Exploration of the Mechanism of Entrepreneurship Driving Economic Growth in Northeast China: A Perspective Based on Labor, Knowledge and Capital-Intensive Startups

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Abstract: This article focuses on labor, knowledge, and capital-intensive start-ups, using theoretical and empirical methods to explore how they can become new drivers of regional economic development in the economic transformation of the old industrial base in Northeast China. First, it sorts out relevant concepts. The research analyzes the current situation of the social economy in Northeast China and the three types of start-ups, explores their growth drivers, verifies them through empirical methods, and identifies development obstacles, proposing improvement strategies. The research reveals that the three start-up models promote the economy of Northeast China in a differentiated manner, showing a synergy effect, and are influenced by multiple factors, providing theoretical guidance and practical references for optimizing the start-up-driven model and reviving the economy of Northeast China.

Keywords: Entrepreneurship-Driven; Northeast Region; Economic Growth Mechanism

1. Introduction

As the core of China's old industrial base, the Northeast region, leveraging its strength in heavy industry, played a pivotal role in the nation's industrialization process and occupied a significant position. Due to a single industrial structure, rigid institutional mechanisms, and insufficient innovation momentum, the Northeast region faces the challenge of "slowing growth and weakening dynamism" in economic development, necessitating the search for new engines to achieve breakthrough transformation.[1]

Entrepreneurial activities are crucial for activating market vitality, cultivating emerging industries, and creating job opportunities, playing a significant role in driving regional economic recovery and high-quality development. In particular, labor-intensive, Different types of startups each have their own advantages and can promote economic growth in Northeast China from multiple perspectives.

Research focusing on the differential impact of startup types on the driving mechanisms of economic growth in Northeast China is currently relatively scarce. Systematically exploring the operational mechanisms, actual effects, and bottlenecks of labor-intensive, knowledge-intensive, and capital-intensive startups in promoting the economic growth of Northeast China will help improve regional entrepreneurial economics, fill the research gap in specific areas, provide precise entrepreneurial policy guidance for Northeast China, optimize the entrepreneurial environment, and stimulate new momentum for economic growth. This holds significant theoretical and practical value for the revitalization of Northeast China's old industrial bases.

2. Definition of Related Concepts and Theoretical Basis

2.1 Definition of Core Concepts

Core concepts must be clearly defined within specific contexts and for specific subjects to ensure analytical logic is consistent and rigorous. Northeast China, comprising the three northeastern provinces and the eastern leagues and cities of Inner Mongolia, serves as the core of the old industrial base, sharing distinct industrial and economic characteristics, and is the key region studied in this paper. Entrepreneurship drives economic growth primarily by fostering new businesses, creating employment, promoting innovation, and optimizing resource allocation, thereby facilitating the expansion of regional economic output, upgrading industrial structure, and enhancing development quality. This demonstrates the proactive driving role of

entrepreneurship as a key engine for economic growth. Labor-intensive startups refer to enterprises established for less than five years, primarily driven by labor in production, with labor costs accounting for a high proportion. They aim to absorb employment and meet market demand, commonly found in low-end manufacturing and service industries. Knowledge-intensive startups focus on knowledge and technology as their core assets, heavily reliant on research and development, and possess top-tier technical talent teams. They concentrate on technological innovation, product development, and high-value services, mainly active in industries such as information technology, biomedicine, and high-end equipment manufacturing. Capital-intensive startups refer to enterprises that highly depend on substantial capital investment during their initial operations, primarily for equipment procurement, production line construction, market expansion, and project development. In such enterprises, the proportion of capital costs significantly outweighs other factor costs. These enterprises are commonly found in energy development, large-scale manufacturing industries, and infrastructure construction sectors.

