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Fertilizer Subsidy Regulatory Coherence, Institutional Capacity, and Sustainable Agricultural Performance in Indonesia

Koherensi Regulasi Subsidi Pupuk, Kapasitas Kelembagaan, dan Kinerja Pertanian Berkelanjutan di Indonesia

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Abstract

Indonesia's fertilizer subsidy governance reforms introduced through a series of regulations enacted in 2025–2026 have strengthened certainty in procurement, distribution, raw material availability, subsidy payments, and production continuity. However, previous studies have examined economic impacts, distribution, institutional capacity, and sustainability separately, leaving the ability of the latest regulatory architecture to produce sustainable agricultural performance insufficiently understood. This study is essential to prevent subsidy performance from being assessed solely through budget absorption, transactions, and distribution volumes. It aims to analyze regulatory evolution and coherence, contributions to institutional capacity, alignment with economic, social, and environmental dimensions, and a results-based regulatory improvement framework. The study employs an integrative qualitative approach combining content analysis of five principal regulations with a systematic literature review guided by PRISMA 2020. The findings show that the regulations have strengthened legal certainty, regulatory capacity, and supply resilience. Nevertheless, fragmented coordination, unequal regional capacity, unintegrated data, digital exclusion, and inadequate indicators of nutrient-use efficiency and soil health persist. The study recommends regulatory consolidation, a dynamic integrated data system, crop-calendar-based coordination, integration of subsidies with agricultural extension and soil management, and evaluation based on an input-process-output-outcome-impact framework.

Kata Kunci:

Subsidi Pupuk; Koherensi Regulasi; Kapasitas Kelembagaan; Tata Kelola; Pertanian Berkelanjutan.

Abstrak

Reformasi subsidi pupuk Indonesia periode 2025–2026 diarahkan untuk memperkuat kepastian pengadaan, penyaluran, pembayaran, pengawasan, dan keberlanjutan produksi. Namun, kondisi ideal berupa tata kelola yang tepat sasaran, terintegrasi, dan mendukung pertanian berkelanjutan belum sepenuhnya tercapai karena fragmentasi koordinasi, ketimpangan kapasitas daerah, data yang belum terintegrasi, serta lemahnya indikator lingkungan. Penelitian ini menganalisis koherensi regulasi, kontribusinya terhadap kapasitas kelembagaan, dan kesesuaiannya dengan kinerja pertanian berkelanjutan. Penelitian menggunakan pendekatan kualitatif

integratif melalui analisis isi lima regulasi utama dan systematic literature review *berpedoman PRISMA 2020 terhadap publikasi Scopus dan Web of Science periode Januari 2010–Juli 2026. Data dianalisis menggunakan* directed content analysis*, sintesis tematik, dan matriks kesesuaian. Hasil menunjukkan regulasi semakin koheren dan memperkuat kapasitas regulasi serta resiliensi pasokan, tetapi kapasitas koordinasi, implementasi, dan adaptasi masih terbatas. Dimensi ekonomi paling kuat, dimensi sosial masih menghadapi risiko eksklusi, sedangkan dimensi lingkungan paling lemah. Penelitian menyimpulkan bahwa koherensi formal belum sepenuhnya menghasilkan kinerja berkelanjutan. Pemerintah direkomendasikan mengintegrasikan data, koordinasi berbasis kalender tanam, penyuluhan, kesehatan tanah, dan evaluasi berbasis* input-process-output-outcome-impact.

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INTRODUCTION

Background of the Problem

Fertilizer is a strategic input in agricultural systems because it directly influences productivity, production costs, farmers' income, and food supply stability (Pambudi et al., 2025; Warr & Yusuf, 2014). Its role is particularly important in the Indonesian agricultural context, which is dominated by smallholder farming, characterized by limited access to capital, and increasingly exposed to climate change risks and fluctuations in input prices. Under these conditions, fertilizer subsidies serve as a government policy instrument to maintain input affordability, enhance productivity, and sustain food production. Cross-country empirical evidence indicates that fertilizer and agricultural input subsidies can increase input use and agricultural productivity, particularly when farmers face liquidity constraints and input markets do not function efficiently (Druilhe & Barreiro-Hurlé, 2012; Holden, 2019). The meta-analysis conducted by Nguyen et al. (2023) further demonstrates that agricultural input subsidy programs are generally positively associated with increased yields, although the magnitude of their effects largely depends on program design, targeting accuracy, timeliness of distribution, and the institutional capacity of implementing agencies.

The fiscal and administrative stakes are considerable. The fertilizer subsidy rose from about Rp34.2 trillion in 2020 to Rp42.1 trillion realised in 2023, with Rp44.2 trillion planned for 2025 (Aberth, 2024), and the 2026 ceiling was set at Rp46.87 trillion for 9.5 million tonnes (Damayanti, 2025). Delivery lags allocation: by 24 September 2025 only 5.5 million of the 9.55 million tonnes allocated (58%) had been distributed (Republika, 2025). The Audit Board (BPK) found that invalid farmer records in the e-Alokasi system still received quotas in 2023 and that 3.9 million kg of subsidized fertilizer (Rp23.05 billion) were distributed contrary to the rules (detikFinance, 2025).

Under ideal conditions (*das Sollen*), fertilizer subsidies should not merely ensure the availability of fertilizer at affordable prices but should also generate broader public benefits. Subsidy policies are expected to ensure that fertilizers are provided in the right type, quantity, price, place, time, and quality, and to the right beneficiaries; enhance

agricultural productivity and farmers' income; ensure equitable access for smallholder farmers; and simultaneously promote efficient fertilizer use and maintain soil health. The Triple Bottom Line perspective emphasizes that sustainability requires a balance among economic, social, and environmental performance (Elkington, 1997). Therefore, government support for agriculture should extend beyond the provision of affordable inputs and be integrated with strengthened institutional capacity, technological advancement, knowledge services, and measurable sustainability targets (Barbosa, 2024; Heyl et al., 2022).

However, empirical conditions (*das Sein*) indicate that the benefits of fertilizer subsidies are not always commensurate with the public resources allocated to the program. Subsidy programs continue to face risks of mistargeting, leakage, distribution delays, substitution for commercial fertilizer purchases, and unequal distribution of benefits. Jayne and Rashid (2013) demonstrate that the benefits of input subsidy programs may be diminished by crowding out, administrative inefficiencies, and weak targeting mechanisms. In the Indonesian context, Osorio et al. (2011) found that the largest 40% of farmers in terms of farm size received approximately 60% of fertilizer subsidy benefits. This condition indicates that price affordability alone does not necessarily ensure an equitable distribution of benefits. The transformation of Indonesia's food system therefore requires public support that is more targeted, inclusive, resilient, and aligned with the sustainable management of natural resources (World Bank, 2021). Because these data predate the e-RDKK, the 2022 restriction to urea and NPK for nine commodities, and the current 2-ha ceiling (Article 3 of Minister of Agriculture Regulation No. 15 of 2025), they are used only to illustrate the regressive risk of price subsidies. Economy-wide modelling by Warr and Yusuf (2014) suggests that a fertilizer subsidy reduces poverty more than import restrictions for the same self-sufficiency target, so the distributional problem lies mainly in targeting design.

Implementation realities reveal inconsistencies in beneficiary data, mismatches between fertilizer allocations and actual needs, distribution delays, limited working capital among distributors, difficulties in fertilizer redemption procedures, and informal transactions. Fatimah and Muhafidin (2024) demonstrate that the effectiveness of fertilizer subsidy implementation in Indonesia continues to be influenced by challenges related to distribution, supervision, policy communication, and targeting accuracy. From a systems perspective, Kiloes et al. (2026) show that fertilizer shortages and distribution irregularities result from complex interactions among data inconsistencies, delivery delays, beneficiary and distributor behavior, and demand from ineligible parties. Accordingly, increasing fertilizer allocations without addressing the underlying institutional problems may create a "*fixes that fail*" archetype (Senge, 1990), whereby short-term interventions alleviate immediate symptoms while perpetuating systemic problems over the long term.

