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Article

Theoretical Logic, Practical Predicaments and Innovative Pathways for Promoting the Two-Way Flow of Urban and Rural Factors

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Abstract: To address the imbalance and inadequacy in urban-rural regional development and advance the implementation of Guangdong Province's High-Quality Development Project of Hundreds of Counties, Thousands of Towns, and Myriads of Villages, this study focuses on innovating the two-way flow mechanism of urban-rural factors and conducts systematic research integrating theoretical analysis and practical investigation. It first clarifies the theoretical logic of urban-rural factor flows, identifying that such flows cover both traditional factors (i.e., labour, land, capital) and new factors (i.e., data, technology, ecology), with a mutually reinforcing relationship between factor flow and urban-rural integration. Subsequently, the study dissects the practical impediments to factor flow in the project's implementation: institutional barriers from fragmented policies and ambiguous property rights; market-level challenges including regional factor deficits and supply-demand mismatches; technological constraints arising from urban-rural digital infrastructure gaps and insufficient digital literacy; and governance shortcomings such as weak village collective capacity and inadequate risk prevention mechanisms. Finally, targeted innovative pathways are proposed to meet the project's factor flow needs, encompassing institutional breakthroughs, market activation, technological empowerment, and governance coordination. This research provides practical insights for Guangdong to resolve urban-rural development imbalances and deepen the project's implementation, while also offering Guangdong's experience for promoting nationwide urban-rural integration.

Keywords: hundreds-thousands-myriads project; two-way flow of urban and rural factors; urban-rural integration; county governance; innovative pathways

1. Introduction

The 20th National Congress of the Communist Party of China has prioritised high-quality development as the foremost task in building a modern socialist country in all respects, calling for efforts to promote integrated urban-rural development and coordinated regional progress. To implement this directive and address imbalances in urban-rural and regional development, Guangdong Province launched the High-Quality Development Project of Hundreds of Counties, Thousands of Towns, and Myriads of Villages (hereinafter referred to as the "Hundreds-Thousands-Myriads Project"). As Guangdong's core strategy for dismantling the urban-rural dual structure and advancing regional coordination, this initiative has, since its implementation in 2023, consistently taken counties as the fundamental unit. It promotes the rational flow and efficient allocation of urban-rural

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factors through coordinated spatial planning, industrial development, and infrastructure construction. Policy documents explicitly state that the project aims to "establish a robust policy framework for the equal exchange and bidirectional flow of urban-rural factors", positioning the circulation of land, capital, labour, data, and other elements as the core engine for its implementation. Previous research has confirmed that the bidirectional flow of urban-rural factors at the county level significantly improves total factor productivity, with this effect being more pronounced in regions with a higher proportion of agricultural industries [1]. This research conclusion aligns closely with the development needs of agricultural counties in Eastern, Western, and Northern Guangdong under the Hundreds-Thousands-Myriads Project, providing empirical support for achieving high-quality development through the bidirectional flow of urban-rural factors.

Theoretically, existing research has established a multidimensional analytical framework. Researchers categorised urban-rural factor flows into three stages: "unidirectional flows within a dual structure", "interactive urban-rural flows", and "integrated bidirectional flows" [2]. They identified that China is currently in the third stage, highlighting the need to address the net outflow of rural factors. This provides a theoretical basis for positioning the phase of factor flows under the Hundreds-Thousands-Myriads Project. A three-tier governance system spanning counties, townships, and villages is deemed indispensable for factor flows, as highlighted in the "factor-governance" coordination framework [3]. This aligns closely with the project's practical logic of "county-level coordination and township-village linkage." The mechanism of new-quality productive forces driving factor upgrading is clarified, with technological innovation identified as a reshaper of factor interaction rules, providing theoretical support for the project's application of data elements and smart agricultural technologies [4]. Empirical research shows that data elements exert a significant impact on labour flow, as data platforms can boost labour matching efficiency by over 30%, offering empirical evidence for the project's "digital empowerment of factor flow" [5]. However, existing theories remain insufficiently integrated with the county-level context of the Hundreds-Thousands-Myriads Project. For example, they fail to address the differentiated needs of counties requiring category-based advancement: the factor demands of the Pearl River Delta region differ sharply from those of other counties, necessitating tailored theoretical adaptations.

