Vol. 7, No. 8, August 2026
E-ISSN:2723 – 6692 P-ISSN:2723– 6595
http://jiss.publikasiindonesia.id/

Reforming National Research Governance: Strategies to Enhance the Adoption of Research Outputs by Industry

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Keywords:
Research Governance; Research Commercialization; Innovation Ecosystem; Industry Collaboration; Technology Transfer

Abstract

The increasing production of scientific outputs, patents, and technological innovations in Indonesia has not been accompanied by a commensurate level of adoption by the industrial sector. This condition indicated the existence of a research commercialization gap, which can be attributed to fragmented national research governance, limited coordination among stakeholders, and weak alignment between research agendas and industrial needs. This research aims to formulate strategic policy recommendations for reforming national research governance to increase the utilization and commercialization of research outputs by industry. The study employed a descriptive qualitative approach using the USG (Urgency, Seriousness, Growth) method to prioritize key problems and the 5 Whys analysis to identify the root causes of low research adoption. The findings reveal that the main problem lies in the absence of an integrated and binding coordination mechanism among government institutions, research organizations, universities, and industry stakeholders. A comparative analysis of innovation governance practices in South Korea, Japan, China, Australia, and Singapore demonstrates that successful innovation ecosystems are supported by strong institutional coordination, industry-oriented research planning, co-funding mechanisms, and long-term collaboration frameworks. Based on a policy evaluation using William N. Dunn's criteria, the National Research Programming Mechanism, established through a Joint Steering Committee (JSC) and a National Research, Innovation, and Industry Master Plan, is identified as the most viable policy alternative. This policy reform is expected to strengthen research commercialization pathways, increase industry participation, and shift national research governance from a supply-driven model toward an innovation ecosystem oriented toward industrial needs and economic impact.

INTRODUCTION

Amid the global transition toward a knowledge-based economy, research institutions and universities bear strategic responsibilities that extend beyond traditional academic functions. These institutions are expected not only to generate measurable scientific outputs but also to demonstrate their capacity to deliver tangible impacts on the national productive sector. In recent years, government investment in research and development (R&D) has shown an upward trend, accompanied by a substantial increase in research outputs, including scientific publications, patents, laboratory prototypes, and technologies ready for application. However, this growth in research outputs has not been matched by a corresponding increase in their adoption by the industrial sector. Indonesia continues to face a major structural challenge in the form of low adoption of national research results by industry, despite the rapid growth in research output.

This gap highlights a significant research commercialization gap within the national innovation ecosystem, reflecting the disparity between the capacity of research institutions to generate new knowledge and their limited ability to transform it into economically valuable innovation products that can be adopted by the business sector (Bozeman, 2000; Siegel et al., 2003). In line with this, the OECD (2019) emphasizes that the limited absorption of public research results by the industrial sector is primarily attributable to weak technology assimilation capacity at the downstream stage. This condition limits the ability of publicly funded research investments to stimulate economic growth and generate substantial economic impacts that enhance national competitiveness.

The empirical condition regarding the research commercialization gap in Indonesia is reflected in the Global Innovation Index (GII) published by WIPO, specifically through two main pillars: Business Sophistication and Knowledge & Technology Outputs. The Business Sophistication pillar reflects the capacity of the industrial sector to absorb innovation through research collaboration, investment, and the use of research resources. Meanwhile, the Knowledge & Technology Outputs pillar measures the tangible outputs of research activities, such as patents, technology licenses, and technology-based products. These two pillars show that although Indonesia has increased research output, major challenges remain in integrating research results into the industrial sector.

A comparison of six ASEAN countries in the 2022–2025 period shows that Indonesia is still lagging behind other developing countries in the Southeast Asian region. In the Business Sophistication pillar, Malaysia is consistently in the 30s in the world, while Thailand, Vietnam, and the Philippines are in the 40–50 ranking range. In contrast, Indonesia ranks 83rd in 2025, down from 68th in 2022. A similar condition can also be seen in the Knowledge & Technology Outputs pillar, where Indonesia is still in the 70s ranking, while Vietnam and the Philippines have risen to the world 30–40 ranking range. This data shows that Indonesia's challenge lies not only in increasing the capacity to produce research, but also in the weak ability of industry to absorb and commercialize research results. A historical comparison of the two indicators is presented in Figures 1 and 2.