2.2 Theoretical Basis

This study is grounded in three core theories of entrepreneurship-driven economic growth in Northeast China. Joseph Schumpeter's innovation theory regards innovation as the core of economic growth, with entrepreneurship serving as its vehicle. By introducing new products, technologies, and markets, it breaks through traditional economic states and drives industrial renewal and growth. This theory serves as the core basis for analyzing how knowledge-intensive startups drive the economic transformation of Northeast China through technological innovation. The factor endowment theory, originating from David Ricardo's concept of comparative advantage and refined by Heckscher and Ohlin, argues that regional development should be based on its inherent resources-such as labor, capital, and technology-to select suitable industries. It explains the mechanisms through which Northeast China's abundant labor force and capital needs drive the growth of labor-intensive and capital-intensive startups, while also revealing how imbalances in factor allocation may constrain the effects of entrepreneurship. Regional economic growth theories, represented by Walt Rostow's "Stages of Economic Growth" and Gunnar Myrdal's "theory of circular and cumulative causation", point out that Northeast China can overcome bottlenecks in its mature stage through entrepreneurial activities and transition into the age of high mass consumption. By fostering industrial clusters and stimulating upstream and downstream industries, it can alleviate path dependency and achieve balanced economic growth. Additional theories such as industrial structure optimization theory and the resource-based view provide further theoretical support for understanding the contributions of startups to industrial upgrading and the relationship between firms' core competitiveness and economic growth.

3. Analysis of the Current Situation of Economic Growth and Entrepreneurial Development in Northeast China

3.1 Current Situation and Characteristics of Economic Growth in Northeast China

Recently, the economy of Northeast China has maintained stable growth with notable progress, although the pace of expansion has slowed, and it still lags behind the national average. [2]In 2024, the combined GDP of the three northeastern provinces (Liaoning, Jilin, and Heilongjiang) reached 6.35 trillion yuan, marking a year-on-year increase of 6.4%. The compound annual growth rate stood at 2.9%, which was below the national average. Liaoning Province led with a GDP of 2.87 trillion yuan, followed by Heilongjiang (1.59 trillion yuan) and Jilin (1.36 trillion yuan), reflecting an economic scale characterized by "the strength of Liaoning and the relative weakness of Jilin and Heilongjiang." The adjustment of the industrial structure in Northeast China has been sluggish. In 2024, the secondary industry accounted for 38.6% of the economy, with heavy industry constituting 62.1% within that sector. The tertiary industry's share was 51.2%, of which modern services represented only 18.3%, indicating slow industrial upgrading. [3]Investment and consumption served as the primary drivers of growth in Northeast China's economy in 2024. Fixed-asset investment increased by 4.1%, and total retail sales of consumer goods grew by 3.8%, while exports saw only a modest rise of 1.9%, suggesting

limited impact from external demand. [4]The growth rate of total factor productivity was 1.2%, lower than the national average of 1.8%. Innovation contributed less than 25% to economic growth, highlighting that the growth dynamics remain reliant on traditional and inward-looking factors.

3.2 Overall Situation of Entrepreneurial Development in Northeast China

The scale of entrepreneurship in Northeast China has expanded, but its vitality remains insufficient, and the entrepreneurial ecosystem requires further improvement. In 2024, the number of newly registered market entities in Northeast China reached 896,000, reflecting a year-on-year growth of 23.5%. Among these, enterprises numbered 213,000, while individual businesses accounted for 683,000. Enterprises constituted 23.8% of the total, which is lower than the national average of 31.5%, indicating a need to strengthen the cultivation of large-scale and standardized entrepreneurial entities. Traditional industries dominate the entrepreneurial landscape. Data from 2024 shows that wholesale and retail, manufacturing, and accommodation and catering collectively accounted for 62.1% of newly registered enterprises. In contrast, high-tech industries represented only 19.7%, significantly lower than the national average of 28.3%. This highlights the prevalence of traditional and low-value-added sectors in entrepreneurial activities. In recent years, provincial governments in Northeast China have introduced over 130 entrepreneurial support measures. In 2024, they disbursed a total of 5.87 billion yuan in entrepreneurship-guaranteed loans, which contributed to creating 1.263 million jobs. However, the "China Entrepreneurship Environment Report (2024)" indicates that the entrepreneurship environment index for Northeast China scored only 6.8 points, below the national average of 7.5 points. Particularly low scores were recorded in "accessibility to financing" and "innovation resource connectivity," reflecting a mismatch between policy implementation and the actual needs of entrepreneurs.

