Research in Economics and Management
ISSN 2470-4407 (Print) ISSN 2470-4393 (Online)
Vol. 10, No. 2, 2025
www.scholink.org/ojs/index.php/rem

Original Paper

Bridging Fiscal Policy and Innovation: The Institutional Logic of the "First-Invest-Then-Equity" Model in Xianyang's Technology Transfer Reform

Yu Bao[1], Xiaoyi Cao[1], Lu Zhou[1], Wei Wang[2], Yan Shen[3*] & Bin Tang[4*]

[1] Office of Science and Technology, Shaanxi Normal University, Xi'an, Shaanxi, China

[2] Qinchuangyuan (Xianyang) Innovation Promotion Center, Xianyang, Shaanxi, China

[3] Xianyang Science and Technology Resources Coordination Center, Xianyang, Shaanxi, China

[4] Center for Experimental Economics in Education, Faculty of Education, Shaanxi Normal University, Xi'an, Shaanxi, China

Corresponding author: Yan Shen, Xianyang Science and Technology Resources Coordination Center, Xianyang, Shaanxi, China. Email: 21808664@qq.com; Bin Tang, Center for Experimental Economics in Education, Shaanxi Normal University, Xi'an, Shaanxi 710119, China. Email: tangbin198994@163.com

Received: September 23, 2025 Accepted: October 4, 2025 Online Published: October 16, 2025

doi:10.22158/rem.v10n2p201 URL: http://dx.doi.org/10.22158/rem.v10n2p201

Abstract

The transformation of scientific and technological achievements is a crucial link in closing the innovation value chain and promoting high-quality regional development. In recent years, under China's national innovation-driven development strategy and the overall layout of the Qinchuangyuan Innovation Promotion Platform in Shaanxi Province, Xianyang City has taken the lead in reforming the fiscal investment and financing mechanisms for science and technology funds, establishing a "First-Invest-Then-Equity (FITE)" policy framework. This paper takes Xianyang's FITE policy as its research object and adopts policy text analysis and comparative research methods to systematically examine the policy's institutional background, operational mechanism, and implementation performance. Moreover, it conducts a comparative analysis with representative cities such as Suzhou, Hefei, Changsha, and Chengdu.

The findings reveal that: (1) the FITE mechanism effectively facilitates the market-oriented operation of fiscal funds and improves the efficiency of technology commercialization; (2) the Xianyang model demonstrates institutional innovation in fiscal guidance, risk sharing, and revenue recycling, yet faces persistent challenges in mobilizing private capital, establishing efficient equity exit mechanisms, and integrating technology finance. Based on these diagnosed problems, this study proposes several optimization pathways, including improving the coordination between fiscal and private capital, establishing a scientific pre-investment evaluation system, strengthening post-investment performance management, diversifying equity exit channels, building an integrated technology–finance ecosystem, and enhancing legal frameworks and interdepartmental coordination.

The research concludes that Xianyang's FITE mechanism not only provides a replicable model for western Chinese cities in leveraging fiscal funds to promote technology commercialization but also offers valuable local experience for deepening China's science and technology system reform and improving the overall innovation governance framework.

Keywords

Technology commercialization, First-invest-then-equity (FITE) policy, Fiscal innovation, Science and technology finance, Innovation governance, Xianyang City

1. Introduction

The transformation of scientific and technological achievements plays a crucial role in bridging innovation and high-quality economic development. It serves as a key mechanism through which research outputs are translated into productivity gains, industrial upgrading, and long-term regional competitiveness (Bozeman, 2000; Mowery et al., 2001). In recent years, as innovation-driven development has become a central policy priority in China, local governments have increasingly experimented with fiscal and financial innovations to address the long-standing challenges of technology commercialization—namely, the difficulties of transforming, landing, and scaling research outcomes. Among these institutional innovations, the "First-Invest-Then-Equity" (FITE) model has emerged as a distinctive approach that integrates fiscal investment, risk management, and market-based incentives to promote technology transfer.

The FITE mechanism refers to an arrangement in which government-guided funds or public investment entities initially intervene through debt, convertible instruments, or other quasi-equity financing. Once a project demonstrates market viability or measurable performance improvement, the prior fiscal investment is converted into equity. This approach aims to achieve policy goals of investing to promote transfer, transforming to generate equity, and linking capital with technology outcomes. Compared with traditional direct equity investment, FITE mechanisms can mitigate information asymmetry, reduce technology evaluation uncertainty, and improve the efficiency of fiscal capital utilization (Grilli & Murtinu, 2014; Brander, Du, & Hellmann, 2015). However, at the national level, the FITE approach remains in its exploratory phase, and many local governments face implementation challenges such as weak risk identification, underdeveloped equity exit systems, and incomplete performance evaluation frameworks (Howell, 2017).

As a key innovative city in Shaanxi Province and a strategic node of the Qinchuangyuan Innovation Promotion Platform, Xianyang has actively explored institutional reform in technology transfer and fiscal investment mechanisms. The municipal government has introduced a series of policy measures to foster a system characterized by fiscal guidance, technology–finance integration, and professionalized technology management. Within this broader policy framework, the FITE mechanism represents a landmark institutional innovation that shifts local fiscal policy from grant-based subsidies toward investment-oriented incentives, and from unilateral support toward risk sharing and benefit co-creation. Nevertheless, practical challenges remain, including limited linkage between fiscal and private capital, insufficient project reserves, and a lack of diversified market exit channels.

