

Cross-domain reorganization of innovation factors: Mechanisms, dilemmas and innovative pathways*

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Abstract Innovation-driven development has become an important national strategy, which in turn has triggered fierce competition among regions around innovation factors. Based on the discussion of the general law and paradox of free flow of innovation factors, it is believed that the improvement of regional innovation level requires not only the spontaneous regulation of market mechanism, but also the appropriate cross-domain reorganization of innovation factors. On the basis of analyzing the realistic dilemma of the current spatial governance means for various types of innovation factors, the "reverse enclave" path of cross-domain reorganization of innovation factors is proposed in the case of Quzhou Hi-Tech Park, and it is argued that, through the innovation of the cooperation mechanism, the model can promote the reorganization and configuration optimization of innovation factors on a regional scale, and realize the double innovation agglomeration effect and the diffusion effect. Improvement. Aiming at the bottlenecks in practice, the planning and governance strategy of "reverse enclave" is proposed, namely, building a multi-center and networked "reverse enclave" collaborative innovation pattern, exploring the "reverse enclave" spatial supply paradigm to adapt to the cross-domain flow of innovations, establishing a robust "reverse enclave" spatial supply paradigm, and establishing the "reverse enclave" spatial supply model. It proposes planning and governance strategies for "reverse enclaves", namely, building a multi-centered and networked "reverse enclave" collaborative innovation pattern, exploring a "reverse enclave" spatial supply paradigm that accommodates cross-domain flows of innovation, and establishing a sound enclave innovation governance system based on new regionalism.

Keywords innovation factors; free flow; regional re
Group; Reverse Enclave; Quzhou Hai Chuang Park

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Regional Reorganization of Innovation Elements: Mechanism, Predicament, and Pathways to Innovation

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Abstract: Promoting innovation-driven development has become an important national strategy, however, fierce competition among regions for innovation elements has ensued. Building on a discussion of theories regarding the free flow of innovation elements, the paper argues that the elevation of regional innovation capacity not only depends on market adjustments but also on favorable cross-regional cooperation. Building on a discussion of theories regarding the free flow of innovation elements, the paper argues that the elevation of regional innovation capacity not only depends on market adjustments but also on favorable cross-regional reorganization of innovation elements. - The paper argues that the elevation of regional innovation capacity not only depends on market adjustments but on favorable cross-regional reorganization of innovation elements. The paper outlines the current dilemmas of various spatial governance approaches to innovation and introduces the reverse enclave pathway for reorganizing innovation elements. The example of Quzhou Oversea Talents Innovation Park is utilized to illustrate the efficacy of the approach in facilitating the agglomeration of innovation businesses and the diffusion of innovation activities. Finally, the paper proposes several planning and governance strategies to address the bottleneck problems encountered in the application of the approach. Finally, the paper proposes several planning and governance strategies to address the bottleneck problems encountered in the application of the reverse enclave strategy. These include building a multi-centric collaborative innovation network, exploring a space provision mechanism tailored to transboundary factor flows, and establishing a governance system based on theories of new regionalism. regionalism.

Keywords: innovation elements; free flow; regional restructuring; reverse enclave; Quzhou Oversea Talents Innovation Park

Since the financial crisis in 2008, global economic growth has remained weak, and in order to meet the challenge of the exhaustion of the traditional economic development momentum, countries around the world have launched a series of strategies anchored on innovation, hoping to seize the new era of economic development through the first investment.

At the forefront of the scientific and technological revolution, policies such as Japan's comprehensive innovation strategy, the United States' national innovation strategy, and Germany's Industry 4.0 have emerged. Since the 18th National Congress of the Communist Party of China (CPC), China's expressions on innovation have also become more and more frequent, from the Five Development Concepts put forward in 2015 to "insisting on innovation-driven development and comprehensively shaping new advantages in development" in the "14th Five-Year Plan," which has gradually risen to become a national strategy at the highest level. innovation-driven development has gradually risen to become the highest level of national strategy. Reflecting on the space, the innovation investment at the national level is mainly implemented through the intensive investment in strategic spaces such as comprehensive national science centers, independent innovation demonstration zones, and innovative cities, etc. However, due to the scarcity of innovation factors and policy supply, inter-regional "innovation tournaments" centered on innovative enterprises and high-end talents are being quietly formed^[1]. It is worth noting that "city-regions" represented by city clusters and metropolitan areas are becoming the main platforms for leading national development and participating in international competition, and the fierce horizontal competition in innovation at the present stage obviously restricts the enhancement of the level of regional innovation, so how to break down the barriers to innovation flow, promote regional innovation cooperation, and then enhance the level of innovation factors? Therefore, how to break down the barriers to innovation flow, promote regional innovation cooperation, and then enhance the overall allocation efficiency of innovation factors in the regional context is an important issue that needs to be responded to in the field of urban and rural planning and public policy^[2-3].

Inter-regional factor barriers have largely constrained the smooth implementation of the country's

"double-cycle" strategy, and in order to eliminate the "double-cycle" strategy, it is important to ensure the smooth implementation of the "double-cycle" strategy.

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Inefficient utilization of resources due to local protection and market segmentation, issued by the State Council of the CPC Central Committee in April 2022

The Opinions on Accelerating the Construction of a Nationally Unified Large Market, for the first time, systematically proposes the promotion of the smooth flow of factor resources on a wider scale through various means, providing important policy support for the rational flow and diffusion and reorganization of innovation factors and other scarce resources. In the field of urban and rural planning, although in recent years, there has been an increasing concern about the inter-regional flow characteristics of various factors such as population, capital, land, etc., the exploration of innovation as a special development factor is not deep enough, and the existing research often focuses on the cross-section portrayal of the innovation pattern, and further in-depth research on the characteristics of the innovation flow in the regional scope, the way of cross-domain reorganization and its spatial governance is still needed.^[4-5] . Based on this, this paper tries to summarize the laws and paradoxes of the free flow of innovation factors, and then analyze the existing means of reorganization of innovation factors, and argues that it is urgent to solve the problem that the utility of innovation cannot be sufficiently diffused to the backward areas through the innovation of cooperation mode. Finally, taking Quzhou Hai Chuang Park as an example, the paper analyzes the mechanism and effect of realizing cross-domain reorganization of innovation factors in the mode of "reverse enclave" and proposes targeted governance strategies.