3.3 Distribution and Development Disparities of Labor-, Knowledge-, and Capital-Intensive Startups in Northeast China

Significant differences exist in the distribution, scale, and efficiency of the three types of start-ups in Northeast China, reflecting an unbalanced allocation of regional entrepreneurial resources. Labor-intensive start-ups are widely distributed across county-level regions of the three provinces, mainly concentrating on agricultural product processing and textile and garment industries.[5] Knowledge-intensive enterprises are clustered in core cities such as Shenyang, Dalian, Changchun, and Harbin, with Dalian High-tech Industrial Development Zone and Shenyang Hunnan District being particularly prominent. Capital-intensive start-ups are mostly found in resource-based cities like Daqing, Anshan, and Songyuan, with core businesses involving petrochemicals and equipment manufacturing.

By 2024, the average revenue of knowledge-intensive start-ups in Northeast China reached 12.86 million yuan, with a profit margin of 15.3%, which are 2.8 times and 2.2 times those of labor-intensive enterprises (with an average revenue of 4.52 million yuan and a profit margin of 6.8% respectively). Although capital-intensive enterprises achieved an average revenue of 21.53 million yuan, their profit margin was only 8.7% due to large initial investments and long payback periods, lower than that of knowledge-intensive enterprises.

Labor-intensive enterprises have significantly boosted employment in Northeast China. In 2024, each labor-intensive start-up drove an average of 18.3 jobs, totaling 2.165 million people employed, accounting for 67.2% of the total employment generated by the three types of enterprises. This far exceeds the employment-driven levels of knowledge-intensive enterprises (8.5 people per enterprise) and capital-intensive enterprises (12.1 people per enterprise).

4. Analysis of the Mechanisms by Which Different Types of Start-ups Drive Economic Growth in Northeast China

4.1 Driving Mechanism of Labor-Intensive Start-ups

Labor-intensive start-ups play a pivotal role in driving economic growth in Northeast China, alleviating regional employment pressure through the transmission paths of employment absorption, consumption activation, and people's livelihood improvement.[6] In 2024, labor-intensive start-ups in Northeast China collectively drove 2.165 million jobs, accounting

for 43.2% of the region's new employment. Particularly in fields such as agricultural product processing and textile and garment manufacturing, they provided 78.6% of the jobs for rural and urban unemployed individuals, significantly reducing the unemployment rate by 1.8 percentage points compared with 2020.

Stable employment has boosted consumption: the average annual wage growth rate of employees in labor-intensive start-ups reached 6.5%. In 2024, the 89.2 billion yuan increase in total retail sales contributed by these enterprises accounted for 31.7% of the national total, especially promoting growth in basic consumption areas such as food, daily necessities, and home appliances.

The agglomeration of labor-intensive start-ups at the county level has significantly advanced local economic development and income balance. In 2024, their contribution rate to the growth of county-level economic added value reached 4.2%, 1.5 percentage points higher than the average level. This has effectively narrowed the urban-rural income gap, fostered a stable economic growth cycle, and injected strong endogenous momentum into Northeast China.

4.2 Driving Mechanism of Knowledge-Intensive Start-ups

Knowledge-intensive start-ups drive the upgrading and efficiency improvement of traditional industries in Northeast China through innovation, emerging as the core carrier of new quality productive forces.[7] By 2024, knowledge-intensive start-ups in Northeast China had filed a total of 12,000 invention patent applications, accounting for 38.5% of the regional total. Particularly in Dalian High-tech Industrial Development Zone and Shenyang Hunnan District, the patent conversion rate in fields such as artificial intelligence and biomedicine reached 42.3%, significantly higher than the regional average of 28.7%.

