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Policy Paper

Models of Research Collaboration to Support the Self-Reliance of Indonesia's Pharmaceutical Industry

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Abstract

Promoting a self-reliant pharmaceutical industry constitutes one of the national strategic agendas. The government undertakes efforts toward self-sufficiency to strengthen health resilience and advance Indonesia's economic transformation. This policy paper aims to formulate an integrated research collaboration model designed to enhance research and development capacity, increase domestic production capability, and reduce dependence on imported pharmaceutical raw materials and products. The research methodology encompasses an analysis of relevant policies and regulations, a comparative study of three countries considered to have more advanced pharmaceutical sectors, and a mapping of key actors and interaction mechanisms within the pharmaceutical research and innovation ecosystem. The problem identification findings indicate that current challenges include limited inter-institutional coordination, weak technology transfer mechanisms, and the suboptimal alignment between research funding and incentives with industry needs. This policy paper further finds that a primary prerequisite for mission-oriented research collaboration is the presence of a jointly agreed strategic vision among stakeholders, supported by collaborative funding schemes and adaptive intellectual property governance arrangements. The resulting policy recommendations emphasize the need to strengthen the role of the state as an orchestrator of collaboration and to ensure closer integration between research initiatives and pharmaceutical industrialization policies.

Keywords: Pharmaceutical Industry; Research Collaboration Model; Mission-Oriented Innovation; State Orchestration.

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1. Introduction

The self-reliance of the pharmaceutical industry has become a national strategic agenda driven by the need to strengthen health resilience, reduce structural dependence on imports, and support Indonesia's economic transformation. Despite increasing public investment in research and development, domestic pharmaceutical production remains heavily dependent on imported active pharmaceutical ingredients (APIs), intermediates, and certain finished products. This condition creates a structure that is vulnerable to disruptions in global supply chains and ultimately constrains the development of science, technology, and innovation capabilities, as well as the enhancement of domestic industrial value added in Indonesia.

In response, the Government of Indonesia has issued various policies to promote pharmaceutical industrialization, strengthen the national innovation system, and enhance collaboration among research institutions, universities, and industry. For example, the Ministry of Health has established three principal programs: research and development, production incentives, and market access guarantees to accelerate self-sufficiency in pharmaceutical raw materials. A similar commitment is reflected in Presidential Instruction Number 6 of 2016 on the Acceleration of Pharmaceutical and Medical Device Industry Development. In the context of research and development implementation, the Minister of Research, Technology, and Higher Education (currently the National Research and Innovation Agency/BRIN) is mandated to: (1) coordinate and direct research and development of pharmaceutical preparations and medical devices oriented toward national needs and utilization; and (2) conduct and promote the development of research personnel and establish research facilities, particularly for clinical and non-clinical studies, to meet the needs of experts and the pharmaceutical and medical device industries. Furthermore, Presidential Regulation Number 12 of 2025 concerning the National Medium-Term Development Plan (RPJMN) 2025–2029 translates research collaboration into the creation of a science, technology, and innovation ecosystem.

This ecosystem functions as an interactive platform that directly connects knowledge producers with end users—namely, industry, government, and society—through the orchestration of intermediary institutions. Existing intermediaries, such as Research and Community Service Institutions (LPPM), Science and Technology Parks (STPs), as well as regional and sectoral science, technology, and innovation hubs, are strengthened in their capacities to support evidence-based public policymaking and a sustainable knowledge-based economy, while accelerating innovation, fostering collaboration, and enhancing the diffusion and utilization of technology across stakeholders. These intermediary institutions serve as repositories and integrative nodes for knowledge generated by universities, research and development centers, and industrial research units. Such knowledge is subsequently matched with the full spectrum of demand for technologies and other research outputs originating from industries of all scales, as well as from society at large.

At the level of policy implementation, existing policy instruments continue to be translated in a fragmented manner, with limited integration between upstream research activities and downstream industrial needs. As a result, research outputs are often not effectively transformed into scalable technologies or commercially viable products, and they offer only a minimal contribution to strengthening domestic industry in terms of value addition and long-term sustainability.

Referring to the study by Yudhoyono et al. (2025), the health sector demonstrates relatively strong academic and research activity (APS 6.7%), exceeding the expected annual level. However, the impact of research as measured by citation performance (FWCI) remains below 13%, indicating the need to improve research quality. From an economic perspective, human health research appears to be overrepresented in quantitative terms relative to its contribution to GDP. This finding reinforces the earlier argument that the principal challenge lies in translational capacity—namely, the ability to convert research outcomes into tangible economic value creation.

