

Financing Dilemmas of Technology-Intensive Silver Economy Startups in China: An Abductive Multiple-Case Study of Asset, Capital, and Institutional Mismatches

Shaowei Miao¹², DU Kaizheng^{1*}, Dong Li¹², Ming Li¹³, Zhao Jinyuan¹, Liu Jing²

¹ INTI International University, Nilai, Negeri Sembilan, Malaysia

² Zhongyuan Institute of Science and Technology, Zhengzhou, China

³ North China University of Water Resources and Electric Power, Zhengzhou, China

* Corresponding author

Abstract: China's ageing population is expanding demand for health, rehabilitation, smart eldercare, and age-friendly digital services, yet young technology firms in these markets can still face financing frictions. This study examines six Chinese ventures through an abductive multiple-case design, moving iteratively between public case evidence, entrepreneurial-finance theory, and the New Quality Productive Forces (NQPF) context. Rather than treating Triple Mismatch as a pre-specified coding template, we refine it through cross-case comparison. The analysis identifies three recurrent frictions: translating productive resources into information or rights that financiers can evaluate; aligning the duration and structure of capital with commercialization; and coordinating requirements across finance, health, eldercare, data, and technology institutions. The cases also provide important counterevidence: several firms secured external finance despite relying heavily on intangible resources. We therefore present Triple Mismatch as a bounded diagnostic framework rather than a universal causal explanation. Building on the case comparison, the paper develops an Asset-Capital-Policy response architecture centered on verifiable rights and risk information, stage-matched financing, and targeted institutional coordination. International examples are used only to clarify mechanisms, not to imply direct policy transferability.

Keywords: Silver economy; technology-intensive startups; entrepreneurial finance; credit rationing; New Quality Productive Forces; patient capital; data governance; multiple-case study

1. Introduction

1.1 Background and research problem

Population ageing is becoming a defining structural feature of the Chinese economy. The National Bureau of Statistics reported that, at the end of 2025, 323.38 million people in China were aged 60 years or above, representing 23.0% of the population, while 223.65 million were aged 65 or above (15.9%). These figures indicate a large and heterogeneous demand base for products and services related to health, mobility, rehabilitation, care, digital inclusion, and ageing-in-place. The 2024 State Council policy on the silver economy also explicitly calls for stronger financial support for qualified silver-economy projects and for the application of information systems and intelligent equipment in eldercare (General Office of the State Council, 2024).

At the same time, a subset of silver-economy firms is increasingly technology intensive. Their productive resources can include software, algorithms, intellectual property, proprietary data-processing capabilities, clinical or operational know-how, and network relationships rather than large stocks of land and machinery. This configuration is relevant to the Chinese policy discussion on New Quality Productive Forces, which emphasizes new production factors, emerging industries, technological innovation, and structural upgrading (Huang & Sheng, 2024; Xi, 2024). The combination creates an important financing question: when the economic value of a young firm is concentrated in knowledge, data, software, or future cash flows, how do lenders and investors translate that value into credible, enforceable, and monitorable financing information?

Credit rationing offers one useful point of departure, but it does not exhaust the problem examined here. Under imperfect information, lenders may ration credit because a higher interest rate can worsen adverse selection or borrower incentives rather than clear the market (Stiglitz & Weiss, 1981). For small firms, the information available to financiers also changes as the business ages and develops; Berger and Udell (1998) show that financing sources tend to shift with

firm size, information quality, and stage. Venture-capital contracts address uncertainty differently. They divide cash-flow, control, voting, and liquidation rights and often release finance in stages (Kaplan & Strömberg, 2003). These arguments explain why young firms can be difficult to finance. They say less, however, about the particular combination considered in this paper: intangible technology, a commercialization path shaped by validation and adoption, and an institutional environment spanning finance and eldercare-related regulation.

1.2 Research gap

The literature leaves three issues insufficiently connected. First, studies of silver-economy ventures are often absorbed into the broader SME-finance literature, even though regulated health data, intangible technology, lengthy validation cycles, and public-service interfaces can create distinctive financing problems. Second, NQPF is discussed mainly at the macro and industrial levels, while its implications for firm-level financing remain underdeveloped. Third, proposed remedies—such as subsidies, guarantees, tax relief, and digital-finance initiatives—are commonly examined in isolation. This makes it difficult to explain how asset recognition, financing horizon, and institutional implementation interact within the same venture.

1.3 Research questions and contribution

- RQ1: How do technology-intensive asset configurations shape financing frictions in silver-economy startups?
- RQ2: How does the timing of commercialization interact with the duration and structure of available capital?
- RQ3: How do institutional and policy arrangements mediate the financing of these ventures?
- RQ4: What bounded financing and policy mechanisms can mitigate the identified frictions without assuming that intangible data automatically become collateral?