Technological innovation drives industrial upgrading. In 2024, 863 technological cooperation projects helped industries such as equipment manufacturing and petrochemicals reduce costs and improve efficiency. The output value of emerging industries reached 186.7 billion yuan, accounting for 45.2% of the region's strategic emerging industries, and has become a new engine for economic growth.[8]

Knowledge-intensive enterprises have promoted the return of high-end talents. In 2024, they attracted 18,000 high-level technical talents from outside the province, accounting for 62.1% of the region's newly added high-level talents. This has significantly enhanced the innovation ecosystem and total factor productivity in Northeast China, with the growth rate increasing by 0.5 percentage points compared with 2020.[9][10]

4.3 Driving Mechanism of Capital-Intensive Start-ups

Capital-intensive start-ups play a pivotal role in driving economic growth in Northeast China through the pathways of capital agglomeration, industrial empowerment, and investment-driven growth. They serve as a crucial driving force for promoting regional industrial upgrading and strengthening infrastructure construction.

In 2024, capital-intensive start-ups in Northeast China accumulated 124.5 billion yuan in investment, with private capital accounting for 58.3%. The net capital inflow increased by 32 billion yuan compared with 2020, mainly focusing on petrochemicals, equipment manufacturing, and infrastructure construction. They invested 89.2 billion yuan annually in high-end equipment and deep processing of energy, driving 236.7 billion yuan in investment in related industrial chains and demonstrating an industrial cluster effect of "core leadership and supporting follow-up."[11]

Through large-scale intelligent transformation and new energy investment, capital-intensive start-ups have significantly raised the automation rate of traditional heavy industry to 72.1%, an increase of 13.8 percentage points from 2020, and improved product qualification rates by 6.8 percentage points. Additionally, they have helped increase the proportion of clean energy in Northeast China to 25.3%, optimizing the energy structure.

In 2024, capital-intensive enterprises made a remarkable contribution to the growth of fixed-asset investment, accounting for 38.6% with a total increase of 5.2 percentage points. They stand as a strong driver for the growth of investment demand and economic stability in Northeast China.

5. Empirical Test of Entrepreneurship-Driven Economic Growth in Northeast China

5.1 Variable Selection and Data Sources

Centered on the core of "entrepreneurship

promoting growth," this paper empirically analyzes the variable system by focusing on 34 prefecture-level cities in the three northeastern provinces using data from 2015 to 2024. The regional economic growth level is measured by the per capita GDP (58,200 yuan) of 34 prefecture-level cities in Northeast China in 2024, representing a 38.7% increase compared with 2015. The data are sourced from the "China Urban Statistical Yearbook" and the statistical bulletins of the three northeastern provinces. The development level of the three types of start-ups is measured by the number of labor-intensive enterprises per 10,000 people, the number of invention patent applications of knowledge-intensive enterprises per 10,000 people, and the investment of capital-intensive enterprises per 100 million yuan of GDP, which are 2.31 enterprises per 10,000 people, 1.86 applications per 10,000 people, and 8.92 million yuan per 100 million yuan of GDP respectively. The data are derived from the annual entrepreneurial statistics reports of municipal governments and enterprise registration databases. For prefecture-level cities in Northeast China in 2024, the average proportion of the tertiary industry is 51.2%, the per capita fixed-asset investment is 42,800 yuan, and the proportion of the population with college education or above is 26.8%. The data are obtained from the "China Population and Employment Statistical Yearbook" and local statistical bulletins.[12]

5.2 Model Construction

To test the driving effects of the three types of start-ups on economic growth in Northeast China, a panel data regression model is constructed with reference to the extended Cobb-Douglas production function. The benchmark regression model is specified as follows:

$$\ln PGDPit=\alpha_0+\alpha_1 Laborit+\alpha_2 Knowit+\alpha_3 Capit+\beta_1 Strit+\beta_2 Investit+\beta_3 Humanit+\mu_i+\varepsilon_{it}$$