This study takes the Xianyang FITE policy as a case to examine its institutional logic, operational mechanism, and implementation performance. Specifically, it aims to:

(1) construct an analytical framework to explain the institutional logic and functional mechanisms of the FITE model;

(2) analyze, through comparative policy research, Xianyang's experience, advantages, and existing bottlenecks in implementing the mechanism; and
(3) propose practical policy recommendations to enhance fiscal–financial integration and risk-sharing frameworks at the local level.

The study contributes to the literature in three aspects. First, it enriches the theoretical understanding of local government-led innovation finance and technology commercialization mechanisms. Second, it provides empirical evidence from western China on the institutional evolution of fiscal investment in technology transfer, offering comparative insights for other regional economies. Third, it proposes actionable strategies for optimizing fiscal innovation, technology finance, and governance coordination, contributing to the discourse on how local fiscal systems can support sustainable innovation-driven growth.

The remainder of this paper is structured as follows: Section 2 reviews the relevant literature and theoretical foundations on technology transfer and FITE mechanisms; Section 3 outlines the institutional background and operational structure of Xianyang's FITE policy; Section 4 conducts comparative analysis and case-based evaluation; Section 5 identifies the main institutional challenges; Section 6 proposes optimization pathways and policy implications; and Section 7 concludes with findings and future research directions.

2. Literature Review and Theoretical Basis

2.1 Research Progress on Technology Transfer

Technology transfer or the commercialization of research outcomes, is a critical component of the innovation system. Its essence lies in the institutional mechanisms that enable the effective flow of knowledge from the research domain into the economy (Bozeman, 2000). Scholars have long emphasized that the efficiency of technology transfer depends on the coordination among three major actors: governments, research institutions, and markets (Etzkowitz & Leydesdorff, 2000).

Early studies focused mainly on the traditional forms of commercialization such as patenting, licensing, and university spin-offs (Siegel et al., 2003). More recent research has shifted toward examining the institutional environments and financial mechanisms that facilitate or hinder the commercialization process (Grimaldi et al., 2011).

In the Chinese context, the reform of national science and technology (S&T) policies has accelerated the transition of technology transfer from a research-driven to a market-oriented paradigm. Despite policy progress, local-level technology transfer still faces practical constraints such as information asymmetry, difficulties in technology valuation, and unclear benefit-sharing arrangements. Hence, developing innovative mechanisms that balance efficiency and risk control has become central to regional innovation system building (Mowery et al., 2001).

2.2 Research on Sci-Tech Finance and the FITE Model

With the deepening integration of science and finance, the design of financing mechanisms for technology commercialization has become a focal point of academic inquiry. Science and Technology Finance refers to the use of capital market instruments to optimize the allocation of innovation resources, thereby alleviating financing constraints for technology-oriented enterprises (Hall & Rosenberg, 2010). Among various financial innovations, the model of government-guided funds combined with market-oriented operations has become a key pathway for promoting regional technological innovation (Brander, Du, & Hellmann, 2015; Grilli & Murtinu, 2014).

Within this framework, the FITE mechanism has emerged as a new institutional arrangement. Under this model, investors—often government-backed or mixed public–private funds—intervene in the early stage of a project through quasi-debt investment or convertible instruments to identify risks and incubate value. Once the project reaches a mature stage, these investments are converted into equity, thus realizing the dual objectives of risk sharing and profit co-creation.

Scholars have highlighted that FITE combines the stability of debt financing with the growth potential of equity investment, making it particularly suitable for early-stage technology projects characterized by high uncertainty and long payback periods (Howell, 2017). Case evidence from Suzhou, Hefei, and Chengdu shows that such models typically establish an integrated process of pre-investment evaluation, mid-term incubation, and post-investment conversion, which significantly improves the efficiency of technology commercialization. Nonetheless, challenges persist, including long investment cycles, difficulties in performance evaluation, and inadequate legal frameworks to safeguard fiscal investment returns.

Overall, systematic research on FITE mechanisms remains limited, particularly regarding their local institutional variations and empirical effects. This study seeks to fill this gap by examining the case of Xianyang City, analyzing how FITE operates within a regional governance framework and identifying the mechanisms that enhance or hinder its implementation.

2.3 Theoretical Foundations

(1) Information Asymmetry Theory

Akerlof's (1978) "market for lemons" model demonstrates that information asymmetry can lead to quality uncertainty and market inefficiency. In the context of technology transfer, significant asymmetries exist in technology evaluation, risk perception, and expected returns between innovators and investors. The FITE mechanism, by allowing early-stage government or institutional involvement, helps mitigate adverse selection and moral hazard, reducing transaction uncertainty (Stiglitz & Weiss, 1981).

(2) Principal–Agent Theory

Technology commercialization involves complex principal–agent relationships among governments, research institutions, and investment entities. Governments often act as principals, delegating professional agencies or fund managers to operate public funds. To align incentives, performance-based evaluation and accountability mechanisms must be embedded throughout the investment process (Eisenhardt, 1989). The FITE approach enables governments to establish performance benchmarks in the "pre-investment" phase and ensure incentive compatibility during the "post-investment" stage, thus enhancing governance efficiency.

(3) Government–Market Synergy (Triple Helix) Theory

The Triple Helix model emphasizes the dynamic interactions among government, universities, and enterprises in fostering innovation (Etzkowitz & Leydesdorff, 2000). Within this framework, governments should shift from direct intervention toward providing institutional support and risk-sharing mechanisms. Through the FITE model, local governments can assume the "first-risk" role, leveraging fiscal capital to attract private co-investment and catalyze market participation. This aligns policy instruments with market mechanisms, fostering a synergistic innovation ecosystem (Aghion, David, & Foray, 2009).