The Government of Indonesia has responded to these challenges through a series of intensive regulatory reforms during 2025–2026. Presidential Regulation No. 6 of 2025 broadened the policy orientation toward fertilizer subsidy governance based on the principles of ensuring the right type, quantity, price, place, time, quality, and beneficiaries. This framework was operationalized through Minister of Agriculture Regulation No. 15 of 2025, which regulates the determination of subsidized fertilizers, procurement and distribution, billing and payment, guidance, supervision, evaluation, and sanctions. Presidential Regulation No. 113 of 2025 subsequently strengthened certainty regarding procurement and distribution, raw material availability, and the continuity of national fertilizer production. Operational adjustments were introduced through Minister of Agriculture Regulation No. 3 of 2026, while Minister of Agriculture Regulation No. 6 of 2026 introduced a *Commercial Value* calculation mechanism based

on market reference prices and cost components up to the official delivery point, replacing the previous *Cost of Goods Sold* approach. These five instruments (hereafter Perpres 6/2025, Permentan 15/2025, Perpres 113/2025, Permentan 3/2026, and Permentan 6/2026) are legally linked: Perpres 113/2025 amends Perpres 6/2025 and Permentan 3/2026 amends Permentan 15/2025, while Perpres 6/2025 revoked the earlier presidential regulations on fertilizer as a supervised good, Permentan 15/2025 revoked Permentan 10/2022 (Article 62), and Permentan 6/2026 revoked the cost-based Permentan 28/2020 (Article 10). Table 1 sets out this chronology.

A more fundamental concern emerges when these regulatory reforms are situated within the framework of sustainable agriculture. Internationally, there are growing calls to repurpose agricultural support from input volumes toward public goods (FAO et al., 2021). Subsidy policies that reduce the relative price of chemical fertilizers may encourage excessive application when fertilizer use is not aligned with agronomic requirements. Inefficient nitrogen use not only generates economic losses but also contributes to water pollution, soil degradation, and greenhouse gas emissions (Menegat et al., 2022). Subsidies can support sustainability transitions when they are directed toward generating public benefits and complemented by measurable environmental targets (Heyl et al., 2022). Therefore, the policy orientation should ideally shift from merely distributing agricultural inputs toward integrated nutrient management, site-specific recommendations, agricultural extension services, and soil health protection. A reorientation of agricultural support is also necessary to ensure that increased food production does not come at the expense of human health, the climate, and environmental carrying capacity (Fan et al., 2021; OECD, 2025).

At this point, an important research gap emerges. First, studies on fertilizer subsidies have largely examined input use, productivity, income, targeting accuracy, or distribution as separate issues. Second, research on institutional capacity has rarely established an integrated linkage between regulatory, coordination, implementation, and adaptive capacities and agricultural performance across economic, social, and environmental dimensions. Third, systematic studies evaluating the overall architecture of Indonesia's fertilizer subsidy regulations following the series of regulatory reforms through 2026 remain limited. Consequently, a significant knowledge gap persists regarding whether improvements in supply certainty, governance, and fiscal accountability have effectively translated into stronger institutional capacity and more sustainable agricultural performance. The closest prior studies illustrate this fragmentation. Osorio et al. (2011) and Warr and Yusuf (2014) analysed the incidence and economy-wide effects of the subsidy; Hendrawan et al. (2011) examined subsidy patterns and distribution systems; Fatimah and Muhafidin (2024) studied implementation problems; Kiloes et al. (2026) mapped the systemic causes of allocation and distribution failures; and our earlier study (Pambudi et al., 2025) evaluated governance against productivity and farmer welfare under the pre-2025 regime. None of them examines the 2025–2026 instruments provision by provision against capacity and sustainability criteria, which is the contribution of this article.

Based on these research gaps, this study aims to analyze the evolution and coherence of the regulatory architecture governing fertilizer subsidies; assess its contribution to regulatory, coordination, implementation, and adaptive capacities; identify gaps between regulatory provisions and scientific evidence on sustainable agriculture; and formulate a results-based framework for regulatory improvement.

Identification of Problems

The reform of fertilizer subsidy governance in Indonesia during the 2025–2026 period represents a significant shift in the government's efforts to strengthen certainty in procurement, raw material availability, production, distribution, subsidy payments, supervision, and the sustainability of fertilizer supply. These reforms also reinforce the principles of ensuring the right type, quantity, price, place, time, quality, and beneficiaries as the foundation of fertilizer subsidy implementation. Monitoring and evaluation of fertilizer subsidies should therefore accommodate variations in subsidy and distribution arrangements according to differences in farming conditions, socioeconomic characteristics, and agroclimatic conditions across Indonesia's rural areas (Hendrawan et al., 2011; Kiloes et al., 2026). The audit and distribution evidence summarised in the Background (detikFinance, 2025; Republika, 2025) points to the same constraints.

Based on these conditions, the research problems are identified as follows:

1. Regulatory coherence has not yet been fully accompanied by operational consistency. The fertilizer subsidy regulatory reforms introduced during 2025–2026 have strengthened legal certainty and the allocation of authority; however, challenges remain in harmonizing procedures, information systems, payment mechanisms, supervision, and policy transition management.
2. Institutional capacity has not developed evenly. The strengthening of regulatory mandates has not been fully supported by effective coordination among stakeholders, data integration, local implementation capacity, human resource competencies, digital infrastructure, and adaptive mechanisms based on evaluation and grievance management.
3. The sustainability orientation remains unbalanced across economic, social, and environmental dimensions. Existing regulations are relatively strong in ensuring fertilizer supply and the continuity of fertilizer production; however, equitable access, protection of vulnerable groups, nutrient-use efficiency, and soil health have not yet become key indicators of policy success.
4. Policy evaluation remains predominantly focused on inputs, processes, and outputs. The effectiveness of fertilizer subsidies has not been systematically linked to *outcomes* and *impacts*, including agricultural productivity, farmers' income, equitable distribution of benefits, nutrient-use efficiency, soil health, food security, and agricultural sustainability.

Accordingly, the central research problem is the extent to which the design of the 2025–2026 regulations contains the institutional prerequisites and sustainability orientation needed for productive, inclusive, and sustainable agricultural performance.

Formulation of the Problem

Based on the preceding discussion, the research questions are formulated as follows:

1. How has Indonesia's fertilizer subsidy regulatory architecture evolved during the 2025–2026 period, and to what extent is it coherent in governing planning, procurement, production, distribution, payments, supervision, evaluation, and policy sustainability?
2. To what extent is the fertilizer subsidy regulatory architecture capable of strengthening institutional capacity, encompassing regulatory, coordination, implementation, and adaptive capacities in the governance of fertilizer subsidies?

3. How are the substantive provisions of fertilizer subsidy regulations aligned with the principles of sustainable agriculture across economic, social, and environmental dimensions, particularly in terms of productivity, farmers' income, equitable distribution of benefits, nutrient-use efficiency, and soil health?
4. Which key gaps between regulatory design and the implementation risks documented in audits, official data, and the literature hinder the transformation of fertilizer subsidies from an input- and process-based policy toward one oriented to sustainable agricultural *outcomes* and *impacts*?
5. How can a results-based framework for improving fertilizer subsidy regulations be formulated through an *input-process-output-outcome-impact* approach to strengthen institutional capacity while simultaneously enhancing the economic, social, and environmental performance of agriculture?