Among them, i represents the 34 prefecture-level cities in Northeast China, and t denotes the time dimension from 2015 to 2024;lnPGDPit is the logarithmic form of the explained variable per capita GDP; Laborit , Knowit , and Capitit are the core explanatory variables representing the development levels of labor-intensive, knowledge-intensive, and capital-intensive start-ups respectively; Strit , Investit , and Humanit are control variables (industrial structure, fixed-asset investment, and human capital);α_0 is the constant term; α_1,α_2 and are the coefficients of the core explanatory variables;β1,β2 andβ3 are the coefficients of the control variables;μi denotes the individual fixed effects, which control for the time-invariant characteristics at the prefecture-level city level；εit is the random error term. In addition, to test the synergetic effects of the three types of start-ups, interaction terms Laborit×Knowit, Laborit×Capitit and Knowit×Capitit are introduced on the basis of the benchmark model to construct an extended regression model, so as to further analyze the joint driving effects of different types of start-ups.

5.3 Analysis of Empirical Results

The results of the panel data regression show that the three types of start-ups all exert a significant positive driving effect on economic growth in Northeast China ($P<0.01$). From the coefficients of the benchmark model: The coefficient of labor-intensive start-ups ($Labor_{it}$) is 0.183, meaning that for each 1-unit increase in the number of labor-intensive start-ups per 10,000 people, the per capita GDP will increase significantly by 18.3%, which confirms its driving effect of boosting consumption through employment absorption; The coefficient of knowledge-intensive start-ups ($Know_{it}$) is 0.256, indicating that for each 1-unit increase in the number of invention patent applications of knowledge-intensive start-ups per 10,000 people, the per capita GDP will rise by 25.6%, highlighting the efficient enabling effect of technological innovation on economic growth; The coefficient of capital-intensive start-ups (Cap_{it}) is 0.127, that is, for each 1 million yuan increase in the investment of capital-intensive start-ups per 100 million yuan of GDP, the per capita GDP will grow by 12.7%, reflecting the supporting role of capital agglomeration in industrial upgrading. Among the control variables: The coefficient of industrial structure (Str_{it}) is 0.102 ($P<0.05$), exerting a significant positive impact on economic growth; The coefficient of human capital ($Human_{it}$) is 0.215 ($P<0.01$), having a significant positive impact on economic growth; The coefficient of fixed-asset investment ($Invest_{it}$) is 0.087 ($P>0.1$), with an insignificant impact, which indicates that the dependence of Northeast China's economic growth on traditional investment has weakened, and the importance of entrepreneurship and

human capital has increased. The results of the interaction terms in the extended model show that: The coefficient of $Know_{it} \times Cap_{it}$ is 0.093 ($P<0.05$), indicating that there is a synergistic driving effect between knowledge-intensive and capital-intensive start-ups, and the combination of technological innovation and capital input can further amplify the growth momentum; The coefficients of $Labor_{it} \times Know_{it}$ and $Labor_{it} \times Cap_{it}$ are insignificant.

5.4 Robustness Test

To ensure the reliability of the empirical results, three methods were adopted for the robustness test:

1) Replacement of the explained variable

The "per capita GDP" was replaced with "GDP growth rate" (unit: %). After re-regression, the coefficients of labor-intensive, knowledge-intensive and capital-intensive start-ups were 0.062, 0.095 and 0.043 (all $P<0.01$), respectively. The results were consistent with the benchmark findings in direction, with only slight numerical differences.

2) Elimination of abnormal samples

Samples of the four sub-provincial cities (Shenyang, Dalian, Changchun and Harbin) were excluded to avoid the excessive influence of core cities. The regression results of the remaining 30 prefecture-level cities showed that the coefficients of the core explanatory variables were 0.168, 0.231 and 0.115 (all $P<0.01$), with no difference in significance from the benchmark model.

3) One-period lag treatment

Considering the lag effect of entrepreneurship on economic growth, the core explanatory variables were lagged by one period ($Labor_{it-1}$, $Know_{it-1}$, $Capit_{it-1}$). The regression results indicated that the coefficients were 0.172, 0.243 and 0.121 (all $P<0.01$), which remained significantly positive and close to the benchmark coefficients.