3. Policy Context and Mechanism Analysis

3.1 Policy Context and Institutional Logic

In recent years, Xianyang City has seized the opportunity presented by national and provincial reforms in the field of technology transfer, actively implementing measures such as the Ten Pilot Measures for Deepening the "Three Reforms" of Technology Commercialization in Shaanxi Province and the Guidelines for Fiscal Investment in "First-Invest-Then-Equity" Projects (Trial). Building upon these initiatives, Xianyang became the first prefecture-level city in the province to issue its own Administrative Measures for Fiscal Investment in FITE Projects. The policy aims to address long-standing bottlenecks in technology commercialization—slow transfer, difficult financing, and high risk—by transforming fiscal S&T funds from one-time subsidies into investment-oriented instruments. Through this transition, the city has constructed a long-term mechanism of cyclic fund utilization, shared risk, and shared return. This institutional design aligns closely with international experience in which governments act as early-stage venture catalysts. Empirical evidence shows that government-backed seed and early-stage equity funds play a vital role in reducing information asymmetry and lowering barriers to private participation in technology markets (Brander, Du, & Hellmann, 2015; Grilli & Murtinu, 2014). Early fiscal intervention helps discover projects with latent market value and, through market-based exit mechanisms, allows funds to recycle back into new innovation activities.

Under the umbrella of the Qinchuangyuan Innovation Promotion Platform, Xianyang has been designated as a pilot zone for technology commercialization. Between 2021 and 2024, the city implemented 395 commercialization projects, attracting over 8.579 billion CNY in total investment and 6.25 billion CNY in technology-contract transactions—ranking first among prefecture-level cities in Shaanxi for twelve consecutive years. Within this process, the FITE mechanism has served as a key institutional driver, supporting five major technology-transfer projects and leveraging over 10 million CNY in private investment. This approach echoes the Triple Helix model proposed by Etzkowitz and Leydesdorff (2000), in which governments, universities, and industries co-evolve to transform knowledge into economic value.

3.2 Operational Mechanism and Organizational Framework

According to the Administrative Measures for Fiscal Investment in FITE Projects of Xianyang City, the mechanism operates through a four-party governance structure consisting of government leadership, fiscal coordination, state-owned enterprise management, and enterprise implementation—forming a closed, institutionally coherent system.

(1) Organizational Structure and Division of Responsibilities

Xianyang Science and Technology Bureau: Leads policy formulation, annual budgeting, and project guideline development; organizes project solicitation, evaluation, acceptance, and performance assessments.

Xianyang Finance Bureau: Oversees allocation and disbursement of special funds, establishes performance-evaluation systems, and monitors fiscal efficiency.

Xianyang Caijin Investment Management Co., Ltd.: Serves as the entrusted fund manager, establishing a special partnership entity—the Xianyang Caijin FITE Investment Fund—responsible for fund operation, due diligence, equity conversion, risk control, and return management.

Project enterprises: Act as the commercialization entities responsible for R&D implementation, fund utilization, and industrialization. Upon fulfilling predefined milestones, they complete the equity conversion process.

This multi-actor governance structure embodies the characteristics of a hybrid government–market innovation system, similar to European public venture and technology-transfer fund models (Luukkonen, Deschryvere, & Bertoni, 2013), balancing the government's risk-absorbing function with the market's efficiency-discovering role.

(2) Operational Process and Stages

The entire mechanism is divided into three sequential stages—project initiation, project implementation, and equity management—forming an integrated management cycle from fiscal input to capital exit.

Stage 1: Project Initiation

The Science and Technology Bureau and Finance Bureau jointly issue project guidelines, organize applications, and conduct expert reviews. Projects that pass screening undergo on-site verification and sign a Project Agreement defining funding amounts, equity-conversion ratios, and timeframes. Dedicated fiscal accounts are established, prioritizing sectors such as electronic information, new materials, and traditional Chinese medicine. This stage resembles the proof-of-concept funding phase in international practice, which validates a technology's commercial potential (Jensen & Thursby, 2001; Howell, 2017).

Stage 2: Project Implementation

Fiscal funds are invested upfront, the "First Invest" phase, typically not exceeding 50 percent of total project investment or 2 million CNY. Enterprises then conduct pilot testing, prototyping, and market validation, subject to mid-term evaluation. Projects failing to meet conversion conditions may extend for one year; otherwise, unqualified funds must be returned. This catalytic role of early government investment parallels programs such as the U.S. Small Business Innovation Research (SBIR) scheme (Audretsch, Link, & Scott, 2002; Lerner, 2009).

Stage 3: Equity Management

Once projects meet conversion criteria, such as achieving sales above 2 million CNY, securing institutional investment, or passing final acceptance, the Caijin Fund signs an Equity Investment Agreement with the enterprise to formalize equity conversion through capital increase. The shareholding ratio generally does not exceed 20 percent, with a maximum holding period of seven years, including a two-year exit phase. Exit options include equity transfer, share buyback, mergers and acquisitions, or stock-market listing, with returns recycled into the special fund for reinvestment. This model mirrors the "government-as-entrepreneur" concept (Link & Scott, 2010), emphasizing a closed policy loop of investment-driven transfer and transfer-driven equity.