From a practical perspective, a tripartite model has been proposed, consisting of "efficient markets optimising industrial competition environments, proactive governments improving business environments, and capable collectives integrating fragmented resources" [6]. Through measures such as consolidating rural projects, refining policy support, and revitalising idle resources, this approach has achieved substantial growth in both village collective economies and villagers' incomes, providing practical references for the bidirectional flow of urban-rural factors. From the case study of demolition and reclamation projects, a land flow mechanism involving "cross-regional land indicator trading with proceeds reinvested in rural areas" has been proposed [7]. This mechanism provides a replicable practical paradigm for the efficient cross-regional flow of land factors under the Hundreds-Thousands-Myriads Project, while also offering crucial experience for improving subsequent policies on the coordinated allocation of urban-rural factors. The "Rural Innovation Special Envoys" system has been explored, which dispatches technical personnel to villages to drive transformation through cultural creativity and establishes institutional channels for the bidirectional flow of resources such as talent within county-level coordination frameworks [8]. A bidirectional flow mechanism for capital elements has also been developed, which achieves value appreciation through market-oriented approaches to address rural financing constraints and capital outflow challenges [9]. This approach bridges urban-rural financial policies, enhances the synergistic allocation of capital with land and labour, and injects capital momentum into integrated urban-rural development and rural revitalisation. Nevertheless, existing case studies lack systematic integration with the large-scale implementation of the Hundreds-Thousands-Myriads Project. For instance, studies focusing on the carrier function of county towns fail to link policy systems with factor flows, hindering the full realisation of policy synergies [10,11].

Building on existing literature, this study responds to the practical needs of Guangdong Province's Hundreds-Thousands-Myriads Project in advancing integrated urban-rural development. Grounded in theoretical frameworks, practical models, and research on real-world obstacles to factor flow, it examines the bidirectional flow mechanisms of core elements (i.e., land, capital, labour, data, technology, and ecology) under the project.

The research aims to achieve three objectives: First, systematically synthesise the core content and underlying logic of urban-rural factor flow from existing literature, distilling typical flow patterns; Second, identify institutional, market, and technological obstacles currently impeding factor flow, and analyse the compatibility conflicts between these barriers and the county-level development goals of the Hundreds-Thousands-Myriads Project; Third, explore how to construct tailored innovative pathways for factor flow under the project from the perspective of new-quality productive forces and data elements, thereby further releasing the efficiency of factor allocation and promoting integrated urban-rural development.

2. Theoretical Logic of Factor Flow Driving Integrated Urban-Rural Development

2.1. Core Dimensions of Urban-Rural Factor Flow

The flow of urban-rural factors serves as the pivotal link in dismantling the urban-rural dichotomy and advancing integrated development. Its patterns, characteristics, and allocation efficiency directly impact the restructuring of urban-rural relations in China's modernisation drive, the implementation of the rural revitalisation strategy, and the attainment of common prosperity. Consequently, thoroughly examining research findings and core concepts regarding this flow holds significant theoretical value and practical guidance for clarifying integrated development pathways and resolving existing impediments. Analysis of relevant literature indicates that mobile factors encompass both traditional production elements (i. e., labour, land, capital) and emerging elements (i.e., technology, data, ecology).