The literature on pharmaceutical innovation in countries such as the United States, China, and India emphasizes the importance of research and development collaboration, technology transfer mechanisms, and mission-oriented policy frameworks (see Abrol and Singh, 2019; Sawant and Kumar, 2025; Wang, 2023). The United States, China, and India are used as benchmarks because they represent three distinct but successful models of integrating pharmaceutical research with industry, each offering relevant lessons for Indonesia. The United States exemplifies a highly mature innovation ecosystem, where strong university–industry linkages, venture capital, and technology transfer offices (e.g., Bayh–Dole framework)

effectively translate research into commercial pharmaceutical products. China demonstrates a state-driven, mission-oriented model, where the government actively orchestrates collaboration, funding, and industrial scaling to rapidly align research outputs with domestic pharmaceutical production. India creates a cost-efficient, industry-integrated model, particularly in generics and biosimilars, where close collaboration between public research institutions and private firms supports large-scale production and global competitiveness. Together, these countries provide complementary models of research–industry integration—market-driven, state-led, and hybrid efficiency-oriented—making them relevant comparative references for designing Indonesia's pharmaceutical innovation system. Nevertheless, a gap remains in the existing body of research, particularly in policy studies that systematically examine how an integrated research collaboration model can be designed and governed to support the self-reliance of Indonesia's pharmaceutical industry. Specifically, there is limited in-depth analysis of the state's role as an orchestrator in aligning stakeholder incentives, funding mechanisms, and intellectual property arrangements across the innovation ecosystem.

Various studies have examined both the barriers to and enabling factors of research collaboration (see Henry Etzkowitz and Loet Leydesdorff (2000); Loggers et al. (2025); O'Dwyer et al. (2023); and Sawant and Kumar (2025)). Identified barriers include intellectual property issues—particularly patent ownership, benefit-sharing arrangements, and publication rights—regulatory complexity, especially in the highly regulated pharmaceutical sector; differences in vision and incentives, where academics tend to prioritize publications and scientific advancement while industry actors focus on commercialization and profit; institutional rigidity, including slow administrative procedures and limited adaptability to industrial needs; and differences in organizational culture that affect communication, decision-making processes, and risk management. Conversely, several enabling factors have been identified as supporting effective research collaboration. These include the presence of a shared strategic vision, reinforced by the joint use of infrastructure such as laboratories, integrated research centers, and clinical trial facilities; effective intermediary structures, including technology transfer offices, incubators, and liaison institutions; trust-based relationships built through long-term interaction, transparency, and established knowledge-sharing routines; geographical and institutional proximity, particularly within scientific clusters; and supportive government policies. Such policy support encompasses substantial and equitably distributed funding among collaborative partners, intermediary institutions (e.g., regional research and innovation agencies, science techno parks, university research and community service institutes, and centers of excellence in science and technology), fiscal incentives, human resource mobility schemes, and conducive regulatory frameworks.

Referring to the outcomes of the Focus Group Discussion (FGD) conducted on 6 January 2026, it was found that Indonesia's pharmaceutical innovation system remains constrained by weak integration between research institutions and industry, resulting in limited translation of research outputs into commercially viable products. This gap is driven by unresolved intellectual property arrangements (e.g., patent ownership and benefit-sharing), misaligned incentives between academia (publication-oriented) and industry (profit- and market-oriented), as well as complex and often non-adaptive regulatory frameworks. In addition, intermediary institutions—such as science techno parks, technology transfer offices, and research hubs—have not yet functioned optimally as effective orchestrators that can bridge supply (knowledge producers) and demand (industry and society). These challenges are further compounded by low levels of trust, short-term collaboration patterns, and limited knowledge-sharing practices, which hinder the development of sustained partnerships. At the same time, structural limitations in funding and human resource mobility exacerbate these issues. Research funding is often fragmented, insufficient, and not designed to support the full innovation cycle from early-stage research to commercialization, creating a persistent "valley of death". Meanwhile, limited mobility between academia, industry, and government reduces opportunities for knowledge exchange and capability building. As a result, Indonesia has yet to establish a well-coordinated, mission-oriented innovation ecosystem, where the state effectively aligns stakeholder incentives, funding mechanisms, and regulatory support. This systemic gap ultimately constrains the country's progress toward pharmaceutical self-reliance, maintaining a high dependency on imported raw materials, technologies, and finished products.

This policy paper aims to develop an integrated and actionable framework for strengthening Indonesia's pharmaceutical self-reliance by systematically addressing three key dimensions: existing regulatory frameworks, research collaboration models, and recommended institutional arrangements.

First, the paper seeks to critically assess existing regulations and policy instruments governing pharmaceutical industrialization and research collaboration. Second, the paper aims to analyze prevailing research collaboration models within Indonesia's pharmaceutical innovation ecosystem, including the roles of universities, public research organizations, industry, and intermediary institutions (e.g., STPs, TTOs, and innovation hubs). Third, drawing on international benchmarks (e.g., market-driven, state-led, and hybrid models) and empirical findings, the paper aims to propose a set of recommended research collaboration models tailored to Indonesia's institutional context.

2. Methods

This study employs a descriptive qualitative approach with a policy analysis design tailored to the formulation of issues related to pharmaceutical industry self-reliance and research collaboration models. This approach was selected to enable a comprehensive understanding of policy dynamics and interactions among actors within the pharmaceutical research and innovation ecosystem.

This study employs a qualitative policy analysis combined with a structured comparative case study approach to identify effective research collaboration models that can support pharmaceutical self-reliance in Indonesia. The methodological approach is designed to generate policy-relevant insights by integrating regulatory analysis, international benchmarking, and empirical validation.

