Article

Research on Collaborative Innovation Path between Local Universities and Regional Industries in the Context of New Quality Productivity

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Abstract: The world of industry and commerce is undergoing a reconfiguration led by green, low-carbon and digital intelligence, and what is called "new quality productivity," meaning that the basis of China's high-quality economic development has the potential for total factor productivity (TFP) leading from science and technology innovation. Higher education institutions are to be sources of regional innovation, but they are suffering from the occurrence of persistence low rates of conversion of academic research into innovation. This mismatch between resources and user-demand not only inhibits the social function of universities, but inhibits the regional industrial chain within key points of constraints. In the face of the dual pressures of carbon emission constraint and digital technological revolution, a key strategic focus is to restructure the collaborative ecosystem of innovation between universities and industry to provide new regional competitive advantages.

Keywords: new quality productivity; local universities; regional industries; collaborative innovation; path research

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1. Introduction

The creation of new productivity calls for an efficient flow of innovation elements between the industrial chain and the knowledge chain, yet the synergy between local higher education and regional industry, is still caught in a system of "supply misalignment" and "demand deficiency". Most of the patents conceived in university labs, remain in the principle verification stage and firms require solutions meeting engineering specifications; professorial teams struggle to engage in substantive technology iteration due to the shortcomings of assessment system limitations, and enterprise R&D staff do not have access to leading-edge theories. This mutual segregation of the two parties is rooted in entrenched institutional barriers: research assessment systems do not value contributions to industry, university-industry collaborations are based on a temporary agreement without permissive ongoing mechanisms, and key intermediary roles, such as technology brokers, have not formed professionalized groups. This paper aims to dismantle the systemic barrier of collaborative innovation, identify the transformation path from consortium cooperation to ecosystem integration, and provide methodological support to unlock the innovation kinetic energy of regional economy.

2. The theoretical basis of new quality productivity and collaborative innovation

2.1. Connotation and characteristics of new quality productivity

As the fundamental paradigm to promote high-quality economic development, new-quality productivity can be viewed as a systematic jump of total factor productivity, under the conditioning of scientific and technological innovation, and represents a break with the traditional model of growth based on resource consumption. The concept of new-quality productivity encompasses three aspects: First, it emphasizes the strategic significance of new-type production factors such as knowledge and data in terms of factor composition; second, it embodies an in-depth coupling of the innovation chain and industrial chain in terms of its mechanism of action; third, it attempts green and low-carbon sustainable growth in terms of value orientation. Typical characteristics of new-type productivity are embodied as follows: New-quality productivity is internally driven by innovation, which relies on catching a "resonant effect" between disruptive technological breakthroughs and industrial upgrading; the allocation of factors is high efficiency, leading to factors such as talents, capitals, and information being clustered into areas with high added-value; and the high-intensity development model is how new-quality productivity reconstructs the production function through digital and intelligent means. This form of productivity requires a higher demand level for the regional innovation ecosystem, and urgently strives to tear down the discipline and industrial barriers creating a constructive dynamic equilibrium between knowledge creation and market application [1].

2.2. Definition of the concept of collaborative innovation between local universities and regional industries

The collaborative innovation between local universities and regional industries specifically refers to the in-depth interactive relationship network formed by knowledge-creating entities and economic-producing entities in close geographical proximity based on common development goals. This innovation model breaks through the traditional one-way technology transfer framework of school-enterprise cooperation, emphasizing the full-process embedded collaboration between the two parties in aspects such as setting R & D directions, designing talent cultivation programs, and organizing technological breakthroughs. Its core lies in building a two-way adaptation mechanism between knowledge supply and industrial demand. Local universities provide intellectual support based on their disciplinary advantages, regional enterprises define application scenarios according to market experience, and government agencies build institutional environments to promote the integration of elements. During the collaborative process, it is necessary to resolve the structural contradictions of knowledge barriers and interest segmentation, ultimately forming a problem-oriented continuous innovation cycle that unifies the frontier nature of academic exploration and the urgency of industrial upgrading in the regional economic context. The effective operation of this model depends on the long-term cultivation of trust relationships and the institutional guarantee of resource sharing.