(3) Incentive and Risk-Management Mechanisms

To encourage enterprises to accelerate commercialization, Xianyang has implemented a dual incentive scheme combining equity-conversion bonuses and exit-reward mechanisms. For projects whose valuation exceeds 100 million CNY or annual sales surpass 5 million CNY, the fiscal equity share may be reduced by 50–75 percent. In addition, part of the realized exit proceeds is distributed to the enterprise's core innovation team.

A "due-diligence exemption" mechanism has also been institutionalized, adopting a "tolerance-for-failure" principle that encourages experimentation and exempts responsible managers from punitive accountability for reasonable trial-and-error. This approach resonates with the innovation-governance literature emphasizing adaptive and learning-oriented policymaking (Aghion, David, & Foray, 2009).

3.3 Policy Priorities and Implementation Outcomes

By the end of 2024, the FITE policy in Xianyang had produced remarkable outcomes across key industries and university-driven projects: (1) Supported five major university commercialization projects

(e.g., Xi'an Jiaotong University, Northwestern Polytechnical University) with 10 million CNY in fiscal S&T investment, leveraging over twice that amount in private capital; (2) Expanded government-guided fund scale to 210 million CNY and established an SME risk-compensation pool, cumulatively disbursing 1.93 billion CNY in S&T loans; (3) Built an integrated innovation-service network of S&T advisors, field specialists, and technology managers, bridging the gap between laboratories and production lines; (4) Achieved the highest provincial ranking in technology-contract turnover for twelve consecutive years, while the number of technology-based SMEs increased 4.8-fold over four years.

These achievements demonstrate that the FITE mechanism has effectively promoted fiscal–financial integration and strengthened the market orientation of university research outcomes. They also corroborate Wright, Lockett, Clarysse, and Binks (2006), who found that institutionalized government-led venture mechanisms can accelerate the evolution of regional innovation ecosystems and foster firm growth.

Overall, Xianyang's FITE model has established a new framework for technology commercialization that combines fiscal guidance, state-owned capital participation, and private-capital co-investment. The mechanism has not only pioneered the market-based recycling of S&T funds within Shaanxi Province but also provided a replicable "Xianyang Model" for other western Chinese cities seeking to leverage fiscal capital to drive technological innovation.

4. Comparative Policy Analysis: Institutional Lessons from Advanced FITE Practices

4.1 Comparative Approach and Dimensions

To assess the institutional features and improvement directions of Xianyang's FITE mechanism, this paper selects Suzhou, Hefei, Changsha, and Chengdu—cities recognized for institutional innovation in technology commercialization—as comparative cases. These localities have accumulated mature experience in government-guided fund operations, pre-investment evaluation, post-investment management, and equity exit systems. The analysis proceeds along three core dimensions: (i) pre-investment evaluation and project initiation; (ii) post-investment management and performance assessment; (iii) equity exit and return distribution. A structured, institution-level comparison provides actionable references for Xianyang to refine the cyclic utilization of fiscal funds.

4.2 Suzhou's Model: Efficient Capital Allocation via "Industry Fund Clusters + Professional Fund-of-Funds"

Leveraging national high-tech zones and industrial parks, Suzhou has built a fund-of-funds (FoF) cluster with a total scale exceeding RMB 120 billion. Through a "fiscal capital + market operation + professional management" model, Suzhou has formed a multi-tier investment system for technology commercialization. The core design uses the FoF as a lever, sub-funds as operational vehicles, and industry-chain orientation as the guiding logic; pre-investment evaluation is combined with industry-match scoring, under a stratified risk-management regime.

On the pre-investment side, Suzhou applies Technology Readiness Level (TRL) appraisal plus commercial feasibility scoring to ensure fiscal resources target projects with strong industrialization potential. In the post-investment stage, a rolling "project growth file" is maintained; fund managers and the S&T authority jointly conduct quarterly reviews of technical progress and market performance and adjust follow-on investments accordingly. For equity exits, Suzhou relies on a technology property-rights exchange and an integrated "invest–convert–exit–reinvest" loop, achieving an average exit cycle of about

five years and an exit IRR around 12%, thereby sustaining fund recycling. Overall, Suzhou exemplifies quasi-market governance of public funds, balancing fiscal guidance with market efficiency.

4.3 Hefei's Model: "Patient Capital" Oriented by Government and Integrated with Innovation

Hefei has developed a nationally influential ecosystem for technology commercialization based on the triad of government funds + anchor enterprises + science parks. The heart of Hefei's FITE practice is the deep coupling of government "patient capital" with frontier innovation, managed through a pipeline of pre-investment strategic assessment → joint R&D during investment → post-investment incubation toward listing.

During pre-investment evaluation, Hefei operates a dual system of technical due diligence + third-party valuation to target breakthrough-potential technologies. Post-investment governance centers on an "industrialization task sheet," incorporating TRL milestones, return on investment (ROI), and talent inflow into performance metrics. For exits, a dedicated Hefei Innovation FoF provides dynamic channels; government shareholding can extend up to 10 years, reflecting a long-term cultivation philosophy consistent with international experiences of the state as patient investor. This approach has facilitated successful transitions from investment to industry in sectors such as photovoltaics, advanced displays, and quantum technologies.

4.4 Changsha's Model: Activating Commercialization Actors through a Local VC System

Changsha emphasizes a three-dimensional synergy of government guidance, social participation, and market operation. The city established the Lugu Technology Commercialization Fund (≈RMB 2 billion), focusing on the industrial landing of university research outputs. Its distinctive features are:

(1) Pre-investment: strengthened coupling of due diligence with scientific evaluation, requiring third-party S&T assessments and explicit innovation-value appraisals;

(2) Post-investment: deep integration with the local VC community, forming a "fiscal first-in, VC follow-on" risk-sharing structure;

(3) Flexible exits: including equity buybacks and management buyouts (MBOs), alongside IPO-based exits.