Data collection was conducted through three main approaches. First, a documentary review (desk study) was undertaken to systematically examine policy and regulatory frameworks governing pharmaceutical industrialization and research systems. This includes Law Number 17 of 2023 on Health, Law Number 11 of 2019 on the National System of Science and Technology, Law Number 3 of 2014 on Industry, Government Regulation Number 45 of 2019 concerning Amendments to Government Regulation Number 94 of 2010 on the Calculation of Taxable Income and the Settlement of Income Tax During the Current Fiscal Year, Government Regulation Number 28 of 2024 on Implementing Regulations of Law Number 17 of 2023 on Health, Presidential Regulation Number 38 of 2018 on the National Research Master Plan for 2017–2045, and Regulation of the National Research and Innovation Agency (BRIN) Number 9 of 2024 on the Governance of Research and Innovation Funding. Second, a comparative case study was carried out for the United States, China, and India using a structured data collection protocol to ensure consistency across cases. The protocol focuses on key dimensions such as research funding mechanisms, university–industry collaboration models, technology transfer systems, intellectual property governance, and the role of the state in orchestrating innovation. Third, empirical insights were incorporated through Focus Group Discussions (FGDs) and stakeholder consultations to validate findings and ensure their relevance to the Indonesian context.

To ensure robustness, this study relies on multiple data sources. These include primary policy documents, such as official government regulations and institutional mandates from both Indonesia and the comparator countries, as well as secondary sources, including peer-reviewed journal articles, policy reports, and publications from international organizations such as the World Health Organization (WHO), World Bank, and OECD. In addition, institutional reports and databases—covering indicators such as research and development expenditure, patent activity, and scientific publications—were utilized to support comparative analysis. Findings were further enriched by FGD outputs and expert inputs, which provide contextual understanding of implementation challenges and institutional dynamics. Primary data were obtained through a Focus Group Discussion (FGD) involving PT Bio Farma (Persero), PT Kimia Farma Tbk, PT Indofarma Tbk, PT Phapros Tbk, the Health Research Organization of Badan Riset dan Inovasi Nasional (BRIN), Danantara, and the relevant sectoral directorates within Kementerian PPN/Bappenas. The FGD was conducted on 6 January 2026. Discussions focused on existing or ongoing research collaboration models, implementation challenges, and policy recommendations for the government.

Several considerations were applied in the use of these data sources to ensure validity and policy relevance. First, comparability across countries was prioritized by selecting data that can be consistently mapped across different institutional settings. Second, the analysis incorporates context sensitivity, recognizing differences in governance systems, levels of industrial development, and market structures, thereby avoiding oversimplified generalizations. Third, data reliability and credibility were ensured by prioritizing official documents, peer-reviewed literature, and internationally recognized data sources. Fourth, the study emphasizes temporal relevance, focusing primarily on developments within the last 10–

15 years to reflect current policy and innovation trends. Finally, data triangulation was applied by cross-validating findings from multiple sources to reduce bias and strengthen analytical consistency.

The analysis applies a policy and innovation system framework to assess how effectively research systems are aligned with the needs of pharmaceutical industrialization. The analytical process begins with a within-case analysis, in which each comparator country is examined based on standardized dimensions, including research funding structures, collaboration mechanisms, technology transfer pathways, intellectual property governance, and the role of the state. This is followed by a cross-case comparative analysis to identify common success factors, distinguish different institutional models (such as market-driven, state-led, and hybrid approaches), and extract policy instruments that effectively bridge research and industry.

Subsequently, the findings are used to conduct a gap analysis for Indonesia, benchmarking the current national system against international best practices. This step aims to identify structural and institutional weaknesses, particularly those related to fragmented policies, weak intermediation, and limited translational capacity. Finally, the study synthesizes these insights into contextualized policy recommendations, focusing on improving regulatory coherence, strengthening research collaboration models, and enhancing the role of the state as an orchestrator of the innovation ecosystem.

Overall, this methodological approach ensures that the analysis is not only descriptive but also analytically rigorous and actionable, combining global comparative evidence with domestic validation to produce policy recommendations that are both context-sensitive and implementation-oriented.

3. Results and Discussions

Based on policy and regulatory analysis, international comparative studies, and the results of a Focus Group Discussion (FGD) with key stakeholders in the pharmaceutical sector, this study identifies that the principal challenge in achieving Indonesia's pharmaceutical industry self-reliance does not merely stem from limited research or industrial capacity. Rather, it lies in the weak integration and orchestration of research collaboration within the pharmaceutical innovation ecosystem. Although various policies (see table 1), programs and institutions have been established to support pharmaceutical research and development, the linkages among upstream research, technology development, and industrialization remain partial and fragmented.

Table 1. Mapping of Policy Support Across Various Regulations in Indonesia

Relevant Regulations	Provisions as Stipulated in the Articles
Law Number 17 of 2023 on Health	✓ Article 326 paragraph (4) point (c): The development and strengthening of governance of the supply chain for Pharmaceutical Preparations and Medical Devices as referred to in paragraph (2) shall be carried out, at a minimum, by providing support for the mastery and utilization of technology and innovation, as well as research and development in the field of Pharmaceutical Preparations and Medical Devices, including through international cooperation undertaken by the government and/or the community on a multilateral, regional, and bilateral basis in accordance with the provisions of laws and regulations ✓ Article 331 paragraph (2): Incentives as referred to in paragraph (1) shall also be granted to any Pharmaceutical Preparations and Medical Devices industry that conducts research, development, and innovation activities domestically, as well as to those that carry out production using domestically sourced raw materials. ✓ Article 403 paragraph (1) letter (e): The Central Government and Regional Governments are responsible for providing funding to be utilized for all research, development, and innovation activities in the health sector.
Law Number 11 of 2019 on the National System of Science and Technology	✓ Article 33 paragraph (2): The Central Government and Regional Governments shall synergize in facilitating the development of technology incubation, industrial partnerships, and/or the development of Science and Technology areas in accordance with regional readiness and advantages. Elucidation: The term "industrial partnership" refers to collaboration or cooperation between research and development institutions and/or assessment and application institutions with business entities to promote outputs from Research, Development, Assessment, and Application activities into products with economic value and utility. ✓ Article 72 paragraph (2): Partnerships as referred to in paragraph (1) shall include: a. ease of access to information; b. ease of access to science and

