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Systemic and Institutional Failures in Financing Science, Technology, and Innovation: The Case of Iran

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ABSTRACT

This study addresses the necessity of analyzing the ecosystem to identify systemic and institutional failures that hinder its effectiveness and to propose actionable solutions for reform. The research employs a qualitative analysis of national policy documents, development plans, and scholarly literature, complemented by expert validation, to extract, categorize, and interpret the main challenges and policy responses. The findings reveal nine categories: (1) Financial System of Higher Education and Research Institutions, (2) Government's Role in Supporting Strategic Research, (3) Supporting Demand-Driven Research, (4) Diversifying Financial Mechanisms and Tax Incentives, (5) Research Budget of Government Organizations and SOEs, (6) Supporting Financial Institutions, (7) Supporting science, technology, and innovation (STI) Financing through the Capital market, (8) Coordination and Cooperation among STI Financing Bodies, (9) Encouraging Private Sector Investment in R&D. To overcome these barriers, the study suggests various solutions, such as mission-oriented and performance-linked budgeting, expanding financial and legal autonomy for STI actors, activating legal capacities of knowledge-based acts, strengthening the capital market's role in innovation financing, diversifying financial institutions and instruments, and promoting university–industry–government collaboration. By categorizing both challenges and solutions into systemic and institutional domains, the paper provides policy solutions to reform Iran's STI financing ecosystem and strengthen its contribution to long-term development goals.

JEL Classification: O38, O31, G38

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1. Introduction

Financial governance in science, technology, and innovation (STI) systems is a cornerstone for achieving knowledge-based economic development. In national innovation systems (NIS), particularly in developing and transitional economies, the capacity to allocate, manage, and monitor public and private financial resources critically determines the effectiveness of universities, research institutions, the commercialization of technologies, and the country's global competitiveness (Mazzucato, 2018; OECD, 2015).

In Iran, the core framework for STI policy is outlined in the Comprehensive Scientific Map of Iran (CSMI), adopted in 2010 by the Supreme Council of the Cultural Revolution (SCCR). This strategic document, alongside provisions in five-year development plans and legal instruments, such as Article 56 of the Law on Financial Regulations (II), has set some objectives for STI financing which include increasing the share of R&D expenditure to 4% of Gross Domestic Product (GDP) and enhancing private sector participation in research financing to 50%.

Despite these ambitious commitments, Iran's STI funding system continues to face fundamental challenges: the share of R&D in GDP has stagnated below 0.5%, more than 70% of R&D relies on government budgets, and less than 20% of legally mandated allocations are actually disbursed to projects. Institutional fragmentation, overlapping mandates, and weak accountability mechanisms exacerbate these gaps. These conditions make it essential to investigate the failures of STI financing, as without reform, the strategic goals of the CSMI and development plans remain unattainable.

Researchers have made efforts in the field of studying CSMI to date (e.g., Alizadeh & Amiri, 2024; ATF, 2024; Janavi et al., 2020; Safdari Ranjbar & Alizadeh, 2021; MSRT, 2023). While these studies provide valuable diagnostic insights, there is a lack of integrated analysis that examines the STI financing institutional and systemic failures.

This study addresses this gap, seeking to address the following questions:

1. To what extent are Iran's STI financial policy instruments aligned with institutional capacities and strategic goals?
2. What explains the underperformance in STI financing despite legal mandates and strategic frameworks?
3. Which institutional and systemic failures and policy reforms are required to build a coherent, mission-oriented, and accountable STI financing system?
4. How can expert-informed, context-sensitive policy actions ensure realistic and implementable pathways for reform?

By combining document analysis and expert validation, this study employs an integrated theoretical and empirical approach to examine systemic and institutional challenges and solutions in STI financing in Iran. Following a review of the theoretical framework (Section 2), a mixed-methods methodology—combining document analysis and expert validation (Section 3)—is applied to investigate these challenges. The findings (Section 4) identify key challenges and policy solutions across nine core dimensions of Iran's STI financing ecosystem. The discussion (Section 5) interprets these results through an institutionalist lens. Section 6 provides conclusion and suggestions for future studies.

2. Theoretical Framework

2-1. Review of Prior Research

Understanding the STI financing challenges in Iran's STI system requires grounding in the scholarly and policy literature that has critically examined its evolution. Over the past decade, a diverse body of research has shed light on institutional fragmentation, weak policy design, and underperforming funding mechanisms. Reviewing this literature not only highlights the systemic shortcomings identified by previous scholars but also helps position the present study in relation to ongoing debates. The following review summarizes key findings from both earlier and more recent contributions.

Zaker-Salehi (2012) emphasized the lack of integration between science, research, higher education, and technology; weak demand for research; fragmented governance; and the absence of targeted instruments in national policies. Godarzi et al. (2014), through an assessment of development plans, recommended stronger inter-agency coordination, stakeholder engagement, and the use of demand-side policy tools. Other studies further demonstrate structural imbalances in policy design.

Mashayekhi (2016) argued that STI indicators have not progressed as expected under the CSMI, calling for problem-oriented goal setting and mechanisms to align science with societal needs. Fatemi and Arasti (2019) analyzed Iran's prioritization mechanisms and advocated for smart specialization and systemic, participatory approaches. Janavi et al. (2020), using scientometric analysis, found progress in quantitative publication metrics but noted persistent gaps in citation quality and impact indicators. Alizadeh and Tabatabaeian (2015) found a policy bias toward entrepreneurial activity, market formation, and resource mobilization, with insufficient support for knowledge diffusion and research guidance in STI policies in Iran. Ghazinoori et al. (2015) showed that nearly 60% of STI-related policy instruments in national plans focused on macroeconomic reforms, with little emphasis on catalytic or demand-side supports. Finally, Safdari Ranjbar and Alizadeh (2021) identified a wide array of legal instruments used to support innovation in Iran, but pointed to the underdevelopment of internationalization, IP protection, and STI diplomacy within those laws.

In sum, prior studies collectively underscore the persistence of fragmented governance, limited private-sector engagement, and underutilized policy instruments within Iran's STI financing landscape. However, most analyses remain either thematically narrow or descriptive, offering little in terms of integrative, implementation-focused frameworks. This study seeks to bridge that gap by combining a review of failures with a conceptual framework that highlights how financial governance can be redesigned to support long-term STI objectives.

