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From "Reindustrialization" to "Re-Innovation and Technologization": A Strategic Study on Upgrading the Capacity of Hong Kong's Innovation Ecosystem

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Abstract: Innovation and Technology (I&T) constitute an important pillar of Hong Kong's re-industrialization agenda and sustained global competitiveness. While benefitting from top-tier universities, a diverse talent pool, and strong global connectivity, Hong Kong faces increasingly severe structural challenges. These include lack of strategic moves of cutting-edge technologies, limited integration across the industry-academia-research-application fields, and slow technology diffusion. In response to these systemic gaps, this study advocates for a pivot to drive "innovation and technologization." The goal is to comprehensively assess Hong Kong's innovation ecosystem, diagnose key bottlenecks, and benchmark its performance against world's leading IT hubs. The study employs a hybrid approach, combining quantitative analysis of longitudinal data from 2015–2024 with case studies, aiming to identify practical pathways to enhance the capabilities, efficiency, and dynamism of the local innovation system. A quantitative assessment of the Hong Kong Innovation and Technology Ecosystem Index reveals that while Hong Kong's overall score is trending upward, the development across the five dimensions is unbalanced. This study proposes a "Re-innovation and Technologization" strategic framework, suggesting strengthening intellectual property protection, establishing a deep integration mechanism of industry, academia, research, and application, and building a Greater Bay Area collaboration network.

Keywords: Reindustrialization; Re-innovation and technologization; Innovation ecosystem

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1. Introduction

1.1. Research background

Hong Kong is currently at a critical historical crossroads. The city is trying to perform industrial restructuring and seeking innovation-driven growth. To keep up with global technological competition, the Hong Kong government has actively promoted a “re-industrialization” strategy and set up the Committee on Innovation, Technology and Re-industrialization in 2017 to guide the development of advanced manufacturing [1]. However, actual progress remains limited. Hong Kong’s manufacturing made up less than 1% of GDP [2]. This is a tiny fraction compared to neighbors like Mainland China, South Korea, Singapore, or Taiwan. Therefore, Hong Kong’s re-industrialization should not be interpreted as a return to large-scale mass production, but as an attempt to rebuild high-value R&D, prototyping, pilot production and IP-control functions [3]. The data clearly highlights the urgency of enhancing Hong Kong’s innovation and technology capabilities. Looking back, Hong Kong’s spent decades on the financial and real estate sectors. It has caused it to miss out on several waves of global technological innovation, including artificial intelligence and semiconductors [4]. This has resulted in an underdeveloped innovation ecosystem, a relatively weak industrial base, and persistent bottlenecks [5].

1.2. Research goal

This study focuses on the transition from “reindustrialization” to “re-innovation and technologization”. The aim is to address the innovation stagnation caused by low integration among government, industry, universities, and research institutions. To solve this, this study has a few specific goals. First, building a new way to measure progress is essential. The multi-layered framework will give policymakers a practical tool they can actually use. Moreover, this study wants to break through the deep-rooted bottlenecks. Meanwhile, the results may help look for ways to help companies survive the “valley of death” during technology transfer. Not only can it make Hong Kong a stronger global innovation hub, but also integrates into the Greater Bay Area’s industrial strategy. This builds up groundwork for future cooperation.

1.3. Research significance

The value of this research is both theoretical and practical. The innovation of this study lies in its fresh perspective, adding to Hong Kong’s current industrial policy and introduce “re-innovation and technologization.” Theoretically, this research fills a gap in the academic field of quantitatively assessing innovation capacity by developing a new analytical framework and the “Hong Kong Innovation Ecosystem Index.” By analyzing the interactions of key stakeholders such as government, industry, universities, financial institutions, and end-users, the study introduces an ecosystem perspective often overlooked in traditional analysis, enriching the theory of regional innovation systems. Practically, the timing is critical. By pinpointing systemic weaknesses, this study can uncover hidden competitive advantages, providing a scientific basis for the integration of fragmented policy interventions. The findings will help policymakers implement precise policies under resource constraints, providing decision-making support for Hong Kong’s deep cooperation and value chain lock-in within the Greater Bay Area framework, thereby driving local GDP and quality employment through innovation and technology.