1 Mechanisms and paradoxes of the free flow of innovation factors

1.1 General law of free flow of innovation factors

From the two-factor theory of "land is the mother of wealth and labor is the father of wealth" to the classic three-factor theory of factors of production in classical political economy (i.e., land, labor, and capital) to the current six-factor theory (including natural resources represented by land, labor, capital, organization, technology, and information) the connotation of the factors of production is constantly extended along with the economic and social development is constantly extended. Various factors of production are always associated with specific regions and have strong spatial attributes, but unlike the territorialized natural resources represented by land and so on, innovation factors^① have more significant regional mobility characteristics due to their ease of movement and scarcity of resources. Therefore, in order to study the mechanism of cross-regional flow and reorganization of innovation factors, it is necessary to have a regular understanding of the flow process, so as to grasp the key links to promote regional collaborative innovation.

Specifically, the flow of innovation factors on a regional scale follows a pattern similar to that of other factors of production, but also exhibits some unique characteristics.

The gaps in the region create an objective environment for factor flows to capitalize on the comparative advantages of each party and then promote the full development of all parties in the region.^[6] Therefore, innovative factor flows can essentially achieve a Pareto improvement in regional development.

Secondly, the flow of innovation factors follows the direction of factor return differentials, leading to regional agglomeration and polarization. Under the action of the market mechanism of factor convergence, innovation factors always flow from low-yield regions to high-yield regions, and form aggregation in the advantageous regions with higher marginal outputs, while the expanding local market effect will further strengthen the advantages of the region, forming a structure similar to the "core-edge" structure of regional innovation pattern^[2, 7]. The expanding local market effect will further strengthen the advantages of the region, forming a regional innovation pattern similar to the structure of "core-edge"^[2, 7].

Finally, further free movement of innovation factors may lead to different eventualities, but none of them avoids the risk of developmental imbalances. Under the premise of sufficient mobility of factors of production, established studies have suggested that regional development patterns will broadly form two scenarios of "convergence" and "divergence"^[8], and this is also true for innovation factors (Figure 1) the former is based on the neoclassical theory of regional equilibrium development, which argues that a large concentration of factors will cause diminishing marginal utility, and the regional innovation pattern will shift from polarization to equilibrium under the regulation of differential returns. It should be noted that the strong knowledge spillover effect of innovation factors will cause the scale diseconomies to have a nodal lag, thus forming a long tail effect on the basis of the traditional inverted U-shaped convergence curve, and it takes a longer time span to gradually move towards equilibrium. The latter, represented by Muldaur, argues that, under cyclical cumulative causation, sufficient factor mobility can lead to widening regional disparities^[9], especially for factors of production such as innovation, which can produce large transformative effects. The cumulative innovation environment and institutional thickness in the advantaged regions will always provide the soil for a new round of innovation, in which the exponential increase in rewards will continue to offset the impact of increasing marginal costs, thus creating a diffuse pattern of innovation. However, regardless of the hypothesis, the free flow of innovation factors will always face the risk of widening regional development gaps or even imbalances at a given stage.

1.2 The paradox of the reality of the free flow of innovation factors

Undoubtedly, regardless of whether the final innovation pattern is convergent or divergent, the full free flow of innovation factors will help to reduce the systemic costs of innovation cooperation and contribute to the good development of innovation activities and innovation markets in the regional context. However, under the constraints of the above general law and the current pattern, there are several paradoxes between the free flow of innovation factors and the overall development of the region, and in the future, if we only emphasize the attribute of the free flow of innovation factors without touching the redistribution of innovation factors and innovation benefits and regional reorganization, we will easily step into the development trap of the Matthew effect.

First, the formation of the current pattern of innovation factors is influenced by The simple "free flow" of innovation factors may further widen the regional development gap, given the great intervention of established policies. In recent years, developed regions, by virtue of their own advantages in production and living environment, financial strength, market effect and other aspects, have initially completed the primitive accumulation of innovation, and stepped into the positive cycle of "innovation agglomeration-urban development-innovation re-agglomeration"^[10]. In the absence of a mechanism for diffusion of innovation utility, the free flow of innovation factors will, on the contrary, push more resources into developed regions with higher marginal returns, thus causing greater distortion to the already imbalanced development

pattern.

Secondly, the different evolution of supply and demand has led to the lack of

The allocation of innovation factors in developed regions tends to deviate from equilibrium. If innovation factors are regarded as a kind of free-flowing special commodities, then the supply and demand status of innovation factors in different regions can be explained by the spider web model[©] in economics (Figure 2) for developed regions, the supply elasticity of innovation factors is often greater than the elasticity of demand, and the mismatch between supply and demand will gradually converge to equilibrium under the guidance of the market mechanism, so developed regions can always obtain higher-quality innovation factors with more suitable inputs. Therefore, developed regions can always obtain better quality innovation factors with more appropriate inputs; for less developed regions, the elasticity of supply of innovation factors is often smaller than the elasticity of demand, and less developed regions are either unable to saturatedly obtain the desired innovation resources or do not have the financial strength to provide sufficient attraction, so it is always difficult to balance between the supply of innovation factors and the inputs.

First, the basis of innovation factor flows stems from differences in factor distribution between regions. As with natural resource endowments, the distribution of innovation factors on a regional scale is non-equilibrium, with differences in quantity, quality, variety and other factors. Achieving balance.

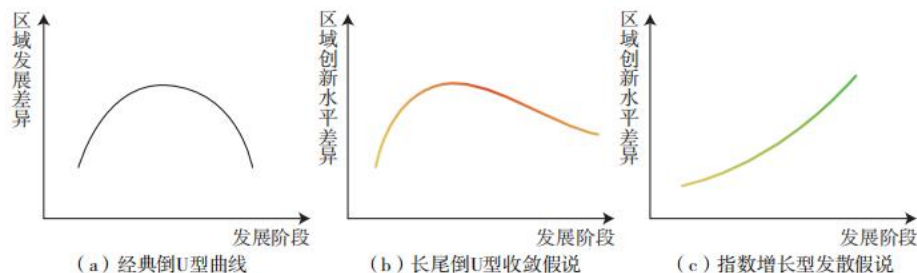


图1 要素自由流动下区域创新的“收敛”和“发散”格局

Fig.1 The "convergence" and "divergence" of regional innovation under the mechanism of free flow of factors