3. Problems and challenges of collaborative innovation in the context of new quality productivity

3.1. Insufficient matching between research achievements of universities and industrial demands

The development of new-quality productivity requires that scientific and technological innovation precisely meet the needs of industrial upgrading. However, there is a significant structural mismatch between the scientific research activities of local universities and the technological demands of enterprises at present. The free-exploration nature of academic research often focuses on the cutting-edge fields of disciplines, with a tendency to publish high-level papers or obtain vertical project approvals. In contrast, regional industries pay more attention to the economic applicability and commercialization cycle of technological achievements. This difference in goals makes it difficult for a large number of laboratory results to cross the "valley of death". University researchers are slow to perceive market pain points, and enterprise R & D departments lack sensitivity to emerging technological trends. A deeper-seated contradiction lies in the fragmentation of the innovation value chain: university patents often remain at the principle-verification stage, while enterprises need solutions with engineering-ready conditions. The academic evaluation system does not fully recognize contributions to industrial services, so researchers lack the motivation to continuously improve products. When the technological seeds of basic research fail to take root in the industrial soil, the regional innovation ecosystem loses the nutrient supply for continuous evolution [2].

3.2. Incomplete collaborative innovation system and mechanism

The fundamental constraint currently faced by the collaborative innovation between local universities and regional industries lies in the systematic absence of institutional design. The decision-making process of cross-entity cooperation is often restricted by administrative segmentation. University scientific research management follows the laws of the academic cycle, while enterprise R & D activities are subject to the rhythm of market response, and there is a lack of effective coordinated conversion interfaces between the two operating logics. Specifically, cooperation projects mostly rely on personal relationships rather than institutional arrangements, and temporary agreements are difficult to support long-term technological breakthroughs; the vague definition of intellectual property rights restrains the enthusiasm for innovation investment, and there are conflicts between university asset management regulations and commercialization needs; the governance structure involving multiple entities has not been widely adopted, and there is a lack of channels for enterprises to express their demands in academic decision-making. At a deeper level, there is a dilemma of the dual-track performance appraisal system: university teachers' promotions focus on the quantity of papers and patents, and contributions to the industrial sector are not included in the core evaluation dimensions. Similarly, the collaborative innovation performance of enterprise technicians has not been effectively recognized.

3.3. Inadequate resource sharing and benefit distribution mechanism

The in-depth development of collaborative innovation between local universities and regional industries is currently facing dual constraints of resource-sharing barriers and imbalanced interest distribution. The two-way flow of innovation elements is blocked. There are usage-right restrictions on large-scale scientific research equipment in key university laboratories and engineering centers. Enterprises are reluctant to fully open their production data and market information to academic teams due to commercial confidentiality concerns. Talent mobility across institutions is hindered by establishment-related barriers and difficulties in social security transfer. The phenomenon of resource islands leads to the coexistence of redundant construction and idle waste. For example, the annual utilization rate of a material testing platform worth tens of millions in a local university is less than 40%, while surrounding small and medium-sized enterprises have to send samples outside the province due to a lack of testing capabilities. The contradictions in interest distribution are even more prominent [3]. The initial definition of intellectual property rights often leads to subsequent disputes, as there are conflicts between the university's system for service inventions and the enterprise's protection of trade secrets. There is a lack of a dynamic adjustment mechanism for the distribution ratio of proceeds from scientific and technological achievements transformation. After receiving transfer fees, professor teams lack the motivation for continuous improvement, and enterprises bear the risks of pilot-scale trials but have difficulty sharing the iterative dividends. The underlying problem is the lack of a third-party evaluation and arbitration system, which makes it impossible to quantitatively calculate the implicit inputs of all parties involved in the cooperation.