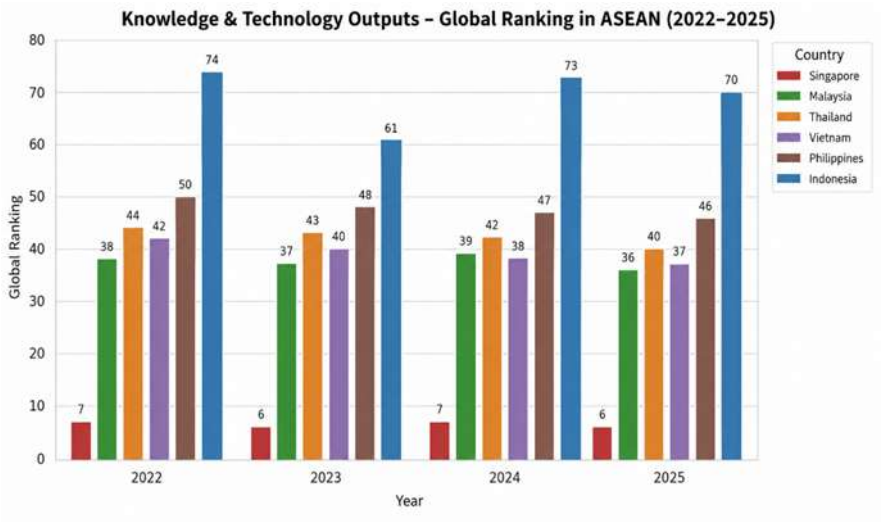

Figure 1. Knowledge & Technology Outputs

Source: World Intellectual Property Organization. (2022–2025). Global Innovation Index. WIPO

Figure 2. Business Sophistication

Source: World Intellectual Property Organization. (2022–2025). Global Innovation Index. WIPO

The limited capacity of the industry to absorb research results and the existence of a research commercialization gap in Indonesia are closely related to structural challenges in the upstream aspects of the innovation ecosystem, especially regarding the governance and posture of national research funding. One of the macro indicators that is an important benchmark to see the commitment and direction of a country's research policy is GERD (Gross Domestic Expenditure on Research and Development). The amount of GERD value, as well as the proportion of funding sources, has a significant influence on how research outputs can be optimally downstreamed to the productive sector.

Theoretically, the structure of research funding reflects the orientation of an innovation ecosystem, indicating whether it is driven primarily by market demand or academic supply. When research funding is predominantly provided by the private sector or business community, research activities tend to be more responsive to real-world commercial challenges and more likely to generate products that are ready for market adoption. Conversely, when research funding remains heavily dependent on public or government budgets, the development of strategic partnerships with the business sector may face greater constraints, resulting in research outputs that remain largely confined to scientific publications or laboratory stage prototypes.

Based on international standards released by the UNESCO Institute for Statistics (UIS) and the Global Innovation Index (GII) of the World Intellectual Property Organization (WIPO), a mature innovation ecosystem is generally supported by the active involvement of private funds. A comparison of the position of the value of Indonesia's research commitment with ASEAN and East Asian countries over the past ten years is summarized in Figure 3.

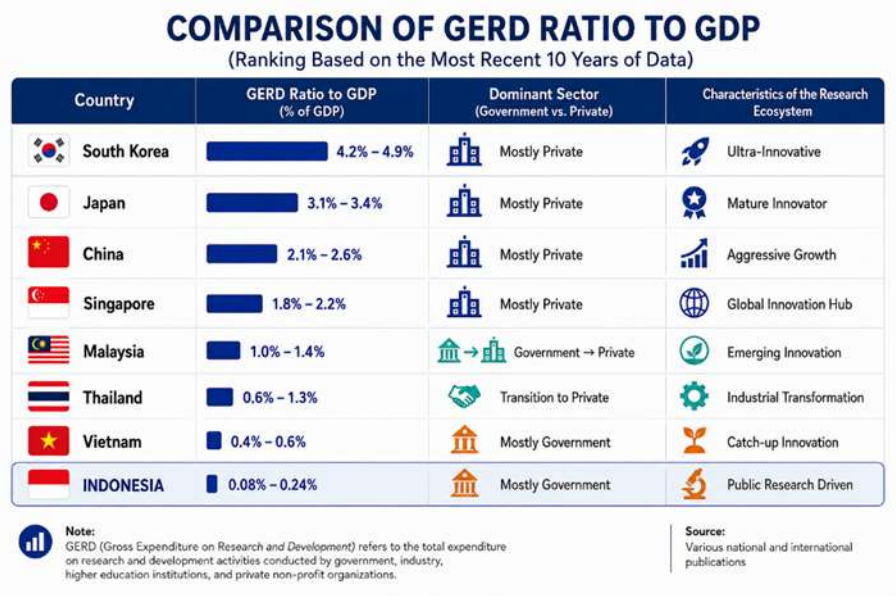

Figure 3. Cross-Country Comparison of R&D Investment Levels, Funding Structures, and Research Ecosystem Characteristics

Source: Processed Data

The gap between research outputs and industrial needs indicates that the utilization of national research results has not been optimal, posing significant strategic implications for R&D investment effectiveness, industrial competitiveness, and innovation-based economic transformation, as reflected in three main challenges: firstly, R&D spending has not generated sufficient economic impact because most research results remain confined to publications, patents, or early prototypes without being widely adopted by industry, necessitating stronger downstream mechanisms and alignment with user needs; secondly, the competitiveness of national industry is developing more slowly due to limited use of domestic research, making the industry more dependent on imported technology and weakening its long-term global competitiveness; and thirdly, the transformation toward an innovation-based economy is hampered by weak linkages between research institutions and the industrial sector, which limits the contribution of research to economic growth and risks trapping Indonesia in the middle-income threshold if not addressed immediately.