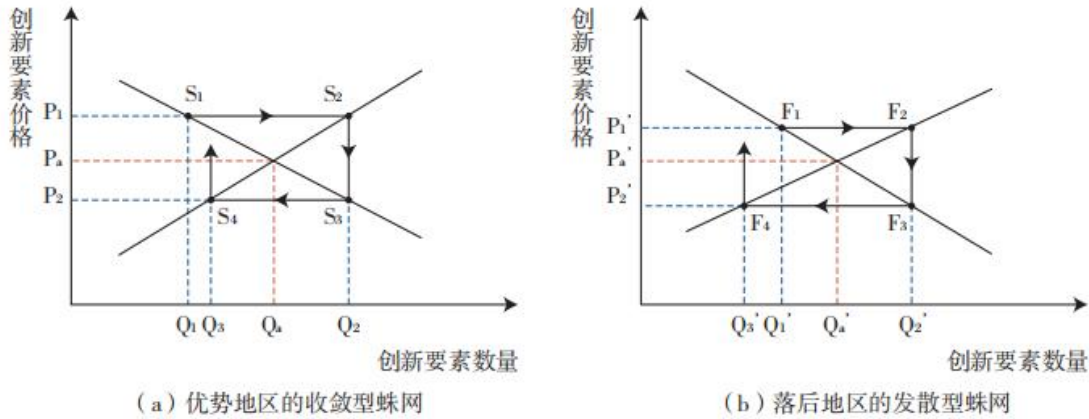
Third, there is a potential mismatch between the tendency of innovation factors to flow and regional development optimization. For innovation factors, wherever they can obtain higher factor returns, lower innovation costs and better innovation links, that is the direction of their flow. However, the flow of innovation factors under the effect of price incentives may also be accompanied by the lack of large-scale production space, far away from raw materials or consumer markets, the lack of supporting industry chain and other problems, which does not always mean the efficient promotion of local development^[11-12].

2 Basic types of cross-domain reorganization of innovation factors and their dilemmas

Under the spontaneous regulation of the market, the gradual transfer of technology and the flow of talents will not bring about a fundamental reshaping of the existing polarized pattern of innovation, and the paradox between the free flow of innovation factors and the imbalance of regional development will always exist. Therefore, in the critical period of innovation transformation and development, the regional allocation around innovation factors cannot simply and unilaterally rely on the market mechanism; on the contrary, the government should become a "capable hand" in this process, through the body of

In practice, science and innovation corridors have many limitations in overcoming administrative and industrial barriers, and the role of promoting the flow and reorganization of innovation factors is not significant^[19-20]. Take the G60 Science and Innovation Corridor in the Yangtze River Delta, for example, whose construction started earlier, as the radiation-driven effect of the corridor is greatly restricted by its geographical and transportation location, Jiaying,

which is close to Songjiang in Shanghai, has seen a large number of factors flowing into the corridor, but the construction of the corridor has not brought in transformative and influential innovation resources to the far-end cities such as Jinhua and Xuancheng.^[21]; even though the integration of the Yangtze River Delta has risen to become a national strategy, there are still major obstacles to promoting the flow of innovation within the corridor. Although the integrated development of the Yangtze River Delta has been upgraded to a national strategy, there are still big obstacles to the flow of innovation within the corridor, and the role of promoting the flow and reorganization of high-end innovation factors among regions is not obvious. Meanwhile, the rapid rise of Jiaxing and other relatively underdeveloped zones can not be directly attributed to the cooperation in innovation, but rather it may be due to the comparative advantages of the differential rent and other factors.



The incoming industrial transfer dividend.

2.2 Faceted integrated science and innovation cooperation zone

Fig. 3 Typical patterns and practices of reorganizing cross-regional innovation elements

创新要素跨城重组的类型	模式示意	实践案例
线性链接的 科创走廊 关键词： 线性走廊 多城市主体 创新分工 尺度上移	创新要素流动 交通骨架 城市A 城市B 城市C 合作	G60科创走廊 资料来源：《G60科创走廊总体规划》 广深科技创新走廊 资料来源：《广深科技创新走廊规划》 武汉光谷科技创新大走廊 资料来源：《光谷科技创新大走廊发展战略规划(2021—2015)》
面状整合的 科创合作区 关键词： 毗邻地区 创新合作 制度接近 尺度下移	制度距离较小 城市A 城市B 合作 创新要素集聚	河套深港科技创新合作区范围与香港园区规划 资料来源：https://new.qq.com/ain/a/20210816A045WU00 横琴粤澳深度合作区一体化地区 资料来源：《横琴新区与保税区、洪湾、湾仔区域一体化发展规划》
点状布局的 创新策源地 关键词： 点状开发 创新投入 前沿创新 尺度下移	高能级 创新资源 资源投放 城市A 创新策源地	深圳光明科学城 资料来源：《深圳光明科学城总体规划(2020—2035年)》 北京怀柔科学城 资料来源：《北京怀柔科学城控制性详细规划(2020—2035)》 东莞松山湖科学城 资料来源：《东莞松山湖科学城发展总体规划(2021—2035)》 合肥滨湖科学城 资料来源：《合肥滨湖科学城总体规划》

The innovation of the system mechanism realizes the moderate and reasonable reorganization of

innovation factors in the regional context. Unlike the main body of factors
Public policies and space for integrated regulation and allocation

The tool^[13] has been regarded by local governments as an important means to promote the cross-regional flow and reorganization of innovation factors. In recent years, some regions with more mature integration development have carried out a round of regional planning and layout around the reorganization of innovation factors through "scale reorganization" (^[14–15]), trying to achieve the transfer of control over capital, innovation and other factors at different scales in a specific geographical organization through this means (^[16]). Specifically, they can be categorized into science and innovation corridors with linear links, science and innovation cooperation zones with surface integration, and innovation curators with point-like layout. See Figure 3.

2.1 Linearly linked science and innovation corridors

Stemming from urban development corridors, science and innovation corridors are a form of belt-like spatial organization with transportation arteries as the backbone, science and technology innovation as the theme, and a high degree of concentration of innovation subjects and activities, and an innovative environment, or it can be said that science and innovation corridors are essentially a regional innovation ecosystem^[17]. With convenient transportation infrastructure and interoperable innovation policies, Science and Innovation Corridors promote the high-frequency flow of innovation factors within a linear range, promote the collaborative division of labor in the innovation chain from front-end innovation to back-end production, and thus optimize the efficiency of innovation factor utilization^[18]. However

Fig.2 Cobweb model interpretation of the supply and demand relationship of innovation elements in different regions

Fig. 3 Typical patterns and practices of reorganizing cross-regional innovation elements and agglomeration effects, thus creating original innovation advantages in several fields. Therefore, such means of cross-domain reorganization are more likely to promote the interaction and progress of frontier innovations, and are unable to solve the problem of the difficulty of effective diffusion of innovation factors to less developed regions^[23].

2.3 A curator of innovation in a point layout

Such an innovative reorganization is to move the high-level innovation resources at the national level to the relative periphery of certain cities, to systematically promote efficient synergy and collective breakthroughs in related scientific research fields, and also to become an incubator and a source of future innovations due to the vast scientific and technological application scenarios in the periphery. For example, the Guangming Science City located at the junction of Shenzhen and Dongguan has been given the important function of a comprehensive national science center, and then a number of large-scale scientific devices such as the Shenzhen Supercomputing Center, the medium-energy synchrotron diffraction limit light source and so on have been injected into the city to make it become a place where high-end innovation factors are concentrated immediately. However, due to the limited resources and huge investment scale, it is difficult to promote the innovation transformation of a large number of small and medium-sized cities in such a point-like layout of innovation space, in addition to facing the problems of "innovation for the sake of innovation", such as scientific research results cannot be effectively converted into productivity, and it is difficult to develop in a coupled way with local industries.