Changsha's experience shows that government-guided local VC systems, combined with rigorous project appraisal and risk-sharing, can significantly raise commercialization rates.

4.5 Chengdu's Model: Platform-Based Commercialization through Government–University–Industry–Finance–Services Integration

Chengdu embeds FITE within the broader Tianfu S&T Finance Port system, operating a triad of results-maturation platforms + fiscal risk funds + equity exit markets. Pre-investment emphasizes technology valuation and joint investment–financing review; post-investment features a "hands-on support" system where government, professional GPs, banks, and law firms collaborate to reduce financial and legal risks. For exits, the Tianfu Technology Exchange and Western Equity Exchange provide secondary-market channels and facilitate value discovery. Chengdu's innovation lies in platform-based governance that enables end-to-end digital oversight from project selection and investment decisions to industrial landing.

4.6 Xianyang's Advantages and Gaps

The comparison reveals three major strengths in Xianyang's FITE practice:

(1) Institutional First-mover: Xianyang has pioneered a tripartite FITE framework of fiscal funds + state capital + private capital, with policy coverage extending to pilot testing and maturation, thereby addressing the early-stage capital gap in provincial commercialization.

(2) Robust Risk Control: the combination of due diligence, performance assessment, and due-diligence-exemption yields a governance design that balances risk tolerance and incentive alignment, enabling fiscal funds to dare to invest, be able to invest, and invest well.
(3) Emerging Fiscal Recycling: equity-exit proceeds flow back into a designated account, forming a recyclable, re-investable fiscal mechanism.
At the same time, several gaps remain:
(1) Limited Private Co-investment: unlike Suzhou and Changsha, Xianyang has yet to establish a mature FoF–sub-fund system and broad private co-investment, constraining fiscal leverage multipliers;
(2) Weak Industry-Chain Coupling: relative to Hefei and Chengdu, project–industry chain alignment is insufficient, and the invest–R&D–industrialization pipeline is not tightly integrated;
(3) Constrained Exit Channels: the absence of local technology-property exchanges and regional equity markets limits exit options and prolongs capital recycling cycles.
In short, Xianyang's FITE is in an ice-breaking phase of institutional innovation. While top-level design and fund management foundations are in place, further optimization is needed in private-capital mobilization, platform-based support, and market-oriented exits. Drawing on Suzhou's fund-cluster model, Hefei's patient-capital mechanism, Changsha's VC-linkage model, and Chengdu's platform governance, Xianyang can evolve a regionally distinctive, sustainable ecosystem for technology commercialization.

5. Challenges

5.1 Limited Sustainability of Fiscal-Driven Mechanisms

Although Xianyang's FITE mechanism is among the most advanced institutional innovations in Shaanxi Province, fiscal funds remain its dominant source of capital, while private investment leverage remains weak. In 2024, the city's dedicated FITE fund totaled approximately 10 million CNY, with private participation accounting for less than 30%.
This heavy reliance on fiscal resources constrains policy sustainability and weakens the mechanism's risk resilience. International evidence shows that government venture funds without market co-investment often suffer from policy dependence and low capital-multiplier effects. By contrast, regions such as Suzhou and Hefei have established fund-of-funds (FoF) structures that amplify fiscal leverage through market collaboration.
To enhance long-term viability, Xianyang must develop a "fiscal guidance + private co-investment + reinvestment loop" that integrates fiscal stability with market sustainability.

5.2 Weak Project Pipeline and Pre-Investment Evaluation System

In practice, Xianyang lacks a standardized system for project screening, value assessment, and technology maturity evaluation. Current pre-investment reviews rely mainly on expert opinion and project documentation, with no quantitative risk-grading framework. As a result, some projects have low technology readiness or unclear commercialization pathways.
Global experience highlights that rigorous pre-investment risk identification and value assessment are crucial for improving the efficiency of public investment. For instance, Hefei combines TRL (Technology Readiness Level) assessment with third-party valuation, while Suzhou integrates technical verification and market-fit scoring to ensure precise targeting of fiscal funds.
Xianyang's project pipeline remains nascent, dominated by small and micro enterprises and early-stage technologies, with few breakthrough or original innovations. Without a scientific evaluation model and

hierarchical project reserve system, the risk of "investing without impact" and "transferring without scale" remains significant.

5.3 Insufficient Post-Investment Management and Performance Evaluation

Currently, post-investment management under Xianyang's FITE mechanism depends largely on periodic supervision by the Science and Technology Bureau and the Caijin Investment Company, lacking a dynamic monitoring and stratified evaluation framework. Some projects experience long acceptance cycles and rely on narrow performance metrics, which fail to capture real commercialization outcomes.

Compared with Suzhou's quarterly performance tracking and growth-archive system, Xianyang has yet to establish an integrated, data-driven monitoring framework. International studies have noted that government-led funds without professional post-investment governance often face adverse incentive effects, weakening project performance and innovation outcomes.

Moreover, Xianyang has not yet adopted a performance-based funding mechanism, and mid-term evaluations are weakly linked to subsequent disbursements. The lack of participation from professional technology managers and third-party fund managers results in slow feedback and limited precision in fiscal investment management.