This study makes two related contributions. Conceptually, it refines Triple Mismatch through abductive comparison of the six cases and uses the framework to connect asset recognition, capital duration, and institutional fit at the firm level. Practically, it develops a bounded Asset-Capital-Policy response architecture that links each friction to a corresponding financing or policy mechanism. These claims are deliberately limited: the analysis does not assume that data automatically become collateral, that additional information eliminates information asymmetry, or that foreign policy instruments can be transferred to China without institutional adaptation.

2. Theoretical Foundations

2.1 Credit rationing and entrepreneurial finance

For this study, the useful part of credit-rationing theory is its focus on information rather than on the nominal price of a loan. A lender that cannot observe project quality or subsequent borrower behavior faces adverse-selection and moral-hazard problems; raising the interest rate may intensify both (Stiglitz & Weiss, 1981). Young firms add another complication because their operating histories are short and their financing needs change quickly. Berger and Udell (1998) describe this as a financial growth cycle in which the available mix of finance changes with the firm's information and asset structure. Venture capital deals with uncertainty through a different contractual technology. Kaplan and Strömberg (2003), for example, document the separation of economic and control rights and the use of staged financing. Collateral is therefore only one part of the financing relationship, which is why the analysis below pays particular attention to what financiers can verify, monitor, and contract on.

Taken together, these perspectives make 'lack of collateral' too coarse an explanation for the firms examined here. The harder question is what a financier can actually observe and contract on. Software, intellectual property, operating data, or clinical know-how may be economically valuable, but their financing relevance depends on whether they can be expressed as credible signals, enforceable rights, monitorable performance indicators, or sufficiently predictable cash flows.

2.2 New Quality Productive Forces as a contextual lens

In this paper, NQPF is treated as a contextual and analytical lens, not as a standalone causal theory of finance. Huang and Sheng (2024) conceptualize NQPF as a system involving new factors, new structural carriers, and new functional orientations. Xi (2024) similarly places technological innovation and productivity upgrading within a broader high-quality development agenda. For technology-intensive silver-economy firms, this lens draws attention to the changing

composition of productive resources: software, data-processing capabilities, algorithms, intelligent equipment, and organizational knowledge may become more important than conventional physical assets.

The implication for this study is intentionally limited. NQPF does not make a digital resource a legally recognized asset, nor does it give an algorithm pledge value. What the concept does is direct attention to a possible mismatch between how a technology-intensive firm creates value and how a capital provider records, verifies, and prices that value.

2.3 Silver-economy startups and technology intensity

The State Council defines the silver economy broadly as economic activities that provide products and services to older people and prepare people for later life (General Office of the State Council, 2024). The present study focuses on a narrower subset: technology-intensive startups operating in smart eldercare, health technology, rehabilitation, digital care, and age-friendly intelligent products. This scope clarification is important because the financing characteristics of a software- or robotics-based AgeTech firm cannot automatically be generalized to the entire silver economy, which also includes tourism, food, retail, household services, and other sectors.

2.4 From Triple Mismatch to a refined analytical framework

Triple Mismatch is used here as a provisional analytical framework comprising Asset Configuration Mismatch, Investment Cycle Mismatch, and Institutional Support Mismatch. These categories enter the analysis as sensitizing concepts rather than findings. Cross-case comparison is used to assess whether they recur, require refinement, or fail to account for relevant evidence. The resulting formulation—asset-recognition friction, capital-duration mismatch, and institutional-fit mismatch—is presented in Figure 2, while Figure 1 summarizes the abductive movement between theory and evidence.