3.4. Lagging supply and training mode of innovative talents

The development of new-quality productivity puts forward revolutionary requirements for the competency structure of innovative talents. Currently, an increasingly wide competency gap is emerging between the talent cultivation system of local universities and the needs of regional industrial technology upgrading. Under the traditional discipline framework, the curriculum system revision cycle lasts for several years, making it difficult to respond to the accelerating technological iteration in fields such as intelligent manufacturing and new-energy materials. The engineering practice teaching mainly stays at the level of verification experiments, lacking training in solving complex problems in real industrial scenarios. Students' knowledge structure shows a tendency of theoretical solidification, with their interdisciplinary integration ability and technological innovation thinking being significantly weak. Enterprises generally report that fresh graduates need more than a year of job reshaping before they can participate in core technology development. The deeper contradiction lies in the two-way blockage of industry-education integration: the proportion of "dual-qualified" teachers with industrial experience in universities is relatively low, and enterprise technical experts face obstacles in title recognition when entering the teaching system; the achievement transformation function of jointly-built laboratories by universities and enterprises has not been effectively activated, and the R & D projects of students in universities have a weak connection with actual industrial needs [4].

4. Suggestions for Optimizing the Path of Collaborative Innovation in the Context of New Quality Productivity

4.1. Construction of demand-oriented industry-university-research cooperative mechanism

The core of breaking the deadlock of the disconnection among industry, academia, and research lies in reconstructing the demand transmission mechanism and promoting the transformation of the scientific research activities of local universities from a supply-led paradigm to a demand-driven one. Regional industrial authorities should take the lead in formulating technology roadmaps for key fields, regularly releasing lists of industrial generic technologies and catalogs of bottleneck problems to guide research teams in local universities to apply for targeted research projects. Enterprise R & D centers need to be deeply involved in the preliminary project establishment of university laboratories, moving the market verification stage forward to the technical solution design phase. At the practical level, an industrial technology research institute with physical operation can be established. A mixed-team composed of R & D personnel jointly dispatched by leading enterprises and universities can implement a closed-loop management model where enterprises put forward demands, universities break down tasks, and the two parties conduct collaborative development. A pilot project in an automotive industrial cluster shows that when it becomes a institutional arrangement for university professors to participate in enterprise product iteration meetings, the development cycle of laboratory prototypes is shortened by an average of 40%. Supporting reforms need to reshape academic evaluation criteria, incorporating the application scope and economic benefits of technological achievements in the industrial chain into the core indicators for title evaluation, and setting up special positions for industrial professors to open up the talent mutual recognition channel [5]. The key to this in-depth embedded cooperation is to cultivate a group of technology managers, who can accurately translate market language and scientific research terms and continuously adjust the dynamic matching between R & D directions and industrial needs, ultimately forming an innovation community where enterprises are willing to invest, universities are eager to transform achievements, and the market can verify the results.

4.2. Improving the construction of innovation resources sharing platform

The efficient allocation of regional innovation elements urgently requires the establishment of a physically-operating shared hub platform to break through the resource misallocation dilemma caused by the traditional decentralized management model. The core approach is to build a digital resource map led by the government and jointly constructed by multiple entities. Hardware resources such as large-scale instruments and equipment in universities, enterprise test production lines, and third-party testing centers are integrated to form a distributed network. A credit-based appointment system and a cost-sharing mechanism are established in support, enabling small and medium-sized enterprises to access high-end R & D facility services at a reasonable cost. The practice of an industrial technology research institute in a certain province shows that when the electron microscope cluster is network-scheduled, the average annual effective machine-hours of the equipment increase by nearly ten thousand hours. To promote the circulation of data elements, a hierarchical and open security architecture needs to be established. On the premise of protecting the core business secrets of enterprises, an industrial data sandbox is set up. Authorized university research teams can use desensitized production data for algorithm training, while enterprises can obtain targeted cutting-edge technology intelligence. In the construction of the platform service ecosystem, priority should be given to cultivating a team of technology brokers who provide full-chain services such as patent navigation, small-scale and pilot-scale tests, and prototype verification. Their professional qualification certification system should be incorporated into the national vocational qualification framework. The sustainable development of the shared platform depends on the innovation of the market-oriented operation model. A membership-based service and value-added service sharing mechanism is explored [6].