2-2. Analytical and Comparative Framework for STI Financing

This study draws upon five complementary theoretical constructs to provide a comprehensive analytical foundation for examining Iran's STI financial governance challenges. These frameworks support a multilayered understanding of how failures arise and how reforms can be strategically designed.

- National Innovation System (NIS): The NIS perspective highlights that innovation is an emergent property of interactions among institutional actors, such as government agencies, higher education institutions, research centers, and private enterprises (Freeman, 1987; Lundvall, 1992; Nelson, 1993). Beyond the mere presence of these actors, the quality of their interlinkages—knowledge flows, coordination, policy coherence—determines system performance (Edquist, 2005). In developing contexts, insufficient financing, weak linkages, and fragmented governance can cause stagnation in the innovation ecosystem (Crespi & Dutrénit, 2014). This framework directly informs RQ1 ('To what extent are Iran's STI financial policy instruments aligned with institutional capacities and innovation goals?') by highlighting how coordination among actors determines overall system performance.
- Financial Governance and Institutional Failure: Financial governance refers to the formal and informal arrangements that shape the mobilization, distribution, and oversight of financial resources (Rodrik, 2008). Inadequacies in transparency, accountability, and coordination can produce institutional failures, defined as persistent inability to meet system objectives (Bresser-Pereira, 2009; North, 1990). These failures may take the form of budget rigidity, underutilized earmarked funds, or overlapping mandates. The link between poor governance and suboptimal outcomes in STI policy has been documented in both OECD and non-OECD contexts (Aghion et al., 2009; Schneider, 2015). This perspective supports RQ2 ('What explains the underperformance in STI financing despite legal mandates and strategic frameworks?') by identifying the governance-related mechanisms—such as budget rigidity and overlapping mandates—that hinder implementation.
- Policy Mix for Innovation: The innovation policy mix refers to the coherent combination of policy instruments used to address system failures and promote innovation (Flanagan et al., 2011; Ghazinoory et al., 2019). An optimal mix typically includes direct tools (e.g., project grants, institutional funding), indirect tools (e.g., tax credits, R&D subsidies) (Alizadeh & Amiri, 2024), and systemic tools (e.g., coordination platforms, innovation clusters) (OECD, 2012; Uyarra et al., 2017). The effectiveness of this mix is influenced by the country's policy capacity and administrative learning processes (Magro & Wilson, 2013). Iran's case illustrates a dominance of direct instruments, with insufficient experimentation in hybrid and indirect approaches. This framework provides the analytical lens for RQ3 ('Which institutional and

systemic failures and policy reforms are required to build a coherent, mission-oriented, and accountable STI financing system?'), as it emphasizes how the balance of direct, indirect, and systemic tools affects outcomes.

- Mission-Oriented and Transformative Innovation Policy: Building on classical industrial policy, recent scholarship emphasizes mission-oriented innovation policies (MOIPs), aligning STI efforts with grand societal challenges and long-term missions (Mazzucato, 2018; Weber & Rohracher, 2012). These policies require strong institutional coordination, adaptive governance, and funding models that incentivize risk-taking and long-term impact (Kattel & Mazzucato, 2018). Financial mechanisms should therefore go beyond cost-efficiency and embrace strategic foresight, learning, and multi-actor governance. This framework connects to RQ4 ('How can expert-informed, context-sensitive policy actions ensure realistic and implementable pathways for reform?') by stressing the need to align financing with long-term missions and societal challenges.
- Developmental State and Innovation Financing: In the context of middle-income countries, the role of the state in orchestrating innovation financing is particularly critical. Studies emphasize the importance of selective policy capacity, public-private coordination, and adaptive experimentation (Cimoli et al., 2009; Evans, 1995). Institutional inertia, fragmented budgeting, and donor dependence often hinder endogenous innovation financing systems in developing countries (Altenburg, 2011; Lall & Teubal, 1998). This perspective cuts across RQ1–RQ4 by situating Iran within a middle-income, state-led context where selective capacity, public–private coordination, and adaptive experimentation are essential for effective financing reforms.

These frameworks are not only theoretical but resonate with international practices. For instance, the European Union's Horizon programs operationalize mission-oriented financing, the OECD Innovation Strategy emphasizes policy mix evaluation, and UNESCO's STI policy guidelines stress national commitments to R&D intensity benchmarks. While Iran's STI financing system operates under distinct political-economic constraints, these international experiences offer comparative insights for adapting reforms to national conditions.

3. Methodology

To investigate the failures and policy implementation gaps in Iran's STI financing system, this study employed a triangulated qualitative methodology. It combined (1) qualitative document analysis (QDA), (2) institutional mapping and policy gap analysis, and (3) expert validation through focus group interviews (FGIs). This integrative approach enabled both a descriptive overview of the policy framework and an interpretive assessment of the institutional bottlenecks that practically hinder effective STI financing. Our use of document analysis and expert validation reflects an interpretive approach aligned with the institutional analysis framework adopted in this study.

Phase 1: Systematic Policy Document Analysis

The content analysis proceeded in four steps: (1) collection of relevant policy documents, (2) initial open coding to identify recurrent categories, (3) axial coding to refine and group codes under broader themes, and (4) selective coding to align findings with systemic failure categories.
In the first phase, a comprehensive content analysis was conducted on national and sectoral policy and legal documents, annual budget laws, and policy reports from 2010 to 2024. Key sources included:

- The Comprehensive Scientific Map of Iran (CSMI)
- The 5th, 6th, and 7th National Development Plans
- Annual Budget Acts (2016–2024)
- Article 56 of Law on Financial Regulation (II), and related R&D budget mandates
- Official data and policy reports from the Supreme Council for Science, Research, and Technology (SCSRT) (ATF, 2024), the Parliament Research Center (Kheradmandnia, 2023), the Ministry of Science, Research, and Technology (MSRT, 2023).
- Sector-specific reports on higher education, innovation financing, tax incentives, and venture capital development
- Comparative international data from UNESCO UIS (UNESCO, 2023), OECD MSTI (OECD, 2022), and the World Bank R&D Indicators (World Bank, 2022).