2. Literature review

2.1. Theories related to innovation ecosystems

The innovation ecosystem is a multi-dimensional system, with the core encompassing participants, collaborative relationships, and their comprehensive impact on innovation performance. Adner’s view in the Harvard Business Review in 2006 is considered the most widely used cornerstone, which states that companies integrate their respective services into coherent customer-oriented solutions through collaborative arrangements [6]. Wang

Pingping proposed in 2019 that different innovation entities undertake different functions and roles, and innovation activities need to achieve their goals and stimulate vitality through effective collaborative mechanisms [7]. In 2020, Granstrand and Holggersson proposed that an innovation ecosystem is a system composed of constantly evolving actors, activities and products, encompassing institutions and relationships that are crucial to innovation performance, especially complementary and substitutive relationships [8]. This perspective explains the underlying reasons why the Hong Kong government has failed to achieve the expected benefits despite launching many innovation and technology policies in recent years. Essentially, Hong Kong faces the problem of limited collaboration among industry, academia, research and application. Ma Jun's research in 2020 found that the pursuit of scientific discovery by academia and the focus on practicality by industry make it difficult for the two sides to build a unified discourse system when cooperating [9]. Arthurs *et al.* proposed a framework with 34 variables, which included environmental conditions such as human capital, infrastructure and regulations [10]. Beaudry and Solar-Pelletier's framework is more targeted, focusing on the efficiency of science and technology to commercial success [11]. In response to the local context of Hong Kong, the PolyU team constructed a two-level indicator system in 2023, which focuses on measuring R&D, talent and industrial impact, and is an important pioneering attempt in local quantitative research [12].

2.2. The historical evolution of Hong Kong's innovation and technology policy

Between 1998 and 2015, policy focus shifted from hardware infrastructure to a soft ecosystem. At first, it was mainly relying on building physical buildings such as laboratories and incubators. The establishment of the Innovation and Technology Bureau in 2015 and the subsequent release of the Blueprint marked a clear shift in the government's role in the field of innovation and technology. The launch of the Lok Ma Chau Loop in 2017 and the Greater Bay Area collaboration after 2022 reflect Hong Kong's conscious effort to overcome the difficulties of local land and labor costs by leveraging regional production networks. This transformation logic utilizes cross-border collaboration mechanisms to deeply integrate Hong Kong's original innovation capabilities with the Greater Bay Area's strong transformation capabilities, thereby achieving strategic cooperation to "Hong Kong R&D and Greater Bay Area Production" [13].

2.3. Case studies of "Re-innovation and Technologization"

From a global perspective, the success of leading technology regions does not stem from manufacturing scale, but from mastery of core control mechanisms under the "Global Production Networks". That is, core cities use their control over R&D, intellectual property and capital markets to conduct virtualized vertical management of production links around the world. Taking Silicon Valley as an example, tech giants such as Apple and Nvidia conduct top-notch R&D locally and rely on Nasdaq for capital operations, but actively move the manufacturing and assembly chain with lower added value to Asia [14]. Similarly, although Boston is plagued by a real estate structure with both "high vacancy rate and high rent", it has nurtured globally influential biotech firms such as Moderna, Vertex and Biogen. Core cities control high-value-added segments through R&D, IP, financing, standards, platform rules, and supply chain governance, while manufacturing can be completed in external regions [15]. The European Union has shown another paradigm of transnational collaboration. The EU case is better understood as a combination of supranational R&D funding through Horizon Europe, cross-border public-private partnerships, and a gradually integrated patent protection infrastructure, rather than a single EU-wide IP Box policy [16]. These international cases collectively suggest a key argument: the vitality of an innovative city does not depend on the completeness of its manufacturing scale, but on its ability to become a core node in a regional innovation network and to secure high-net-worth R&D and intellectual property rights through a powerful capital market.

3. Research design and methodology

3.1. Methodology

In response to the frictions among various units in the innovation ecosystem mentioned above, this study aims to systematically assess the dynamic evolution of Hong Kong's innovation ecosystem through policy analysis and quantitative modeling, identifying key elements and diagnosing core bottlenecks. The quantitative research employs the Composite Index Method, constructing a multi-dimensional indicator system to achieve a quantitative measurement of the complex ecosystem.

3.2. Composite index synthesis logic

This study employs a multi-level linear weighted summation model to construct a comprehensive index for Hong Kong's innovation ecosystem. The synthesis logic aims to reflect the balanced evolution of various dimensions of the system through scientific weight allocation.