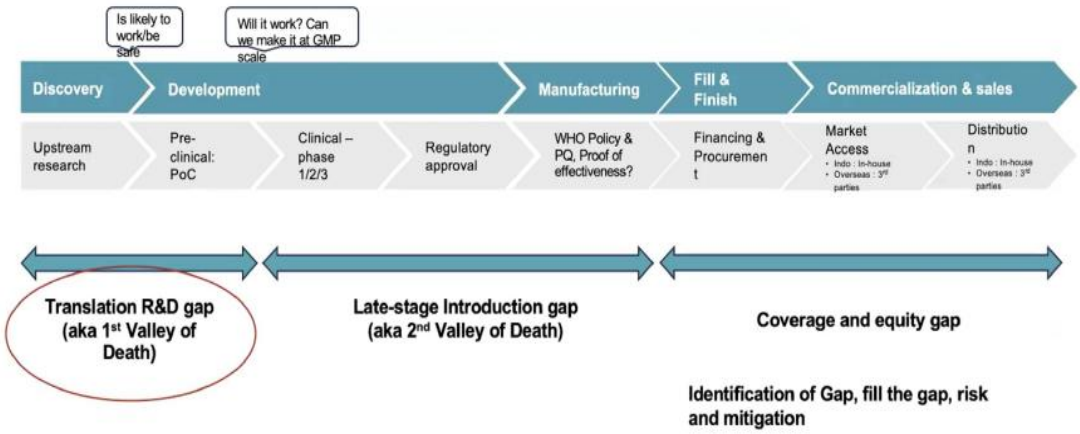
	technology facilities and infrastructure; and c. mobility of human resources in the field of science and technology. ✓ Article 83 paragraph (3): The development of Science and Technology networks as referred to in Article 81 paragraph (2) shall be carried out through the facilitation of partnerships between Science and Technology institutions and the Central Government, Regional Governments, business entities, the public, foreign Science and Technology institutions, foreign institutions, and international organizations.
Law Number 3 of 2014 on Industry	✓ Article 86 paragraph (1): Domestic products as referred to in Article 85 shall be mandatorily used by: a. state institutions, ministries, non-ministerial government institutions, and regional government work units in the procurement of goods/services where the funding sources originate from the State Budget (APBN), Regional Budgets (APBD), including loans or grants from domestic or foreign sources; and b. state-owned enterprises, regionally owned enterprises, and private business entities in the procurement of goods/services financed by the State Budget (APBN), Regional Budgets (APBD), and/or where the work is carried out through public–private partnership schemes and/or involves the utilization of state-controlled resources. ✓ Article 87 paragraph (1): The obligation to use domestic products as referred to in Article 86 paragraph (1) shall be implemented in accordance with the domestic content level of each good/service, as indicated by the value of the Domestic Component Level (TKDN). ✓ Article 42: The Government and Regional Governments shall facilitate: a. cooperation in research and development of science and technology in the industrial sector between Industrial Companies and universities or industrial research and development institutions, both domestic and foreign.
Government Regulation Number 45 of 2019 concerning Amendments to Government Regulation Number 94 of 2010 on the Calculation of Taxable Income and the Settlement of Income Tax During the Current Fiscal Year	Article 29C paragraph (1): Domestic corporate taxpayers conducting certain research and development activities in Indonesia may be granted a reduction in gross income of up to 300% (three hundred percent) of the total expenditures incurred for such research and development activities in Indonesia, which are deductible over a specified period.
Government Regulation Number 28 of 2024 on Implementing Regulations of Law Number 17 of 2023 on Health	✓ Article 54 paragraph (5): The community, in the form of business entities, may play a role in providing support for research and development activities in adolescent health. ✓ Article 935: Paragraph (1): The utilization of natural resources for the research and development of Natural Medicines and the maintenance of Natural Medicines shall be carried out through the regulation of sustainable agricultural cultivation systems. Paragraph (3): The utilization of natural resources as referred to in paragraph (1) may be conducted through partnerships involving business actors and farmers. ✓ Article 939: Paragraph (1): In the context of supporting the domestic production of Pharmaceutical Preparations and Medical Devices, the Central Government and Regional Governments shall provide incentives to the Pharmaceutical Preparations and Medical Devices industry and business actors that endeavor to achieve resilience in Pharmaceutical Preparations and Medical Devices. Paragraph (2): In addition to the support as referred to in paragraph (1), the Central Government and Regional Governments shall provide facilitation in research licensing and research support for institutions and/or the public conducting research. Paragraph (4): Incentives as referred to in paragraph (1) shall be granted to the Pharmaceutical Preparations and Medical Devices industry that meets the criteria of engaging in partnerships with research institutions, educational institutions, farmers, micro enterprises, small enterprises, and cooperatives. ✓ Article 940 paragraph (3): The Central Government and Regional Governments may facilitate the financing of public–private partnerships in the development of the domestic Pharmaceutical Preparations and Medical Devices industry that is still in the early stages of the industrial cycle and in the process of development, which requires protection from international competition until such industry becomes mature and stable. ✓ Article 996 paragraph (1): The implementation of research, development, and assessment of Health Technology as referred to in Article 994 letter (b) may be carried out through partnerships involving the Central Government, Regional Governments, and/or the community.