Following the methodological guidance of Bowen (2009) and Rapley (2007), the coding process generated nine overarching themes:

1. Financial System of Higher Education and Research Institutions
2. Government's Role in Supporting Strategic Research
3. Supporting Demand-Driven Research
4. Diversifying Financial Mechanisms and Incentives
5. Research Budget of Government Organizations and State-Owned Enterprises (SOEs)
6. Supporting Financial Institutions (venture capital funds, technology development funds, investment firms, and development banks)
7. Supporting STI Financing through the Capital market
8. Coordination and Cooperation among STI Financing Bodies
9. Encouraging Private Sector Investment in R&D

To ensure the validity of the content analysis, we used triangulation across multiple sources, including statutory documents, development plans, and official reports published by the Budget and Planning Organization (BPO), the Ministry of Science, Research and Technology (MSRT), and SCCR. Validity was also reinforced through expert judgment, whereby two independent STI policy scholars reviewed the coding scheme for conceptual consistency. Reliability was established by applying intercoder agreement: two researchers independently coded 20% of the documents, achieving a Cohen's Kappa coefficient of 0.80, which indicates substantial agreement.

Phase 2: Focus Group Interviews (FGIs) for Policy Validation

To validate findings and co-design practical reform strategies with a focus on CSMI, we conducted three rounds of Focus Group Interviews (FGIs). For the focus groups, methodological rigor was ensured through the purposive sampling of experts with diverse backgrounds (academia, government, and industry) to capture different perspectives on STI financing. Our panel included 13 experts from universities, the BPO, the MSRT, the Parliament Research Center, and the Oil Industry Research and Technology Fund. The criteria for inclusion were: (1) direct experience with STI financing, (2) senior-level responsibilities in budgeting, governance, or policy design, and (3) previous participation in national STI policy programs. This ensured both the diversity of perspectives and direct familiarity with Iran's STI financing mechanisms. In the final round, a separate panel (n = 4) validated proposed practical policy solutions. This iterative approach enhanced both the credibility and applicability of findings (See Table 1).

Validity was enhanced by developing a semi-structured guide aligned with the research questions and theoretical framework. To ensure reliability, the discussions were audio-recorded and analyzed. Member checking was also applied. To validate interpretation, four key participants were invited to review and confirm summaries of the discussions. Sessions were moderated by senior faculty with expertise in STI policy and were designed to facilitate structured discussions around the nine domains derived from the previous step on STI financing challenges. Participants reviewed the preliminary findings and critically assessed the proposed reform package across the nine strategic domains, which correspond to the national strategies in the curent version of CSMI articulated in the findings Section.

All discussions were transcribed and thematically coded. Policy actions were refined and prioritized based on expert consensus regarding their strategic relevance, legal feasibility, and operational applicability. Only those proposals that met the criteria of consensus and alignment with national priorities were included in the final policy solutions.

The analytical design of this study was guided by a set of core research questions formulated in alignment with the problem statement outlined in the introduction. These questions aimed to bridge the gap between Iran's formal STI financing frameworks and the realities of their implementation. Our analytical approach followed recent methodological advances in policy research that favor interpretive and realist paradigms over purely positivist models (Fischer, 2003; Yanow, 2000), particularly in governance systems where implementation often diverges from legal or policy intentions.

Table 1. Profile of Focus Group Participants

No.	Affiliation & Position	Area of Expertise (Role in Focus Group)
1	Faculty Member and Head of Science & Technology Financing Group, National Research Institute for Science Policy (NRISP)	STI Financial Policy & Governance (Session Moderator)
2	Faculty Member, University of Tehran	S&T Governance and Policy (Session Chair)
3	Deputy Director for Higher Education Budgeting, Plan and Budget Organization	Public Budgeting; Financial Oversight in Higher Education
4	Director-General for Planning and Programs, Ministry of Science, Research, and Technology	Strategic Planning; Higher Education & Research Funding
5	Faculty Member, Allameh Tabataba'i University	Public Policy; STI Strategy and Priority Setting
6	Faculty Member, University of Tehran; Former Deputy Secretary-General of ATF	Science Policy Governance; Institutional Coordination
7	Faculty Member, Tarbiat Modares University	Innovation Systems; R&D Commercialization
8	Deputy Director for Budget Affairs, Office of Planning and Programming, Ministry of Science, Research and Technology	Public Budgeting; Financing in Higher Education
9	Faculty Member and Head of the Technology Development and Knowledge-Based Production Group, Parliament Research Center	Financing of knowledge-based companies
10	Faculty Member, National Research Institute for Science Policy (NRISP), Head of the Office of the Deputy for Research Affairs, Ministry of Science, Research and Technology	Public Budgeting
11	Faculty Member, National Research Institute for Science Policy (NRISP)	Financing of knowledge-based companies
12	Deputy and Advisor to the President of the Oil Industry Research and Technology Fund	Financing through the capital market and non-governmental research and technology funds
13	Director-General of Higher Education Planning, Ministry of Science, Research and Technology	Financing in Higher Education

4. Findings

This section presents the key findings derived from a comprehensive review of national STI- policy documents, and expert interviews. The findings are organized around two core dimensions: first, the analysis of challenges for STI financing; and second, policy remedies aimed at reforming and strengthening Iran's STI financing architecture. The themes network extracted from the coded themes of the documents is presented in Figure 1.