5.4 Inefficient Equity Exit and Low Capital Recycling

The equity exit phase remains a major bottleneck in Xianyang's FITE practice. The city lacks a mature technology-property exchange or regional equity market, leading to limited exit channels. At the same time, fiscal shareholding withdrawals involve complex, multi-departmental procedures, prolonging capital recovery cycles.

Survey evidence indicates that several equity-converted projects have extended exit periods beyond seven years due to valuation fluctuations or the absence of suitable buyers, significantly undermining fund turnover efficiency.

International experience shows that diversified and liquid exit mechanisms are critical for the success of public venture funds (Wright et al., 2006). Cities such as Suzhou and Hefei have achieved flexibility through technology exchanges and mechanisms like buyback-plus-listing exits. By contrast, Xianyang's single-path exit design lacks a secondary-market recycling channel for fiscal funds.

Future reforms should prioritize the establishment of a local technology-property exchange, a fiscal investment exit pool, and a project-return reinvestment system to enhance fund turnover and sustainability.

5.5 Weak Sci-Tech Finance Synergy and Professional Service Capacity

While Xianyang has initiated science–finance integration (e.g., a risk-compensation pool for S&T loans), financial institutions still lack adequate capacity to assess technology-transfer risks. Most bank products remain collateral-based, with few credit or IP-backed financing instruments targeting tech-oriented SMEs.

Additionally, the technology manager workforce remains underdeveloped. As of 2024, the city had 933 certified technology managers, of whom only 30 (3.2%) were full-time; professionals with cross-disciplinary backgrounds in finance, law, and investment are scarce. This shortage constrains project evaluation, investment matchmaking, and risk management throughout the transfer process.

By comparison, Chengdu's Tianfu Science and Finance Port integrates investment banks, law firms, and accounting institutions into a unified investment–financing support ecosystem, substantially improving commercialization success rates. Xianyang should similarly foster coordinated development between financial institutions and S&T intermediaries, forming a complete "evaluation–financing–exit" service chain.

5.6 Insufficient Policy Coordination and Institutional Synergy

Although the FITE framework in Xianyang has taken shape, institutional fragmentation persists. Overlaps exist among the Science and Technology Bureau, Finance Bureau, and Caijin Investment Company in project evaluation, fund management, and performance assessment. Data interoperability remains limited, resulting in information silos and multi-agency management inefficiencies.

Furthermore, weak coordination with education, industry, and talent policies has led to a lack of top-level design for an integrated commercialization system. As Aghion, David, and Foray (2009) argue, the degree of institutional coherence within innovation systems strongly influences local innovation performance.

Xianyang should therefore adopt a systemic governance approach, establishing cross-departmental and cross-level coordination mechanisms that enable real-time data sharing and dynamic supervision across the science, finance, and industry sectors. Such integration would advance the city toward a collaborative, adaptive, and efficient governance model for technology commercialization.

6. Policy Optimization and Strategic Pathways

6.1 Strengthening Fiscal Guidance and Private Co-Investment

To address the overreliance on fiscal funding and low private participation, Xianyang should establish a multi-source investment framework combining fiscal funds, private capital, and professional investment vehicles. Drawing on Suzhou's fund-of-funds (FoF) and Hefei's industrial fund clusters, the city could build a "Xianyang Science and Technology Commercialization Guidance Fund Cluster," where fiscal resources serve as anchor capital and market funds act as amplifier capital, forming a layered investment structure.

Partnerships with provincial investment platforms and state-owned enterprises should be pursued to launch co-funded sub-funds guided by fiscal input, market co-investment, and industrial orientation. Empirical evidence indicates that collaboration between public and private venture capital significantly enhances the success rate of innovation projects (Brander, Du, & Hellmann, 2015; Grilli & Murtinu, 2014).

In addition, introducing structured co-investment mechanisms—where government assumes first-loss risk in early stages—can attract private investors and achieve a higher fiscal leverage multiplier.

6.2 Establishing a Data-Driven Pre-Investment Evaluation System

A scientific and data-oriented pre-investment framework should be developed, integrating Technology Readiness Level (TRL), commercial feasibility, and market-demand alignment into a unified quantitative model. Building on Hefei's third-party valuation + due diligence approach, Xianyang should create a dynamic project reserve database with risk-tiered management to ensure that fiscal investment targets innovative and commercially viable technologies.

Artificial intelligence and big-data tools can assist decision-making by scoring projects across multiple dimensions—technical feasibility, team capacity, market demand, and IP protection—thereby enabling evidence-based, dynamic, and precise investment management. To enhance objectivity, universities, industry associations, and third-party agencies should participate in evaluation through an integrated technology–finance–legal framework.

6.3 Strengthening Post-Investment Management and Performance Evaluation

A comprehensive post-investment governance system should be established, featuring project growth archives, phased performance reviews, and an early-warning mechanism. A "Xianyang Science and

Technology Commercialization Database", jointly managed by the Science and Technology Bureau, Finance Bureau, and Caijin Investment Company, can track project progress, market performance, and IP output using a "red-yellow-green" monitoring model.

A performance-based funding system should link follow-up disbursements directly to commercialization indicators, improving fiscal efficiency (Link & Scott, 2010). Moreover, professional post-investment teams and technology managers with cross-disciplinary backgrounds in investment, technology, and industry should be engaged to ensure scientific evaluation, professional monitoring, and dynamic performance management.

6.4 Expanding Equity-Exit Channels and Enhancing Fund Recycling

To overcome long exit cycles and slow fund turnover, Xianyang should develop diversified exit mechanisms and an integrated commercialization platform.