Based on the background and urgency outlined above, this study aims to formulate strategic policy recommendations for reforming national research governance to increase the utilization and commercialization of research outputs by industry, specifically by identifying the root causes of low research adoption through systematic analysis of governance fragmentation, conducting a comparative study of innovation governance practices in South Korea, Japan, China, Australia, and Singapore to extract relevant policy lessons, and evaluating viable policy alternatives to formulate a prioritized recommendation most suitable for the Indonesian context. The findings are expected to provide theoretical contributions to the literature on innovation governance and research commercialization in developing countries, as well as practical benefits as a decision-support tool for policymakers (BRIN, Kemdiktisaintek, Kemenperin, and Bappenas) in designing more effective and coherent national research strategies, while also offering actionable insights for industry stakeholders to engage more actively in research planning and for academic institutions to align their research

agendas with real-world industrial needs, thereby accelerating the downstreaming of research results and supporting Indonesia's transition toward an innovation-based economy.

METHOD

The writing of this policy recommendation used a descriptive qualitative approach with the USG (Urgency, Seriousness, Growth) method to determine the priority of problems related to the level of adoption of research results by the industry is still low compared to the number of research results produced. Data were collected through the scientific literature and three main problems were compiled which were then assessed using USG scoring. The number of USG is used to determine priority, where the problem with the highest score is designated as the main problem. This main problem is then further revealed to be the cause of the problem by using 5 whys.

Table 1. USG Calculation Results

No	Problems	Urgency (U)	Seriousness (S)	Growth (G)	Total
1	The needs of the industrial sector have not been systematically integrated into the national research planning process	**5**	**5**	**5**	**15**
2	Institutional capacity in technology transfer and commercialization of research results is still limited	4	5	4	13
3	Limitations of Domestic Industry Absorptive Capacity in Adopting Research Technology	4	4	4	12

Source: Author's analysis based on USG priority assessment, 2026

Based on the USG priority analysis, the main problem identified was that "The needs of the industrial sector have not been systematically integrated into the national research planning process." Through an in-depth analysis using the 5 Whys method, the underlying structural root cause was identified as follows:

Figure 4. Whys Root Cause Analysis

Source: Author's analysis based on USG priority assessment and problem identification, 2026

Problem Statement

The low utilization of national research results by the industrial sector is caused by the fragmented governance architecture of national research and innovation and the absence of a binding coordination mechanism across governments, research institutions, industry, and other stakeholders. As a result, research priorities are determined more based on the perspective of research providers than user needs, thereby widening the research commercialization gap, reducing the effectiveness of R&D investments, and hindering the improvement of national industrial competitiveness.

RESULTS AND DISCUSSION

Existing and Ongoing Policies for Research Commercialization and Industry Engagement

In general, the government has developed various policies to strengthen the downstream of research results and increase industry involvement, including through collaborative funding schemes, fiscal incentives, the construction of Science and Technology Parks, as well as the application of the principles of co-funding, co-creation, and industry call. However, most of these policies are still operating at the program level and are managed sectorally by each institution in accordance with their authority. As a result, the planning, funding, and implementation of research collaboration programs have not been integrated into a single national governance framework that is able to align industry needs with the national research agenda consistently. Table 2 presents the existing policies that support the research commercialization and industry engagement agenda discussed in this study.

Table 2. Existing Policy

Existing Policy	Purpose
RIIM (Research and Innovation for Advanced Indonesia) – BRIN	Funding collaborative research with partners, including industry, government, and society.
Downstream Research Priority and Strategic Program of the Ministry of Higher Education, Science and Technology–LPDP	Accelerating the downstream of university research results towards products that are ready for industry adoption through various schemes, such as SINERGI, Product Testing, and Technology Boosting.
Tax Incentives for R&D (Super Tax Deduction)	Encourage companies to increase research and development investment through tax incentives.
Science and Technology Park (STP)	Developing an ecosystem of innovation, business incubation, and commercialization of research results in various universities and BRIN areas.

Source: Compiled by the author based on policy document reviews (BRIN, 2023; Kemdiktisaintek, 2023; Ministry of Finance, 2020; Bappenas, 2021).

International Comparative Studies

International comparative studies are conducted to identify policy practices (best practices) that are proven to be able to increase the connectivity between research institutions and the industrial sector, resulting in a higher level of utilization and commercialization of research results. This comparative approach is not intended to replicate the policies of other countries in its entirety, but rather to obtain policy lessons on institutional design, funding mechanisms, and regulatory instruments that are relevant to the Indonesian context.

The election of South Korea, Japan, China, Australia, and Singapore was based on two key considerations. First, the five countries are part of the Asia-Pacific region which has developed into one of the growth centers of innovation, technology investment, and knowledge-based industries at the global level. This region has development dynamics that are relatively closer to Indonesia than Western countries, both in terms of geography, economic relations, and the intensity of regional cooperation. Second, the five countries are Indonesia's strategic partners in various fields, including research cooperation, technology development, higher education, investment, and industrial development. Their experience shows various governance models that are able to strengthen synergy between the government, research institutions, universities, and the industrial sector in building a national innovation ecosystem. Despite having different economic characteristics and institutional structures, all countries have succeeded in building mechanisms that ensure that industrial needs become an integral part of the process of planning, funding, implementation, and utilization of research results.