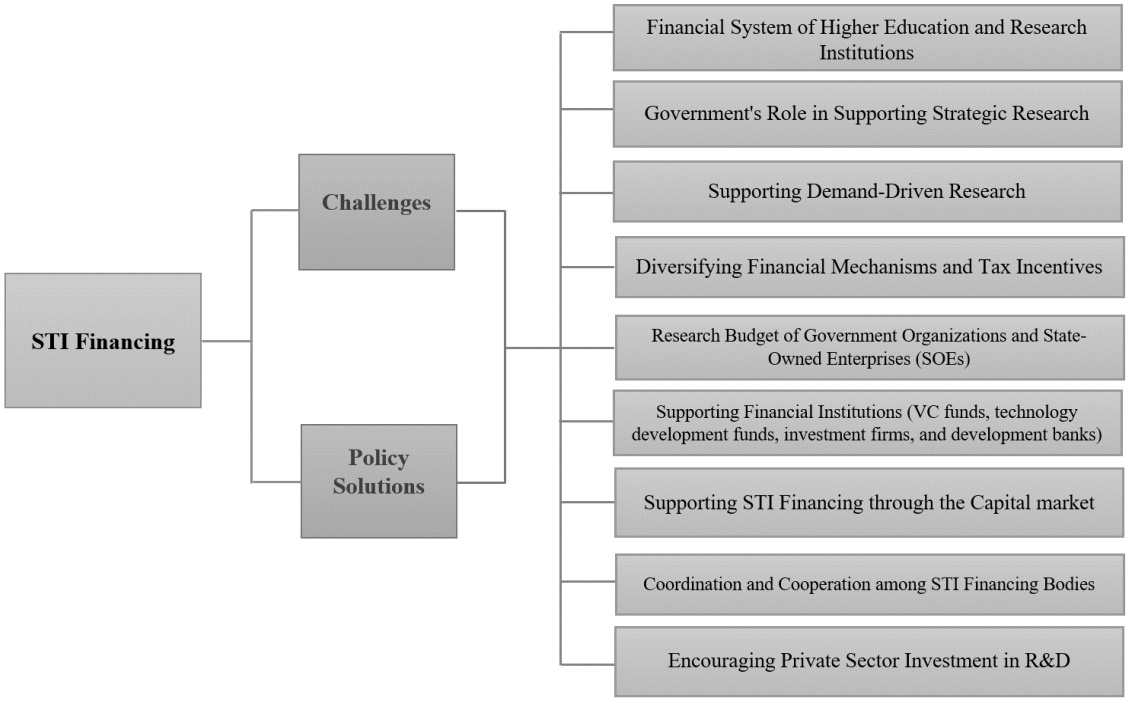

Fig. 1. Research Theme Network

4-1. Financial System of Higher Education and Research Institutions

There are deep-rooted challenges in Iran's higher education financing system, primarily characterized by incremental, non-performance-based budgeting, and limited evaluation mechanisms. Currently, university budgets are determined by historical expenditure patterns rather than outputs or outcomes, discouraging innovation and efficiency. Financial oversight remains narrowly focused on compliance audits, with little regard for academic quality or societal impact. This has contributed to declining research productivity and a proliferation of low-impact projects disconnected from real-world needs.

To overcome the above challenges, some actions should be taken by the policymakers and administrators:

- Reforming the student admission system based on scholarships, and revising the method of employing PhD students and postdoctoral researchers by linking capacities to the active needs of society and industry.
- Enhancing efficiency and reducing the costs of higher education through structural reforms and improving productivity in education, and promoting a new business model for universities based on offering professional training and accredited online programs.
- Reforming the salary and compensation system for faculty members (including base salary and additional income from community and industry engagement projects).
- Strengthening the legal framework for the financial and legal autonomy of universities to diversify financial resources and utilize non-governmental funds.
- Establishing transparent financial reporting systems, independent auditing, and oversight mechanisms to ensure the achievement of mission-based goals in educational and research institutions.
- Implementing mission-oriented budgeting by classifying universities based on core mandates (e.g., teaching, research, regional impact), allocating budgets accordingly, and introducing performance-linked budget allocation mechanisms based on measurable indicators, such as research output, societal impact, industry partnerships, and graduate employability.
- Developing programs for capacity building within university management teams in financial management, legal compliance, and institutional governance.

4-2. Government's Role in Supporting Strategic Research

Government Budget Allocations for R&D in Iran is reflected in the annual budget and comprises three components (Alizadeh, 2025a):

- R&D resources within research-related budget sections and programs: Until 2023, the national budget structure consisted of ten main categories, such as public services, defense and security, judiciary, economy, environment, housing and urban/rural development, health, culture and sports, education and research, and social welfare. Each category included a specific section for R&D with relevant programs, such as R&D in social welfare.
- R&D resources listed in miscellaneous budget items: In addition to formal R&D sections, the annual budget acts also allocate research funds under miscellaneous items. These items are unstable and unpredictable, making effective planning and oversight difficult. Budgetary best practices recommend minimizing such items.

Table 2. R&D Allocations in Miscellaneous Budget Items (in Billion IRR)

Year	2021	2022	2023	2024	2025
Miscellaneous Allocations	21,830	19,000	18,020	74,110	98,370

Source: Alizadeh (2025a)

- Under Article 56 of the Law on Financial Regulations (II), government organizations are required to allocate at least 1% of their operational budgets for research and technology development. SCSRT has implemented a national research management system, "SAMAT", to centralize this process. All eligible expenditures must go through this platform. In 2023, less than 20% of the legally mandated R&D funds were translated into actual projects or contracts. Over 80% of the funds were unused and returned to the treasury. This illustrates structural

inefficiencies and excessive bureaucracy, indicating that even increasing the R&D budget may not lead to better utilization unless processes are improved.

Table 3. Total Allocated vs. Actually Utilized R&D Budgets (in Billion IRR)

Year	2019	2020	2021	2022	2023	2024	2025
Total Allocated	30,000	23,000	25,000	27,000	41,360	53,010	10,539
Approved Projects	166	475	913	N.A.	365	N.A.	N.A.
Amount Disbursed	39	97	131	N.A.	59	N.A.	N.A.

Source: ATF (2024) and Kheradmandnia (2023). N.A.: Not Available

The finding analysis shows that challenges regarding government's role in supporting strategic research could be listed as follows:

- Incomplete Budget Utilization: As presented in Table 3, there is a significant gap between allocated and actually utilized R&D funds. In some years, less than 5% has been spent.
- Low Project Absorption: In 2023, over 80% of the funds lacked proper project proposals or defined research tasks.
- Complex Bureaucracy: The approval and funding process via SAMAT is rigid, causing delays and reduced effectiveness.
- Lack of Capacity in Executive Bodies: Many agencies lack dedicated research units, expert staff, or planning capabilities.
- Incompatibility with Internal Budget Systems: SAMAT is centrally designed and not aligned with internal financial mechanisms of various agencies.
- Lack of Incentives: There are no clear rewards or penalties for compliance, leading to organizational apathy toward research spending.

To control these problems, some policy solutions could be proposed:

- Establishing an intermediary body or “National Research Coordination Fund” to align budgeting and allocation with national research priorities, oversee the creation of internal R&D units within executive agencies, and prevent duplication across institutions.
- Defining strategic research projects for executive agencies as outputs of the 1% research budget allocation, based on a national list of R&D priorities to prevent scattered and non-priority spending.
- Reforming the SAMAT system architecture into a “National Research Information Ecosystem” as the central research database linked to citation, ranking, and financial systems, with traceability, evaluation, transparency, simplified interface, real-time financial tracking, and integration with national budgeting systems.
- Designing and implementing incentive mechanisms (increased authority or bonus budgets for compliant agencies, reductions or restrictions for non-compliant ones), with more flexible, output-oriented financial rules adapted to R&D expenditures.
- Establishing an annual ranking system for executive agencies’ research performance based on absorption rates, project quality, outputs, and university collaboration, with mandatory public reporting to Parliament and the SCSRT.