Labour flow refers to the spatial transfer and allocation of the working-age population between urban and rural areas in terms of employment choices, residential locations, and access to public services. It represents the most dynamic element in urban-rural factor flows [12, 13]. Its core is to achieve "capability matching" and "equal rights" for labour across urban and rural areas. This includes both the transfer of surplus rural labour to non-agricultural industries in cities and the downward migration of urban talent to rural areas, ultimately optimising the allocation of labour resources between urban and rural areas. During the unidirectional flow phase, the migration of young and able-bodied rural labour to cities led to rural "hollowing-out"; simultaneously, the loss of this demographic hindered the scaling-up of agricultural operations and precipitated an "ageing" of agricultural production [12,13]. In the transition to two-way flows, the urbanisation of agricultural migrants can be effectively advanced by decoupling household registration from public services. Concurrently, policies such as the "Three Rural Initiatives" can guide urban talent to return to the countryside [6,14].

Land factors refer to the flow and allocation processes of urban and rural land resources related to property rights demarcation, circulation, transactions, and land use conversion. This encompasses types such as rural contracted land, homestead land, collectively-owned operational construction land, and urban construction land. The core objective is to achieve equal rights and value for land factors alongside efficient utilisation through clear property rights and market-based transactions [7,9]. This flow involves not only the spatial relocation of land but also the division and restructuring of land property rights, serving as a pivotal link connecting urban-rural spaces and industries. The core contradiction currently lies in the gap between equal rights and unequal value of urban and rural land: the entry of collectively-owned operational construction land into the market faces obstacles. Under the dualistic urban-rural land management system, local governments tend to prioritise land expropriation to capture land appreciation gains, resulting in limited market participation of rural collectively-owned operational construction land. Concurrently, the absence of detailed implementation rules for the "three rights separation" of homestead land hinders the activation of farmers' property rights over land [15].

Capital elements refer to the flow and allocation of monetary funds, financial assets, and physical capital between urban and rural areas. This includes forms such as agricultural credit, social capital flowing into rural areas, and fiscal support for agriculture. Its core objective is to resolve the dual predicament of rural "difficult and costly financing" and urban capital's "challenges in flowing into rural areas and high risks", thereby achieving efficient circulation of capital in urban-rural industries [16,17]. This flow entails not merely spatial capital transfers but also requires complementary risk compensation and guarantee mechanisms to safeguard capital security and farmers' rights. The traditional phase witnessed a "blood-sucking" flow pattern where rural

financial institutions "deposited more than they lent", with rural funds flowing extensively to cities via state-owned banks, leading to chronic capital shortages for rural industrial development [8,17]. Concurrently, farmers face practical obstacles in accessing loans, including insufficient collateral (e. g., limited coverage of land management rights mortgage pilots) and agricultural insurance that only compensates for material costs [12].

Technological elements in urban-rural contexts focus on the transformation of technological achievements and the sharing of skills and knowledge across agricultural production innovation, ecological governance optimisation, and digital scenario implementation. This spans the entire chain from application training guidance to the promotion and implementation of outcomes. Its core objective is to resolve the mismatch between urban and rural technological supply and demand, as well as the intergenerational disconnect, shifting the flow of technology from urban-dominated output to a new paradigm of mutual empowerment and collaborative innovation between urban and rural areas [2]. In agriculture, the downward diffusion of urban smart cultivation technologies enables farmers to precisely control production processes, injecting momentum into agricultural modernisation [18]. As a vital conduit for technological factor flow, digital technologies not only amplify the value of rural specialised industries through e-commerce platforms and remote services but also bridge spatial barriers and cultural cognitive gaps between urban and rural areas [8]. From an industrial synergy perspective, the high-frequency flow of technological factors between urban and rural areas can drive deep integration across upstream and downstream industries [12].

Data elements refer to the processes of generating, sharing, applying, and distributing benefits from information resources related to agricultural production, factor allocation, and public services between urban and rural areas. They constitute a core new factor in the digital era for breaking spatial constraints between urban and rural areas and enhancing factor matching efficiency [5, 8]. Their flow must balance data privacy protection with benefit sharing, achieving a unified approach to data empowerment and rights safeguarding. The core value of data elements lies in overcoming spatial barriers: empirical research indicates they can improve the efficiency of labour matching between urban and rural areas. Although they currently restrain the flow of urban labour to rural areas, narrowing the gap in population flow between urban and rural areas and across regions lays a crucial foundation for subsequently establishing a two-way labour flow mechanism and promoting integrated urban-rural development [2,5,19].