The analysis of the five countries is expected to produce lessons on the most appropriate policy design alternatives to overcome the low adoption of research results by industry in Indonesia.

South Korea - Co-Funding Matchmaking Scheme

This policy shifts control of research planning from academic institutions to industry through conditional financial incentives. The government no longer provides 100% research grants to public research institutions; rather, it requires matching funds from the industrial sector.

Institutional

South Korea has succeeded in eroding sectoral egos by not uniting public research institutions under the ministry of education. The commercial research sector is managed as an extensive network of Government-funded Research Institutes (GRIs) that specialize in each industry field under the coordination of the Ministry of Science and ICT (MSIT) through the National Research Council of Science & Technology (NST). This structure makes it easier for the government to direct the focus of research funding according to the needs of the industrial sector, while universities continue to focus on education and academic research through competitive funding.

Institutional Implementation

Government: Act as a provider of stimulant funds and regulators. Through the relevant ministries, the government stipulates that public research proposals will only pass curation if they are co-funded by industry at least 30-50%.

Public Research Institutions (GRIs) / Universities: Acts as a technical implementer (R&D provider). Because applied research budgets depend on industry commitments, researchers are forced to step out of the supply-push zone and adapt research topics to the commercial needs of partner companies.

Industry: Acts as an investor as well as a determinant of the research agenda (demand driver). The industry formulates real problems in the production line and selects competent research institutions to solve them.

Policy Implications

The co-funding scheme makes industry needs one of the bases in determining the research agenda, so that the planning and funding process takes place in a more integrated manner. This

mechanism also strengthens coordination between governments, research institutions, and industry through clearer division of roles. (Ministry of Science and ICT, n.d.; National Research Council of Science and Technology, n.d.; Lee & Yoo, 2019)

Japan - National Research Consortium Based on Performance Contracts

The Japanese government regularly maps the future direction of technology through the national Technology Foresight. Based on the roadmap, the government formed a thematic research consortium that legally binds three actors in a joint performance contract.

Institutional

Japan overcomes macro fragmentation by organizing its public research institutions into clustered networks of National Research and Development Agencies. Basic research institutions are centralized under RIKEN, while applied research and industrial bridges are coordinated centrally by AIST (National Institute of Advanced Industrial Science and Technology) under the Ministry of Economy, Trade and Industry (METI). This integration is fully supported by the Japan Science and Technology Agency (JST) as a national mission-based strategic funding channel, not the interests of the ministry's partitions.

Institutional Implementation

Government: Designing a national long-term technology roadmap with representatives of strategic industry associations. The government acts as a long-term funder of the ecosystem.

Research Consortium: A temporary 5-10 year forum in which researchers from various top universities are grouped and placed side by side with R&D engineers from multinational corporations.

Industry: Provides satellite laboratories within the consortium area, provides access to industrial-scale testing machines, and takes full responsibility for the downstream commercialization of the final product.

Policy Implications

Performance contract-based research consortiums strengthen inter-agency coordination through common targets oriented to value creation. This approach reduces institutional fragmentation and improves the continuity of cross-sectoral research collaboration. (RIKEN, n.d.; Agency for Science and Technology of Japan, n.d.; Ministry of Economy, Trade and Industry, n.d.; Japan Science and Technology Agency, n.d.; Ministry of Education, Culture, Sports, Science and Technology, n.d.; Stuart, 2020)

China - Mission-Oriented National Innovation System through Strategic Alliance

The Chinese government integrates the national research agenda through the State-led Innovation & Industrial Policy paradigm by mobilizing all strategic resources centrally (Whole-of-Nation System). The government drafted the National Innovation Blueprint and established the Industrial Technology Innovation Strategic Alliance that hierarchically binds public and corporate research institutions to solve bottleneck technologies.

Institutional

China centralizes policy control and funding under the Ministry of Science and Technology (MOST) and the National Natural Science Foundation of China (NSFC). The world's largest public research institution, the Chinese Academy of Sciences (CAS), is managed as one integrated giant network focused on the substitution target of imported technology. This state-led context is strengthened by the strategic role of State-Owned Enterprises (SOEs) and

national private corporations which are required by the country's industrial policy blueprint to act as lead innovators, absorbing, testing, and directly commercializing research outputs from CAS networks and top-tier universities.

Institutional Implementation

Government: Acts as a key architect of macro innovation, regulators, and long-term anchor fund providers through the Government Guidance Funds scheme. The government has set regulations that strictly align the allocation of public research funds with national industrial policy targets.

Public Research Institute (CAS) / Higher Education: Acting as a technical implementer of large-scale applied research. Scientist performance indicators are oriented to solve concrete technical targets proposed by industry alliances, thereby removing the trap of pure academic orientation (supply-push).

Industry (SOEs and Strategic Corporations): Act as a leader of innovation alliances downstream. The industry provides industrial-scale pilot facilities, injects accompanying capital, and is fully responsible for adopting the final product to be ready for use in the domestic and global markets.