Firstly, to eliminate differences in dimensions and magnitudes among different indicators while preserving the longitudinal growth trend in the time series, this study uses a global standardization method to perform dimensionless processing on the original data:

$$x_{ij}^{'} = \frac{x_{ij} - \min\left(x_j\right)}{\max\left(x_j\right) - \min\left(x_j\right)} \tag{1}$$

Where x_{ij} represents the original value of the j-th indicator in the i-th year; $\min\left(x_j\right)$ and $\max\left(x_j\right)$ represent the global minimum and maximum values of the indicator during the observation period from 2015 to 2024, respectively; $x_{ij}^{'}$ is the processed standardized value, and $x_{ij}^{'} \in [0,1]$.

In terms of weighting, this study adopts subjective weighting. Based on the structural balance of the symbiotic theory of innovative ecosystems and combined with the professional judgment of policy research experts, this model assigns equal weights to all five secondary dimensions (symbiotic unit, symbiotic matrix, symbiotic platform, symbiotic network, and symbiotic environment), i.e., the weight coefficient of each dimension is 0.2. By setting the same initial weights, the heterogeneity of the performance of each dimension under the same policy input background can be observed more clearly. Within each secondary dimension, this study considers that the contribution of the corresponding tertiary indicator $x_{ij}^{'}$ to that dimension is of equal importance. Therefore, the indicators within each dimension are first arithmetically averaged to calculate the score of that dimension S_{ki}:

$$S_{ki} = \frac{1}{n}\sum_{j=1}^{n} x_{ij}^{'} \tag{2}$$

Where S_{ki} is the score of the k-th dimension in the i-th year; n is the total number of tertiary indicators included under this secondary indicator;$x_{ij}^{'}$ is the standardized value of each indicator. This approach could reduce the impact of abnormal fluctuations in any single indicator.

By doing so, the overall scores are more stable and reliable. The scores of the five dimensions S_{ki} are linearly weighted and summed with their corresponding weights W_k to obtain the original comprehensive score. To make the calculation results more interpretable, the study maps the final synthesized comprehensive score to the interval [0, 100] :

$$Score_i = 100 \times \sum_{k=1}^{5} S_{ki} W_k \tag{3}$$

This mapping method can capture small progress in the ecosystem, and in particular, it can effectively amplify the marginal effects brought about by inflection points.

3.3. Indicator system

Based on symbiosis theory, while considering the characteristics of Hong Kong's innovation and technology development, this study constructs an evaluation index for Hong Kong's innovation ecosystem, comprising 5 secondary indicators and 26 tertiary indicators. This system aims to comprehensively assess Hong Kong's innovation ecosystem through quantitative analysis of each dimension. Specific indicators and their definitions are shown in **Table 1**.

Table 1. Hong Kong innovation ecosystem indicator evaluation system

Primary indicators	Secondary indicators	Tertiary indicators
Hong Kong Innovation Ecosystem	Symbiotic Unit	Number of industrial enterprises X_1
		Number of technology companies incubated by HKSTP X_2
		Number of start-ups X_3
	Symbiotic Matrix	Number of R&D personnel in higher education institutions X_4
		Number of R&D personnel in business sector X_5
		Total expenditure on in-house R&D activities in the business sector X_6
		Ratio of gross domestic expenditure on R&D to GDP X_7
	Symbiotic Platform	Percentage of value added in innovation and technology industries to GDP X_8
		Funding from the ITC to promote applied R&D projects X_9
		Funding from the ITC to promote technology application projects X_{10}
		Funding from the ITC to promote new industrialization X_{11}
		Funding from the ITC to promote the patent application subsidy grants X_{12}
		Funding from the ITC to promote the operation of public technology support organisations X_{13}
		Funding from the ITC to promote technology transfer, entrepreneurship, and commercialization of R&D outcomes X_{14}
	Symbiotic Network	Number of Guangdong-Hong Kong-Macao joint laboratories X_{15}
		Number of enterprises engaged in innovation activities X_{16}
		Number of companies collaborating on innovation across organizations X_{17}
		Number of companies engaged in R&D activities X_{18}
		Number of companies collaborating on R&D activities across organizations X_{19}

Hong Kong Innovation Ecosystem	Symbiotic Environment	GDP per capita X_{20}
		Percentage of candidates meeting the general entrance requirements for local undergraduate programs X_{21}
		Library stock X_{22}
		Total retail sales X_{23}
		Gross National Disposable Income X_{24}
		Direct investment inflow during the year X_{25}
		Number of mainland companies based in Hong Kong X_{26}

The data in this study primarily comes from the Hong Kong Census and Statistics Department. To ensure the objectivity of the evaluation results, the study adopted Global Min-Max Normalization. This method eliminates dimensional differences while ensuring strict comparability of scores across years.

