services and other related activities under the guidance of the concept of symbiosis and sustainable development.

4.1. Large Pharmaceutical Enterprises should Carry out the Construction and Operation of Pharmaceutical Corporate Incubators based on the Concept of Mutually Beneficial Symbiosis and Coordinated Development

Pharmaceutical corporate incubators and parent companies should always adhere to the concept of collaborative symbiosis, fully consider the interests of all stakeholders, and establish a fair risk-benefit sharing criteria or norms. Large pharmaceutical enterprises should seek a balance between share ownership and the sustainable development of pharmaceutical corporate incubators, design appropriate governance models to ensure their own income and technological innovation, and at the same time try their best to meet the interests of resident startups, venture capital institutions and innovation support community.

4.2. The Government should Actively Create an Atmosphere of Innovation and Entrepreneurship

The government mainly plays a guiding, encouraging and standardizing role in the innovation and development of the pharmaceutical industry, and introduces policies such as tax relief, R & D funding support, accelerated examination and approval, and dynamic adjustment of the medical insurance catalogue for each link of the pharmaceutical innovation value chain. At the same time, we should also strengthen the training and introduction of talents, strengthen the construction of local supporting industries and infrastructure, provide excellent working and living environment for innovative subjects. In addition, attention should be paid to the cooperation between policies to ensure the feasibility and maneuverability of policies.

4.3. Universities and Scientific Research Institutes should Actively Transform Innovative Achievements

Universities and scientific research institutes should properly meet the market demand to carry out cutting-edge basic research, at the same time, they should actively promote the transformation and application of scientific and technological achievements, and truly adhere to the concept of cooperative innovation to participate in the construction and operation of pharmaceutical corporate incubators. Universities and scientific research institutes can support resident startups and related enterprises through the output of high-level talents and scientific and technological achievements, and improve their scientific research ability in turn.

4.4. Intermediary Service Institutions, Financial Institutions and Other Departments should Give Full Play to the Supporting Role of Innovation

In addition to providing funds, information and other resources, intermediary service institutions, financial institutions and other departments should also actively optimize the cooperation mode with pharmaceutical corporate incubators to ensure the smooth graduation of resident startups and achieve win-win cooperation among stakeholders.

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