Policy Implications

This policy directly solves the root problem of the misalignment between government research and the real needs of the industrial world. Through the state's firm direction from upstream to downstream, research institutions can no longer work alone in a closed manner. The state ensures that all research focuses in laboratories must be in line with the real technological needs needed by the national industry. (Chinese Academy of Sciences, n.d.; Ministry of Science and Technology, n.d.; National Natural Science Foundation of China, n.d.; Liu & Lundin, 2022)

Australia - Cooperative Research Centres

The Australian government develops a research collaboration mechanism through Cooperative Research Centres (CRCs), which are independent research entities in the form of long-term consortiums (7–10 years) that bring together public research institutions, universities, industry, and the government in producing innovative solutions oriented to industrial needs and commercial utilization.

Institutions: Australia is not building expensive new laboratory buildings, but rather creating a collaborative legal forum centralized under the Department of Industry, Science and Resources. The CRC program binds the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia's largest public research institution, as well as universities under the Australian Research Council (ARC) to put their best researchers under the management of a consortium controlled by the private sector. This model ensures that the state's knowledge assets are not confined within pure academic institutions, but are directly managed under the target market.

Institutional Implementation:

Government: Act as a competitive long-term funding provider and regulator. The government will only disburse grant funds if the proposed consortium has a clear downstream plan and is led by industry players, not by the university rectorate.

Public Research Institute (CSIRO) / Higher Education: Acts as a provider of scientific talent (R&D provider). Researchers are released from their institution's rigid internal credit score rules to work within CRCs with performance targets purely determined by the needs of partner industries.

Industry (Business Associations & Private Corporations): Act as the supreme leader of the consortium. The industry defines operational problems in the market, provides matching funds, and controls the commercialization rights of the final product.

Policy Implications

This policy sharply breaks down the barrier between research institutions. Universities and government agencies are forced to unify their facilities and agendas because state funding is only given to joint industry-led entities, so research from day one automatically runs according to the real needs of the market.

(Department of Industry, Science and Resources, n.d.; Commonwealth Scientific and Industrial Research Organisation, n.d.; O'Kane et al., 2020)

Singapore - Open Innovation Platform & Integrated Cluster Ecosystem

The Singapore government solves the problem of research fragmentation by building a fully integrated physical and digital cluster ecosystem through a one-stop command at the central government level. Public research institutions are placed directly in the heart of industrial estates to respond quickly to market needs, ensuring that research results are not stagnant in the laboratory but are optimally utilized by the industry.

Institution:

Singapore is addressing the fragmentation of research planning through a one-stop governance system under the National Research Foundation (NRF) which is directly under the Prime Minister's Office. The NRF has compiled the Research, Innovation and Enterprise (RIE), a five-year national strategy blueprint that locks in funding allocations and is mandatory for all ministries and universities to comply with. Singapore's public research function is consolidated into a single parent organization, A*STAR (Agency for Science, Technology and Research). As the main implementer of the RIE agenda, A*STAR operates dozens of cross-disciplinary research institutes in the One-North integrated area, a physical innovation hub where government laboratories, universities (NUS/NTU), and multinational industries are in direct contact to facilitate instant technology transfer.

Institutional Implementation:

Government (NRF under PMO): Answering *"What are the research priorities and how is it funded?"* through the preparation of the RIE. Keeping policies cross-sectoral and free from the ego of the ministry. In RIE2030 commitment, the Singapore government allocated a very significant amount of national research budget to fund a range of competitive research based on strategic missions (such as AI, semiconductors, and decarbonization).

Major Public Research Institutions (A*STAR) & Universities: Answering *"Who is doing the research and producing the technology?"* Researchers do not pursue administrative outputs, but are bound by performance contracts to bridge pure science to industrial commercialization (bridging academia and industry).

Supporting Agency (Economic Development Board & Enterprise Singapore): Acting downstream to bring together A*STAR's research technology with investors, the deep-tech startup ecosystem, and the global market.

Policy Implications

The integration of the RIE master document at the central government level and the physical unification of the laboratory are effective in overcoming governance fragmentation. Through this system, the orientation of research institutions shifts from a purely academic approach towards real problem-solving. The tightly locked state budget allocation on strategic sectors ensures that all research outputs have a clear commercial adoption path and are in line with industry needs from the beginning of planning.

(National Research Foundation, 2025; Agency for Science, Technology and Research, n.d.; Wong et al., 2020)

Policy Alternatives and Evaluations

Alternative I: Reform of National Research Planning Governance through the National Research Programming Mechanism

This alternative departs from the assumption that the low adoption of research by industry is more due to the absence of a mechanism for aligning research agendas since planning, rather than solely due to the capacity of research institutions. Without formal coordination mechanisms, the gap in innovation adoption tends to widen, especially in developing countries with fragmented innovation systems (Gulbrandsen & Thune, 2017; Freitas, Marques, & Silva, 2020).