To sum up, the existing mechanisms for cross-regional reorganization of innovation factors, either driven by high-level policies or limited by the capacity of cities and geographical location, are unable to realize the in-depth reorganization and optimization of the allocation of innovation factors and their benefits within the region in the true sense, especially the effective diffusion of innovation to less developed regions. Therefore, there is an urgent need to explore other possible paths for the cross-regional reorganization of innovation factors through the innovation of regional cooperation models.

3 The "Reverse Enclave" Path of Cross-domain Reorganization of Innovation Factors: The Case of Quzhou Hai Chuang Park

Unlike the traditional enclave economic model^[24] which is built on the basis of factor price differences and is mainly characterized by the trans-regional transfer of labor- or resource-intensive industries, a new model of "reverse enclave" with innovation factors as the first guide is emerging, specifically, it means that the less developed regions (enclave) take the initiative to set up reverse enclave parks in the developed regions (enclave), thereby promoting innovation-driven transformation and coordinated regional development. Specifically, it means that less developed regions (enclaves) take the initiative to set up enclave parks in developed regions (enclaves) in the reverse direction to divert innovation elements, and promote innovation-driven transformation and coordinated regional development through the separation of innovation R&D and production on the ground.^[25] A representative example in practice is the establishment of enclave parks in Hangzhou, where innovation factors converge, by relatively underdeveloped regions such as mountainous areas in Southwest Zhejiang, supported by the Mountain-Sea Collaboration^③ policy at the provincial level, in an attempt to promote innovation-driven transformation and coordinated regional development by means of this model.

The new platform of one-scale reorganization realizes the purpose of absorbing innovation elements and promoting its own transformation and development. Among them, Quzhou Hi-Tech Park in Hangzhou Future Science and Technology City, as the first innovation-oriented "reverse enclave" opened under the background of the Mountain and Sea Collaboration Project, has not only established a better cooperation mechanism among enclaves, but also proposed the model of gathering talents from other places, which is "R&D and incubation are carried out in Hangzhou, industrial transformation is carried out in Quzhou, and work and life are carried out in Hangzhou, The model of gathering talents in different places is^[26]. And since the opening of the park in 2016, Quzhou HaiChuangPark has attracted a large number of innovative talents and startups around the fields of new materials, life and health, intelligent manufacturing, digital economy, etc., and some of which have returned to Quzhou to realize large-scale production and promote the transformation and upgrading of local industries, so it can be said that Quzhou HaiChuangPark has realized the innovation of cross-domain collaboration mechanism and the way of reorganization of innovative elements across the domains, which has strong typicality. Therefore, this paper selects Quzhou Hi-Tech Park as the research object, and based on the information obtained from field surveys, observations and semi-structured interviews, summarizes the reasons for the formation of the cross-domain collaboration mechanism and the evolution process, analyzes a number of typical modes and effects of the cross-domain reorganization of innovation, and then distills the "reverse enclave" that promotes the directional aggregation of innovation factors and the flexible diffusion of innovation utility." path.

3.1 Evolution of collaborative mechanisms: cooperative assistance based on differences in factor supply and demand

Due to the differences in natural resources endowment and economic and social development stages, different regions will inevitably have different needs for various development factors, but in reality, the development of factor markets between different regions in China lags far behind the marketization process of the consumer market, and the distortion of the factor markets caused by many factors seriously restricts the efficiency of the innovation and production activities^[27]. In the above mentioned modes of cross-regional reorganization of innovation factors, different regional entities or science and innovation departments mainly cooperate around the specific factor of innovation. Although the efficiency of regional innovation can be improved to a certain extent through the combination of government regulation and market mechanism, it is still subject to the constraints of inter-private competition and innovation stickiness, which can't give full play to the comparative advantages of each region and respond to the different demands of each region, and there exists

the possibility of cooperation failure. There is a possibility of cooperation failure. The new model of "reverse enclave" in Quzhou HIP has formed a cross-regional collaboration mechanism based on the supply and demand of different factors, which not only provides an opportunity for redistribution of innovation factors and their utility, but also explores a cooperation path for various types of factor transactions.

In fact, at the beginning of this century, Quzhou, as a western Zhejiang

One of the economic depressions in the south of the country has started the process of "mountain and sea collaboration" with Hangzhou. The two places mainly focus on industry

Cooperation in development, infrastructure connectivity, cadre exchanges, etc., even based on the difference in supply and demand of traditional production factors, reached an agreement on the exchange of land resources with supporting funds and industrial projects, initially constructing a framework for regional collaboration with complementary resources. However, as China enters a new period of innovation-driven development, the above growth-oriented collaboration model can no longer bring transformative power to Quzhou, and there is an urgent need to realize the complementary win-win situation around innovation factors through institutional mechanism innovation. However, it is worth noting that such scarce key development factors as innovation are strongly dependent on the innovation ecosystem, and it is difficult to allocate them top-down simply by means of administrative orders. In view of this, Quzhou and Hangzhou, on the basis of their established cooperation and oriented to the law of demand for innovation activities, have innovatively constructed enclave parks and established a collaborative mechanism revolving around the exchange of innovation factors and land indicators, which provides a path reference for the cross-domain reorganization of innovation factors (Figure 4) Specifically, for Quzhou, which hopes to seek innovation and transformation, it is in the long-term interest to use relatively surplus land indicators to exchange for a platform that can independently attract innovation factors in the long term. Compared with the talent attraction enclaves set up unilaterally in Hangzhou in some localities, enclave parks with outstanding location advantages and institutionalized cooperation have created a double guarantee at both the spatial and systemic levels in attracting the return of all kinds of high-end factors and upgrading the level of local economic development. For Hangzhou, which is short of land indexes but has a strong demand for spatial development, exchanging small-scale park construction land for larger land development indexes not only fulfills the task of counterpart support, but also does not affect the trend of gathering innovative talents and enterprises. Despite the possible impact on development performance statistics (e.g. tax revenue, innovation indicators), with the special policy advantage, locally rooted enclave parks have the opportunity to attract more innovation factors, and in the process of localized buzzing interactions with the local innovation network[Ⓐ] can create a strong innovation spillover effect. In this way, the new "reverse enclave" collaboration mechanism evolved around different development demands and factor supply-demand relationships not only improves the allocation efficiency of regional innovation factor resources, but also facilitates the formation of a relatively solid cooperation framework between the two sides and avoids conflicts due to the sharing of benefits.