Objectives and Benefits of Research

Research Objectives

This study aims to: (1) analyze the evolution and coherence of Indonesia's fertilizer subsidy regulatory architecture during the 2025–2026 period in governing planning, procurement, production, distribution, payments, supervision, and evaluation; (2) evaluate the contribution of these regulations to strengthening institutional capacity, encompassing regulatory, coordination, implementation, and adaptive capacities; (3) identify the alignment and gaps between the substantive provisions of fertilizer subsidy regulations and the principles of sustainable agriculture across economic, social, and environmental dimensions; (4) identify the key gaps between regulatory design and documented implementation risks; and (5) formulate a results-based regulatory improvement framework using an *input-process-output-outcome-impact* approach to strengthen institutional capacity and enhance sustainable agricultural performance.

Research Benefits

Theoretically, the study links regulatory coherence, institutional capacity, and sustainable agricultural performance; practically and for policy, it offers a basis for data integration, crop-calendar-based coordination, extension, soil health management, risk-based supervision, and outcome-based evaluation; and for future research, a framework for empirical testing.

THEORETICAL AND CONCEPTUAL FRAMEWORK

Theoretical Framework

This study employs institutional theory as its primary theoretical foundation to explain how regulatory quality shapes the behavior and capacity of actors involved in fertilizer subsidy governance. Institutions comprise formal and informal rules that structure interactions and reduce uncertainty in socioeconomic activities (North, 1990). Institutional effectiveness depends not only on the existence of rules but also on their alignment with local conditions, monitoring mechanisms, user participation, sanctions, and conflict-resolution mechanisms (Ostrom, 1990). In the context of public policy, institutional capacity is further conceptualized through regulatory, coordination, implementation, and adaptive capacities, consistent with the concept of *policy capacity*, which emphasizes analytical, operational, and political competencies at the individual, organizational, and systemic levels (Wu et al., 2015). Regulatory coherence, the study's

core construct, is defined as the extent to which instruments are internally consistent, mutually reinforcing across levels and sectors, and directed at shared objectives (Nilsson et al., 2012; OECD, 2019). The four capacity dimensions are an operational adaptation of Wu et al.'s (2015) matrix: regulatory capacity corresponds to systemic analytical competence, coordination capacity to systemic operational competence, implementation capacity to organizational operational competence, and adaptive capacity to the analytical competence used for policy learning; political capacity is treated as a contextual condition (Figure 1).

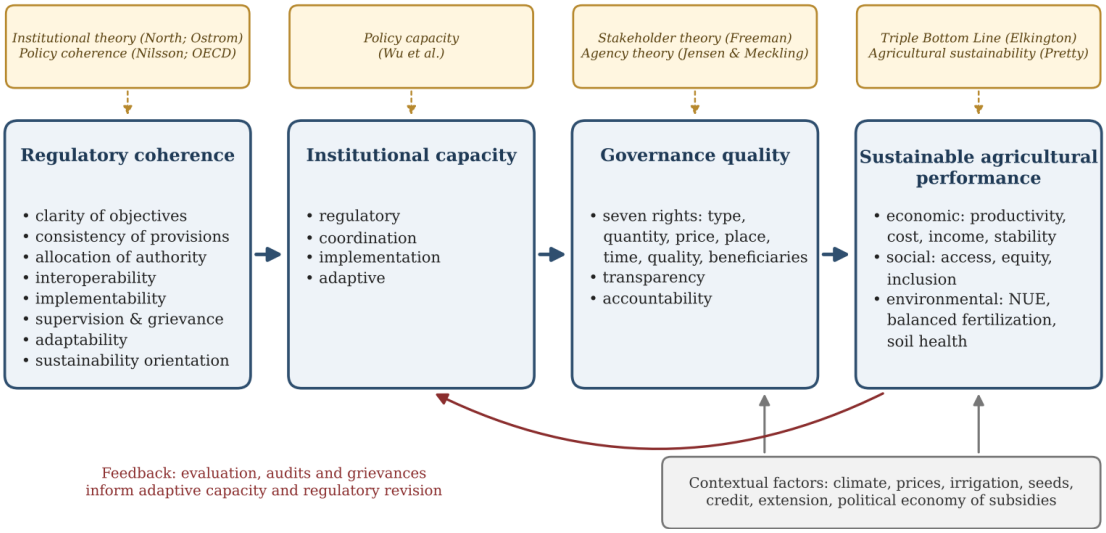


Figure 1. Analytical Framework of the Study
Source: Authors' elaboration, 2026. The pathway is a heuristic, not a tested model.

Relationships among actors are analyzed using stakeholder theory, which emphasizes the importance of managing the interests and interdependencies among government institutions, producers, distributors, retailers, agricultural extension workers, farmer groups, and farmers (Freeman, 1984). Meanwhile, agency theory explains the risks arising from information asymmetry, moral hazard, and opportunistic behavior in the relationship between the government as the principal and policy implementers as agents (Jensen & Meckling, 1976). Two principal–agent chains are analysed: the Ministry of Agriculture and the Ministry of Finance as principals and Pupuk Indonesia, distributors, and delivery-point recipients (kiosks, Gapoktan, and cooperatives) as agents; and the state as principal and registered farmers as beneficiary agents, with central and local governments forming a multiple-principal structure. Information asymmetry was coded through provisions on reporting, verification, redemption traceability, and sanctions.

Sustainable agricultural performance is analyzed using the Triple Bottom Line framework, encompassing economic, social, and environmental dimensions (Elkington, 1997). The economic dimension includes productivity, costs, income, and production resilience; the social dimension encompasses equitable access, inclusion, and distribution of benefits; while the environmental dimension includes nutrient-use efficiency, balanced fertilization, and soil health (Menegat et al., 2022). Because the Triple Bottom Line originated in corporate accountability, it is used only as an organizing heuristic; the indicators within each dimension follow agricultural sustainability frameworks that stress yields, resource-use efficiency, and natural capital (Pretty, 2008).

Conceptual Framework

The conceptual framework of this study is developed to explain how fertilizer subsidy regulatory coherence can be translated into sustainable agricultural performance through strengthened institutional capacity and improved subsidy governance quality. Regulatory coherence serves as the starting point and is analyzed in terms of clarity of objectives, consistency of regulatory provisions, allocation of authority, coordination and interoperability, implementability, transparency, supervision, grievance mechanisms, adaptability, and sustainability orientation.

Regulatory coherence is subsequently linked to institutional capacity, which comprises four dimensions: regulatory, coordination, implementation, and adaptive capacities. Regulatory capacity refers to the ability to establish clear, consistent, and implementable rules; coordination capacity reflects the ability to align authority, data, budgets, production, and cropping calendars; implementation capacity represents the adequacy of human resources, financing, procedures, technology, agricultural extension services, and supervision; while adaptive capacity refers to the ability to utilize evaluation findings, grievances, and changing conditions as a basis for continuous policy improvement.

Strong institutional capacity is expected to improve the quality of fertilizer subsidy governance, particularly in ensuring the right type, quantity, price, place, time, quality, and beneficiary, while strengthening transparency and accountability. The quality of governance is subsequently assessed based on its contribution to sustainable agricultural performance across three dimensions: the economic dimension, encompassing productivity, costs, income, and production stability; the social dimension, encompassing equitable access, inclusion, and equitable distribution of benefits; and the environmental dimension, encompassing nutrient-use efficiency, balanced fertilization, and soil health.

Conceptually, the research pathway is formulated as follows:

Regulatory Coherence → Institutional Capacity → Fertilizer Subsidy Governance Quality → Sustainable Agricultural Performance

The pathway is an analytical heuristic for organizing the documentary evidence, not a causal model tested in this study; contextual factors and feedback loops (Figure 1) also shape performance.