In the current conditions, National Research and Innovation Agency (BRIN), the Ministry of Higher Education, Science, and Technology (Kemdiktisaintek), technical ministries, and funding institutions are still developing program priorities based on their respective sectoral mandates. As a result, although all institutions have the same goal of increasing national competitiveness, the direction of research funding often develops in parallel and has not been fully integrated with the technological needs of the productive sector. This fragmentation, according to Edler and Fagerberg (2017), is not caused by the absence of new organizations, but by the absence of coordination mechanisms. Therefore, this alternative offers a reform of the planning mechanism, rather than the formation of a new organization, an approach recommended to avoid excessive transaction costs and overlapping mandates (Borrás & Edler, 2020).

The government established a national mechanism that integrates the entire process of preparing research agendas before funding allocation is made by each funding agency. The mechanism is carried out through a Joint Steering Committee across ministries and institutions involving BRIN, Kemendiktisaintek, Ministry of Development Planning (Bappenas), the technical ministry, the Ministry of Industry (Kemenperin), industry associations, Indonesian Chamber of Commerce and Industry (KADIN), and other stakeholders. The effectiveness of cross-sector steering committees has been tested: Rampersad, Quester, and Troshani (2018) found that joint committees representing government, industry, and academia significantly improved the effectiveness of implementing national research agendas compared to stand-alone sectoral approaches. Mazzucato and Penna (2019) emphasize that this kind of coordination is

needed so that research funding does not just respond to the market, but actively shapes the direction of economic transformation.

The planning process begins with the identification of technological needs of the industrial sector which is carried out systematically through the Ministry of Industry and industry associations. These needs are then synergized with the results of technology foresight, national development priorities, and national research capacity owned by BRIN, Kemendiktisaintek and universities. This approach is in line with best practices in countries that have successfully transformed their innovation systems. Georghiou and Keenan (2017) emphasized that technology foresight integrated with national research planning, and not just a separate academic exercise, has proven effective in aligning the public research agenda with the long-term technological needs of the industry. In a more recent study, Calof and Smith (2021) showed that countries such as South Korea and Germany consistently use technology foresight as a systematic bridge between the identification of industrial needs and the allocation of research funding, resulting in higher adoption rates of innovation.

The integration of all these stages is the basis for the preparation of the National Research, Innovation, and Industry Master Plan as a five-year strategic document that sets the direction of research and innovation policies while ensuring alignment between the national research agenda, industrial technology needs, and economic transformation priorities. The presence of a multi-ministerial strategic roadmap has been identified as a critical factor in reducing research funding fragmentation and increasing national innovation output (Kuhlmann, Shapira, & Smits, 2022).

Alternative II: Research Funding Reform through Joint Programming and Co-Funding Matchmaking Schemes

This alternative proposes the establishment of a Joint National Research Program (JNRP) as a joint programming mechanism that integrates BRIN, Kemendiktisaintek, and industry into one joint research program. Strategic research projects are no longer funded separately, but are managed as a single national portfolio. Braun, Benninghoff, and Ramuz (2021) show that joint programming is able to reduce funding fragmentation because it forces sectoral actors to share agendas and resources within a single collective framework.

The implementation of JNRP began with the identification of technology needs, then BRIN and the Kemendiktisaintek opened a joint call for proposals. Industry contributes through matching funds or in-kind, BRIN provides research infrastructure, and the Kemendiktisaintek mobilizes the capacity of universities. Cunningham, Menter, and O'Reilly (2019) prove that co-funding schemes that require industry contributions significantly increase the relevance of research to the market and create structured institutional interdependence, rather than simply relying on individual commitments.

Proposals are evaluated by a joint panel based on scientific quality, Technology Readiness Level (TRL), and potential industry implementation. Janssen, Bogers, and Chesbrough (2021) emphasized that the effectiveness of public-private collaboration is largely determined by the institutional design of funding that creates structural interdependence, not by personal relationships alone. Borrás and Edler (2020) concluded that countries that succeed in increasing the economic impact of public research are those that are able to design funding schemes that by design force integration between public research capacity and the needs of the productive sector without the need to form new organizations.

Alternative III: Development of Innovation Consortiums Based on Strategic Industry Clusters

This alternative proposes the establishment of a Strategic Industry Cluster-Based Innovation Consortium as an institutional model for medium and long-term collaboration. The consortium was formed in national priority sectors such as semiconductors, electric vehicles, health, food, energy, and digital technology by bringing together BRIN, Kemendiktisaintek, universities, industry, technical ministries, local governments, and funding institutions in one innovation ecosystem that has a common research agenda. Nishimura and Okamuro (2018) found that cluster-based research consortiums involving heterogeneous actors significantly increase innovation capacity, especially in the high-tech sector.

In contrast to the approach that focuses on the development of physical areas only, this alternative places the Science and Technology Park (STP) as a supporting instrument, not a policy objective. STP serves as an operational location that provides shared laboratories, testing facilities, incubation, and demonstration centers. Minguillo, Tijssen, and Thelwall (2019) emphasize that the effectiveness of STP lies in the quality of collaborative networks and governance, not just physical infrastructure.