4-3. Supporting Demand-Driven Research

The main challenges and obstacles to support demand-driven research can be outlined as follows:

- Weaknesses in the operational structure of the “NAN” (Ideas and Needs platform), resulting in many government organizations and industrial firms either failing to register their needs properly or lacking effective participation in defining and following up on them.
- Lack of financial or institutional motivation for employers, such that companies and government organizations are often unwilling to fund 50% of research projects costs—especially under inflationary conditions and market unpredictability.
- Universities and research institutes lack sufficient capacity for negotiation, contract management, and technology transfer, leading to numerous research projects being defined unilaterally.

- Financial bureaucracy and delays in budget allocation, where the approval and payment process for project budgets discourage or delay private sector collaboration.

Our data analysis indicates that to support demand-driven research, some measure should be taken:

- Redesigning and strengthening the NAN platform as the national hub for managing research demand, with full integration into SAMAT and government financial systems.
- Developing a tripartite collaboration model between universities, employers, and government for national priority projects, alongside strengthening university–industry–community engagement through specialized legal, financial, and technology transfer offices.
- Activating existing legal capacities and the articles of the Knowledge-Based Production Act (state-owned enterprise R&D budgets, Article 11 for co-funded research, and Article 14 for the commercialization of public assets via PPPs) under the coordinating role of the Supreme Council for Science, Research, and Technology and its fund.
- Establishing a co-funded demand-driven research fund with government and employer contributions, and introducing incentive schemes for employers (tax relief, preferential loans, customs benefits) to reduce risk and promote engagement.
- Redefining evaluation criteria for demand-driven projects to emphasize problem-solving impact, employer satisfaction, commercialization success, and measurable economic or technological outcomes.

4-4. Diversifying Financial Mechanisms and Tax Incentives

Governments in many countries have sought to increase the private sector and innovative enterprises' share in financing research and technology through appropriate policies and incentive tools. However, Hamidi et al. (2021) argue that in the current situation of STI financing in Iran, there is a predominant emphasis on direct public funding tools. Given the fiscal constraints of the government, relying heavily on such instruments in the coming years is highly questionable.

With the implementation of the Law on Supporting Knowledge-Based Companies, the capitalization of the Iran National Inoovation Fund (INIF), and the ratification of Knowledge-Based Production Act, the aforementioned mechanisms and incentives have been partially executed (Alizadeh, 2025b). Therefore, several challenges remain regarding diversifying financial mechanisms:

- Dominance of direct public funding tools
- Despite the implementation of some tax incentives, there is no transparent, documented evidence of their impact on increasing R&D expenditures.
- Many tax incentives are not stable or predictable due to Iran's macroeconomic conditions and government budget fluctuations.
- Startups, due to the lack of profit or taxable base, cannot benefit from tax credits or exemptions—despite their greater need for support.
- A disconnect between Tax Organization, Vice-Presidency for Science and Technology (VPST), and INIF hinders coordination and slows the implementation of tax incentives.

Diversifying financial mechanisms could be improved by:

- Designing a comprehensive, transparent, and standardized "National Innovation Incentive Policy Framework," including principles, scope, types of incentives, tailored packages by company life cycle, and alignment with national innovation goals and legal instruments.
- Establishing a national-scale evaluation system for innovation incentive policies to assess the effectiveness of indirect supports on R&D indicators, with mandatory outcome assessments for each scheme.
- Strengthening the legal infrastructure for knowledge-based companies by removing systemic barriers, diversifying acceptable collateral, easing financial constraints, and facilitating engagement with the Central Bank and Customs.
- Designing and implementing innovative financing models (joint investment contracts, crowdfunding, innovation bonds) linked to platforms such as NAN and SAMAT, prioritized by strategic innovation outcomes.
- Establishing performance-based allocation mechanisms to ensure that incentives are granted based on proven innovation effectiveness.

- Creating an institutional coordination framework involving key governmental bodies (Tax Organization, Customs, Central Bank, MEAF, VPST) to streamline implementation, oversight, and synergy across the incentive system.

4-5. Organizing the Research Budget of Government Organizations and State-Owned Enterprises (SOEs)

According to the Iran's annual budget act, SOEs are required to allocate 60% of their allocated research budget to research activities. From 2019 to 2023, the ratio of research expenditures to the total budget of SOEs has declined significantly—from 0.13% in 2019 to just 0.03% in 2023. As a result, the legislature prohibited cuts to SOE research budgets in 2023, while the removal of the research clause in the 2024 budget act led to a 23% reduction in research allocations compared to the previous year (Gharakhanlou, 2023).

There has been no proportional increase in research expenditures of SOEs in line with their overall budget growth. For example, in 2023, research expenditure by SOEs was projected to exceed 10,810 billion IRR. However, despite a 17% increase in their overall budget in 2024, their research expenditure dropped by 23%.

Major Challenges regarding SOEs' research budget are as follows:

- Despite the increase in SOEs' total budgets in 2024, their research budgets decreased—showing a lack of research capacity building.
- A significant portion of SOEs' research funds is returned to the treasury, and there is no effective oversight of how the remaining funds are spent.
- The research budgets of SOEs are not effectively aligned with national scientific and technological priorities (e.g., the CSMI or the NAN platform).

To overcome these problems, some policy solutions could be proposed. For example:

- Designing a legally binding framework to encourage research participation by state-owned companies, embedding R&D spending obligations in national development plans or permanent budgets, tailored to each SOE's mission, size, and technological capacity, aligned with the CSMI.
- Launching the "National Monitoring System for Research in SOEs" with annual public reporting under SCSRT supervision, fully integrated with SAMAT and the National Budgeting System to track R&D allocations and expenditures transparently.
- Aligning SOE research programs with strategic guidance from SCSRT/ATF to ensure coherence with national priorities and prevent fragmented or non-strategic investments.

4-6. Supporting Financial Institutions within the STI system (including venture capital funds, technology development funds, investment firms, and development banks)

Today more than 60 research and technology funds (semi-public/private) have been established at national, provincial, or specialized levels. These funds serve as financial intermediaries for start-ups and knowledge-based companies. In addition, some private investment companies have tried to invest on innovation. However, capital market tools, such as innovation bonds, exchange-traded venture capital funds, and tech-focused investment portfolios, are not yet fully operational.