3.2 Cross-domain reorganization of innovations: Segregated flows in response to optimal factor returns

The flow of innovation factors is always following the law of the highest return "vote with your feet", so under the condition that the innovation environment is not yet mature, the less developed regions want to reverse the gradient of the introduction of innovative talents and enterprises will have to pay a great deal of money.

The large cost to make up for the gap in factor returns between less developed regions and developed regions has also led directly to the fact that less developed regions are often restricted in introducing innovative factors. So, is there a way to create the factor income advantage of less developed regions as much as possible, so that innovation factors can flow to less developed regions in accordance with the market mechanism? In this regard, the spatial

demand flexibility and multi-dimensional proximity characteristics of innovation activities themselves provide a special path for innovation cross-domain reorganization to crack this problem, which is fully reflected in Quzhou Haixin Park, which also provides a new dimension at the spatial level for the analysis of the way of agglomeration and organization of innovation activities. By establishing two-dimensional coordinates based on the dimensions of whether innovation R&D and large-scale production are separated in administrative space and the urban energy level of innovation activity agglomeration, innovation production activities can be analyzed in four quadrants, corresponding to four different types of spatial assemblage .

5). In Quzhou and Hangzhou, for example, innovation and production are not

The traditional mode of separation either faces the problem of high production cost in Hangzhou, or is constrained by the difficulty of effectively organizing innovation and R&D activities in Qu and the inefficiency and high consumption of innovation, and theoretically does not achieve the optimal resource allocation efficiency. Spatial separation can be subdivided into two types of situations: in general, innovation in Qu and innovation in Hangzhou will superimpose the disadvantages of low innovation returns and high production costs, but the above possibilities exist under special circumstances (e.g., to meet market demands, for the personalized needs of talents for the environment, etc.) innovation in Hangzhou and production in Qu is the cross-domain reorganization of innovations promoted by Quzhou HaiChuangyuan, which can theoretically better bring into play the comparative advantages of both parties of the enclave and achieve the innovation and R&D efficiency of both parties of cooperation, and realize the innovation and R&D efficiency of the enclave. Theoretically, it can better utilize the comparative advantages of both sides of the enclave and realize the double benefits of innovation and production costs.

Improvement. Among them, for the transformation of traditional enterprises and emerging

The scale effect and fierce horizontal competition will also lead to a gradual decrease or even less than zero marginal returns of start-ups in Hangzhou. In this regard, innovation subjects are bound to seek other ways to maximize the profit level of innovation factors, and the "Hangzhou Startup Incubation, Quzhou Production Return" model promoted by Quzhou Haixin Park provides an opportunity for this. Specifically, enterprises residing in the Quzhou Sea Innovation Park,

Employees can not only enjoy Hangzhou's policy subsidies and social security services, but also obtain additional policies such as rent reductions and tax incentives provided by the platform of Quzhou Hai Chuang Park, and some enterprises that need to land on the ground for production on a large scale after incubation and maturity can also dock into the lower-cost development hinterland provided by Quzhou. For example, a certain automated pneumatic product research and development enterprise with strong design capability in the park reached a cooperation intention with a leading machine controller production enterprise in Longyou, Quzhou, and successfully returned to Longyou Economic Development Zone in Quzhou for large-scale production under the coordinated support of the local government and the administrative committee of the park. Since 2019, the enterprise has applied for and authorized the transfer of more than 40 patents (including the most innovative invention patent).

(13 patents, accounting for nearly 30%, while as of May 2023, Longyou County had a total of 5,693 effective patents, of which only 615 were invention patents, accounting for about 10.8% of the total number of patents)^⑤, which has been selected as a national high-tech enterprise, a provincial science and technology SME, and a provincial "specialized, special, and new" SME, and has, in the process of interacting with the local enterprises In the process of interaction with local enterprises, it has effectively stimulated the innovation and development of upstream and downstream industrial chain related to intelligent manufacturing in Quzhou. In this way, based on the "reverse enclave" mode of separating innovation and production, the overall benefit level of innovation factors has been improved: from the viewpoint of the micro subjects, innovative enterprises and innovative talents do not need to be divested of the established and mature innovation environment, and are able to continue to enjoy the superior urban support, but are

supported by the policies of both sides of the enclave, and in particular have the opportunity to inject more resources from less developed regions; analyzing from a macro perspective, less developed regions can obtain relatively high-quality innovation factors at a relatively low cost to promote the transformation of local industries, and developed regions still maintain the interaction and agglomeration trend of innovation factors, which contributes to the stable development of the innovation ecosystem.

3.2.1 Typical model I: start-up incubation in Hangzhou, return to Quzhou for production

The development of innovative activities requires the integration of a large number of resources to support, which not only puts forward the requirements for the abundance of local innovative resources, but also subject to the level of basic public service facilities, social and cultural atmosphere and other supporting environment, especially in the early stage of accelerating the innovation incubation, the main body of innovation on the above soft and hard innovation environment is very prominent. Because of this, Hangzhou, which has relatively outstanding advantages in science, education, culture and health, has been able to gather a large number of innovative enterprises and talents. However, in the research process, the park of an Internet industry company frankly said, "Hangzhou's Internet innovation has been localized excess, survival competition is very fierce, many small and medium-sized enterprises can not cause the government to pay attention to, but also can not get preferential treatment on the policy". It can be seen that the gathering of innovation elements does not only bring positive