4. Research results

4.1. Indicator system calculation results

According to **Figure 1**, Hong Kong's innovation ecosystem has shown a significant long-term steady upward trend during the observation period. The total score jumped from 5.53 points in 2015 to 85.08 points in 2024. These numbers suggest that the systemic resilience and comprehensive strength of Hong Kong's ecosystem have been substantially enhanced. Meanwhile it had the potential of pivoting from traditional industries to an international innovation and technology center. From the perspective of evolution, the system exhibits distinct development characteristics: 2015 to 2018 was the "initial climbing period," with the index rising steadily along with the initial release of innovation and technology policies, reflecting the early accumulation of basic elements such as R&D personnel and start-ups; 2019 to 2021 entered the "structural adjustment period," affected by external disturbances such as global macroeconomic fluctuations and social health events, the overall index experienced a brief decline, mainly due to the phased decline in environmental indicators such as retail activity and foreign direct investment. However, the real shift happened in 2022. The system has entered a period of "accelerated transformation," with the index soaring from 47.73 to 85.08, showing a significant upward inflection point. The sharp turn is consistent with the timing of intensified policy support, but further causal analysis is required to establish the magnitude of policy effects. In summary, the results reveal the outstanding resilience of Hong Kong's innovation ecosystem. Even under the pressure of external shocks, the system can quickly return to an upward path, indicating that Hong Kong's supporting conditions and resource allocation have formed a strong ability to withstand risks.

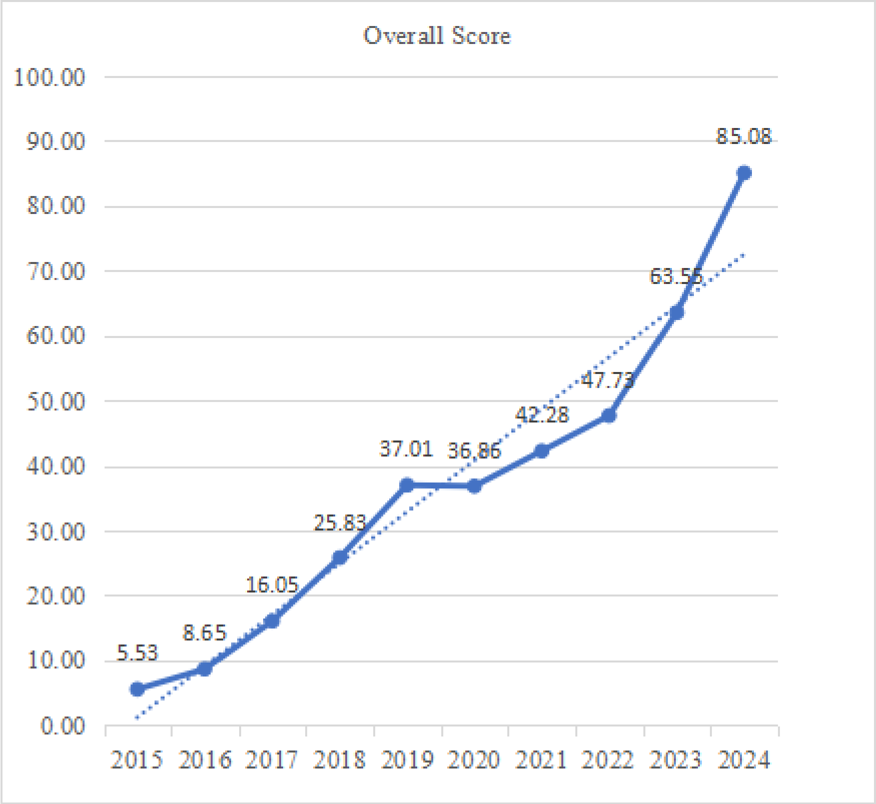

Figure 1. Overall score of Hong Kong's innovation ecosystem from 2015 to 2024.