In this model, industry acts as a lead partner that conveys technological needs while providing an implementation environment, BRIN acts as a scientific coordinator and national research infrastructure provider, while the Kemendiktisaintek coordinates university participation and human resource capacity development. This clear division of roles is essential. Dhewanto, Prasetio, and Fauzi (2021) emphasized that without an explicit division of roles, consortiums are vulnerable to a governance vacuum.

With a consortium that works continuously, the process of problem identification, research, testing, and commercialization can take place in a complete innovation cycle. This sustainability is a critical factor that distinguishes a consortium from a short-term project scheme. Based on a longitudinal study from Scandura (2019), research consortiums designed with a long-term collaborative framework perspective produce a much higher level of technology commercialization than annual project funding schemes, because it allows for the accumulation of knowledge, trust, and mutual commitment between partners.

Formulation of Alternative Policy Evaluation

The three policy alternatives that have been formulated offer a different approach in addressing the low adoption of research results by the industrial sector, which is rooted in the lack of integrated governance of national research planning, funding, and implementation. Although all alternatives are directed at increasing the utilization of research results by industry, each has different characteristics, resource needs, levels of complexity of implementation, and potential impacts. These differences require a systematic evaluation process to identify the most effective, feasible, and appropriate policy alternatives in Indonesia's research and innovation governance.

The evaluation in this study uses the policy analysis framework of William N. Dunn (1999) which includes six criteria, namely effectiveness, efficiency, adequacy, equity, responsiveness, and administrative and political feasibility). This framework was chosen because it is able to comprehensively assess policy alternatives, not only in terms of achieving goals, but also considering the efficiency of resource use, the ability of policies to solve the root of problems, equitable distribution of benefits, responsiveness to stakeholder needs, and opportunities for implementation in the government system.

Table 3. Operational Definition of Evaluation Criteria William N. Dunn

Criteria	Operational Definition
Effectiveness	The ability of alternative policies to achieve the main goal, which is to increase the adoption of research results by industry
Efficiency	Comparison between the benefits generated by the costs and resources required
Sufficiency	Policy ability to solve the root cause of low research adoption significantly
Equity	Equitable distribution of policy benefits among stakeholders, sectors, and regions
Responsiveness	How quickly does the policy respond to the industry's urgent needs for research results
Administrative and Political Eligibility	Policy ability to be realistically implemented in the Indonesian government system

Rating Scale: 5 = Excellent, 4 = Good, 3 = Adequate, 2 = Less, 1 = Very Less

Source: Adapted from Dunn, W. N. (1999). Public policy analysis: An introduction (2nd ed.). Prentice Hall

Table 4. William N. Dunn Criteria Evaluation

Evaluation Criteria	Alternative 1 Score and Assessment Policy	Alternative 2 Score and Assessment Policy	Alternative 3 Score and Assessment Policy
Effectiveness	5-Most structurally effective. Coordination forums + master plan documents ensure all actors move in the same direction.	4-Effectively force de facto coordination, but depends on the willingness of the industry to invest.	3-Effective limited to priority sectors. It does not touch the national ecosystem.
Efficiency	4-No need for new organization. Simply modify the existing coordination mechanism + joint secretariat. Low-medium cost.	4-No need for new organization. Modification of existing funding mechanisms	3-Major investment for each consortium (facilities, human resources, multi-year funding).
Sufficiency	5-Directly target the root of the problem. Creating a formal coordination mechanism that binds across actors.	3-Limited to addressing funding issues, without resolving fragmentation in planning and coordination	4- Provides a platform for sustained collaboration, but remains limited to the sectoral level rather than extending to the national level
Equivalence	4-All actors (government, research institutions, industry, associations) get a place in the Joint Steering Committee.	3-Large industries are more able to provide companion funds. SMEs need an affirmative action scheme.	3-Only priority sectors are affordable.

Responsiveness	3-It takes time to build political consensus, draft master plan documents, and enforce compliance across ministries/agencies.	4-Can be implemented in 1–2 budget cycles. Matching fund incentives are quick to respond to industry needs.	3-It takes 1–3 years to form a mature consortium
Administrative and Political Eligibility	3- Resistance from ministries/agencies accustomed to institutional autonomy; requires a Presidential Regulation or joint regulation among the relevant ministries	4-Easier to accept. Fiscal incentives can reduce industry resistance.	3-The industry's readiness to lead the consortium is still low. Resistance from research institutions that are usually leads.
Total Score	24	22	19
Average	**4**	**3,67**	**3,17**

Source: Author's analysis based on policy evaluation using Dunn's criteria, 2026

Selected Policy Recommendations

Based on the evaluation using the framework of Dunn (1999) Alternative I: Governance Reform National Research Planning through the National Research Programming Mechanism was identified as the most appropriate policy option for addressing the root cause of fragmentation in national research governance. This alternative demonstrates significant advantages in terms of effectiveness and adequacy, as it establishes a formal and binding coordination mechanism across relevant actors. Rather than serving merely as a consultative forum, the mechanism ensures that its decisions serve as a common reference for research planning and budgeting across ministries and institutions.