4.3. Optimizing the incentive mechanism for transformation of scientific and technological achievements

The key to improving the efficiency of scientific and technological achievement transformation lies in reconstructing the property-rights system and income distribution system with incentive compatibility, so as to dispel the dual concerns of university researchers' "unwillingness to transform" and enterprises' "fear of accepting". The core reform requires the implementation of the intellectual property segmentation and right-confirmation model, allowing inventors to negotiate with universities to determine the ownership ratio of achievements, and piloting to grant research teams long-term usage rights of over ten years to eliminate the inertia in transformation under the traditional service invention system. The income distribution mechanism should establish a dynamic adjustment framework. A combined scheme of transfer fees, sales commissions, and equity incentives should be implemented for professor teams [7]. For example, a new-materials team at a university retained a 15% sales commission right and continuously improved the process of new-type lithium-battery separators for five years, increasing the enterprise's market share by 30%. Supporting policies need to reconstruct the asset management rules of universities. The equity formed through technology valuation and investment should be included in the assessment scope of preservation and appreciation rather than the scope of state-owned asset loss, and a green channel for title evaluation for achievement transformation positions should be established. Tax incentives for enterprises should be more sustainable. Enterprises that undertake the industrialization of university patents should be given a higher additional deduction ratio for R & D expenses. Local governments should establish a transformation risk compensation fund pool to share the losses of pilot-scale test failures. The guarantee for the implementation of the system lies in cultivating professional evaluation institutions, constructing a matrix-style evaluation model of technological maturity and market prospects, and regularly releasing regional scientific and technological achievement transformation indices to guide resource allocation.

4.4. Strengthening the cultivation and mobility of innovative talents

The development of new-quality productivity urgently requires breaking the temporal and spatial barriers between talent cultivation and industrial practice, and reconstructing an educational ecosystem where educational supply is dynamically matched with market demand. Local universities should establish a physical operation mechanism for industrial technology institutes. Leading enterprises should participate in formulating competency standards and curriculum modules, and transform real-world technological research projects into graduation design topics. Students should complete a cumulative one-year immersive learning experience at enterprise R & D centers. To optimize the teaching staff structure, a dual-appointment program for industrial professors should be implemented. Enterprises' technical experts should be given the authority to recognize the qualifications of supervisors for master's students [8]. University teachers should participate in enterprise R & D for a cumulative period of no less than six months every five years, which should be included as a necessary condition for promotion. The key to innovating the talent mobility system lies in building a regional innovation talent archive database, opening up the channels for the continuation of social security and housing provident funds across institutions. University researchers who take part-time jobs in enterprises can have their teaching workloads calculated accordingly. R & D backbones in enterprises who pursue engineering doctorates can enjoy flexible academic systems and credit mutual recognition [9]. A pilot project in a smart manufacturing industrial cluster shows that when university teachers lead student teams to develop intelligent detection systems in factories, enterprises can simultaneously complete the master's degree courses for their technical backbones, forming a two-way cycle of knowledge transfer and experience feedback. Supporting reforms need to reshape the dimensions of talent evaluation. The contribution of technological achievements to industrialization should be included in the core indicators of title evaluation, and a cross-evaluation mechanism between skill masters and academic leaders should be established. Ultimately, a community of compound talents who understand principle innovation and can solve complex engineering problems will be cultivated, providing sustainable intellectual support for the regional industrial leap [10].

5. Conclusion

The core of collaborative innovation in the era of new-quality productive forces is to create our knowledge value-added and industrial upgrading community of common destiny. Local universities need to align their discipline construction with the regional industrial map and capture the technology pain points of enterprises as research objectives in their key laboratories. The industrial circle needs to open up production line teaching scenarios, including allowing engineers serious participation in the design of the curriculum. Competition is now governed by the metabolic efficiency of the innovation ecosystem. There is a pressing need to create a three-fold support system: at the operational level, adopt the "professor studios stationed in industrial parks" model to shorten the technology pilot-test cycle; at the institutional level, implement a gradual, revenue-sharing system where achievement transformation enhances the sustained improvement motivation of research teams; at the governance level, establish a regional innovation council to new a collaborative map of directions for major technical research collaborations. When talent cultivation is integrated into the industrial upgrading process, scientific research activities respond to market demand changes, and policy design conforms to the laws of innovation, the spiral-rising channel of "basic research-technology development-industrial application" can be truly connected, ultimately unleashing the fission energy for high-quality development of the regional economy.

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