Ecological elements refer to the flow and allocation processes of resources with ecological service functions and economic value between urban and rural areas within frameworks of value assessment, transaction circulation, and compensation mechanisms. Their core is to convert rural ecological advantages into economic benefits, achieving synergy between ecological conservation and rural revitalisation [4, 18]. This flow includes not only cross-regional transactions of ecological products but also the urban-rural sharing of ecological technologies and ecological cultural tourism resources. Under the overarching requirements of urban-rural ecosystems, green infrastructure constructs interconnected green space networks across cities and villages, integrating mountains, waterways, forests, farmland, lakes, grasslands, and other elements into an organically unified ecological network system. Such a system can regulate heavy rainfall, mitigate flood hazards, improve water quality, and reduce urban management costs. The flow of ecological elements provides the necessary resource allocation support for the efficient operation of this system [1,18,20].

2.2. The Intrinsic Relationship between Factor Flows and Urban-Rural Integration

On the one hand, factor flows serve as the core engine driving urban-rural integration. By dismantling the urban-rural dual structure, promoting industrial synergy, and optimising spatial layout, these flows inject fundamental momentum into urban-rural convergence. Regarding the resolution of the dual structure, Previous research measured county-level urban-rural integration development and found that bidirectional factor flows improve county-level total factor productivity and narrow the urban-rural income gap, highlighting the role of factor flows in mitigating urban-rural disparities [1]. Concerning industrial synergy, a case study of the Chongqing Tea Group illustrates how urban technology integrates with rural land and labour resources, forming an industrial fusion model that combines urban technology with rural resources [14]. It is further noted that factor flow shifts urban-rural industries from homogeneous competition to differentiated synergy, enabling rural

industries to transition from monoculture cultivation to tertiary-industry integration and reinforcing a mutually reinforcing industrial-agricultural framework [21]. Regarding spatial layout optimisation, county towns are emphasised as pivotal hubs for factor flow [10]. By consolidating farmland through county-level coordination and facilitating unified connections with urban agricultural enterprises, these towns achieve precise matching between urban capital and rural land. An integrated concept of "intensive production spaces, liveable residential spaces, and green ecological spaces" has been proposed, advocating differentiated resource allocation based on factor endowments to transform urban-rural spatial relationships from segmentation and opposition to functional complementarity [22].

Concurrently, urban-rural integration serves as the foundational guarantee for factor flows. Through equalised public services, spatial integration, and benefit-sharing mechanisms, it reduces costs, expands platforms, and mitigates risks for factor flow. Regarding public service equalisation, such measures have been pointed out to substantially reduce the living costs for talent moving to rural areas and migrant workers settling in cities as urban residents [12]. Concerning spatial integration, an "urban-rural convection" spatial model has been put forward, which advocates the timely infiltration of urban factors into rural regions and the orderly export of rural factors to cities, thus forming a boundless spatial network [23]. It has been elaborated that spatial integration between village protection and cultural tourism development can be achieved by revitalizing cultural heritage and facilitating the migration of urban talent to rural areas, which provides a carrier for factor flow [18]. In terms of benefit-sharing mechanisms, it has been emphasized that rural areas are capable of gathering various elements to stimulate entrepreneurial enthusiasm, cultivate new business models and boost local industries, thereby promoting all-round social and economic development and realizing rural revitalization [15]. It has been further pointed out that urban-rural integration offers fundamental support for factor flows through five core dimensions, namely industrial, institutional, cultural, public service and spatial convergence [20].