4.2. Results analysis and evaluation in each dimension

Hong Kong's innovation ecosystem is not only growing in total value. It's fundamentally changing in shape. As shown in **Figure 2**, the change in Hong Kong's innovation landscape is striking. In 2015, the system exhibited an evidently singular, supportive structure, relying on the symbiotic environment. However, by 2024, every corner of the radar chart had expanded significantly outwards, forming a much fuller and more balanced shape. This development demonstrates that Hong Kong has moved beyond its early passive model of attracting businesses solely, transforming into a fully functional innovation ecosystem with comprehensive capabilities. This is no longer simply about resource input, but rather about how government, industry, and academia are actually talking to each other and working together to drive growth.

The actual numbers back up this evolution. The number of start-ups increased from 1,558 in 2015 to 4,694 in 2024, a growth of over 201%. But the number of industrial enterprises has been declining, reflecting the lagging transformation of traditional industries. The total number of R&D personnel in enterprises falls behind that of universities in both base numbers and growth rate. As of the end of September 2025, the ITF had approved a cumulative total of approximately HK$54.8 billion in funding, demonstrating the government's continued investment in innovation and technology. Starting in 2021, a breakthrough was achieved from scratch in Symbiotic Platform, with indicators soaring over three years and a stable growth momentum. Collaborative innovation has become more prominent. Data shows that firms engaging in cross-company innovation and R&D rose from 389 and 475 in 2021 to 755 and 663 in 2024. Perhaps the biggest driver has been the "symbiotic environment" itself. The standardized value rises from 0.28 to 0.79 between 2015 and 2024. An increase of 182% makes it the core engine of systemic development. The number of mainland companies based in Hong Kong reached over 2,600 in 2024.

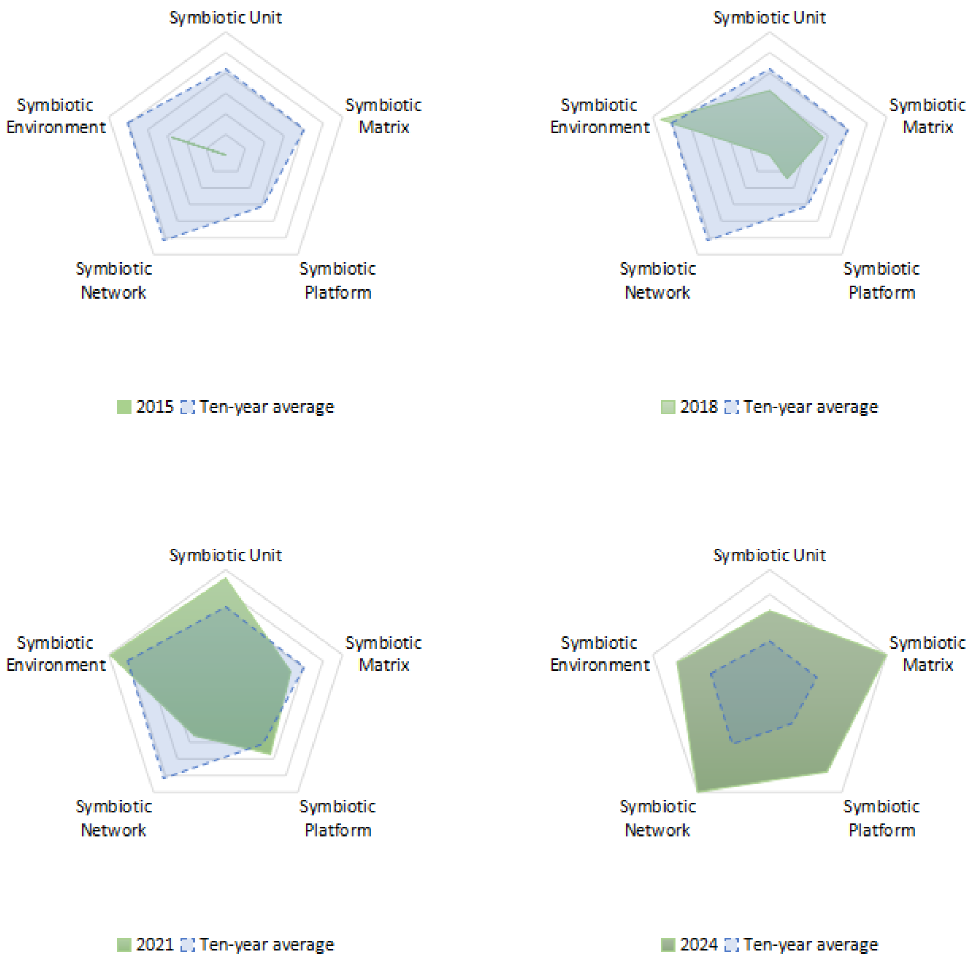

Figure 2. Radar charts of Hong Kong's innovation ecosystem (2015, 2018, 2021, 2024). Note: The charts illustrate the evolution of the five ecosystem dimensions across four representative years. Each axis is scaled from 0 to 1. Data points at 0 indicate indicators excluded due to unavailability.