Presidential Regulation Number 38 of 2018 on the National Research Master Plan for 2017–2045	Improvement of the Research System and Enhancement of Research Funding: a) research funding originating from the private sector as part of corporate social responsibility; b) evaluation and revitalization of government research grant schemes at both the central and regional levels; c) evaluation of regulations governing the management of research funding within implementing institutions sourced from the private sector; d) incentives for research collaboration with global partners, both domestic and international; and e) research infrastructure grant schemes and other strategies deemed necessary.
Regulation of the National Research and Innovation Agency (BRIN) Number 9 of 2024 on the Governance of Research and Innovation Funding	Article 2: Research and Innovation funding may be utilized for: strengthening collaboration among research institutions.

The regulatory framework governing research collaboration in Indonesia's health sector is substantively comprehensive. However, the primary bottleneck lies not in regulatory insufficiency but in the lack of effective orchestration mechanisms that integrate research, development, industrialization, and public procurement into a coherent innovation pipeline. Furthermore, the FGD findings reveal a shared perception among state-owned pharmaceutical companies, research institutions, and policymakers that dependence on imported active pharmaceutical ingredients (APIs) and certain finished products remains very high. The discussion further indicates that raw materials are closely linked to proprietary technologies, making technological mastery, particularly of hard components, critically important. Technology producers are generally unwilling to separate raw material production from their established ecosystems, preferring that pharmaceutical inputs originate from the same integrated technological environment. This condition underscores the urgency of strengthening national research capacity to generate technologies and products that can be sustainably produced domestically. It also reaffirms that pharmaceutical industry self-reliance constitutes a systemic issue requiring cross-sectoral and multi-actor policy approaches (see Shawar et al., 2023; Xia, 2025; Odebunmi, 2025; Akbar and Zaman, 2025; World Health Organization, 2024; Wirtz et al., 2017).

Fragmentation of Research Funding and Its Impact on Downstreaming

One significant finding of this policy review is the fragmentation of pharmaceutical research funding. Policy analysis indicates that existing funding schemes are dispersed across multiple ministries and agencies and are not yet integrated within a coherent mission-oriented framework to support pharmaceutical industrialization. Research funding remains largely concentrated on basic research and early-stage applied research, with limited support for advanced development stages, such as Phase I, Phase II, and Phase III clinical trials.



Source: Presentation by Biofarma at the Discussion on Collaboration Models between Government, Universities, and Industry to Support Pharmaceutical Industry Self-Reliance, 6 January 2026

Figure 1. Critical Phases of Vaccine Development

The FGD revealed that the pharmaceutical industry, particularly state-owned enterprises (SOEs), faces a funding gap during the transition from research to production. The technological and commercial risks at this stage are considered too high to be borne entirely by industry, while public funding schemes have not yet been designed to bridge this gap. Similar challenges are observed in other government

research institutions, including universities. Down streaming costs and compliance with global standards constitute major obstacles. As a result, many research outputs stall at intermediate technology readiness levels and do not progress to commercialization.

Current research funding is primarily competition-based (Call for Proposals). This situation highlights the need for mission-oriented or affirmative funding schemes, particularly for research that has reached mid-level technology readiness (e.g., levels 5–6). According to information shared during the FGD, Danantara also promotes the adoption of advanced technologies and industrial innovation within SOEs to strengthen national economic growth and enhance Indonesia's competitiveness globally.