3. Practical Obstacles to Two-Way Flow of Urban-Rural Factors

3.1. Insufficient Policy Coordination and Ambiguous Property Rights Demarcation

On one hand, fragmented policies lead to chaotic rules governing factor flow. Urban and rural factor policies are formulated by multiple departments (including natural resources, finance, and human resources), leading to the formation of institutional silos [24]. Based on research across five county types, it is further revealed that some counties lack coordinated mechanisms for factor flow, with frequent inter-departmental buck-passing severely reducing efficiency [11]. On the other hand, ambiguous property rights also reduce the willingness to transfer factors. As highlighted in relevant studies, the unequal exchange of urban and rural factors is a prominent issue: collective construction land faces "equal rights but unequal prices" when entering the market, discouraging underdeveloped regions from participating [25]. Additionally, the absence of detailed rules for the "three-rights separation" of homestead land leaves farmers worried about potential rights erosion, resulting in low transfer willingness. A comparative case study confirms the critical impact of property rights demarcation on factor flow, showing that regions with clear property rights have significantly higher participation rates in factor transfers than those with ambiguous rights [6].

3.2. Coexisting Regional Deficits and Factor Mismatch

The one-way net outflow of regional factors exacerbates the urban-rural divide. Analysis based on data from the Hundreds-Thousands-Myriads Project reveals that the number of talents migrating from core to non-core regions is significantly lower than the number of labourers transferring from non-core to core regions, resulting in a drain of human capital from non-core areas [26]. The capital flow exhibits a pronounced siphoning effect, with non-core regions featuring low loan-to-deposit ratios in financial institutions. Substantial funds flow through the banking system towards core regions, leaving local industries grappling with dual constraints: difficulty in securing land and accessing financing. Spatial econometric research further confirms that this deficit is more pronounced in inter-provincial peripheral zones, where the survival rate of capital-to-rural-areas projects is lower than in counties surrounding core regions [19]. Moreover, mismatches between supply and

demand for factor types inhibit the efficiency of flows. Previous research on urban agriculture models further indicates that the essence of factor misallocation lies in the mismatch between factor supply and county-level industrial demand, necessitating differentiated policies to guide factor flows [14].

3.3. Digital Infrastructure Divide and Insufficient Digital Literacy

The urban-rural disparity in digital infrastructure hinders remote factor flow. Researchers found in their digital village survey that county-level smart factor platforms lag in development, with only some counties completing platform construction and insufficient data interoperability rates [8]. Hardware deficiencies directly impair the efficiency of remote factor matching: recruitment platforms in certain counties experience low job-matching success rates due to network issues; some agricultural product traceability platforms suffer high failure rates during peak access periods due to server problems, impacting product sales. Moreover, generational disparities in digital literacy diminish the impact of technological empowerment. Previous research indicates that while increased value of data elements facilitates rural-to-urban labour migration, it significantly inhibits urban-to-rural movement, with employment and income serving as key mechanisms [5]. Relevant researchers further supplemented that only a minority of rural e-commerce practitioners possess skills such as live-streaming sales and data analysis. This hinders the use of digital technology to boost agricultural product sales, thereby constraining the enabling role of data elements in labour flow [8].

3.4. Weak Collective Capacity and Absence of Risk Prevention

Insufficient "self-sustaining" capacity within village collectives hinders factor integration. Previous research indicates that some village collectives face an "ageing" issue, lacking the energy and capability to consolidate fragmented factors. Incomplete collective asset management systems—with some villages failing to establish asset ledgers—create risks of opaque operations in factor flows [6]. Relevant researchers further highlighted in their rural revitalisation study that weak collective capacity directly reduces farmers' willingness to participate in factor flow, creating a vicious cycle of weak collectives, fragmented households, and stagnant factors. Moreover, the absence of risk prevention mechanisms leads to distorted factor flow [15]. Research identified key risks in factor flow: capital flowing into rural areas tends to have non-agricultural tendencies, with some projects illegally encroaching on farmland; data elements face privacy breaches, as certain county-level smart factor platforms lack data security safeguards; and inadequate dispute resolution mechanisms for factor flow disrupt the continuity of such flows [16]. Further research on capital flow emphasizes that the absence of risk prevention mechanisms diminishes market entities' willingness to participate [9].