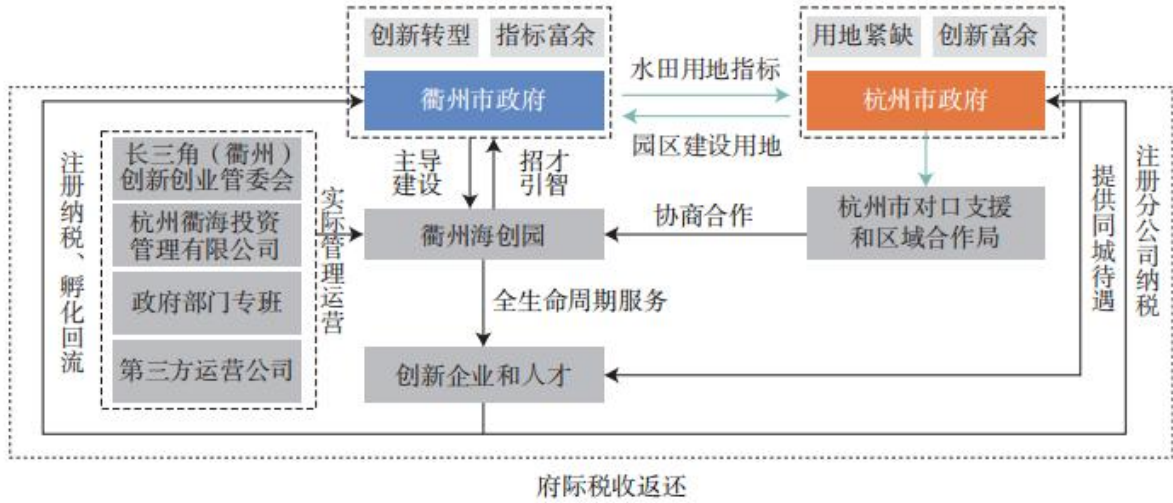


图4 衢州海创园的区域协作机制

Fig.4 Regional cooperation mechanism of Quzhou Oversea Talents Innovation Park

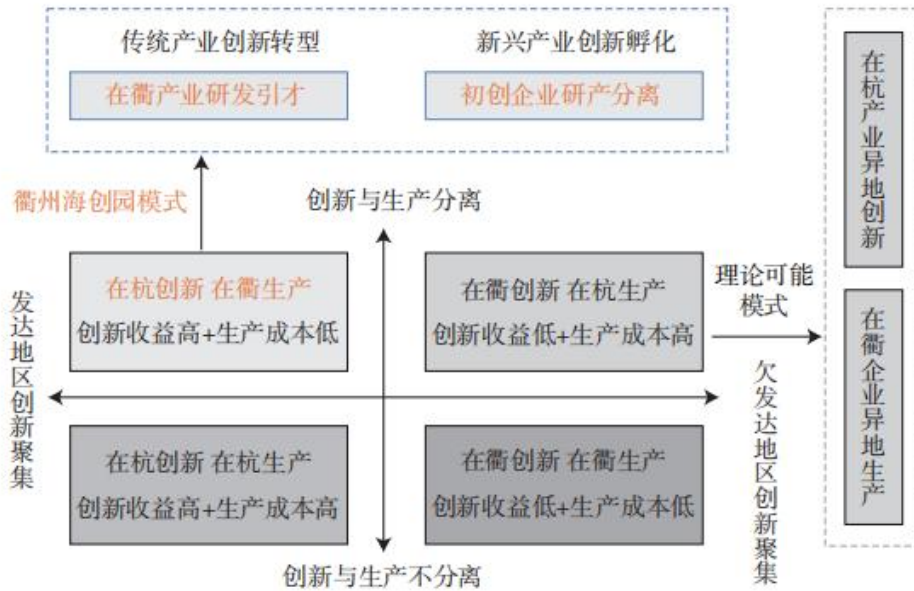


图5 传统模式与反向飞地模式下创新生产活动的空间组合类型

Fig.5 Types of spatial organization of innovation production for conventional approach and reverse enclave approach

3.3 Evolutionary Logic of Directed Aggregation and Flexible Diffusion of Innovation Factors

At present, China's regional innovation development is at a special bottleneck stage: on the one hand, the innovation concentration and collaboration level of central cities are still insufficient to solve the neck-breaking technical problems, and the leading role of innovation still needs to be improved; on the other hand, the continuous loss of innovation factors in marginal areas may make the original imbalance of the regional development pattern further deteriorate. Therefore, how to promote further aggregation and interaction of innovation factors in advantageous regions and how to promote innovation factors to generate industrial upgrading and technological revolution in underdeveloped regions has always been a dilemma in the process of promoting regional collaborative innovation, and such innovation-oriented "reverse enclaves" as Quzhou HaiChuangyuan, with the help of the abovementioned typical model, provide a solution to the problem of targeted aggregation and flexible diffusion of innovation factors (Figure 6).

In response to the former, the construction of enclave parks can attract

The inflow of external innovation factors is conducive to the further aggregation of innovative R&D activities, capital and talents in strategic innovation spaces such as Hangzhou Future Science and Technology City. At the same time, innovation is a non-linear and complex process that requires the absorption of tacit and muted innovation knowledge in diversified innovation interactions^[28], innovative enterprises and talents in the park do not need to be divested from the established exchange environment, and thus the regional innovation efficiency will not be reduced due to the destruction of the original innovation network. For the latter, the enterprises and talents introduced into the enclave parks in targeted categories can diffuse the great utility of innovation through production applications, creative planning, etc., giving full play to the advantages of Quzhou's localized economy^⑥ in intelligent manufacturing, chemical industry, biomedicine, etc., and avoiding the economic disadvantages of urbanization caused by the city's disadvantageous location and small scale^[29]. In addition to promoting the development of upstream and downstream industrial chains, these returning elements can also promote the development of the upstream and downstream industrial chains through the cooperation of invention patents, weekend engineers and other technology diffusion and innovation.

The innovation cooperation approach implicitly enhances the technological level and market competitiveness of Quzhou's related industries. With the continuous improvement of the local innovation network system, Quzhou has the opportunity to further cluster innovative enterprises in niche fields and possess certain talent attraction capabilities, and ultimately realize the leap in local innovation capacity.

In short, unlike those means of rigid cross-domain reorganization of innovation factors, in the "reverse enclave" mode, the logic of the role of innovation factors has changed: the innovation factors of entities are still clustered in developed regions under the action of the market mechanism, but the benefits generated by innovation activities are shared by less developed regions, thus achieving the double improvement of the aggregation and diffusion effects of innovation factors. In this way, the double improvement of the aggregation and diffusion effects of innovation factors can be realized - the less developed regions can avoid the high cost of trial and error of innovation, and combine their industrial characteristics to introduce enterprises and technologies that have already been incubated and matured, while the developed regions can further enjoy the scale effect brought by the innovation agglomeration.

4 Rethinking the Planning and Governance of "Reverse Enclaves" for Cross-domain Reorganization of Innovation Factors

4.1 Building a multi-center, networked "reverse enclave" collaborative innovation pattern

Under the macro backdrop of innovation-driven development, the relative scarcity of innovation factors at this stage will surely lead to fierce competition among cities, which is

specifically reflected in the latest boom in the construction of "reverse enclaves", and a number of problems have arisen as a result, such as: enclave platforms blindly attracting enterprises with the inertia of growthism, ignoring the original intention of incubating innovation; Enclaves compete for resources and increase policy subsidies, leading to profit-taking by enterprises; disregard the industrial foundation of both enclaves and embrace windfall industries in an all-encompassing manner; and so on. Although Quzhou Hi-Tech Park is one of the more successful typical cases, it also suffers from the above pitfalls. Improvement of regional interests requires matching governance authority at the regional level, and negative externalities such as these are not always easy to overcome.