Figure 1. Abductive analytical process

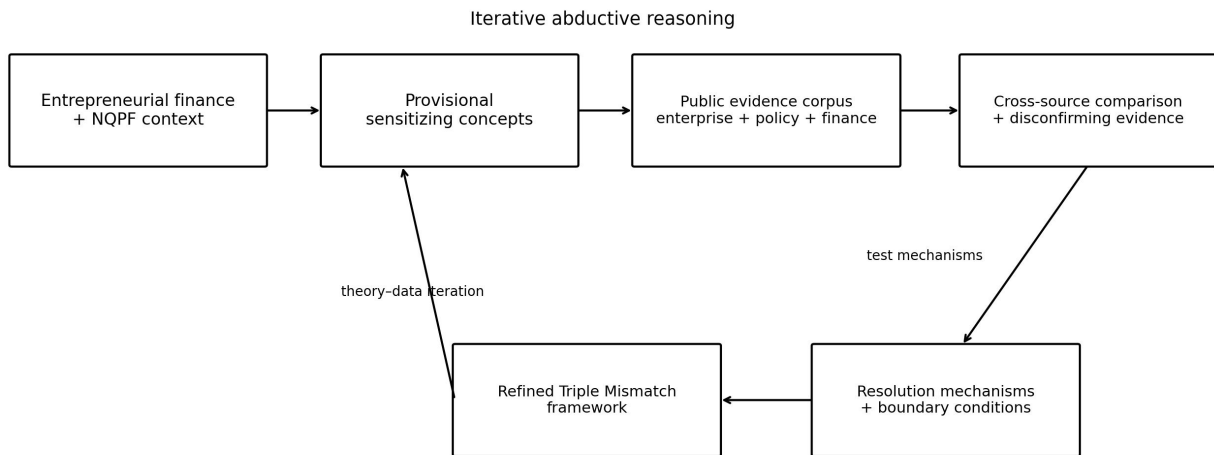
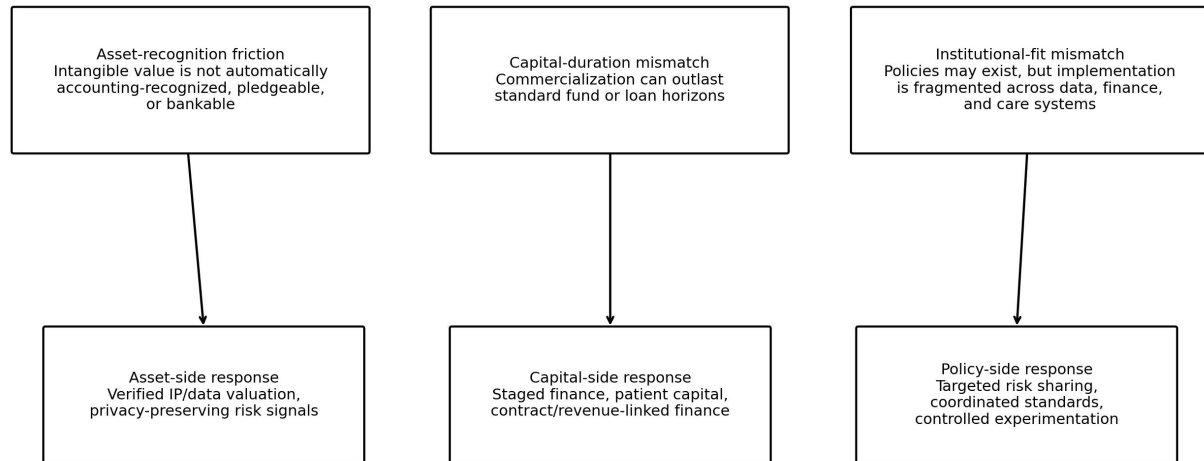


Figure 2. Refined Triple Mismatch framework and bounded responses



3. Research Design

3.1 Abductive multiple-case design

An abductive multiple-case design was chosen because the financing episode cannot be separated cleanly from the institutional setting around the firm (Eisenhardt, 1989; Yin, 2018). The analysis also began with theory already on the table. Credit rationing, entrepreneurial finance, and the NQPF policy context shaped the initial questions, so describing the exercise as purely inductive would be misleading. We instead moved repeatedly between those ideas and the case record, asking where an observation fitted the initial account, where it complicated it, and where it required a different interpretation. This use of iteration is consistent with systematic combining and abductive theory construction (Dubois & Gadde, 2002; Timmermans & Tavory, 2012). Gioia et al. (2013) informed the practical distinction we maintained between case-level observations and higher-order interpretation.

The unit of analysis is the financing trajectory of a technology-intensive silver-economy startup within its financial and policy environment. Six identifiable ventures were selected because sufficient public evidence was available to reconstruct their technology domain, financing history, and relevant deployment or institutional context. Case-level factual claims are documented in the Evidence-Traceability Register in Appendix A.

3.2 Case selection and evidence corpus

The six cases were selected purposively to provide variation in technology, financing stage, and commercialization model while remaining within the study's defined silver-economy scope. The sample includes rehabilitation and eldercare robotics, digital cognitive health, neurological assessment, eldercare SaaS, and medical-grade wearable sensing. This variation allows the analysis to examine whether similar financing frictions appear across different technological and commercialization settings.

The sample deliberately spans different technologies and financing stages. Case A is Shanghai Rushen Robotics (RobotGym), a rehabilitation and eldercare robotics venture. Case B, Shanghai BestCovered Technology (博斯腾科技), develops digital tools for cognitive-impairment assessment and intervention. Case C is Beijing CAS Ruiyi Information Technology (中科睿医), which works on intelligent diagnosis and quantitative neurological assessment. Shanghai Yufu Technology (遇服科技), Case D, provides low-code/PaaS eldercare SaaS. Case E is Soft Sense / Xiamen Guanjun Zhichuang Technology, focused on medical-grade flexible wearable sensing. Case F, Shanghai Deyin Technology (得印科技), develops eldercare robots for nursing, mobility, and AI-enabled companionship.