Several VC funds have also been launched on the stock exchange. However, the amount of capital raised by these funds remains limited, and their secondary markets are underdeveloped (Soltani & Shaverdi, 2019) .

Meanwhile, the idea of establishing a Development Bank for innovative enterprises was proposed in the Sixth and Seventh Development Plans. Although it has not yet been officially launched, some of its functions are currently performed by the INIF and other financial institutions.

Key challenges associated with financial institutions **include:**

- Various entities (INIF, research and technology funds, capital market institutions, investment firms) operate without a unified roadmap, synergistic mechanisms, or common standards.
- Due to the nature of their financial structure, commercial banks are generally reluctant to fund high-risk tech projects. As a result, venture capital investment is still mainly reliant on public

sources and many of VC funds still heavily depend on government support and lack sustainable business models.
- Instruments such as exchange-traded VC funds, innovation bonds, and tech investment firms have not been effectively launched or have very limited reach and no sustainable secondary markets.
- Tools including innovation risk insurance, B2B and B2G financing models, intellectual property secondary markets, advance purchase agreements, and technology debt securities are absent in Iran's innovation financing landscape.
- Although included in the Sixth and Seventh Development Plans, a dedicated Technology Development Bank has yet to be launched, creating a significant gap in the innovation financing chain.

Our findings show that some actions are necessary to support financial institutions within STI system. For instance:
- Developing a comprehensive framework for the expansion of knowledge-based financial institutions, identifying their types, functions, and linkage with the innovation commercialization chain.
- Developing the "National Program for Diversifying Innovation Financing Instruments" with participation from relevant bodies.
- Facilitating the use of existing legal capacities by non-governmental research and technology funds to increase capital and support innovation financing.

4-7. Supporting STI Financing through the Capital Market

The Iran's SME market has been designed for the admission of knowledge-based, technological, startup, and small companies. The goal of this market is to facilitate access to financial resources for small companies through the capital market, with simpler conditions, lighter reporting requirements, and financial transparency at an acceptable level. More than 20 knowledge-based companies have entered this market to date; however, compared to the country's actual capacity, this number is very low.

In addition, NoAfarin market is a trading platform for offering securities of innovative and non-listed companies. Its purpose is to create a pathway for startups and knowledge-based companies to enter the public financial system, even if they do not fully meet the requirements for entering the stock market. This market is still in its pilot and development stage and faces challenges such as the lack of accurate valuation of startups.

However, some challenges regarding STI financing through the capital market still exist:
- Complex and lengthy admission processes in the capital market
- The problem of evaluating knowledge-based companies, especially startups
- Lack of a dynamic and liquid secondary market for SMEs and startups
- High risk and lack of risk coverage tools (such as innovative investment insurance)

To support STI financing through the capital market, the requirements are as follows:
- Designing a "National Valuation Framework for Knowledge-Based and Startup Companies" with an emphasis on intangible assets, developed jointly by SEO, VPST, INIF, and financial institutions.
- Designing support packages for empowering knowledge-based companies and startups, including admission consulting, financial advising, auditing, technology rating, and financing through a "Capital Market Admission Support Fund."
- Developing a policy support package for SME and NovAfarin markets, including tax incentives, guaranteed minimum returns, and partial compensation of investor losses to reduce risks.
- Designing and implementing "Innovation Investment Insurance" and "Product Liability Insurance" in collaboration with INIF, Central Insurance, and MEAF for investors in emerging innovation markets.
- Designing a joint program with SEO for capital market tools in the technology sector, including venture capital funds, innovation bonds, and structured investment products.
- Developing an active secondary market for technology companies by attracting market makers, institutional investors, and creating a dedicated innovation market index.

4-8. Establishing a Coordination and Cooperation Network among STI Financing Bodies

The distribution and fragmentation of resources in STI across various organizations, institutions, and funds (such as the Iran National Science Foundation (INSF), ATF Fund, INIF, etc.) is a serious institutional issue, which necessitates centralized or semi-centralized management (at least regarding public funding) with the ability to consolidate, spend effectively, and prevent parallel, scattered, and redundant activities. More exactly, the main challenges regarding coordination among STI financing bodies in Iran can be listed as follows:

- Absence of a system for consolidating and jointly managing public resources for STI
- Lack of a unified database for tracking and evaluating research funding
- Duplication in the provision of facilities and supports without a unified policy

More coordination and cooperation among STI financing bodies requires:

- Defining the roles of ATF, VPST, MEAF, the Central Bank, and INIF to reduce redundancy and improve strategic coherence, with a permanent inter-agency council within VPST or PBO to coordinate resource planning across public and private stakeholders.
- Launching integrated financial databases to support transparency, coordination, and monitoring of STI allocations and expenditures through a unified digital platform connecting all national funds, ministries, and the Plan and Budget Organization.
- Defining and institutionalizing the functional division of STI financing institutions, assigning clear mandates for basic research (INSF), commercialization (INIF), and mission-oriented programs (ATF Fund) in alignment with national priorities.
- Ensuring public STI funding aligns with the Comprehensive Scientific Map of Iran (CSMI), the NAN demand system, and national R&D programs to prevent fragmentation and enable outcome-oriented budgeting.

4-9. Encouraging Private Sector Investment in R&D

In Iran, unlike developed countries where the majority of R&D investment is provided by the private sector, the primary burden of funding remains on the government. According to recent statistics, the share of R&D from GDP in Iran is around 0.5% or less (while the global average is above 2%). Of this amount, over 70% of R&D funding comes from public government budgets. In contrast, in advanced countries, over 60% of R&D funding is provided by the business sector on average.

The following are the key problems related to private investment in R&D:

- Ineffective enforcement of existing laws (e.g., the Knowledge-Based Production Act), despite tax and credit incentives.
- Weak alignment between macro-level policymaking and private sector priorities, with government–private sector interactions lacking binding and motivational mechanisms.
- Support and facilities (e.g., from INIF) are limited to officially recognized knowledge-based companies, excluding many large and innovative industries.

To increase private investment in R&D, there is a need for:

- Establishing a comprehensive system to incentivize private sector investment in R&D through policies, PPP mechanisms, and diversified tools such as tax incentives and technology pre-purchase markets.
- Creating an integrated statistical system to measure private R&D investment relative to GDP, with periodic publication in national science and innovation reports.
- Providing legal and policy frameworks for the transfer, valuation, and economic exploitation of research results, patents, and innovations.
- Creating a national network of innovative investors to define structural roles for private sector actors aligned with national STI policies.