Management of the company's operations with third-party organizations in the market Mechanism, the active involvement of government forces for the local enterprise R & D off-site to clear the policy to protect, management and operation, market development and many other aspects of the obstacles, greatly pressurized

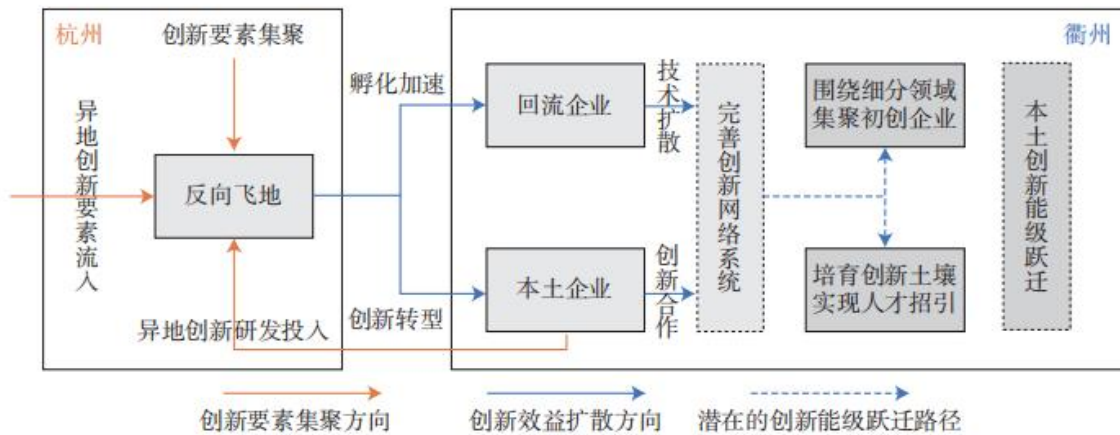


Fig. 6 Logic of Directed Aggregation and Flexible Diffusion of Innovation Factors in Quzhou Sea Innovation Park

Fig.6 The rationale of targeted clustering and flexible diffusion of innovation elements in Quzhou Oversea Talents Innovation Park

Since innovation cannot be solved at the city scale, it is necessary to go beyond the perspective of both enclaves and make a coordinated planning of the "reverse enclave" collaborative innovation pattern at the regional level according to the scope of innovation overflow. As there are different levels and types of innovation, the existing pattern of "reverse enclave" in Zhejiang Province with Hangzhou as the single center is not only prone to trigger an "innovation arms race", but also does not give full play to the innovation-driven role of other high-capacity cities, which should be guided to build a multi-center and networked "reverse enclave" in the future. In the future, we should guide the construction of multi-center and networked "reverse enclave" collaborative innovation pattern, and fully promote the multi-point aggregation and balanced allocation of innovation factors. Specifically, all kinds of small and medium-sized cities should recognize their own advantages and cooperate with developed regions with similar industrial categories and innovative resources, which is not only conducive to enhancing the diffusion efficiency of innovation benefits, but also helps to cultivate the formation of multiple innovation centers in the region. Of course, cities at different stages of development can also set up enclave platforms for each other, for example, less developed small cities and medium developed cities can cooperate on innovation in the field of production technology with strong applicability and timeliness, while cities with higher innovation capacity can try to explore interaction in the field of original research and innovation, and future emerging industries, so as to form an open, diversified and richly layered collaborative innovation network of enclaves.

4.2 Exploring a "reverse enclave" space provision paradigm that accommodates cross-domain flows of innovation

In the face of innovative economy, urban planning needs to change the original static control paradigm and start updating many traditional planning concepts. In this regard, in recent years, many studies have been conducted by academics and the industry in terms of innovation-oriented control and detailed planning reform, mixed land supply policies, and inner-city renewal strategies^[30–33]. However, with the increasing degree of regional integration, the intensity of cross-domain innovation flows between cities will be greatly strengthened, and the core proposition of spatial planning will be expanded from how to adapt to innovation activities at the neighborhood scale to how to adapt to the reorganization of innovation flows at the city and regional scales, especially for the "reverse enclave" model that is emerging and has much room for replication. Especially for the "reverse enclave" model that is emerging and has much room for replication, the corresponding spatial supply paradigm must be iteratively innovated in due course, taking into account the needs and laws of the flow of innovation subjects. For example, for enclaves like Quzhou, the high-speed railway stations, highway entrances and exits, and other important crossings for external transportation links are the main nodes for the flow of innovation factors, and they should be developed differently from ordinary high-speed railway new towns and industrial parks by providing conveniently accessible space for rest and exchange, conference activities, product pilot tests, and other places required for innovation activities, or by taking into account the uncertainties of innovation, through the "reverse enclave" model.

Through the land white space, functional mixing and other measures to deal with the potential flow back to the needs of enterprises, etc.; for Hangzhou, such as flying into the land, should not be limited to a simple independent park land concessions, but also through the planning of industry-academia-research synergistic clustering enclave park space, the construction of a shared pilot plant and other spatial resources to promote the enclave parks from the negative dispersion of win-win situation to the mutual benefit of the parks, but also in the stock of land for the efficient transformation of the land, At the same time, more institutional exploration can also be carried out in the efficient conversion of stock land, revitalization of idle building space, and so on. However, the reality is that the above concepts and paradigm shifts have not yet been taken into account in the current practice. For example, Quzhou West Railway Station, as an important node that can quickly connect to Hangzhou West Railway Station in the West Science and Technology Innovation Corridor of Hangzhou City, is still surrounded by the traditional spatial supply paradigm, which is dominated by business and commercial, and commercial/residential mixed land use. Therefore, future spatial planning must proactively match the spatial demand for cross-domain flow of innovation factors, and explore richer and more specific spatial supply strategies, so as to amplify the positive effect of "reverse enclaves" in promoting cross-domain flow of innovation factors.