RESEARCH METHODS

This study employs an integrative qualitative approach combining regulatory content analysis and a systematic literature review (SLR). This approach was selected to analyze the coherence of the fertilizer subsidy regulatory architecture, its contribution to institutional capacity, and its alignment with the principles of sustainable agriculture. The regulatory units of analysis comprise five key policies: Presidential Regulation No. 6 of 2025, Presidential Regulation No. 113 of 2025, Minister of Agriculture Regulation No. 15 of 2025, Minister of Agriculture Regulation No. 3 of 2026, and Minister of Agriculture Regulation No. 6 of 2026. These instruments were selected because they are the binding national regulations issued since January 2025 that define the governance architecture of subsidized fertilizer. The revoked Permentan 10/2022 and Permentan 28/2020 served as pre-reform comparators, whereas ministerial decrees on allocation and HET, Ministry of Finance payment regulations, and regional regulations were excluded because they implement rather than design the architecture. Because content analysis can establish only regulatory design, implementation was examined through secondary evidence (BPK audit findings, official allocation and distribution data, a Ministry of

Agriculture policy brief, and Indonesian empirical studies), and implementation statements are reported as documented risks rather than measured outcomes.

Regulatory data were obtained from official government documents through the Legal Documentation and Information Network of the Ministry of Agriculture and the regulatory database of the Audit Board of the Republic of Indonesia. Document analysis employed directed content analysis, using deductive coding based on the theoretical framework and inductive coding to capture emerging themes from the documents (Hsieh & Shannon, 2005). The analytical categories included clarity of objectives, consistency of regulatory provisions, allocation of authority, coordination and interoperability, implementability, transparency, supervision, grievance mechanisms, adaptability, and economic, social, and environmental orientations. Following Bowen (2009), the coding unit was the article or paragraph (*pasal/ayat*); coding was conducted and inductive codes were added when a provision fell outside the deductive categories. The codebook (category, operational definition, and example provision) is summarised in Appendix Table A1.

The SLR was conducted in accordance with PRISMA 2020 (Page et al., 2021), covering publications from January 2010 to July 2026 indexed in Scopus and the Web of Science Core Collection. The literature search employed combinations of keywords related to fertilizer subsidy, agricultural input subsidy, governance, regulation, institutional capacity, policy capacity, sustainable agriculture, farmer welfare, nutrient use efficiency, and soil health.

The data were analyzed through thematic synthesis (Thomas & Harden, 2008; coding steps from Braun & Clarke, 2006), after which the scientific evidence was compared with the substantive provisions of the regulations using an alignment matrix categorized as strong, partial, weak, or gap. The credibility of the analysis was strengthened through the use of a codebook, source triangulation, documentation of the decision trail, and coding consistency checks (Krippendorff, 2018). Finally, the findings were synthesized into an input-process-output-outcome-impact framework to formulate results-based improvements to the fertilizer subsidy regulatory framework. Source triangulation means that each judgement was checked against the regulatory text, the reviewed literature, and secondary implementation evidence. The rubric in Appendix Table A2 defines each level, including the intermediate levels used when sub-provisions fall in adjacent categories, and the review design follows Snyder (2019).

RESULTS AND DISCUSSION

Results

Evolution and Coherence of Fertilizer Subsidy Regulations

The analysis of five key regulations enacted during 2025–2026 reveals a shift in the fertilizer subsidy policy architecture from a predominantly commodity-oriented regulatory approach toward a broader governance framework encompassing the entire policy chain. Presidential Regulation No. 6 of 2025 established the foundation for this reform by introducing the principles of ensuring the right type, quantity, price, place, time, quality, and beneficiaries. Minister of Agriculture Regulation No. 15 of 2025 subsequently operationalized provisions concerning the determination of subsidized fertilizers, procurement and distribution, billing and payment, guidance, supervision, evaluation, and sanctions. Compared with the pre-2025 regime under Permentan 10/2022, allocation is now set after a ministerial coordination meeting led by the Coordinating Ministery for Food (Article 5 of Perpres 6/2025 as amended), organic fertilizer is subsidized again alongside urea and NPK (Article 5 of Permentan 15/2025),

the regime covers fish farmers (Article 4), and redemption uses the identity card verified by central and sub-district teams (Articles 39–41). Eligibility remains limited to farmer-group members registered in the e-RDKK who cultivate at most 2 ha of nine commodities per season (Article 3); allocations are tiered from the e-RDKK (Articles 17–24), payment follows verification (Article 50), and supervision and sanctions are set in Articles 52–58.

Presidential Regulation No. 113 of 2025 further strengthened provisions concerning procurement, distribution, raw material availability, and the continuity of national fertilizer production. These provisions were subsequently followed by Minister of Agriculture Regulation No. 3 of 2026. Furthermore, Minister of Agriculture Regulation No. 6 of 2026 introduced a *Commercial Value* mechanism based on market prices and cost components incurred until fertilizers are available at designated official delivery points, replacing the previous *Cost of Goods Sold* approach. Perpres 113/2025 (24 October 2025) introduced advance payment for raw materials and a subsidy equal to the Commercial Value minus the HET (Articles 14–14B). Permentan 3/2026 (20 February 2026) transposed these rules into Permentan 15/2025 (Articles 7, 9, and 50 amended; Articles 50A–50E on BPKP review, quarterly reporting, and reconciliation), assigned e-RDKK preparation to district offices with extension workers (Article 24(4)), and added ministerial evaluation (Articles 55A–55B). Permentan 6/2026 (3 March 2026) defines the Commercial Value as a South-East Asian reference price plus a lump-sum α for bagging, handling, and distribution to the delivery point (Articles 4–5), with a β adjustment bounded by statistical ceilings and floors (Article 6). By reimbursing a market benchmark rather than the producer's own costs, the mechanism limits cost pass-through and rewards efficiency at Pupuk Indonesia, but it exposes the subsidy bill to world prices and the exchange rate: the Ministry's simulation for January–November 2025 estimated Rp34.61 trillion under the Commercial Value against Rp29.83 trillion under HPP (Kementerian Pertanian, 2026). Article 6(8) refers only to a competent auditor, so the roles of BPKP and BPK in verifying α and β remain unspecified.

Vertically, the five regulations demonstrate a relatively coherent relationship. The Presidential Regulations establish the overarching regulatory framework, while the Minister of Agriculture Regulations govern its operational aspects. However, three amendments in 13 months, with transition deadlines of 30 July 2025 (Article 61 of Permentan 15/2025) and 31 March 2026 (Article II of Permentan 3/2026), create a design-level risk that information systems, supply contracts (SPJB), payment procedures, and technical guidelines lag behind the rules; the Ministry's policy brief also notes the need for new verification procedures and safeguards for advance payments (Kementerian Pertanian, 2026). Horizontally, this framework has also not yet been fully integrated with public service delivery, farmer protection, data governance, agricultural extension services, and environmental protection.