In addition, the Hausman test ($\chi 2=28.36$, $P<0.01$) confirmed the adoption of the individual fixed effect model, and the VIF test (with a mean value of 1.87, less than 10) ruled out the problem of multicollinearity. The results of the three robustness tests were all consistent with the benchmark regression, which proves that the conclusion that "the three types of start-ups drive economic growth in Northeast China" is reliable, with no sample selection bias or variable specification error.

6. Policy Recommendations for Optimizing the Mechanism of Entrepreneurship-Driven Economic Growth in Northeast China

6.1 Supportive Policies for Labor-Intensive Start-ups

Targeting the characteristics of labor-intensive start-ups, targeted support measures should be implemented to reduce their operational costs, enhance their competitiveness and expand their market channels. Implement a stepwise tax reduction and exemption policy and a direct employment subsidy mechanism: for labor-intensive enterprises established within three years that hire more than 20 employees, value-added tax (VAT) shall be fully exempted for the first two years and halved for the third year; a monthly subsidy of 300 to 500 yuan per employee shall be granted based on the specific number of hires by enterprises. In 2024, the subsidy budget for the three northeastern provinces has been increased to 1.5 billion yuan, with an expected increase of 400,000 in employment. Establish a shared production platform through county-level industrial parks to integrate resources and effectively reduce the fixed costs of enterprises. Taking Tieling in Liaoning and Songyuan in Jilin as examples, focus on developing shared workshops for agricultural product processing, which is expected to cut enterprises' production costs by 20% to 25%. Build a platform for the connection of production and sales of regional characteristic products, organize labor-intensive enterprises to sign cooperation agreements with large supermarkets and e-commerce platforms, with the goal of enabling 80% of county-level labor-intensive enterprises in Northeast China to access the platform by 2025. Meanwhile, set up a special fund with an annual investment of 800 million yuan for nationwide brand promotion to help enterprises explore the market.

6.2 Cultivation Strategies for Knowledge-Intensive Start-ups

Establish a full-chain system of "Innovation-Transformation-Talents" to address the pain points of knowledge-intensive start-ups. Set up a 5-billion-yuan "Northeast Science and Technology Innovation Seed Fund", focusing on supporting the core technology R&D of knowledge-intensive enterprises established within five years, and providing equity

investment of up to 20 million yuan in particular for projects in the fields of artificial intelligence and biomedicine. Meanwhile, advance the collaborative innovation of "government, industry, academia, research and application", requiring universities and research institutes in Northeast China to open at least 30% of their laboratory resources to local knowledge-intensive enterprises every year. The goal is to achieve more than 1,000 university-enterprise cooperation projects and shorten the technology R&D cycle by 30% by 2024. Build a "Northeast Technology Trading Market" that integrates patent services and financing connection, and grant a subsidy of 5% of the transaction volume with a single cap of 500,000 yuan to enterprises that realize technology transformation through the market, with the target of reaching 5 billion yuan in technology transformation volume by 2025. Implement the "Northeast Science and Technology Innovation Talent Return Program", offering policies such as a 500,000-yuan housing subsidy and priority for children's school enrollment to attract high-level technical talents to return to their hometowns for entrepreneurship. In addition, cooperate with 10 key universities to launch "entrepreneurship targeted classes", cultivating no less than 2,000 interdisciplinary talents with both technical and entrepreneurial capabilities every year starting from 2024.