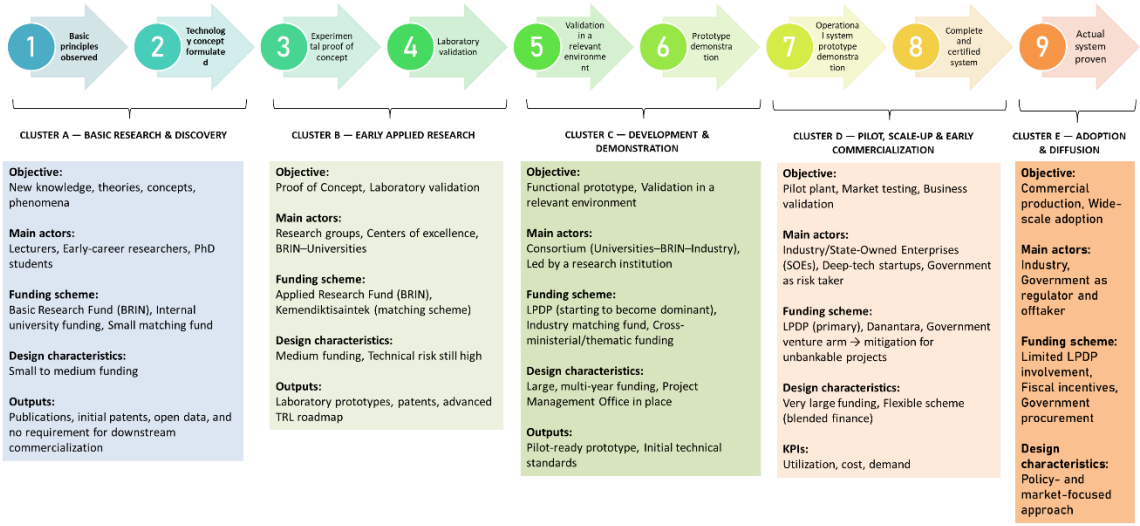


Figure 2. Research Funding Design Based on Technology Readiness Level

These findings align with international practices showing that countries with strong pharmaceutical industries generally provide collaborative funding schemes explicitly aimed at bridging the "valley of death" between research and industry (Hudson and Khazragui, 2013; Calza et al., 2021; Ellwood et al., 2022). In the context of Indonesia, the absence of an integrated, mission-oriented funding mechanism remains a major barrier to translating research outputs into strengthened domestic pharmaceutical industry capacity.

Weaknesses in Technology Transfer Mechanisms within Research Collaboration

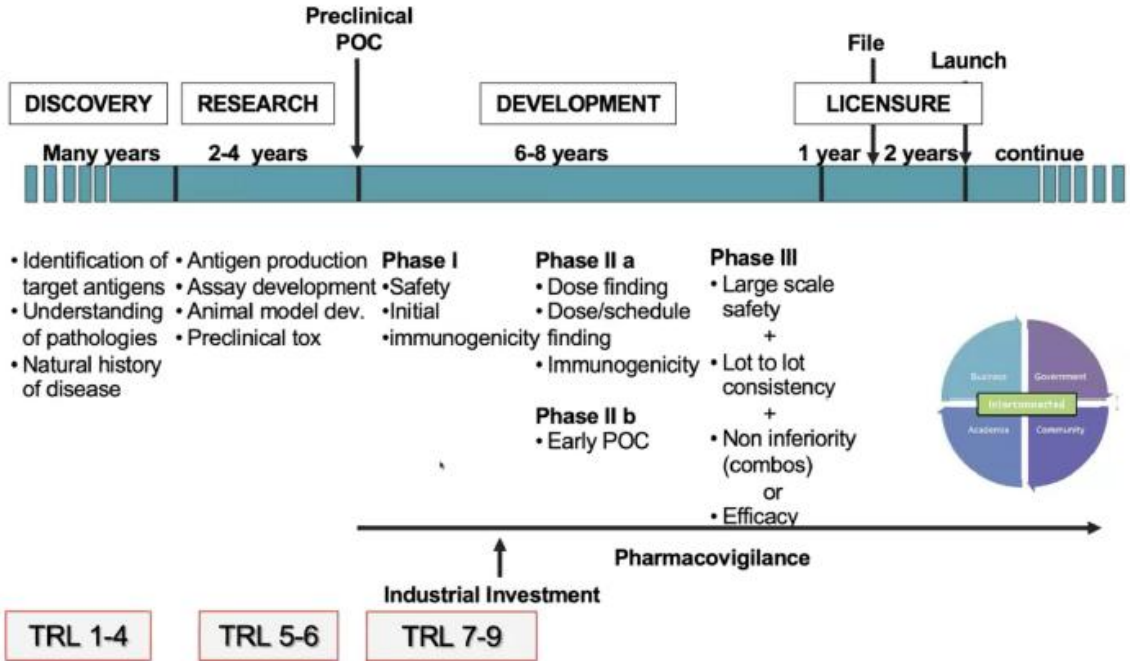
This study also found that technology transfer mechanisms in pharmaceutical research collaboration are not yet functioning effectively. Although various forms of cooperation exist between research institutions and industry, such collaborations are generally limited to early-stage research or laboratory testing. Technology transfer to an industrial scale frequently encounters technical, institutional, and regulatory challenges.

Technical challenges arise primarily during scale-up, where laboratory-scale results may not remain stable or maintain consistent quality when manufactured at an industrial scale. Industries also face challenges regarding standards, especially for research focused on innovation rather than invention. Another fundamental issue is raw material quality, which can lead to inconsistencies in final products.

Institutional challenges include the difficulty for the industry to maintain collaboration with researchers, who often remain focused on academic publication. Once the research is published, ongoing collaboration can become fragile. Researchers themselves often lack experience in commercialization, which results in insufficient consideration of economic feasibility and pricing factors that are essential from an industry perspective.

Regulatory challenges involve compliance with standards set by the Indonesian Food and Drug Supervisory Agency, which require strict testing for safety, quality, and efficacy before marketing authorization is granted. This is critical, given the importance of pharmaceutical applications for both humans and animals. Industry stakeholders also emphasize the need for harmonization of national and international standards, including those established by the World Health Organization.

Market risk arises from the lack of government procurement guarantees for domestic research and innovation products, including APIs, either through state-owned pharmaceutical companies, public procurement policies, or integration into the National Health Insurance (JKN) scheme. This poses a major challenge for the industry in pursuing downstream processing, as commercial risks remain high even after the technology has been successfully developed.