Table 1. Evolution and Orientation of Fertilizer Subsidy Governance Regulations

Regulation	Main Provisions	Capacity Strengthened	Key Limitations
Presidential Regulation No. 6 of 2025 (30 Jan 2025; revokes earlier rules)	Governance framework and the seven-right principles	Regulatory and coordination capacity	Environmental indicators and farming outcomes are not explicitly defined
Minister of Agriculture Regulation No. 15 of 2025 (15 May 2025; revokes Permentan 10/2022)	Determination, procurement, distribution, payment, supervision, evaluation, and sanctions (Arts. 3, 5, 17–24, 39–41, 50, 52–58)	Implementation capacity and accountability	Policy success remains susceptible to predominantly administrative interpretation
Presidential Regulation No. 113 of 2025 (24 Oct	Procurement, raw materials, distribution, and national fertilizer production (Arts. 5, 14, 14A, 14B, 17, 17A)	Regulatory capacity and supply-chain resilience	Sustainability remains primarily oriented toward fertilizer production

Regulation	Main Provisions	Capacity Strengthened	Key Limitations
2025; amends Perpres 6/2025)			
Minister of Agriculture Regulation No. 3 of 2026 (20 Feb 2026; amends Permentan 15/2025)	Subsidy = Commercial Value – HET (Art. 7); BPKP review (Arts. 9, 50A); advance payment and reconciliation (Arts. 50–50E); e-RDKK by extension workers (Art. 24(4)); evaluation (Arts. 55A–55B)	Implementation and adaptive capacity	Requires policy dissemination and adjustment of regional implementation systems
Minister of Agriculture Regulation No. 6 of 2026 (3 Mar 2026; revokes Permentan 28/2020)	Commercial Value and raw material components (Arts. 4–6, 8)	Fiscal accountability and production certainty	Subsidy payments are not directly linked to farmers' *outcomes*

Source: Authors' Analysis, 2026. Judgements follow the codebook and rubric in Appendix Tables A1–A2.

Contribution of Regulations to Institutional Capacity

The analysis indicates that the regulatory reforms have made varying contributions to four dimensions of institutional capacity: regulatory, coordination, implementation, and adaptive capacities. In terms of regulatory capacity, policy objectives, scope, governance stages, actors, and the seven-right principles have become increasingly explicit. However, the operational definitions of several indicators remain limited, particularly those concerning the right timing, quantity, and beneficiaries. These dimensions map onto Wu et al.'s (2015) framework as explained in the Theoretical Framework; political capacity, the ability to sustain reform against vested interests and electoral pressure, is not addressed by any provision. Examples of limited operational definitions are that allocation decisions must be issued by December of the preceding year (Articles 21(3) and 23(3) of Permentan 15/2025) without a delivery-time standard linked to cropping calendars, that the right quantity is the e-RDKK allocation rather than a soil-based recommendation, and that the right beneficiary is defined by land size, commodity, and group membership (Article 3), with no explicit provision for tenant or landless cultivators.

Regarding coordination capacity, the division of roles among actors and the procurement chain has become more structured. However, data on farmer identities, land tenure, commodities, cropping calendars, fertilizer requirements, stocks, production, transportation, and transactions have not yet been fully integrated into a unified decision-making cycle. The absence of a clearly designated actor responsible for end-to-end service delivery also constitutes a coordination gap. BPK's finding of invalid records in e-Alokasi illustrates this risk (detikFinance, 2025). The regulations assign e-RDKK preparation to district agriculture offices with extension workers and synchronisation with SIMLUHTAN (Article 24 of Permentan 15/2025 as amended), stock and distribution reporting to Pupuk Indonesia (Articles 35–38), and redemption verification to central and sub-district teams (Article 41), but no provision designates an actor accountable for delivery from allocation to the farmer.

In terms of implementation capacity, procedures for beneficiary determination, distribution, payments, and supervision have been established. Nevertheless, the uniform national procedures do not differentiate for regional disparities in human resources, connectivity, digital infrastructure, logistics, and operational budgets. Digitalization has improved transaction traceability but may also create risks of exclusion for farmers facing limitations in documentation, digital literacy, or connectivity. Provincial data on village connectivity and extension workers per farm household are

needed to quantify this risk. Identity-card redemption (Article 39) reduces dependence on bank cards, which remain usable during the transition (Article 61), but it still requires a match with e-RDKK records, so unregistered farmers remain excluded.

Regarding adaptive capacity, regulatory changes demonstrate responsiveness to challenges related to raw materials, production, distribution, and payments. Nevertheless, the utilization of evaluation findings, audits, transaction data, and grievances as sources of policy learning remains limited. Frequent change is ambiguous: it signals responsiveness but also policy instability that raises compliance costs for implementers. The Ministry simulated the fiscal effect of the Commercial Value before Permentan 6/2026 was issued (Kementerian Pertanian, 2026), but we found no published regulatory impact assessment or evidence that audit findings or grievances informed the 2025–2026 amendments.

Table 2. Contributions, Gaps, and Derived Recommendations for Institutional Capacity

Dimension	Regulatory Contribution	Implementation Gaps	Derived Recommendations
Regulatory Capacity	Policy objectives, governance stages, and the seven-right principles have become increasingly explicit	Limited operational definitions and *outcome* indicators	Measurable standards and transitional guidelines
Coordination Capacity	Division of roles and the procurement chain have become more structured	Data, schedules, and decision-making processes remain insufficiently integrated (e.g., invalid e-Alokasi records)	Designated process owner and escalation protocols
Implementation Capacity	Procedures for determination, distribution, payments, and supervision have been established	Uneven regional capacity in human resources, digital infrastructure, logistics, and budgets	National minimum standards and region-specific differentiation
Adaptive Capacity	Regulatory changes respond to supply and payment challenges	Evaluation and grievance mechanisms have not been optimally utilized for policy learning	Review clauses, grievance analysis, and periodic evaluation

Source: Authors' Analysis, 2026

Results of the Systematic Literature Review

Three clusters emerge. Input subsidies raise fertilizer use and yields, but effects depend on targeting, timing, and complementary services (Druilhe & Barreiro-Hurlé, 2012; Holden, 2019; Jayne & Rashid, 2013; Nguyen et al., 2023). Benefits are often captured by larger farmers where governance is weak (Jayne et al., 2018; Osorio et al., 2011). Sustainability gains require explicit environmental objectives and nutrient-efficiency measures (Heyl et al., 2022; Menegat et al., 2022). Indonesian implementation evidence remains thin (Fatimah & Muhafidin, 2024; Kiloes et al., 2026).

Alignment of Regulations with Sustainable Agricultural Performance

The alignment analysis indicates that the regulatory provisions are strongest in the economic dimension, particularly in ensuring procurement, raw material availability, production, distribution, and payments. In the social dimension, the right-beneficiary principle provides a foundation for strengthening access; however, indicators related to the equitable distribution of benefits and farmers' procedural rights remain limited. The environmental dimension demonstrates the lowest level of alignment, as nutrient-use efficiency, soil health, water quality, and emissions have not yet been established as key indicators of policy success.

Regarding productivity and supply, the level of alignment is categorized as partial–strong. Fiscal efficiency, farmers' income, equitable access, as well as transparency and

grievance mechanisms are categorized as partial. Nutrient-use efficiency is categorized as weak–partial, while soil and environmental health are categorized as weak.

Table 3. Regulatory Alignment Matrix with Sustainable Agricultural Performance

Aspect	Regulatory Strengths	Gaps	Level of Alignment
Productivity and Supply	Greater certainty in procurement, raw material availability, production, and distribution	M&E gap: Incremental productivity gains have not yet been measured (cf. Nguyen et al., 2023)	Partial–Strong
Fiscal Efficiency	The *Commercial Value* mechanism and payment arrangements are more clearly defined	Design gap: Not directly linked to service quality and policy *outcomes*; bill exposed to world prices (Kementerian Pertanian, 2026)	Partial
Farmers' Income	HET caps the purchase price (Art. 7, Permentan 3/2026); no income provision	M&E gap: Net farm income and transaction costs have not yet been incorporated as performance indicators	Partial
Equitable Access	The right-beneficiary principle has been reinforced	Design gap: eligibility by land size, commodity, and group membership (Art. 3); Digital exclusion, data inaccuracies, and elite capture within farmer groups remain concerns (detikFinance, 2025; Osorio et al., 2011; Yasmin et al., 2026)	Partial
Transparency and Grievance Mechanisms	Supervision, evaluation, and sanctions have been formally established	Design gap: no complaint provision; Standards for grievance resolution and policy learning from grievances remain limited	Partial
Nutrient-Use Efficiency	The right-type and right-quantity principles support balanced fertilization	Design gap: Limited integration with soil testing and site-specific recommendations (Menegat et al., 2022)	Weak–Partial
Soil and Environmental Health	Opportunities for integration exist through the right-type and right-quantity principles	Design and M&E gap: Indicators for organic matter, water quality, emissions, and soil health are not explicitly defined (Heyl et al., 2022)	Weak

Source: Authors' Analysis, 2026. Studies cited in the cells come from the review (Appendix Table A3).