Case	Verified entity	Technology domain	Verified financing evidence	Operational/public evidence	Audit status
A	Shanghai Rushen Robotics Co., Ltd. (RobotGym)	Rehabilitation & eldercare robotics	Angel+ tens of millions RMB (2025); multiple rounds; Pre-A RMB 100m announced in 2026	Official company site; VCBeat; GIES 2025 profile	Verified
B	Shanghai BestCovered Network Technology Co., Ltd. (博斯腾科技)	Digital cognitive-impairment assessment & intervention	RMB 100m A round (2021); RMB 100m A+ round (2022)	Official site; VCBeat; Shanghai Civil Affairs deployment record	Verified
C	Beijing CAS Ruiyi Information Technology Co., Ltd. (中科睿医)	AI-enabled neurological assessment/diagnosis	Pre-A (2022), A (2023), A+ tens of millions RMB (2024)	Lenovo Capital disclosures; official company archive	Verified
D	Shanghai Yufu Technology Service Co., Ltd. (遇服科技)	Low-code/PaaS eldercare SaaS	Strategic industrial investment by Everjoy Duobao / Everjoy Health affiliate, disclosed 2024	Yufu official platform site; Everjoy Health announcement	Verified
E	Soft Sense / Xiamen Guanjun Zhichuang Technology Co., Ltd.	Medical-grade flexible biosensing wearables	Multi-million-US-dollar angel round announced July 2026	VCBeat first-report financing article	Verified with one core industry-news source
F	Shanghai Deyin Technology Co., Ltd. (得印科技)	Eldercare robotics, mobility, nursing & AI companion	Tens of millions RMB angel round (Apr 2025); tens of millions RMB Pre-A (Nov 2025)	Investment profile; Pudong government deployment document	Verified

3.3 Evidence traceability and source hierarchy

We did not treat all public sources as equivalent. For a factual claim, the preferred record was a legal or regulatory document, an official government publication, a dated company disclosure, a patent record, or another institutional source with a clear provenance. Industry media and statements by founders were retained when they added context or documented a financing announcement, but they were not treated as independent confirmation merely because they repeated a claim. Where two sources differed, we recorded the discrepancy and considered what each source was actually positioned to know.

Direct quotations were included only when their original source could be identified and independently checked. Because the evidence corpus is based on public secondary sources rather than interview transcripts, the analysis relies primarily on traceable factual records and paraphrased themes. This choice reduces narrative detail but strengthens the distinction between documented evidence and interpretation.

3.4 Abductive coding procedure

Coding did not begin by assigning every item to one of three mismatch boxes. We first recorded financing-relevant observations in their case context, while keeping credit rationing, entrepreneurial finance, NQPF, and the silver-economy setting as sensitizing ideas. The within-case records were then compared for recurrence and, just as importantly, for exceptions. This produced several points at which the initial framework had to be narrowed. Only after those comparisons were the observations grouped into the three aggregate dimensions reported here. We retained a dimension when it recurred across cases or evidence types and when competing evidence did not support a more convincing interpretation. In this sense, Triple Mismatch is the product of iteration between the provisional model and the case record, not the coding scheme used to manufacture the result.

Analytical stage	Purpose	Output
1. Sensitizing concepts	Define what to look for without predetermining the result	Asset recognition, capital duration, institutional fit
2. First-order coding	Capture financing-relevant observations in case context	Observed financing frictions, enabling conditions, exceptions
3. Within-/cross-case comparison	Identify recurrence and variation	Case matrices and rival explanations
4. Abductive refinement	Compare evidence with the provisional model	Refined Triple Mismatch framework
5. Mechanism mapping	Link each friction to bounded responses	Asset–Capital–Policy architecture

3.5 Reliability, validity, and ethics

Qualitative rigor was addressed through a documented source hierarchy, within- and cross-case comparison, attention to disconfirming evidence, and an explicit separation between factual records and higher-order interpretation. Because the analysis uses publicly available secondary materials and reports no unpublished personal data, no new human participants were recruited for this study.

4. Findings

4.1 Cross-case pattern

The cross-case comparison does not support a single explanation based on capital scarcity. Instead, three recurrent frictions appear in different combinations. First, firms may possess economically valuable resources that are difficult for financiers to verify or convert into enforceable claims. Second, available financing may not match the timing of technical validation, regulatory approval, procurement, or customer adoption. Third, ventures operating across finance, health, eldercare, data, and technology systems may face inconsistent evidentiary or implementation requirements. These dimensions are analytically distinct, although they can reinforce one another.