5. Conclusions and policy recommendations

5.1. Conclusions

The findings suggest that Hong Kong's innovation ecosystem has improved over the past decade, particularly in terms of start-up formation, public funding infrastructure, and cross-boundary collaboration. However, the development remains uneven across ecosystem dimensions. The most persistent bottleneck is not the absence of research capacity, but the weak conversion of university-based knowledge into enterprise-led prototyping, pilot production, IP commercialization, and scalable industrial application. Therefore, Hong Kong's next-stage reindustrialization should be reframed as a strategy of re-innovation and technologization transformation, with emphasis on IP retention, enterprise-led translational mechanisms, and coordinated production networks in the Greater Bay Area.

5.2. Policy recommendations

5.2.1. Strengthen public funding contract terms and align with Patent Box tax incentives

To really make “re-innovation and technologization” work, Hong Kong needs a new governance framework. It should be something that puts intellectual property at the center and having pilot-scale production and commercialization. Building upon Hong Kong’s existing patent box mechanism, this initiative will connect public R&D funding, substantive local R&D in Hong Kong, local IP registration, repatriation of patent licensing revenue, and industrialization KPIs. This idea aims to create a full circle, breaking the long-standing deadlock of hollowed-out research and mandating the retention of high-end local jobs through minimum requirements for high-value-added processes. This method ensures that even if production is outsourced to the Greater Bay Area, the decision-making brain and R&D activities remain in Hong Kong.

5.2.2. Optimize financial coordination and compliance governance

Hong Kong needs to take in account its advantages as an international financial center. The goal is to build a financial support system that can both incentivize value creation and comply with international compliance standards, in order to support the cross-border industrial chain layout. Under the framework of “Hong Kong parent company + Greater Bay Area manufacturing base.”, Hong Kong is not only a location for holding intellectual property rights, but also a center of value creation in high-value-added segments. All royalty, cost-sharing, contract manufacturing, and transfer pricing arrangements must comply with the arm’s length principle, BEPS requirements, and the Hong Kong Inland Revenue Department’s nexus approach to IP income.

5.2.3. Establishment of a dynamic pilot-scale platform

To bridge the structural gap in Hong Kong’s innovation ecosystem, where going from “0 to 1” is relatively easy but going from “1 to 100” is difficult, establishing a government-led shared pilot production platform is crucial to filling this gap. Hong Kong currently has no shortage of physical space planning; the San Tin Technopole and the Shenzhen-Hong Kong Science and Technology Innovation Cooperation Zone in the Lok Ma Chau Loop have already planned spaces covering offices, pilot production, testing, and small-batch production. The key point of the proposal is to activate these spaces through institutional innovation, transforming them from static real estate development to dynamic industrial services. The government should establish a database of the needs of potential businesses. In-depth research into the actual technological requirements of target industries should be achieved as early as possible, allowing for proactive forecasting during the planning phase. High ceilings and high-load-bearing floors should be reserved for enterprises that require large-scale precision instruments or vertical production lines to avoid high-end production lines having nowhere to be located due to outdated building codes.

5.3. Research limitations

During the making of the Hong Kong Innovation Ecosystem Index, this study assigned an equal weight of 0.2 to all five secondary indicators. This design aims to neutrally reflect the equal importance of each dimension in the early stages of the ecosystem. However, it must be acknowledged that this weighting design has limitations. The equal weighting scheme may not fully capture the dynamic evolution of policy priorities at different stages between 2015 and 2024. The final scores and rankings of each dimension are somewhat sensitive to the weight allocation. If different weighting methods such as entropy weighting are used, slight fluctuations may occur in the rankings between dimensions. Therefore, future research could introduce weight perturbation analysis or combined weighting methods to verify the robustness of the research conclusions under different weighting scenarios and further improve the objectivity of the index.

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Disclosure statement

The authors declare no conflict of interest.

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