4. Innovative Pathways for Urban-Rural Two-Way Factor Flow Mechanisms

4.1. Institutional Breakthrough: Establishing a Tailored Rule System for Factor Flow

4.1.1. Precision Reform of Property Rights Systems

In the land sector, it is necessary to extensively promote the mechanism of demolishing old structures for land reclamation and cross-regional indicator trading [7]. A specific proportion of the revenue generated from cross-regional trading of land increase-decrease linkage indicators within counties covered by the Hundreds-Thousands-Myriads Project should be earmarked for rural infrastructure development and public service enhancement. For homestead land transfers, drawing on the experience of collective title confirmation and farmer shareholding, the transfer duration and farmer profit-sharing ratio should be specified [6]. Suburban villages in the Pearl River Delta may adopt the co-development and dividend pledge model for homestead land: some villages integrate homestead land through collective arrangements for joint development with enterprises on eco-friendly homestays and rural cultural tourism projects, where households contribute their homestead land use rights as equity to receive fixed dividends and shares of operational profits. This model requires strengthened risk prevention through property rights registration to avoid disputes arising from ambiguous ownership. Regarding data elements, comprehensive rules covering rural data resource rights confirmation, revenue distribution, and security supervision should be established [5]. Concurrently, a tiered data authorisation

system should be implemented based on digital security recommendations [8].

4.1.2. Systematic Development of Policy Coordination Mechanisms

To address the institutional silos highlighted in relevant research, functions across natural resources, finance, human resources, and data departments should be coordinated through regular coordination meetings and phased performance evaluations [24]. Platforms should consolidate departmental factor policy catalogues into integrated policy packages covering land transfers, mortgage loans, and skills matching. Three factor flow lists should be developed: the Prohibition List explicitly bars capital flowing into rural areas from funding "non-agricultural" projects; the Encouragement List prioritises support for rural deployment of data elements and introduction of ecological technologies (e.g., industrial counties in the Pearl River Delta opening agriculture-related industrial data to rural areas); the Accountability List incorporates factor flow indicators into county-level assessments, including metrics such as the number of talents deployed in non-Pearl River Delta counties and the proportion of land indicator transaction revenues reinvested locally. Prior research indicates that counties incorporating these metrics demonstrate higher factor flow efficiency than those that do not [11].

4.1.3. Regionally Differentiated Institutional Provision

The Pearl River Delta region must focus on enabling the downward flow of data elements. Guided by the theory of new-quality productive forces, it should formulate implementation measures for industrial data to radiate into rural areas, requiring relevant enterprises to open up agriculture-related technology data [4]. Concurrently, a data element revenue reinvestment fund should be established to upgrade county-level digital infrastructure. Safeguards for capital factor introduction should be strengthened by establishing an agricultural industrial risk compensation fund, drawing on the capital flow risk compensation mechanism [27]. This fund would provide proportional risk compensation for capital-to-rural projects invested in grain cultivation and specialised animal husbandry. A paired-element mechanism should be implemented to direct capital and technology transfers, incentivising agricultural enterprises to invest in agricultural product processing parks and thereby boosting farmer employment. The market-based monetisation of ecological factors should be advanced: integrating the theory of ecological factor gradient differentiation, technical guidelines for realising the value of ecological products should be issued, standardising technical protocols for forest carbon sink measurement and ecological cultural tourism resource assessment [28]. Concurrently, an ecological technology correspondent system should be piloted, deploying environmental experts to provide village-level guidance.