Results-Based Regulatory Framework

The synthesis of the findings produces a fertilizer subsidy governance framework structured along the input-process-output-outcome-impact chain. *Inputs* comprise budget allocations, raw materials, human resources, data, production capacity, and logistics. *Processes* encompass validation, production, distribution, transactions, agricultural extension services, supervision, and grievance mechanisms. *Outputs* include farmers served, fertilizer distributed, and compliance with established price and delivery-time requirements.

At the *outcome* level, the results are classified into three dimensions. Economic outcomes encompass productivity, costs, income, and production stability; social outcomes include equity, smallholder access, data correction, and satisfaction; while environmental outcomes comprise nutrient-use efficiency, balanced fertilization, organic matter, and soil health. At the *impact* level, the framework encompasses food security, resilience, and sustainable agriculture. Only outputs are directly attributable to the subsidy programme; outcomes are contribution-level indicators because prices, weather, irrigation, seeds, and extension also affect them. Satisfaction is a farmer-survey score on access and timeliness, data correction is the share of e-RDKK complaints resolved within a service standard, and nutrient-use efficiency is measured as partial

factor productivity of nitrogen (kg grain per kg N) or the nitrogen balance proposed by the EU Nitrogen Expert Panel (2015). The framework assumes that validated data and timely delivery precede balanced fertilization, which is necessary but not sufficient for yield, income, and soil-health gains.

Table 4. Proposed Results-Based Fertilizer Subsidy Regulatory Framework (Normative Proposal)

Results Chain	Indicators (Unit; Data Source)	Lead (Supporting) Institutions	Evaluation Function
Input	Budget realised (Rp); raw-material stock (t); extension workers per 1,000 farm households (budget documents, Pupuk Indonesia reports)	MoA, MoF (Pupuk Indonesia)	Resource adequacy
Process	Validated e-RDKK records (%); days from allocation decision to stock at delivery point (e-RDKK, redemption transactions)	MoA, district agriculture offices (Pupuk Indonesia, distributors)	Process compliance and efficiency
Output	Registered farmers redeeming (%); redemptions at HET within the planting window (%) (redemption transactions, supervision commission reports)	Pupuk Indonesia (distributors, kiosks, Gapoktan)	Service quality
Economic Outcome	Yield (t/ha); fertilizer cost share (%); net farm income (Rp/ha) (BPS farm surveys)	MoA (BPS, local governments)	Economic effectiveness
Social Outcome	Benefit share of farmers below 0.5 ha (%); complaint resolution time (days); satisfaction score (farmer survey, Ombudsman RI)	MoA, local governments (farmer groups, Ombudsman RI)	Inclusion and equity
Environmental Outcome	Partial factor productivity of N (kg/kg); soil organic carbon (%); plots with soil-test recommendation (%) (soil surveys)	MoA soil research units (extension workers, farmers)	Ecological sustainability
Impact	Rice self-sufficiency ratio; soil-health trend (BPS, soil monitoring)	Coordinating Ministry for Food (Bappenas, MoA)	Long-term public benefits

Source: Authors' Analysis, 2026. Baselines and targets are to be set in the ministerial evaluation (Art. 55A of Permentan 15/2025 as amended); process and output indicators quarterly, outcomes annually, impacts every five years.

Discussion

Formal Coherence Has Not Yet Fully Translated into Implementation Coherence

The first finding indicates that the 2025–2026 reforms have established relatively strong vertical coherence. The relationship between Presidential Regulations and Minister of Agriculture Regulations demonstrates an increasingly clear hierarchical structure, while the revocation of previous provisions has reduced the potential for regulatory dualism. This condition supports North's (1990) argument that clear formal rules can reduce uncertainty by clarifying the rights, obligations, authority, and consequences applicable to the actors involved. Table 1 identifies the revoked instruments. Yet three amendments within 13 months may also erode the certainty North describes; regulatory quality

principles call for ex ante impact assessment and predictable revision cycles (OECD, 2012).

However, the findings suggest that regulatory coherence is not synonymous with implementation coherence. Information systems, contractual arrangements, payment mechanisms, technical guidelines, and local implementation capacity may adjust at different speeds when regulations are revised within a relatively short period. Thus, the capacity to formulate new regulations represents adaptive capacity at the policy level, but does not automatically indicate equivalent adaptive capacity at the implementation level. This argument echoes the implementation literature, in which top-down designs depend on the discretion of street-level implementers such as kiosk operators and extension workers (Lipsky, 1980; Sabatier, 1986).

Horizontal gaps are even more substantive. The regulatory framework has linked production, distribution, payments, and supervision, yet its integration with public service delivery, farmer protection, data governance, agricultural extension services, and environmental considerations remains limited. Consequently, individual actors may fulfill their administrative obligations without necessarily ensuring the achievement of system-level objectives. Producers may meet production targets and distributors may achieve distribution targets, while farmers may continue to experience delays, data inaccuracies, or receive fertilizers that do not correspond to their agronomic requirements. These findings broaden the understanding of regulatory coherence: coherence should not be assessed solely on the basis of hierarchical consistency among regulatory provisions, but also on the capacity of the regulatory framework to integrate policy objectives, actors, data, service delivery, and policy outcomes. Documented Indonesian cases support this concern (detikFinance, 2025; Fatimah & Muhafidin, 2024; Kiloes et al., 2026). The broader definition proposed here aligns with policy coherence for sustainable development, which emphasises coherence across sectors and levels rather than legal hierarchy alone (Nilsson et al., 2012; OECD, 2019).

Institutional Capacity as the Link between Regulation and Performance

The second finding is consistent with the proposition that institutional capacity is a critical mechanism linking regulations to policy outcomes. Regulations provide mandates, coordination aligns actors and resources, implementation translates mandates into service delivery, while adaptation enables the system to learn and improve. This relationship is consistent with Wu et al. (2015), who identify analytical, operational, and political capacities across multiple levels as key determinants of overall policy capacity.

Targeting challenges further demonstrate the relevance of *agency theory*. Information asymmetries among the government, distribution actors, farmer groups, and beneficiaries create opportunities for *moral hazard* and opportunistic behavior (Jensen & Meckling, 1976). At the same time, digitalization should not be understood merely as a control mechanism. When digital requirements fail to account for users' capacities, policies may inadvertently transform leakage problems into administrative exclusion. Therefore, digitalization should be complemented by offline services, data correction mechanisms, transparency regarding beneficiary status, and support from agricultural extension workers. Concretely, the regulations reduce information asymmetry through identity-card redemption (Article 39 of Permentan 15/2025), verification teams (Article 41), monthly electronic reporting (Articles 35–38), and BPKP review of payments (Articles 9 and 50A as amended), whereas advance payment for raw materials (Article 14 of Perpres 113/2025) and the lump-sum α and β adjustment (Articles 4 and 6 of

Permentan 6/2026) create new moral-hazard risks if verification is weak. India's Aadhaar-linked point-of-sale system for fertilizer offers a comparable experience.