4.2 Asset-recognition friction

The cases make the asset problem more concrete. Rushen Robotics combines physical robots with software, control systems, and accumulated deployment data. BestCovered sells digital cognitive-assessment and intervention capabilities, while CAS Ruiyi relies on quantitative neurological assessment and software-enabled diagnostic infrastructure. Soft Sense adds another configuration: flexible sensors, algorithms, and longitudinal physiological signals. None of this is equivalent to saying that these firms hold readily collateralizable 'data assets'. A more precise reading is that productive value exists in forms that conventional underwriting may struggle to verify, price, or convert into enforceable claims.

What counts for financing, then, is not intangibility by itself. Ownership or lawful usage rights have to be demonstrable; technical performance and regulatory status may need verification; contracts and revenue histories matter; and lenders or investors must be able to observe enough of the risk to price it. Health-related data make the limit particularly visible because privacy and regulatory constraints rule out any simple move from 'valuable data' to assetization.

4.3 Capital-duration mismatch

The financing histories are uneven, which is analytically useful. BestCovered moved from Pre-A to A and A+ financing while developing a regulated digital-cognitive-health offering. CAS Ruiyi also progressed through several rounds as its products moved through clinical, registration, and market-development stages. Rushen Robotics and Deyin Technology raised successive early-stage rounds while taking robotics from development toward deployment; Soft Sense, by contrast, remains at the angel stage. The evidence points toward a stage-fit interpretation. It does not show a universal capital shortage. What changes across these firms is the mix of technical, regulatory, and commercialization uncertainty—and, with it, the type of capital that can plausibly fit.

This does not mean that venture capital is inherently too short-term. The mismatch is more specific: an instrument can become a poor fit when its expected holding period, repayment structure, milestone schedule, or risk tolerance runs ahead of—or lags behind—the venture's validation and adoption cycle.

4.4 Institutional-fit mismatch

Financing is also entangled with the institutions through which these products are validated, purchased, and deployed. BestCovered has participated in local-government cognitive-health programs. Deyin products have entered eldercare settings through public-sector-supported application scenarios, while Yufu's SaaS model spans institutional, community, and home-care environments. For CAS Ruiyi and Soft Sense, medical-device requirements, clinical validation, and data governance add another layer. This is not evidence of a simple 'policy gap'. The more specific problem is coordination: finance, health, eldercare, data, procurement, and technology rules can impose different evidentiary requirements on the same venture.

The 2024 State Council silver-economy policy supplies a broad mandate for support. The cases suggest, however, that the practical bottleneck sits one level below that mandate: standards, verification arrangements, procurement pathways, and the ability of intermediaries to evaluate technology-specific risks determine how much of the policy direction becomes usable in financing decisions.

4.5 Disconfirming evidence and boundary conditions

The counterexamples matter. BestCovered, CAS Ruiyi, Rushen Robotics, Soft Sense, and Deyin all attracted external capital, despite business models in which software, data, algorithms, clinical knowledge, or other intangibles play an important role. That observation rules out a strong version of the claim that intangible intensity makes these ventures unfinanceable. It also shows why bank lending cannot stand in for 'finance' as a whole: venture capital, strategic investors, public programs, and commercialization linked to customers provided alternative routes in the cases. Institutions were not uniformly restrictive either. Public deployment programs sometimes created validation opportunities or market access. Nor did the firms share one appropriate capital horizon. A digital cognitive-health business, a medical-device venture, and a robotics producer face different validation and adoption sequences. We therefore treat these differences as boundary conditions on Triple Mismatch rather than as observations to be explained away.

For that reason, the framework should be used selectively. It is most plausible where difficult-to-verify resources, extended commercialization, and cross-domain institutional interfaces occur together. The evidence here does not justify treating Triple Mismatch as an explanation for the silver economy as a whole.

5. Discussion

5.1 The refined Triple Mismatch framework

The refined framework treats financing friction as a translation problem across three interfaces. At the asset interface, productive resources must be converted into verifiable information or enforceable rights. At the capital interface, financing duration and contractual structure must fit the venture's commercialization trajectory. At the institutional interface, requirements arising from policy, regulation, data governance, procurement, and financial intermediation must be sufficiently coordinated to permit financing and deployment. Figure 2 summarizes these relationships.