4.3 Establishment of a sound governance system for enclave innovation based on new regionalism

In the case of emphasizing government regulation and intervention, the efficiency of innovation will decline due to the a priori and rigidity of the plan, while in the case of spontaneous market-driven situation, the innovation activities will be mismatched with the real development needs due to the disorderly tendency of capital. In the process of development, Quzhou Hi-tech Park also faced the above dilemma of "death if managed" and "chaos if released": at the initial stage, HIP adopted the mode of packaged and hosted third-party operation, which triggered the problems of lack of gate-keeping for the introduced projects and weak binding force of the assessment indexes. In the later stage, the government recovers part of the buildings and operates them independently, but there are also phenomena such as poor efficiency in attracting projects and failure to recover operating costs; and on a larger scale, in government-led enclave cooperation, the front-end and back-end matching of the innovation and production chains is not efficient, and the actual process of project introduction and return relies to a large extent on the government's efforts rather than on the role of the market mechanism. In response to these problems, the new regionalism^⑦ provides a way of thinking that emphasizes the competing forces of government, market, and society based on the market code of conduct to promote the overall interests of the region in various aspects^[34–35]. Under this perspective,

in order to promote the construction of innovation-oriented "reverse enclaves", the government should clarify its own functional boundaries and guide multiple actors to participate in the establishment of a sound supporting system to serve regional collaborative innovation, which should be carried out in the following aspects: first, establish a multi-party communication and coordination platform for innovation collaboration, and regulate innovation factors through regular joint meetings and other forms of cooperation. First, establish a multi-party communication and coordination platform for innovation collaboration, and regulate the cross-domain reorganization of innovation factors through regular joint meetings and other forms.

Secondly, we should fully mobilize the enthusiasm of all kinds of innovation and service industry players in the market, guide the construction of cross-regional technology trading platforms, innovation stations and public investment fund systems, and cultivate key roles such as technology brokers and common technology research and development platforms, so as to reduce the institutional costs of innovation flows; thirdly, we should promote innovation cooperation and exchanges beyond the material space level by organizing activities such as innovation and entrepreneurship exchange and sharing sessions, technology promotion and short-term exchange and training. institutional costs of innovation flows; third, promote innovation cooperation and exchanges beyond the material space level, and promote the formation of close ties between high-end innovative enterprises, talents and other mobile elements and the production networks of the fly-out places by organizing cross-domain innovation and entrepreneurship exchanges and sharing sessions, technology promotion meetings, short-term exchange training and other activities, and strengthen the technological penetration of advanced productivity in the fly-in places into the local industries, so as to help the less-developed regions to establish a This will help underdeveloped regions to establish a sustainable innovation environment.

5 Conclusion and discussion

All innovation activities are both anchored on a specific space and flow between different incubation soils, and the process of innovation flow is also essentially the process of regional innovation Pareto improvement. However, by summarizing the general law and reality paradox of free flow of innovation factors, this paper argues that one-sided emphasis on the free flow attribute of innovation factors cannot effectively optimize the regional development pattern, and may even locally fall into the trap of the Matthew effect, and therefore must be regulated through proactive and positive public policies. Different from the spontaneous regulation of the market, urban planning can guide and reallocate the innovation factors in the region to a greater extent through the targeted supply of space and policies. Spatial planning programs such as science and innovation corridors, cooperation zones, and science cities are a series of pilot practices for realizing the cross-regional reorganization of innovation factors. However, due to the constraints of policy scarcity, urban capacity, and geographic location, these means are unable to realize the innovation cooperation for all the cities in the region, and even less able to effectively diffuse the great utility brought by innovations to the less-developed regions. In exploring various paths for cross-regional reorganization of innovation factors, the "reverse enclave" model, with Quzhou HaiChuangPark as a typical case, provides a new way of thinking for regional collaborative innovation. It should be noted that this model does not exclude the market law that innovation factors flow and gather in developed regions, but through institutional mechanism innovation, the flowable attributes of innovation factors are fully utilized, and the benefits generated by the offsite gathering of innovations can be continuously diffused to less developed regions.

In the context of the trend towards deepening regional integration.

The movement of innovation factors across geographic boundaries is becoming more frequent, and public

The suitability or otherwise of sectoral planning and management and innovation mobility needs will, to a large extent, affect the performance and comprehensive competitiveness of regional innovation. Therefore, spatial planning in the new era should not only pay attention to the fixed jurisdiction of various types of factors, but also think about the development guidance for

mobile factors in a timely manner, so as to seize the opportunity of catching up in the era of innovation, and reverse the status quo pattern of uncoordinated regional development through innovation reorganization and redistribution. In this process, how to innovate the existing means of urban planning and change the previous planning paradigm under the premise of conforming to the market mechanism, and how to leave corresponding elastic space for the current innovative flow demand and potential future innovative opportunities are important issues that deserve attention, and require more and more specific attempts at the theoretical and practical levels.

marginal notes

- ① Consolidating the definitions given by related studies, the factors of innovation referred to in this paper include not only the main factors such as knowledge, information and human capital, but also the indirect factors such as social environment, policies and facilities.
- ② cobweb model (cobweb model) is the use of the principle of elasticity to explain the different fluctuations of certain commodities with long production cycles in the loss of equilibrium occurs in a kind of dynamic analysis of the theory, can be divided into convergent cobwebs, dispersive cobwebs, closed cobwebs and so on three categories.
- ③ Mountain and Sea Collaboration Project is a major strategic initiative taken by the Zhejiang Provincial Party Committee and Provincial Government in order to promote the coordinated regional development of the province, which was formally implemented in 2002, with the intention of encouraging the pairing up of developed coastal areas and underdeveloped mountainous areas in the province to promote the leapfrog development of the underdeveloped areas, in which "mountain" mainly refers to the underdeveloped areas mainly in the mountainous areas of Southwest Zhejiang and Zhoushan Sea Island. Among them, "mountain" mainly refers to the underdeveloped areas mainly in the mountainous areas of southwestern Zhejiang Province and Zhoushan Island, and "sea" mainly refers to the developed coastal areas and economically developed counties (cities and districts) At present, Zhejiang Province is still making every effort to create an upgraded version of the mountain and sea collaboration project, and to promote the 26 counties in mountainous areas to realize leapfrog high-quality development through the construction of the "1+2+26+N" policy system.
- ④ Local buzz is one of the modes of knowledge cooperation proposed by Bathelt et al. It refers to the formal or informal connections formed by geographically neighboring innovation subjects within a certain range during their daily communication and interaction, and this high-frequency and continuous knowledge exchange is similar to buzzing, which can spread knowledge widely by subconsciously.
- ⑤ The inventions protected by China's Patent Law include three types of patents, including invention patents, utility model patents and design patents, among which: invention patents need to have outstanding substantive features and significant progress, and should possess novelty, inventiveness and utility; while utility model patents and design patents have lower authorization standards.
- ⑥ While localized economies generally refer to externalities arising from the agglomeration of firms in the same or certain related industries, urbanized economies emphasize the co-occurrence of facilities as a result of the expansion of the size of the city. The externalities of activities such as sharing and cross-sectoral cooperation.
- ⑦ In contrast to past regionalism, which emphasized the concept of regional integration dominated by governmental hierarchical management, the new regionalism emphasizes the establishment of a flexible cooperation mechanism in which the government, the market and the social forces participate together to form a high-level, open cooperation network, thereby breaking down the constraints of the administrative boundaries and achieving the optimal allocation of regional affairs.

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