Imbalances across Sustainability Dimensions

The third finding reveals an imbalance across the economic, social, and environmental dimensions of sustainability. The regulatory framework is strongest in the economic dimension, as considerable attention is given to ensuring raw material availability, production, distribution, payments, and prices. This finding is consistent with Nguyen et al. (2023) and Holden (2019), who demonstrate that input subsidies can increase fertilizer use and agricultural productivity, although their impacts depend on program design, targeting accuracy, implementation, and input market conditions.

Nevertheless, the volume of fertilizer distributed cannot serve as the sole proxy for economic success. Incremental productivity, changes in production costs, net farm income, farming stability, and the distribution of benefits should also be incorporated into policy evaluation. This is consistent with Druilhe and Barreiro-Hurlé (2012), who argue that fertilizer subsidies cannot substitute for complementary support such as credit, agricultural extension services, infrastructure, and market development. Indonesian evidence is mixed: Warr and Yusuf (2014) find that the subsidy reduces poverty more than import protection, whereas Osorio et al. (2011) show regressive incidence. With budgets of Rp42–47 trillion a year (Aberth, 2024; Damayanti, 2025), allocated versus realised volumes and cost per tonne should be reported routinely.

In the social dimension, the right-beneficiary principle provides an important foundation, but procedural uniformity does not necessarily ensure substantive equity. Article 3 of Permentan 15/2025 limits eligibility to farmer-group members registered in the e-RDKK who cultivate at most 2 ha of nine commodities, so cultivators outside farmer groups, growers of other crops, and those absent from the registry are excluded by design; whether tenants, women, older farmers, and remote communities are disproportionately affected requires empirical verification. This finding reinforces the relevance of Ostrom's (1990) principles concerning user participation, monitoring, proportionate sanctions, and conflict-resolution mechanisms in building effective institutions. Ostrom's principles, developed for common-pool resources, apply here because rationed allocation within farmer groups and kiosks is managed locally, as the role of Gapoktan in distribution suggests (Yasmin et al., 2026).

The most substantial gap is found in the environmental dimension. The right-type and right-quantity principles provide a basis for balanced fertilization, but they have not yet been strongly linked to soil testing, nutrient maps, site-specific recommendations, organic matter management, and soil health indicators. Menegat et al. (2022) demonstrate that the production and use of synthetic nitrogen fertilizers contribute to agricultural emissions, while inefficient fertilizer use also increases the risks of nutrient losses and environmental degradation. Indonesia-specific evidence on urea overuse and soil organic carbon would strengthen this point. Permentan 15/2025 covers organic fertilizer (Article 5) but sets no nutrient-balance or soil-test requirement. International experience links subsidies to soil information, for example China's 2015 Zero Growth Action Plan for fertilizer use (Jin & Zhou, 2018) and India's Soil Health Card scheme.

This finding is consistent with Heyl et al. (2022), who argue that subsidies can support sustainability transitions only when they are directed toward public benefits and explicit environmental objectives. From a *Triple Bottom Line* perspective (Elkington, 1997), economic success cannot be considered sustainable when accompanied by inequitable distribution of benefits and environmental degradation. Accordingly, the meaning of

"sustainability" within the regulatory framework needs to be broadened from the sustainability of fertilizer production to that of the agricultural system. This recommendation sits within the smart-subsidy debate on targeting, market development, and exit strategies (Jayne et al., 2018; Morris et al., 2007) and within calls to repurpose agricultural support toward public goods (FAO et al., 2021; OECD, 2025).

Transformation Toward Results-Based Regulation

The fourth result, a normative proposal derived from the analysis rather than an empirical finding, highlights the need for a shift from administrative compliance-based governance toward results-based governance. The *input-process-output-outcome-impact* framework enables a more comprehensive evaluation of fertilizer subsidies. Budget allocations and fertilizer availability remain important as *inputs*, while distribution and transactions constitute components of the *process* and *output* stages. However, ultimate policy success should be reflected in agricultural productivity, farmers' income, equitable distribution of benefits, nutrient-use efficiency, soil health, food security, and agricultural sustainability. Its feasibility is constrained by the cost of outcome data, the attribution problem, the lack of a legal basis for holding implementers accountable for outcomes, and political economy: fertilizer subsidies are electorally popular, and changes in eligibility or performance criteria are likely to meet resistance (Jayne et al., 2018).

Based on the study findings, this transformation requires six areas of strengthening. First, regulatory consolidation should be accompanied by transitional guidelines that clearly map authority, procedures, data, systems, contractual arrangements, and implementation timelines. Second, a dynamic integrated data system is required to consolidate information on farmer identities, land, commodities, cropping calendars, allocations, stocks, transactions, and grievances. Third, coordination should be aligned with cropping calendars and agroecological conditions. Fourth, supervision should shift toward a risk-based approach supported by transaction analytics. Fifth, fertilizer subsidies should be integrated with agricultural extension services, soil testing, nutrient mapping, site-specific fertilization, and organic matter management. Sixth, administrative evaluation should be complemented by economic, social, and environmental *outcome* indicators.

This framework shifts the unit of accountability from sectoral performance to system-level performance. Producers would no longer be accountable solely for production volumes, distributors solely for quantities distributed, local governments solely for data updates, and retailers solely for transaction numbers. Instead, all actors would be positioned within an integrated accountability chain focused on service quality and the benefits received by farmers. In practical terms, this approach has the potential to transform fertilizer subsidies from an instrument primarily designed to maintain input affordability into a more outcome-oriented instrument of agricultural support. Such accountability requires concrete mechanisms: performance clauses in the SPJB supply contracts that appoint delivery-point recipients (Article 29 of Permentan 15/2025), incentives linked to timeliness and data quality, and the existing sanctions of payment suspension and revocation of appointment (Articles 56–58).

Research Limitations

This study has several limitations. First, the methodological approach is based on regulatory document analysis and literature synthesis; therefore, it does not empirically examine how the 2025–2026 regulatory changes are perceived and implemented by

farmers, local governments, producers, distributors, retailers, agricultural extension workers, and oversight institutions. Second, the regulations introduced in 2026 are relatively recent, meaning that their medium- and long-term effects on productivity, farmers' income, equitable distribution of benefits, nutrient-use efficiency, and soil health cannot yet be fully observed. Third, the *systematic literature review* was limited to publications from January 2010 to July 2026 retrieved from Scopus and the Web of Science Core Collection; consequently, evidence from literature not indexed in these two databases may not be fully represented. Fourth, the categories of strong alignment, partial alignment, and gaps are derived from qualitative synthesis and therefore do not provide causal estimates or quantify the magnitude of relationships among variables. Further limitations are the absence of primary implementation data, which also qualifies the implementation risks reported in the Results; the residual subjectivity of the alignment scoring; the exclusion of regulations from other ministries and regions; and the authors' positionality.

Novelty/Contribution

The novelty of this study lies in its integrated analysis of Indonesia's fertilizer subsidy regulatory architecture through 2026, linking regulatory coherence, four dimensions of institutional capacity, fertilizer subsidy governance quality, and three dimensions of sustainable agricultural performance within a unified results-based framework. Unlike previous studies that examine productivity, distribution, targeting, or subsidy impacts separately, this study proposes a framework for assessing the extent to which regulatory frameworks are translated, through regulatory, coordination, implementation, and adaptive capacities, into economic, social, and environmental outcomes. Compared with Kiloes et al. (2026), who model distribution failures, Hendrawan et al. (2011), who compare subsidy patterns, and our earlier evaluation (Pambudi et al., 2025; a self-citation) of governance before the 2025 reforms, this article adds an article-level analysis of the new instruments linked to sustainability criteria.