Dimension	Core mechanism	What the evidence supports	What it does not support
Asset-recognition friction	Gap between productive-resource value and finance-ready evidence	Verification and rights can improve financeability	Data automatically becoming collateral
Capital-duration mismatch	Mismatch between commercialization timing and instrument horizon	Stage-matched and patient capital can improve fit	A universal 12–15 year fund requirement
Institutional-fit mismatch	Fragmentation across finance, data, health/care and innovation rules	Coordination and controlled experimentation may reduce friction	That generic subsidies are ineffective in all cases

5.2 Theoretical implications

The cases extend entrepreneurial-finance reasoning in two ways. First, they shift attention from the binary presence or absence of collateral to the process through which productive resources become usable financing information. This remains consistent with credit-rationing theory because information asymmetry is still central; the practical question is whether information can be verified, incorporated into contracts, and used for monitoring. Second, the cases highlight the temporal dimension of financing fit. An instrument suitable during product validation may become inappropriate once

regulatory approval, procurement, or recurring revenue becomes the dominant constraint. Institutional arrangements matter because they shape which information is credible, which rights are usable, and which financing structures can operate in practice.

NQPF therefore functions here as context, not as a causal variable. It helps us ask why emerging productive resources may sit awkwardly within inherited financial infrastructure. The cases do not show that NQPF itself causes financing constraints, and we do not make that claim. Keeping this distinction explicit also makes the argument easier to relate to the wider entrepreneurial-finance literature.

5.3 International comparison: lessons without direct transplantation

The international material is comparative rather than prescriptive. Social impact bonds are relevant because they illustrate financing tied to verified outcomes: private capital can fund an intervention before the outcome payment is made (Gustafsson-Wright et al., 2015). That mechanism is useful for thinking about alternatives to collateral-centered finance. It does not, however, turn an algorithm, a medical record, or health data into collateral, and the paper does not use it to support such a claim.

Japan offers a useful comparison through the Japan Finance Corporation. Its startup programs show that repayment horizons can be extended for eligible early-stage firms: equipment finance may run for as long as 20 years, while working-capital finance is generally available for up to 10 years. We use this example only to illustrate the design possibility of longer-duration debt. It does not support the earlier, unverified claim that Japan maintains a dedicated 'Silver Economy Promotion Fund'.

Yozma illustrates a different mechanism. According to the OECD, the original 1993 program used a government-backed fund-of-funds to attract foreign investors and help build Israel's domestic venture-capital market. The relevant mechanism is crowding in private expertise and capital at the ecosystem level, rather than guaranteeing startup losses. Whether an analogous arrangement would work in China is an empirical and institutional question, not an inference made from the Israeli case.

6. Resolution Paths

6.1 Asset-side: from intangible resources to finance-ready evidence

On the asset side, verification is a more defensible starting point than automatic collateralization. In practice, financial institutions, data exchanges, sector regulators, and qualified intermediaries could standardize evidence on ownership or lawful use rights, data-compliance status, intellectual-property scope, model performance, operating history, and recurring contractual revenue. Where lenders need risk signals but should not receive raw sensitive data, privacy-preserving computation may be worth testing. The aim is narrower: make relevant risks more observable and underwriting more informed. This is not to claim that raw personal data should be treated as financial assets.

For suitable growth-stage firms, intellectual-property-backed lending, receivables finance, contract-based lending, or other established mechanisms may be more realistic than creating a new category of 'data collateral.' A specialized valuation or verification function could support these mechanisms, but any public institution should prioritize standard setting and independent verification rather than guaranteeing asset values.

6.2 Capital-side: match instruments to commercialization stage

Seed-stage firms with high technical uncertainty require risk-bearing equity or quasi-equity more than conventional working-capital loans. Firms with validated products and recurring contracts may become candidates for receivables finance, supply-chain finance, or revenue-linked structures. Growth-stage firms with predictable cash flows may be eligible for more conventional debt and securitization mechanisms subject to legal and cash-flow requirements.

We use patient capital as a design principle, not as shorthand for a prescribed fund life. A public guidance fund, insurer, institutional investor, or strategic corporate investor can alter the effective financing horizon through milestone design, follow-on reserves, and performance measures that do not force every company toward the same exit date. What counts as 'patient' will therefore differ across ventures. For the firms considered here, technology validation, regulatory approval, customer adoption, and the emergence of visible cash flows are more informative benchmarks than a single number of years.

6.3 Policy-side: targeted risk sharing and coordinated implementation

A policy instrument should correspond to a diagnosed financing friction. Consider a qualified firm's first loan. If the main obstacle is uncertainty that neither the bank nor the borrower can efficiently absorb, a limited risk-sharing arrangement could be tested with explicit eligibility rules, an independently reviewed credit decision, a cap on public loss sharing, and a sunset date. That design would be inappropriate where the real obstacle is lawful access to data for underwriting. In the latter case, a controlled sandbox could instead test what information a bank may use, how consent or usage rights are documented, and whether privacy-preserving methods can provide a useful risk signal without transferring raw sensitive data. The point is to separate these problems before selecting the instrument.