(1) Leverage the Qinchuangyuan Innovation Platform to establish a Xianyang S&T Equity and Technology Exchange Center offering project listing, equity transfer, and return-tracking functions.

(2) Create a Fiscal Exit Pool, allowing municipal funds to repurchase equity when exit conditions are met and recycle proceeds through re-investment.

(3) Encourage hybrid exit options, including management buyouts (MBOs), third-party mergers and acquisitions, and IPOs, to enhance liquidity.

International evidence confirms that diversified exit routes not only improve fund efficiency, but also sustain an ongoing innovation-capital cycle (Lerner, 2009).

6.5 Building an Integrated Science–Finance Ecosystem

The city's financial system should evolve from single-loan support to full-chain financial empowerment. Xianyang should deepen government–bank–insurance–guarantee–investment collaboration, forming an integrated system of technology credit, result-insurance, and investment–loan linkage.

A technology-credit rating system based on firms' innovation capacity, IP quality, and commercialization performance would provide quantitative signals for lenders, lowering financing risk (Etzkowitz & Leydesdorff, 2000).

Additionally, a Technology-Manager Alliance should be established to offer end-to-end services—from technical evaluation and financing matchmaking to incubation—thereby enhancing SMEs' financing access and commercialization success. Studies show that effective intermediary and post-investment service systems are critical to technology-transfer performance. Xianyang should thus cultivate a "technology–finance–capital–service" innovation ecosystem.

6.6 Enhancing Legal Safeguards and Cross-Departmental Coordination

The effectiveness of the FITE policy ultimately depends on robust legal and governance frameworks. Based on the Xianyang Ordinance on Promoting Technology Commercialization, the city should issue detailed implementation rules for fiscal S&T investment, clarifying procedures for project selection, fund use, equity management, performance evaluation, and risk accountability.

A cross-departmental coordination mechanism should be institutionalized, led by the Science and Technology Bureau with participation from the Finance Bureau, Development and Reform Commission, Financial Office, and State-owned Assets Commission. A shared data platform connecting science, finance, and industry departments would enable real-time supervision and intelligent risk control across the entire FITE process.

As Aghion, David, and Foray (2009) emphasize, institutional coherence is central to the long-term success of innovation policy. Xianyang should therefore move from departmental fragmentation to

systemic governance, building a replicable and scalable model for modern technology-commercialization governance.

7. Conclusion and Implications

7.1 Main Findings

Drawing on Xianyang's institutional practice of the FITE policy and comparative analyses of Suzhou, Hefei, Changsha, and Chengdu, this study examined how local governments can leverage fiscal innovation to promote the efficient commercialization of scientific and technological achievements. The findings indicate that the FITE mechanism represents a crucial transition from a "subsidy-based" to an "investment-oriented" model of fiscal governance, embodying a fundamental restructuring of how local governments allocate and manage science funding under innovation-driven development.

First, in policy logic, the FITE mechanism signifies a shift in government roles—from funder to investor. By intervening through fiscal investment at the pre-commercialization stage and later converting investments into equity, local governments assume early-stage risks ("first-loss capital") while recapturing returns through equity exits. This cyclical capital flow aligns with the theories of government as entrepreneur (Link & Scott, 2010) and innovation system synergy (Etzkowitz & Leydesdorff, 2000), effectively bridging the early-stage "valley of death" in technology transfer.

Second, in operational design, Xianyang's FITE policy has built a three-tiered governance structure of government guidance, fiscal coordination, and market participation, forming a closed loop of project initiation → pre-investment evaluation → in-process supervision → post-investment equity conversion → exit and reinvestment. This mechanism represents an innovative governance model for fiscal technology funds in western China, offering a replicable framework for regional innovation systems.

Third, from a comparative perspective, although Xianyang lags behind leading cities in fund scale and market maturity, it demonstrates strong institutional dynamism and risk tolerance. Features such as due-diligence exemption and reinvestment of equity returns reflect a locally adapted approach to "marketizing fiscal funds" and exemplify how non-metropolitan regions can engage in adaptive policy experimentation.

7.2 Policy Implications

(1) Fiscal innovation should emphasize sustainability and collaboration.

Xianyang's experience shows that single-source fiscal investment is insufficient to sustain long-term commercialization. Future policy design should promote co-investment between fiscal and private capital, transforming government funds from one-off subsidies into revolving, market-driven capital.

(2) Technology-transfer policy should evolve from "funding-oriented" to "system-oriented."

Successful commercialization depends not only on financial input but also on the coordination of finance, law, IP management, and human capital. Local governments should foster alignment across the innovation, industry, and capital chains to ensure efficient knowledge flow from laboratory to market (Aghion, David, & Foray, 2009).

(3) Encouraging risk tolerance and balanced incentives is vital.

The essence of FITE lies in institutionalized trial and error under uncertainty. Local policies should embed a "tolerance-for-failure" principle, balancing accountability with innovation incentives so that fiscal funds can "dare to invest" while maintaining prudent risk management (Lerner, 2009). Such adaptive learning mechanisms are essential to unlock innovation vitality within controlled risk boundaries.

(4) Regional innovation governance requires professional and platform-based support.

The FITE model demonstrates that commercialization success depends on building professional platforms integrating investment, intermediary services, and technology exchange. Establishing a Technology Exchange Center, Technology Managers Alliance, and Science-Finance Platform can significantly improve the efficiency of market-oriented technology transfer.

(5) Western and inland cities can generate scalable innovation models through policy experimentation.