Source: Presentation by Biofarma at the Discussion on Collaboration Models between Government, Universities, and Industry to Support Pharmaceutical Industry Self-Reliance, 6 January 2026

Figure 3. Drug/Vaccine Research and Development and Value Chain

Comparative international analysis indicates that countries that have successfully developed self-reliant pharmaceutical industries generally possess bridging institutions tasked specifically with managing technology transfer, supporting production process development, and facilitating intensive interactions between researchers and industry actors (Villani et al., 2017; Watkins et al., 2015). In the context of Indonesia, such intermediary functions have not yet been systematically established, resulting in technology transfer processes that depend largely on individual initiatives or specific projects.

Intellectual Property Regulation and Collaboration Incentives

Intellectual property (IP) regulation emerges as another critical issue. Policy analysis shows that the national IP framework provides protection for research outputs but does not fully support complex multi-stakeholder collaboration models, particularly between public research institutions and industry. FGD findings indicate that unclear allocation of IP rights and benefits often discourages industry participation from the early stages of research. Industry actors tend to be cautious about investing in collaborative research if future access to and utilization of technology is uncertain. Conversely, research institutions face pressure to retain IP ownership as a performance indicator, which does not always align with downstreaming objectives.

This discussion highlights that strengthening pharmaceutical industry self-reliance requires more than increasing patent counts or research outputs; it necessitates an adaptive, utilization-oriented IP framework. International experience demonstrates that flexibility in IP management, including industry-friendly and mission-oriented licensing schemes, can serve as a crucial incentive for sustained research collaboration (Herder, 2006; Puliga, 2019).

The adoption of aspects of the Bayh–Dole Act of 1980 could also be considered in Indonesia, particularly the emphasis on patenting research outputs. Ideally, patents with high commercialization potential should be protected without imposing burdensome annual maintenance costs on the managing

institution. Additionally, licensing activities should be routinely reported as a form of performance accountability.

The Role of the State as Orchestrator of Research Collaboration

Another key finding from this policy review is the importance of the state's role as orchestrator in pharmaceutical research collaboration. Analysis indicates that while the state has acted as regulator and funding provider, its orchestration function—bringing together actors, aligning objectives, and ensuring policy continuity—has not yet been fully implemented. FGD results emphasize that stakeholders require clearer and more consistent policy direction regarding the implementation of national pharmaceutical research priorities. Without a mutually agreed-upon mission framework, research collaborations tend to operate in isolation and fail to produce systemic impact.

Furthermore, effective orchestration requires consistent dialogue, milestone-based evaluations, contract-based deliverables, cross-ministry steering committees, and output-based audits, rather than focusing solely on procedural compliance.

Source: The Authors (2026)

Figure 4. Mission-Oriented Research and Innovation Policy

FGD findings further indicate that the state occupies a strategic position in establishing a national mission-oriented research agenda that connects public health needs with industrialization strategies. Specifically, government support as an orchestrator encompasses the following roles:

1. Anchor Investor: Through investment agencies, the government functions as an anchor investor in technology development projects of national strategic value, creating market confidence and attracting private investors. The government can manage national innovation pipeline by directing investment to priority technologies, facilitating cross-actor co-investment scheme, and ensuring sustainable funding from research to commercialization.
2. Promoter and Catalyst: The government facilitates the alignment of research outputs with industry and investors, enhancing technology adoption and investment in the technology sector.
3. Fiscal Incentives Provider: The government provides fiscal incentives to stimulate R&D, technology investment, and innovation commercialization, thereby strengthening participation of both the private sector and state-owned enterprises in the technology ecosystem.

This discussion reinforces the argument that a mission-oriented research collaboration approach provides a relevant framework for Indonesia. It enables the integration of research, industrial, and health policies within a single agenda, with the state serving as the principal coordinator bridging public and industrial interests (Al-Jayyousi et al., 2023; Celis & Heitor, 2019; Jütting, 2020; Castelnovo & Florio, 2020; Pratistha, 2022).

Implications for Strengthening Pharmaceutical Industry Self-Reliance

Overall, the findings highlight that pharmaceutical industry self-reliance results from complex interactions among research policies, collaboration mechanisms, and innovation governance. The main challenges are governance and integration-related rather than purely technical or resource-based.

The policy implication is the need to reformulate research collaboration approaches from fragmented, project-based models to integrated, national mission-oriented frameworks. This approach requires alignment of funding, stronger technology transfer mechanisms, and adaptive intellectual property regulation that supports industrialization, including clear market signal particularly from the government through affirmative policies on the use of domestic products.

Conclusions

This policy paper formulates an integrated research collaboration model to support national pharmaceutical industry self-reliance by enhancing research and technology capacity while reducing dependency on imported raw materials and pharmaceutical products. Based on policy analysis, literature review, and empirical findings from FGDs with key stakeholders, the study confirms that the primary challenges of Indonesia's pharmaceutical industry self-reliance are operational and systemic, rooted in weak governance integration rather than technical or resource limitations.

The main contribution to knowledge lies in the development of a national mission-oriented research collaboration framework with the state as the orchestrator of the pharmaceutical innovation ecosystem. This framework expands the existing literature by demonstrating that research collaboration effectiveness depends not only on the intensity of inter-institutional cooperation but also on goal alignment, sustained funding across innovation stages, institutionalized technology transfer mechanisms, and adaptive IP regulation supporting industrialization. This shifts analysis from project- or sector-based approaches to systemic, mission-oriented approaches, including outcomes and impact.