Table 4 indicates a summary of findings on the challenges of STI financing in Iran as well as the proposed solutions. The table distinguish between systemic failures (structural, policy-level, and coordination issues) and institutional failures (organizational, operational, and implementation challenges). Accordingly, the solutions are also classified under these two categories. Systemic solutions such as establishing a National Research Coordination Fund, creating integrated financial databases, implementing mission-oriented and performance-based budgeting, and designing a National

Innovation Incentive Policy Framework. Institutional solutions incude reforming university admissions and salary systems, strengthening SOEs research participation, enhancing transparency through financial reporting, and building managerial capacity in universities and agencies.

Table 4. Summary of Findings on the Challenges of STI Financing in Iran and Proposed Solutions

Main Themes	Sub-themes	
	Challenges	Solutions
	Basic Themes	
Financial System of Higher Education and Research Institutions	• Incremental, non-performance-based budgeting (Systemic) • Little regard for academic quality or societal impact in evaluation mechanisms (Systemic)	• Reforming student admission and researcher employment systems (Institutional) • Enhancing efficiency, reducing costs, and promoting new university business models (Institutional) • Reforming faculty salary and compensation system (Institutional) • Strengthening financial and legal autonomy of universities (Systemic) • Establishing transparent financial reporting and oversight mechanisms (Systemic) • Implementing mission-oriented and performance-linked budgeting (Systemic) • Developing capacity building programs for university management teams (Institutional)
Government's Role in Supporting Strategic Research	• Instability and unpredictablity of miscellaneous budget items (Systemic) • Structural inefficiencies and excessive bureaucracy in the utilization of R&D budget (Systemic) • Incomplete Budget Utilization (Institutional) • Incompatibility with Internal Budget Systems (Systemic) • Low Project Absorption (Institutional) • Lack of Capacity in Executive Bodies (Institutional) • Lack of Incentives (Institutional)	• Establishing a National Research Coordination Fund (Systemic) • Defining strategic research projects based on national R&D priorities (Systemic) • Reforming the SAMAT system into a National Research Information Ecosystem (Systemic) • Creating internal R&D units in executive agencies (Institutional) • Designing incentive mechanisms and flexible financial rules for R&D funding (Institutional) • Establishing an annual ranking and public reporting system for executive agencies' research performance (Institutional)
Supporting Demand-Driven Research	• Weaknesses in the operational structure of the NAN (Ideas and Needs) platform (Systemic) • Financial bureaucracy and delays in budget allocation (Systemic) • Lack of financial or institutional motivation for employers (Institutional) • Insufficient capacity for negotiation, contract management, and technology transfer in universities and research institutes (Institutional)	• Redesigning and integrating the NAN platform with SAMAT and financial systems (Systemic) • Activating legal capacities and provisions of the Knowledge-Based Production Act under SCSRT supervision (Systemic) • Strengthening tripartite collaboration and university–industry–community engagement (Institutional) • Establishing a co-funded demand-driven research fund and employer incentive schemes (Institutional) • Redefining evaluation criteria for demand-driven research projects (Institutional)
Diversifying Financial Mechanisms and Tax Incentives	• Dominance of direct public funding tools (Systemic) • Tax incentives are not stable or predictable due to Iran's macroeconomic conditions and government budget fluctuations (Systemic) • Lack of transparent, documented evidence of tax incentives impact on increasing R&D expenditures (Systemic)	• Designing a national innovation incentive policy framework (Systemic) • Establishing a system to evaluate the effectiveness of innovation incentives (Systemic) • Coordinating key institutions to streamline implementation and oversight (Systemic) • Strengthening the legal and regulatory infrastructure for knowledge-based companies (Institutional) • Implementing innovative financing models linked to national platforms (Institutional) • Allocating incentives based on performance and proven innovation outcomes (Institutional)

Research Budget of Government Organizations and State-Owned Enterprises (SOEs)	• Decrease in SOEs' research budgets (Systemic) • Research budgets of SOEs are not effectively aligned with national scientific and technological priorities (Systemic)	• Establishing a legal framework to mandate SOE research participation (Systemic) • Aligning SOE research programs with national priorities (Systemic) • Launching a monitoring system for the transparent tracking of SOE R&D (Institutional)
Supporting financial institutions (venture capital funds, technology development funds, investment firms, and development banks)	• Various entities (INIF, research and technology funds, capital market institutions, investment firms) operate without a unified roadmap, synergistic mechanisms, or common standards (Systemic) • Instruments such as exchange-traded VC funds, innovation bonds, and tech investment firms have not been effectively launched (Systemic) • A dedicated Technology Development Bank has yet to be launched (Systemic) • Commercial banks are generally reluctant to fund high-risk tech projects. As a result, venture capital investment is still mainly reliant on public sources (Institutional)	• Expanding knowledge-based financial institutions and linking them to innovation commercialization (Systemic) • Diversifying innovation financing instruments at the national level (Systemic) • Facilitating the use of legal capacities by non-governmental research and technology funds (Institutional)
Supporting STI Financing through the Capital market	• Complex and lengthy admission processes in the capital market (Systemic) • Lack of a dynamic and liquid secondary market for SMEs and startups (Systemic) • The problem of evaluating knowledge-based companies, especially startups (Institutional) • High risk and lack of risk coverage tools (such as innovative investment insurance) (Institutional)	• Establishing a national valuation framework for knowledge-based and startup companies (Systemic) • Developing capital market tools for the technology sector, including venture funds and innovation bonds (Systemic) • Creating an active secondary market and dedicated innovation market index (Systemic) • Providing support packages and financial advisory services for startups and knowledge-based firms (Institutional) • Implementing policy incentives and risk-reduction measures for SME and NovAfarin markets (Institutional) • Introducing innovation and product liability insurance for investors in emerging markets (Institutional)
Coordination and Cooperation among STI Financing Bodies	• Absence of a system for consolidating and jointly managing public resources for STI (Systemic) • Lack of a unified database for tracking and evaluating research funding (Systemic) • Duplication in the provision of facilities and supports without a unified policy (Systemic)	• Clarifying roles of key STI institutions and establishing an inter-agency coordination council (Systemic) • Launching integrated financial databases for transparency and monitoring of STI funding (Systemic) • Institutionalizing functional divisions among STI financing institutions (Systemic) • Aligning public STI funding with national priorities and programs (Systemic)
Encouraging Private Sector Investment in R&D	• Ineffective enforcement of existing laws (e.g., the Knowledge-Based Production Act) despite tax and credit incentives (Systemic) • Weak alignment between macro-level policymaking and private sector priorities, with government–private sector interactions lacking binding and motivational mechanisms (Systemic) • Support and facilities (e.g., from INIF) are limited to officially recognized knowledge-based companies, excluding many large and innovative industries (Institutional)	• Incentivizing private sector investment in R&D through policies and PPPs (Systemic) • Measuring and reporting private R&D investment relative to GDP (Systemic) • Establishing legal and policy frameworks for research commercialization (Systemic) • Creating a national network of innovative investors aligned with STI policies (Institutional)