This policy is recommended to the Head of the National Research and Innovation Agency and the Minister of Higher Education, Science, and Technology as the main person in charge of the implementation of national research; The Minister of Industry as the liaison for the technological needs of the industrial sector; and The Minister of National Development Planning/Head of Bappenas as the person in charge of integrating research adoption indicators within the framework of national development planning.

To ensure that the respective roles and mandates of these stakeholders are coordinated within a unified and binding policy framework, the following regulatory measures are required:

1. A joint regulation issued by the Head of the National Research and Innovation Agency and the Minister of Higher Education, Science, and Technology to establish a Joint Steering Committee (JSC) involving relevant ministries and institutions and mandate the development of a National Research, Innovation, and Industry Master Plan as a common reference.
2. A Regulation of the Minister of Industry requiring industry associations and KADIN to systematically identify and report the technological needs of the industrial sector as mandatory inputs into the preparation of the Master Plan.
3. A Regulation of the Minister of Higher Education, Science, and Technology requiring all universities to align their research agendas with the Master Plan and periodically report on the adoption of research results by industry.

4. A Presidential Regulation on the National Medium-Term Development Plan (RPJMN) establishing indicators of research adoption by industry as part of the national science and technology development performance indicators.

The substance of the policy regulates several main things:

Establishment of the Joint Steering Committee (JSC) as a Permanent Coordination Forum

The JSC will serve as a permanent coordination forum bringing together BRIN, Kemdiktisaintek, Bappenas, Kemenperin, the Ministry of Finance, industry associations, and academic representatives. Unlike a merely consultative forum, the JSC will have a binding decision-making function, with its decisions serving as a common reference for research planning and budgeting across ministries and institutions.

Preparation of a Single and Binding National Research, Innovation, and Industry Master Plan as a Reference for Planning and Budgeting

The JSC will develop a National Research, Innovation, and Industry Master Plan as a single and binding five-year strategic document. The national research agenda will be integrated into a single document jointly agreed upon by the JSC. Accordingly, BRIN and Kemdiktisaintek will no longer establish research priorities separately, but will formulate them through a single forum that produces jointly agreed national priorities. The Master Plan will serve as a binding instrument for research planning and budgeting, rather than merely as an administrative document.

The preparation process will be carried out systematically through three main stages. First, the Kemenperin, together with industry associations KADIN, will identify the technological needs of the industrial sector as a mandatory input and starting point for the preparation of the Master Plan. Second, BRIN will conduct national technology foresight to project Indonesia's long-term technology needs, ensuring that the Master Plan not only responds to current needs but also anticipates future needs, while remaining aligned with national development priorities. Third, the JSC will formulate national research priorities, establish measurable adoption indicators—including the Research Commercialization Rate, the percentage of projects involving industry partners, and increases in Technology Readiness Levels (TRLs), and determine resource allocations and the division of roles among ministries, institutions, and industry partners.

Determination of the Adoption of Research Results by Industry as an Indicator of National Science and Technology Development

Bappenas should integrate indicators measuring the adoption of research results by industry into the RPJMN as benchmarks for national science and technology development. This integration would encourage a shift in research policy orientation from a primary focus on research outputs toward the utilization and broader impact of research results. It would also ensure that the performance of national science and technology development is assessed based on the extent to which research results are adopted and generate added value for the industrial sector. Consequently, relevant ministries and institutions would share common targets and accountability for promoting research downstreaming, strengthening linkages between research institutions and industry, and enhancing the contribution of research to national productivity and competitiveness.

CONCLUSION

The low adoption of research results by the industrial sector remains a structural problem despite continued increases in national R&D spending. Global Innovation Index data place Indonesia below other ASEAN countries, particularly in the pillars of Business Sophistication and Knowledge & Technology Outputs. The 5 Whys analysis identifies the root cause as lying at the upstream policy formulation stage, where the needs of the productive sector have not been systematically integrated into the preparation of the national research agenda. To date, ministries and institutions have developed research priorities independently through a siloed approach, without a binding coordination mechanism across actors. As a result, research funding allocations have developed in parallel, while research orientation remains predominantly driven by a supply-push approach focused on publication targets rather than addressing industrial technology needs. Alternative I: Governance Reform of National Research Planning through a National Research Programming Mechanism was selected as the most appropriate policy to address siloed governance fragmentation. This alternative provides a formal coordination mechanism that is binding across relevant actors through the establishment of a Joint Steering Committee (JSC) and the development of a National Research, Innovation, and Industry Master Plan, which will serve as a common reference for research planning and budgeting. BRIN and Kemendiktisaintek would no longer develop research agendas separately within their respective institutional silos, but instead would do so through a single forum that establishes national priorities based on industry needs as a key input. The strategic implications of this policy include three aspects. First, BRIN and Kemdiktisaintek should jointly issue a regulation as the legal basis for establishing the JSC and developing the Master Plan. Second, Kemenperin, together with industry associations and KADIN, should act as demand-side representatives by providing data on industry technology needs as mandatory inputs into the preparation of the Master Plan. Third, Bappenas needs to integrate indicators of research adoption by industry into the RPJMN as benchmarks for national science and technology development.

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