4.2. Market Activation: Cultivating Efficiently Allocated Factor Flow Vehicles

4.2.1. Multi-Tiered Factor Trading Platform Development

At the provincial level, urban-rural factor trading markets should be upgraded by integrating land, capital, labour, data, and other resources, with intelligent supply-demand matching systems established [10]. Big data analytics should be utilised to track factor flows, enabling automated demand matching while developing factor price indices to inform pricing and prevent "equal rights, unequal prices". At the county level, factor flow service centres implementing a "one-stop" service model should be established [11]. By consolidating service windows from departments such as natural resources, finance, and social security, farmers can complete procedures including land transfer registration, mortgage loan applications, and labour force registration at these centres. Additionally, specialised counters should be established based on county types: Agricultural counties should set up land transfer counters to provide consultations on farmland stewardship and homestead joint development; Ecological counties should establish ecological factor counters to facilitate the matching of cultural and tourism resources, thereby improving operational efficiency.

4.2.2. Cultivating New Market Entities

In the intermediary services sector, a brokerage workforce should be cultivated under the Hundreds-Thousands-Myriads Project, drawing on "Rural Innovation Special Envoys" service model [29]. Professionals

should be selected through government training and market recruitment, requiring brokers to possess policy interpretation and resource matching capabilities. They shall be responsible for identifying idle rural resources, connecting urban demand, and driving scaled-up growth in factor circulation. In the business entity sphere, priority support should be given to developing new organisational forms such as "homestead cooperatives" and promoting the "farmland bank" model adopted in certain regions. Agricultural stewardship companies should be cultivated to provide end-to-end services covering cultivation, planting, harvesting, and marketing, aiming for high coverage rates, as some stewardship firms already serve substantial numbers of farmers and reduce cultivation costs. Concurrently, Pearl River Delta enterprises should be guided to establish county-level industrial alliances, pairing with non-Pearl River Delta counties for factor cooperation. These alliances integrate their technological data with the agricultural product demands of paired counties, driving premium pricing for agricultural goods [30].

4.3. Digital Empowerment: Breaking Factor Flow Barriers

4.3.1. Integrated Development of Digital Infrastructure

Comprehensive coverage of county-level smart factor platforms should be advanced, data standards unified, and interconnectivity across provincial, municipal, and county-level platforms achieved. Specifically: strengthen rural digital infrastructure by expanding broadband and mobile internet coverage in remote villages; advance digital upgrades of traditional infrastructure such as rural roads, water conservancy, and logistics to narrow the urban-rural infrastructure gap and solidify foundations for factor flow; leverage digital village initiatives to expand the coverage and service capacity of Beneficial Farmers' Information Centres, utilising online platforms to train rural labourers and enhance their digital literacy and human capital for orderly labour migration; promote the deep integration of digital technologies with rural industries, developing smart rural cultural tourism and strengthening online promotion to foster rural e-commerce development and industrial convergence, thereby attracting capital, technology, and talent to rural areas; simultaneously foster coordinated digital rural development and urban-rural integration across regions, utilising digital technologies to overcome geographical constraints, strengthen economic division of labour and cooperation, and facilitate the flow of factors of production, ultimately achieving a regionally interconnected urban-rural development pattern [8].

4.3.2. Integrated Application of New-Quality Productivity

In scenarios of equal exchange of urban-rural factors and integrated urban-rural development, the integrated application of new-quality productive forces requires a complete chain from policy formulation, transmission pathways, and operational channels to target feedback [28]. At the policy level, differentiated application strategies should be formulated for distinct regions, with policy guidance clarifying priority sectors for new-quality productive forces. Regarding transmission pathways, intelligent urban-rural factor matching platforms should be established to facilitate the diffusion of urban industrial data to rural areas and the flow of rural ecological data to cities. Concerning operational channels: first, deepen the integration of digital technologies with rural industries to attract urban capital and technology to rural areas; second, leverage new-quality productive forces to enhance village collectives' capacity for factor integration and improve factor allocation efficiency. In the feedback loop, an evaluation mechanism for new-quality productivity outcomes should be established, incorporating indicators such as factor flow efficiency, urban-rural income disparities, and industrial integration levels. Consequently, application strategies can be optimised and adjusted to continuously expand the development space for new-quality productive forces, thereby facilitating the formation of a new paradigm characterised by equitable exchange of factors and integrated urban-rural development.