The conceptual contribution of this study is the extension of fertilizer subsidy evaluation from a regulation–distribution relationship toward an integrated pathway of regulatory coherence → institutional capacity → governance quality → sustainable agricultural performance. Its analytical contribution lies in the development of a regulatory alignment matrix that distinguishes among strong alignment, partial alignment, and gaps. Meanwhile, its practical contribution is the *input-process-output-outcome-impact* framework, which enables fertilizer subsidy performance to be assessed not only in terms of budget allocations, production, transactions, and distribution volumes, but also through productivity, farmers' income, equitable distribution of benefits, nutrient-use efficiency, soil health, food security, and agricultural sustainability.

CONCLUSIONS AND SUGGESTIONS

Conclusion

Regarding RQ1, this study concludes that Indonesia's fertilizer subsidy regulatory reforms during the 2025–2026 period have established a more coherent, and adaptive governance architecture, particularly by strengthening certainty in procurement, raw material availability, production, distribution, payments, and supervision. However, formal regulatory coherence has not yet been fully translated into implementation consistency, as rapid policy changes continue to pose challenges related to the adjustment of procedures, information systems, coordination mechanisms, and implementation capacity.

Regarding RQ2, and on the basis of document analysis and secondary evidence rather than direct observation, clearer mandates and the principles of ensuring the right type, quantity, price, place, time, quality, and beneficiaries have strengthened regulatory capacity. Nevertheless, coordination, implementation, and adaptive capacities remain constrained by fragmented responsibilities, insufficient integration of data and decision-making processes, disparities in capacity across regions, and the limited use of evaluation findings and grievance mechanisms as instruments for policy learning.

Regarding RQ3, the alignment between the regulatory framework and sustainable agriculture also remains uneven. The economic dimension receives the strongest support through greater supply certainty and payment mechanisms, whereas the social dimension continues to face risks related to unequal access, data inaccuracies, and digital exclusion. The environmental dimension represents the most substantial gap, as nutrient-use efficiency, balanced fertilization, organic matter management, and soil health have not yet been established as key indicators of policy success.

Regarding RQ4, the key gaps between design and documented implementation are the absence of an end-to-end accountable actor, eligibility rules that exclude cultivators outside the registry, frequent amendments with short transition periods, unspecified verification of the Commercial Value, and the lack of soil-based quantity rules; these are risks identified from the design and secondary evidence, not measured effects.

Therefore, the effectiveness of fertilizer subsidies cannot be adequately assessed solely on the basis of budget allocations, production volumes, transaction records, or quantities distributed. Regarding RQ5, the study proposes transforming fertilizer subsidy evaluation toward an input-process-output-outcome-impact framework that systematically links regulatory coherence, institutional capacity, governance quality, and sustainable agricultural performance. Theoretically, the study extends institutional and policy-capacity analysis by assessing coherence across levels, sectors, and outcomes; practically, it offers indicators for the forthcoming evaluation of the 2025–2026 reforms under Article 55A.

Suggestions

This study recommends six measures aligned with the Discussion. In the short term (2026–2027): (1) the Ministry of Agriculture should issue transitional technical guidelines mapping changes in authority, procedures, SPJB contracts, and timelines; (2) the Ministry of Agriculture and the Ministry of Finance should specify the verification of α and β and the roles of BPKP and BPK, and move supervision to a risk-based approach using redemption-transaction analytics (ministerial regulations); and (3) district agriculture offices should align allocation and delivery schedules with cropping calendars and agroecological conditions (district decisions under Articles 22–23 of Permentan 15/2025).

In the medium term (2027–2029): (4) the Ministry of Agriculture, BPS, and local governments should build an integrated, dynamic data system linking farmer identity, land, commodities, cropping calendars, allocations, stocks, transactions, and grievances, with an end-to-end service owner and escalation protocol (amendment to Perpres 6/2025); (5) subsidies should be integrated with extension, soil testing, nutrient mapping, and organic-matter management, with offline services for farmers with limited digital access; and (6) Bappenas and the Ministry of Agriculture should embed the outcome indicators in Table 4 into the ministerial evaluation (Article 55A). Measures (4) and (5) entail fiscal costs for data systems and soil testing that should be budgeted explicitly. Future research should use difference-in-differences designs exploiting

regional variation in implementation timing, farm-household surveys on access and transaction costs, and soil-sampling studies linked to subsidy uptake.

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AUTHOR CONTRIBUTION STATEMENT

The authors conceptualized the study, formulated the research problem, designed the methodology, collected and analyzed the data, and interpreted the findings. They also conducted the literature review, developed the analytical framework, prepared the initial manuscript, critically revised its content, ensured its academic integrity, and approved the final version for publication.

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APPENDIX

Table A1. Codebook for the regulatory content analysis

Category	Operational definition	Example provision
Clarity of objectives	Objectives, scope, and success criteria are explicit	Seven-right principles (Perpres 6/2025)
Consistency	No conflict between levels; amendments explicit	Permentan 3/2026 amends Permentan 15/2025
Allocation of authority	Actor, task, and decision instrument specified	Arts. 17–25 Permentan 15/2025 (tiered allocation)
Coordination and interoperability	Data sharing and joint decision rules	Art. 24 (e-RDKK synchronised with SIMLUHTAN)
Implementability	Procedures, deadlines, and resources defined	Arts. 21(3), 23(3) (allocation by December)
Transparency and supervision	Reporting, verification, and audit	Arts. 35–38, 41, 50A–50E
Grievance	Complaint channel and resolution standard	No provision found
Adaptability	Review, evaluation, and amendment clauses	Arts. 55A–55B
Economic orientation	Supply, price, fiscal, and productivity provisions	Art. 7; Arts. 4–6 Permentan 6/2026
Social orientation	Eligibility, access, and equity provisions	Art. 3 (eligibility)
Environmental orientation	Nutrient-efficiency, soil, and emission provisions	Art. 5 (organic fertilizer)

Table A2. Rubric for the alignment levels

Level	Criterion
Strong	Explicit provision with a responsible actor and a measurable standard, consistent with the reviewed evidence
Partial	Explicit provision without a measurable standard or enforcement mechanism
Weak	Only an indirect or implied basis in the provisions
Gap	No relevant provision
Partial–Strong; Weak–Partial	Sub-provisions of the aspect fall in two adjacent levels

Table A3. Studies informing the alignment matrix

Study (design; context)	Finding used
Druilhe and Barreiro-Hurlé (2012) (Review; sub-Saharan Africa)	Subsidies need credit, extension, and market complements
Holden (2019) (Review; Africa)	Input use and yields rise; effects depend on design
Jayne and Rashid (2013) (Synthesis; Africa)	Crowding out and weak targeting reduce benefits
Jayne et al. (2018) (Review; Africa)	Elite capture and political targeting in second-generation programmes
Nguyen et al. (2023) (Meta-analysis; global)	Positive yield effects conditioned by targeting and timing
Menegat et al. (2022) (Global estimate)	Synthetic N production and use drive emissions
Heyl et al. (2022) (Review; agriculture)	Subsidies aid sustainability only with explicit goals
Bodin (2017) (Review; governance)	Collaborative governance depends on network structure
Warr and Yusuf (2014) (CGE model; Indonesia)	Subsidy reduces poverty more than import protection
Fatimah and Muhafidin (2024) (Case study; Indonesia)	Distribution, supervision, and communication problems
Kiloes et al. (2026) (Systems analysis; Indonesia)	Data inconsistency, delays, and opportunism cause shortages
Osorio et al. (2011)* (Incidence analysis; Indonesia)	Largest 40% of farmers receive about 60% of benefits
Hendrawan et al. (2011)* (Policy analysis; Indonesia)	Subsidy patterns and distribution systems
Pambudi et al. (2025)* (Evaluation; Indonesia)	Governance, productivity, and welfare before 2025

* Contextual evidence, not counted in the PRISMA flow.