The 2024 State Council policy already provides a legitimate policy basis for stronger financial support to eligible silver-economy projects. The research implication is to connect this broad policy direction to operational standards: who verifies data rights, who certifies technology performance, how banks document due diligence, and how risk-sharing arrangements are monitored. The paper does not recommend arbitrary increases in NPL tolerance or administrative immunity for lending officers, because such measures could weaken financial discipline.

7. Conclusion, Limitations, and Future Research

7.1 Conclusion

The six cases point to a financing problem that is more specific than a general shortage of capital. In some ventures, productive value is concentrated in resources that are difficult for a financier to verify or turn into enforceable rights. In others, the relevant tension is temporal: technical validation, regulation, procurement, and customer adoption do not necessarily unfold on the timetable built into the available financing instrument. A further difficulty appears where several institutional systems meet, particularly finance, data governance, health, technology, and eldercare. These observations are consistent with the three dimensions of Triple Mismatch, but they do not establish a universal causal relationship. We therefore use the framework as a case-bounded diagnostic device whose value lies in distinguishing different sources of financing friction.

For practice, the distinction changes the question from how to increase the volume of finance to how to improve its fit. A lender considering an intangible-intensive firm needs evidence that can be checked and used in a credit decision, not simply a declaration that the firm's data or intellectual property is valuable. Investors and public funds face a different issue: milestones and expected holding periods need to reflect the venture's validation and revenue path. Policy intervention has a role where standards are fragmented or a clearly specified risk can be shared without removing normal screening incentives. Across these settings, intangible value becomes relevant to finance only when the associated rights are lawful, the evidence is sufficiently observable, the route to cash flow can be documented, and the intermediary has the capacity to evaluate the remaining risk.

7.2 Limitations

The study has several limitations. The six cases were reconstructed from publicly available secondary sources, including financing announcements, company disclosures, investor records, and government documents. These sources vary in depth and do not provide the same access to decision processes as transaction files or interviews with financiers and founders.

The study is exploratory and cannot estimate the prevalence or causal effect of the three mismatches across the entire silver economy.

International examples are mechanism analogies and should not be interpreted as evidence of direct policy transferability.

The proposed mechanisms require legal, accounting, data-governance, and financial-regulatory testing before implementation.

7.3 Future research

Future research should test the framework with richer and more comparable data. A structured case database could record source provenance, financing outcomes, and standardized measures of asset recognition, capital duration, and institutional fit. Where policy pilots generate meaningful regional or temporal variation, quasi-experimental designs could examine whether targeted guarantees, data-enabled underwriting, or longer-horizon financing affect financing costs, access, or firm survival. Survey, interview, and transaction-level studies could then test whether the three dimensions

identified here predict lender behavior and investor allocation.

References

- Berger, A. N., & Udell, G. F. (1998). *The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle*. *Journal of Banking & Finance*, 22(6–8), 613–673. [https://doi.org/10.1016/S0378-4266\(98\)00038-7](https://doi.org/10.1016/S0378-4266(98)00038-7)
- Dubois, A., & Gadde, L.-E. (2002). *Systematic combining: An abductive approach to case research*. *Journal of Business Research*, 55(7), 553–560. [https://doi.org/10.1016/S0148-2963\(00\)00195-8](https://doi.org/10.1016/S0148-2963(00)00195-8)
- Eisenhardt, K. M. (1989). *Building theories from case study research*. *Academy of Management Review*, 14(4), 532–550. <https://doi.org/10.5465/amr.1989.4308385>
- General Office of the State Council of the People's Republic of China. (2024, January 15). *Opinions on developing the silver economy and enhancing the well-being of the elderly* (Guobanfa [2024] No. 1). The Central People's Government of the People's Republic of China.
- Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). *Seeking qualitative rigor in inductive research: Notes on the Gioia methodology*. *Organizational Research Methods*, 16(1), 15–31. <https://doi.org/10.1177/1094428112452151>
- Gustafsson-Wright, E., Gardiner, S., & Putcha, V. (2015). *The potential and limitations of impact bonds: Lessons from the first five years of experience worldwide*. Brookings Institution.
- Huang, Q. H., & Sheng, F. F. (2024). 新质生产力系统：要素特质、结构承载与功能取向 [The system of new quality productive forces: Factor characteristics, structural carriers and functional orientations]. *改革 [Reform]*, (2), 15–24.
- Japan Finance Corporation. (n.d.). 創業融資のご案内 [Guide to startup financing]. Japan Finance Corporation.
- Kaplan, S. N., & Strömberg, P. (2003). *Financial contracting theory meets the real world: An empirical analysis of venture capital contracts*. *The Review of Economic Studies*, 70(2), 281–315. <https://doi.org/10.1111/1467-937X.00245>
- National Bureau of Statistics of China. (2026, February 28). *Statistical communiqué of the People's Republic of China on the 2025 national economic and social development*.
- OECD. (2025). *Benchmarking government support for venture capital: A comparative analysis*. OECD SME and Entrepreneurship Papers, No. 71. OECD Publishing. <https://doi.org/10.1787/81e53985-en>
- Stiglitz, J. E., & Weiss, A. (1981). *Credit rationing in markets with imperfect information*. *American Economic Review*, 71(3), 393–410.
- Timmermans, S., & Tavory, I. (2012). *Theory construction in qualitative research: From grounded theory to abductive analysis*. *Sociological Theory*, 30(3), 167–186. <https://doi.org/10.1177/0735275112457914>
- Xi, J. P. (2024). 发展新质生产力是推动高质量发展的内在要求和重要着力点 [Developing new quality productive forces is an inherent requirement and an important focus for promoting high-quality development]. *求是 [Qishi]*, (11), 4–8.
- Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). SAGE Publications.