4.4. Governance Synergy: Refining Safeguards for Factor Flow

4.4.1. Three-Tier Factor Governance Synergy System

Optimising the three-tier governance structure of "county-township-village" is pivotal for facilitating factor flow in urban-rural integration. As hubs for aggregating urban and rural factors, county governments can

establish mechanisms for optimised factor allocation to achieve combined economies of scale and scope, leveraging complementary resources to cultivate distinctive industries that enrich local communities. Furthermore, county governments should spearhead efforts to dismantle institutional barriers to factor flow, catalyse new models of industrial integration, and employ coordinated governance to reduce costs and unleash multiplier effects. Township governments serve as pivotal connectors, acting as transit points for factors moving "into towns" and "into villages". They can undertake preliminary integration of disparate factor endowments while leveraging platforms to cultivate distinctive agriculture and extend industrial chains, and must establish supply-demand matching platforms and explore co-construction and sharing models to ensure value-added benefits reach rural communities. Villages constitute the ultimate units for converting factor value: through systematic planning and market-oriented operations, they must achieve localised resource transformation. Village-level organisations should harness self-governance to engage farmers, establish mechanisms for coordinated agricultural development, and promote synergistic growth between collective economies and household incomes [27].

4.4.2. Risk Prevention and Benefit-Sharing Mechanisms

Regarding risk prevention, based on market-government coordination theory, differentiated regulatory systems should be established according to factor characteristics [31]. For land factors, reference should be made to the experience of demolition and reclamation to establish land use controls, dynamic monitoring, and a three-colour warning system [7]; For capital factors, a negative list and a full-process monitoring platform should be established; for data factors, a tiered authorisation system and security contingency plans should be established in line with relevant recommendations [8]; for ecological factors, norms should be standardised and third-party assessments introduced [28]. Meanwhile, addressing the spatial differentiation characteristics highlighted by previous researchers, regional risk compensation funds should be established [19]. Regarding benefit sharing, factor revenue distribution rules should be clarified [17], and for land, data, and ecological factors, relevant experience from Village Y documented in previous studies should be referenced respectively [6]; Cross-regional rebate mechanisms and pairing models should be established drawing on the relevant approach [30], with rebate ratios incorporated into county-level assessments as per existing research findings [11]. For risk-benefit coordination, a three-tiered (i.e., county, township, village) dynamic adjustment and feedback platform should be created to ensure closed-loop safeguards for balanced factor flows [27].

5. Conclusions

This study, grounded in the practice of Guangdong's Hundreds-Thousands-Myriads Project, explores the bidirectional flow of urban-rural factors to empower integrated urban-rural development. Theoretically, the flow of urban-rural factors has shifted from traditional unidirectional transfers to a bidirectional cycle where conventional factors synergise with new elements such as data and ecology. Moreover, this factor flow and integrated urban-rural development exhibit a mutually reinforcing "engine-guarantee" relationship, validating the practical value of relevant theories. However, in practice, factor flows remain constrained by four major impediments: institutional fragmentation and ambiguous property rights at the policy level; regional deficits and factor misallocation at the market level; the digital divide and insufficient digital literacy at the technological level; and weak collective capacity and inadequate risk prevention at the governance level—these constraints create a mismatch with the project's objectives. To address this, the study proposes innovative pathways: institutional breakthroughs (including property rights reform, policy coordination, and regionally differentiated supply); market activation (including multi-tiered transaction platforms and new market entity cultivation); technological empowerment (including integrated digital infrastructure and application of new-quality productive forces); and governance synergy (including the three-tier "factor-governance" system and risk-benefit mechanisms). Future research may further focus on three key directions: policy effect evaluation, cross-regional coordination mechanisms, and the dynamic impact of technological progress. Overall, the innovation of the two-way factor flow mechanism under the Hundreds-Thousands-Myriads Project is not only pivotal to resolving Guangdong's urban-rural development imbalance but also provides Guangdong's experience that

offers valuable insights for nationwide urban-rural integration.

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