5. Discussion

This section reflects on the study's central research questions by synthesizing the findings from document analysis and expert validation. The aim is to draw interpretive insights that go beyond description and contribute to an actionable understanding of Iran's STI financing system.

5-1. Alignment of STI Policy Instruments with Institutional Capacity

The findings reveal that while Iran has developed a relatively robust set of STI financing policy instruments—including mandatory R&D budget allocations, strategic plans, tax incentives, and venture funding schemes—there is a clear mismatch between policy design and institutional capacity. Policy instruments often fail to account for the absorptive and managerial capacities of the implementing bodies, particularly public universities and research centers. Many legal mandates, such as the 1% R&D allocation by executive agencies and lacking enforcement mechanisms, are not accompanied by sufficient guidance, monitoring, or budget flexibility. This misalignment has led to widespread underutilization of allocated funds and fragmented implementation across sectors.

5-2. Explaining the Gaps Between Policy Design and Implementation

Despite formal policy frameworks, Iran's STI financing continues to underperform due to a combination of systemic and institutional constraints. Chief among these are the fragmentation of financing institutions, overlapping mandates, lack of transparent performance evaluation, and inadequate inter-agency coordination. Additionally, STI financing has remained highly centralized and state-dominated, with limited room for bottom-up innovation or the flexible use of funds by research institutions. Budget rigidity, poor linkages between research supply and demand, and the underdeveloped legal framework for financing partnerships further hinder the realization of policy objectives. These gaps reflect a broader governance issue where policy intentions are not sufficiently translated into implementation architecture.

5-3. Toward a Coherent and Mission-Oriented Financing Architecture

The proposed actions in Section 4 outlines nine national strategies aimed at addressing these systemic and institutional weaknesses. These include strengthening autonomy, linking research budgets to national missions, reforming incentive structures, activating capital markets, and enhancing coordination among financing bodies. By introducing mission-oriented budgeting and targeted funding tools—such as innovation insurance and demand-driven contracts—the financing system can evolve toward greater coherence, flexibility, and impact. Institutional reforms, such as financial decentralization, transparent reporting, and integrated digital monitoring systems, are also crucial for enabling a more adaptive and accountable financing architecture.

5-4. Feasibility and Relevance of the Proposed Policy Actions

The focus group interviews confirmed the strategic relevance and legal compatibility of most proposed actions. Experts emphasized that implementation success depends on aligning the reforms with existing governance frameworks, improving the operational capacity of funding institutions, and ensuring high-level political and budgetary support. Feasibility concerns were mainly raised around cross-agency coordination and private sector engagement, suggesting the need for piloting reforms in select institutions before full-scale rollout. Nonetheless, the expert-informed policy actions proposed in this study offers a realistic and context-sensitive roadmap for reforming Iran's STI financing architecture

6. Conclusion and Future Directions

This study has provided a comprehensive analysis of Iran's STI financing system, highlighting the structural and institutional failures that have hindered the country's progress toward its ambitious scientific and economic goals.

Our findings reveal that while Iran has enacted a wide array of strategic policies, these initiatives have largely failed to materialize in practice. For example, despite the legal obligation for executive agencies to allocate 1% of their operational budgets to R&D, actual disbursement rates remain dismally low. Likewise, attempts to activate financial instruments, such as tax incentives, public-

private partnerships, and capital market integration, have been limited in scope, poorly coordinated, and insufficiently evaluated.

In response to these challenges, the study proposed solutions for STI financial reform in Iran under nine ctegories: (1) Financial System of Higher Education and Research Institutions, (2) Government's Role in Supporting Strategic Research, (3) Supporting Demand-Driven Research, (4) Diversifying Financial Mechanisms and Tax Incentives, (5) Research Budget of Government Organizations and SOEs, (6) Supporting Financial Institutions, (7) Supporting STI Financing through the Capital Market, (8) Coordination and Cooperation among STI Financing Bodies, and (9) Encouraging Private Sector Investment in R&D. These proposals are grounded in empirical evidence and validated through national expert consultations, providing a roadmap toward a more resilient, accountable, and innovation-oriented STI financial ecosystem overall.

Breifly speaking, the reform of Iran’s STI financing ecosystem requires a fundamental shift in governance and institutional culture. This includes:

- Institutionalizing financial commitments within permanent legal frameworks to ensure long-term continuity and stability;
- Strengthening cross-agency coordination to reduce redundancy and ensure aligned mission execution;
- Empowering universities and research institutions with financial autonomy while ensuring transparent accountability structures;
- Designing outcome-based incentive systems for both public and private actors, particularly in linking financial support to innovation performance;
- Developing tailored financing instruments that reflect the needs of different types and stages of innovation, from early-stage R&D to commercialization;
- Enhancing statistical and data infrastructure for regular monitoring and evidence-based decision-making;
- Engaging the private sector not only as a source of funding but also as an active partner in defining and delivering innovation missions.

While this study seeks to provide a comprehensive institutional and systemic diagnosis, further empirical research is required to deepen understanding and inform practice:

- Quantitative evaluations of policy tools, such as tax credits, grant schemes, and capital market instruments, are necessary to measure their real-world impact on innovation outcomes.
- Comparative studies examining STI financial governance in other middle-income and resource-constrained countries could generate transferable lessons for Iran.
- Micro-level studies of universities and research institutions could reveal how financial autonomy affects their performance and mission alignment.
- Behavioral and political economy analyses could help explain resistance to reform within bureaucracies and public agencies.
- Exploration of digital technologies and fintech innovations in public funding platforms (e.g., blockchain-based transparency tools) may offer practical solutions for enhancing accountability and efficiency.

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