Xianyang's case illustrates that even in regions with smaller economies and less mature capital markets, institutional clarity and disciplined fiscal design can yield transformative results. Continuous refinement of the "invest–convert–reinvest" cycle can generate a sustainable "Xianyang Model" for regional innovation.

7.3 Limitations and Future Research

This study relies mainly on policy documents and comparative case analysis; quantitative evaluation of project-level performance remains limited. Future research could extend in three directions:

(1) Empirical assessment of FITE's investment return, commercialization rate, and private-capital leverage using econometric models;

(2) Quasi-experimental comparisons across cities to identify causal effects of FITE implementation on innovation outcomes (e.g., patent applications, technology contracts);

(3) Policy diffusion analysis examining how and under what institutional conditions the "Xianyang Model" can be replicated elsewhere.

The FITE mechanism represents a significant shift in local fiscal governance—from passive subsidization to active, risk-tolerant investment. Through institutional innovation, Xianyang has pioneered a replicable path for mobilizing public capital toward technology transfer, offering both practical insights for local innovation governance and theoretical value for refining China's national framework for technology commercialization.

Acknowledgements

The authors are supported by Xianyang Soft Science Research Program (L2024CXNLRKX0007), Natural Science Foundation of Shaanxi Province (2023-JC-QN-0784), and Xi'an Soft Science Research Program (24RKYJ0039). The authors would also like to thank funds and support from Bureau of Science and Technology of Xianyang City for their collaboration.

References

Aghion, P., David, P. A., & Foray, D. (2009). Science, technology and innovation for economic growth: Linking policy research and practice in 'STIG Systems'. *Research Policy*, *38*(4), 681-693. https://doi.org/10.1016/j.respol.2009.01.016

Akerlof, G. A. (1978). The market for "lemons": Quality uncertainty and the market mechanism. In *Uncertainty in economics* (pp. 235-251). Academic Press. https://doi.org/10.1016/B978-0-12-214850-7.50022-X

Audretsch, D. B., Link, A. N., & Scott, J. T. (2002). Public/private technology partnerships: Evaluating SBIR-supported research. *Research Policy*, *31*(1), 145-158. https://doi.org/10.1016/S0048-7333(00)00158-X

Bozeman, B. (2000). Technology transfer and public policy: a review of research and theory. *Research Policy*, *29*(4-5), 627-655. https://doi.org/10.1016/S0048-7333(99)00093-1

Brander, J. A., Du, Q., & Hellmann, T. (2015). The effects of government-sponsored venture capital: International evidence. *Review of Finance*, *19*(2), 571-618. https://doi.org/10.1093/rof/rfu009

Eisenhardt, K. M. (1989). Agency theory: An assessment and review. *Academy of Management Review*, *14*(1), 57-74. https://doi.org/10.2307/258191

Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university–industry–government relations. *Research Policy*, *29*(2), 109-123. https://doi.org/10.1016/S0048-7333(99)00055-4

Grilli, L., & Murtinu, S. (2014). Government, venture capital and the growth of European high-tech entrepreneurial firms. *Research Policy*, *43*(9), 1523-1543. https://doi.org/10.1016/j.respol.2014.04.002

Grimaldi, R., Kenney, M., Siegel, D. S., & Wright, M. (2011). 30 years after Bayh–Dole: Reassessing academic entrepreneurship. *Research Policy*, *40*(8), 1045-1057. https://doi.org/10.1016/j.respol.2011.04.005

Hall, B. H., & Rosenberg, N. (Eds.). (2010). *Handbook of the Economics of Innovation* (Vol. 1). Elsevier.

Howell, S. T. (2017). Financing innovation: Evidence from R&D grants. *American Economic Review*, *107*(4), 1136-1164. https://doi.org/10.1257/aer.20150808

Jensen, R., & Thursby, M. (2001). Proofs and prototypes for sale: The licensing of university inventions. *American Economic Review*, *91*(1), 240-259. https://doi.org/10.1257/aer.91.1.240

Lerner, J. (2009). *Boulevard of broken dreams: why public efforts to boost entrepreneurship and venture capital have failed--and what to do about it*. Princeton University Press. https://doi.org/10.1515/9781400831630

Link, A. N., & Scott, J. T. (2010). Government as entrepreneur: Evaluating the commercialization success of SBIR projects. *Research Policy*, *39*(5), 589-601. https://doi.org/10.1016/j.respol.2010.02.006

Luukkonen, T., Deschryvere, M., & Bertoni, F. (2013). The value added by government venture capital funds compared with independent venture capital funds. *Technovation*, *33*(4-5), 154-162. https://doi.org/10.1016/j.technovation.2012.11.007

Mowery, D. C., Nelson, R. R., Sampat, B. N., & Ziedonis, A. A. (2001). The growth of patenting and licensing by US universities: An assessment of the effects of the Bayh–Dole act of 1980. *Research Policy*, *30*(1), 99-119. https://doi.org/10.1016/S0048-7333(99)00100-6

Siegel, D. S., Waldman, D., & Link, A. (2003). Assessing the impact of organizational practices on the relative productivity of university technology transfer offices: An exploratory study. *Research Policy*, *32*(1), 27-48. https://doi.org/10.1016/S0048-7333(01)00196-2

Stiglitz, J. E., & Weiss, A. (1981). Credit rationing in markets with imperfect information. *American Economic Review*, *71*(3), 393-410.

Wright, M., Lockett, A., Clarysse, B., & Binks, M. (2006). University spin-out companies and venture capital. *Research Policy*, *35*(4), 481-501. https://doi.org/10.1016/j.respol.2006.01.005