From a policy application perspective, the findings provide a scientific basis for formulating research collaboration policies integrated with pharmaceutical industrialization strategies and national health resilience agendas. The proposed model can serve as a reference for designing collaborative funding programs, strengthening intermediary technology transfer institutions, and drafting IP policies that incentivize early-stage industry involvement, including designing market-shaping based policy instruments such as offtake guarantees and public procurement to create market certainty for industry. Mission-oriented approaches also allow stronger alignment among research, industrial, and health policies.

Future research could empirically test the proposed collaboration model in specific pharmaceutical subsectors, such as active pharmaceutical ingredients, and develop performance indicators for research collaboration as well as economic and health impact assessments of mission-oriented policies. Ongoing collaboration initiatives can serve as policy laboratories to test the effectiveness of this approach in operational settings.

Overall, this policy paper provides strong scientific and policy justification that strengthening Indonesia's pharmaceutical industry self-reliance requires integrated, sustainable, and mission-oriented research collaboration governance transformation.

Recommendation

Based on the analysis, the policy paper identifies three main policy options to strengthen pharmaceutical industry self-reliance through research collaboration. One option is recommended as the most effective and sustainable, while the other two have significant limitations:

Considered Policy Options

Option 1: Continue fragmented research collaboration (status quo). This maintains the current sectoral, program-based collaboration schemes with limited inter-agency coordination. While relatively easy to implement and requiring minimal institutional changes, this option fails to address structural challenges to industry self-reliance. It tends to produce research outputs disconnected from industrial needs and does not promote sustainable domestic production capacity. Therefore, it is not recommended.

Option 2: Strengthen research collaboration through industry incentives without a national mission framework. This option focuses on increasing industry participation via fiscal incentives, regulatory easing, or co-funding, but without alignment under a national mission-oriented research agenda. It may increase short-term industry involvement but risks opportunistic, company-centered collaboration. Without strong state orchestration, it could widen subsector gaps and does not ensure systemic contribution to industry self-reliance. This option is not recommended as the main policy.

Option 3: Implement integrated, national mission-oriented research collaboration with the state as orchestrator. This option positions research collaboration as a strategic tool in pharmaceutical

industrialization policy through a clear national mission, cross-stage funding alignment, strengthened technology transfer offices, and adaptive IP regulation. The state orchestrates research, industry, and supporting actors within an integrated governance framework, and internalizing market shaping instruments such as offtake guarantees to create demand certainty and encourage downstream innovation. A key performance indicator could be reduced time-to-market.

Recommended Policy Option

The policy paper recommends **Option 3: implementing an integrated, national mission-oriented research collaboration model**. This option is superior as it comprehensively addresses the root causes of pharmaceutical industry self-reliance challenges. Mission-oriented approaches integrate research, industrial, and health policies, enhancing the relevance and utilization of research outputs by industry.

Additionally, this model provides certainty for industry through sustainable collaborative funding schemes and clear IP arrangements, while incentivizing research institutions to produce outputs ready for down streaming. The state's role as orchestrator ensures cross-sector policy consistency and program sustainability across planning periods.

Policy Rationale and Implementation Implications

Compared to the status quo and partial-incentive approaches, integrated, mission-oriented research collaboration offers advantages in effectiveness, efficient use of public resources, and long-term impact on pharmaceutical industry self-reliance. It not only increases collaboration intensity but also improves quality and strategic direction aligned with national development goals.

For implementation, the government needs to establish clear national pharmaceutical mission priorities, create cross-ministry coordination mechanisms, and develop funding and IP governance instruments that support multi-stakeholder collaboration. Research collaboration thus becomes a pillar of Indonesia's pharmaceutical industry self-reliance strategy, rather than a supporting activity.

Limitations

The qualitative-descriptive approach with policy analysis design, while providing an in-depth understanding of research collaboration dynamics and governance, limits quantitative generalizability. Findings emphasize patterns, relationships, and policy mechanisms and should be interpreted in specific policy and institutional contexts. Primary data were obtained through FGDs with key stakeholders in the pharmaceutical sector, particularly SOEs, universities, and relevant government agencies. While purposively selected to represent strategic actors, perspectives from smaller private firms, non-SOE raw material producers, professional associations, and consumers are underrepresented, limiting the breadth of analysis. The study relies heavily on secondary data such as policy documents, regulations, and official reports. Limited access to microdata—such as research costs, internal industry incentive structures, or commercially sensitive information—constrains detailed economic analysis of research collaboration policy effectiveness. Consequently, impact evaluation is largely qualitative and conceptual. The international comparative studies are selective, aimed at conceptual policy learning rather than direct model replication. Differences in institutional contexts, fiscal capacity, and industry structures limit transferability to Indonesia, requiring policy adaptation. The policy paper does not yet include a long-term evaluation of the recommended research collaboration model. Given the dynamic, long-term nature of innovation and industrialization policies, longitudinal and quantitative studies are needed to assess effectiveness, efficiency, and real impacts on pharmaceutical industry self-reliance. These limitations highlight the need for further exploration and evidence strengthening in future policy research.

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