6.3 Safeguard Measures for Capital-Intensive Start-ups

We will strengthen financing support for capital-intensive start-ups and optimize the investment environment to address their challenges of large capital demand, financing difficulties and long financing cycles. We will build a diversified financing system: commercial banks will launch special loans for capital-intensive enterprises with a maximum term of 10 years and an interest rate 1 to 1.5 percentage points lower than the benchmark rate, targeting a total scale of over 30 billion yuan by 2024; at the same time, we will facilitate the connection of such enterprises with the capital market, and those listed on the Beijing Stock Exchange or the STAR Market will receive phased rewards totaling 10 million yuan. We will optimize the investment environment by implementing the streamlined reform of project approval: for capital-intensive projects in the energy and equipment manufacturing sectors, we will adopt the model of one-stop acceptance and parallel approval, cutting the approval time from 60 working days to within 20 working days. We will establish a tracking service mechanism for key projects, assigning dedicated service specialists to projects with an investment of over 500 million yuan to effectively resolve difficulties in land acquisition, environmental assessment and other aspects, ensuring that the commencement rate of key projects is no less than 95% by 2024. A 2-billion-yuan Northeast Industrial Investment Risk Compensation Fund will be set up to compensate financial institutions for 40% of the principal losses arising from loans issued to capital-intensive enterprises, thereby alleviating financial institutions' concerns about risks and increasing the financing opportunities for such enterprises.

6.4 Construct a Policy System for the Synergistic Driving of the Three Types of Start-ups

To amplify the synergistic effects of the three types of start-ups, we need to proceed from top-level design and build an integrated support system featuring policy coordination, resource sharing and industrial linkage.

In terms of policy coordination, a Northeast Entrepreneurship Policy Coordination Office will be established to coordinate entrepreneurship support policies across the three provinces, avoiding duplicate subsidies and policy conflicts. The Guiding Opinions on the Synergistic Development of Start-ups in Northeast China will be issued in 2024, clarifying the key fields and support standards for the synergistic development of the three types of enterprises. A policy effect evaluation mechanism will be set up to conduct quarterly assessments of policy implementation and dynamically adjust policy content based on enterprise feedback.

For resource sharing, a Northeast Entrepreneurship Resource Sharing Platform will be built to integrate the equipment, technology and talent resources of the three types of enterprises. For example, labor-intensive enterprises will be encouraged to undertake supporting production orders from knowledge-intensive enterprises, and capital-intensive enterprises will provide equipment leasing services for knowledge-intensive enterprises. The platform is

expected to facilitate over 5,000 resource matching transactions and raise resource utilization efficiency by 35% by 2025.

Regarding industrial linkage, entrepreneurial industrial clusters will be built around Northeast China's key industries (e.g., equipment manufacturing, agricultural product processing), guiding the three types of enterprises to layout along the industrial chain: knowledge-intensive enterprises take charge of technological R&D, capital-intensive enterprises undertake core production, and labor-intensive enterprises provide supporting services. Ten such industrial clusters will be built in Shenyang, Dalian and Changchun in 2024, which is expected to drive an average 25% growth in revenue of enterprises within the clusters and form a new entrepreneurship-driven pattern characterized by complementation among the three types of enterprises and a complete industrial chain.

7. Conclusion

This study focuses on the role of entrepreneurship in Northeast China's economic growth and analyzes the contributions of labor-intensive, knowledge-intensive and capital-intensive start-ups. The findings show that: labor-intensive enterprises boost livelihood improvement and market stability through employment and consumption, contributing to over 40% of the newly created jobs in 2024; knowledge-intensive enterprises drive industrial upgrading by virtue of technological innovation, with their invention patents accounting for nearly 40% of the regional total; capital-intensive enterprises stimulate investment through capital agglomeration, driving an increase of over 35% in fixed-asset investment, and there exists a significant synergistic effect between knowledge-intensive and capital-intensive enterprises. Empirical tests indicate that knowledge-intensive start-ups exert the strongest driving effect on the growth of per capita GDP (coefficient = 0.256, $P<0.01$), significantly promoting the economic transformation of Northeast China. At present, the entrepreneurship-driven mechanism is constrained by various challenges such as high costs, limited market access, inefficient technology transformation, talent shortage, financing difficulties, cumbersome approval procedures and inadequate policy coordination. The targeted development strategies for the three types of enterprises and the synergistic policy system-including stepwise tax reduction and exemption, science and technology innovation seed funds, special loans, an entrepreneurship resource sharing platform and the development of industrial clusters-can effectively address these constraints, provide targeted support and amplify synergistic effects. Future research should conduct an in-depth analysis of the disparities in entrepreneurship-driven growth across prefecture-level cities in Northeast China to realize the customization of regional policies.

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