Appendix A. Final Evidence-Traceability Register

All empirical case claims retained in the manuscript are linked below to reproducible public sources. No participant or founder quotation is retained unless its exact source is available. Priority is given to official corporate, government, investor, or regulatory sources; specialized industry media are used for financing-event details when no primary filing is publicly available.

I D	Ca se	Source / type / URL	Claim supported	Confidence	Use in manuscript
--------	----------	---------------------	-----------------	------------	----------------------

A-01	A	Shanghai Rushen Robotics – About Us (accessed 2026-08-29) Official company https://www.robot-gym.com/about-us	Founded 2023; rehabilitation/eldercare robotics; multiple funding rounds claimed by company	High for identity/business; medium for self-reported funding count	Identity, technology domain
A-02	A	VCBeat, 2025-09-09 Industry financing report https://www.vcbeathealth.com/article/1697	Angel+ round worth tens of millions RMB; Dalton Venture; stated use of proceeds	High-medium	Financing event
A-03	A	Gerontech and Innovation Expo cum Summit 2025 Conference/institutional profile https://2025.gies.hk/en/summit/speakers-profile.html	Founder identity; eldercare focus; five rounds within two years stated in profile	Medium-high	Funding trajectory triangulation
B-01	B	BestCovered official website (accessed 2026-08-29) Official company https://bestcovered.com/	Digital cognitive-impairment assessment/intervention and AI/digital-therapy positioning	High	Identity, technology
B-02	B	VCBeat, 2022-09-16 Industry financing report https://www.vbdata.cn/1518872299	RMB 100m A+ round; investors; use of proceeds	High-medium	Financing event
B-03	B	Shanghai Civil Affairs Bureau, 2022-09-26 Government https://mzj.sh.gov.cn/laonianrenzhi/20220926/04d3db1e4be94033b273533c2be824df.html	Community deployment of digital cognitive-risk screening and intervention	High	Operational deployment
C-01	C	Lenovo Capital, 2023-02-28 Investor disclosure https://capital.lenovo.com/news/detail/id/776/s/1.html	Tens of millions RMB A round; neurological intelligent diagnosis	High	Financing and technology
C-02	C	Lenovo Capital, 2024-12-18 Investor disclosure https://capital.lenovo.com/news/detail/id/1063/s/1.html	Tens of millions RMB A+ round; cumulative financing trajectory	High	Financing trajectory
C-03	C	CAS Ruiyi official media archive (accessed 2026-08-29) Official company https://www.cas-ruiyi.com/pages/page-news.html	Product lines and financing announcements	High for company-reported facts	Triangulation
D-01	D	Yufu Technology official site (accessed 2026-08-29) Official company https://www.yffrom.com/	Founded 2019; PaaS/low-code eldercare SaaS; industrial investment reported	High for identity/product; medium-high for funding	Identity, business model
D-02	D	Everjoy Health Group, 2024-02-19 Official corporate announcement https://www.everjoyhealth.com/news/4565	Everjoy Duobao strategic investment in Yufu and smart-eldercare cooperation	High	Investment confirmation
E-01	E	VCBeat, 2026-07-03 Industry financing report https://www.vbdata.cn/1519083787	Multi-million-USD angel round; flexible medical-grade sensing; eldercare application	High-medium	Identity, financing, technology
F-	F	PEdaily company profile (accessed 2026-08-29) Investment database/media	Deyin founded 2022; angel and Pre-A rounds	Medium-high	Financing trajectory,

01		https://vc.pedaily.cn/company/865473.html	in 2025; eldercare robots		identity
F-02	F	Pudong New Area government document, 2025 Government https://www.pudong.gov.cn/zwgk/zwgk_zfxxgkml_atc_yj/2025/77/339242/985d1c28f79b4418b07eb2e2e5a784e7.pdf	Deyin nursing robot deployed in eldercare institutions; policy context	High	Operational deployment