

# Similar but Different: Comparative Seed Policy Implementation for Food Security in Indonesia and Malaysia

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## Abstract

**Purpose:** This study aims to compare the implementation of high-quality seed and seedling management policies in Indonesia and Malaysia and to understand their role in strengthening national food security.

**Research Methodology:** This study employs a qualitative comparative approach focusing on Indonesia and Malaysia as ASEAN countries with different agricultural governance systems. Data were collected through document analysis of national regulations, policy reports, agricultural plans, and official publications related to seed and seedling management. The analysis applies a policy implementation framework to examine institutional arrangements, distribution systems, and stakeholder involvement, relying solely on secondary data.

**Results:** The findings show clear differences in policy implementation between the two countries. Malaysia has developed an integrated seed management system supported by strong institutions, digital distribution mechanisms, and continuous research and development. This system encourages compliance and effective user behavior among farmers. Indonesia, however, remains at an early implementation stage, facing challenges such as fragmented institutions, limited coordination, and inefficient seed distribution systems. These conditions reduce policy effectiveness and slow progress toward food security goals.

**Conclusions:** The study concludes that institutional coherence, digital governance, and strong research support are critical factors in successful seed policy implementation.

**Limitations:** This study is limited to document-based analysis and does not include field observations or farmer interviews.

**Contributions:** This study contributes to agricultural policy studies, food security research, and comparative public policy by providing insights for policymakers, researchers, and regional institutions in ASEAN.

**Keywords:** *Food Security, High-Quality Seeds and Seedlings, Policy Implementation, Indonesia, Malaysia, ASEAN*

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## 1. Introduction

Food security has become one of the most critical policy concerns within the Association of Southeast Asian Nations (ASEAN, 2020) region over the past two decades. According to the ASEAN Integrated Food Security (AIFS) Framework published in 2020, food security has been a strategic priority for ASEAN since 2009 (ASEAN, 2020). During the period 2009-2020, ASEAN formulated and implemented the Integrated Food Security Framework (AIFS) along with two Strategic Action Plans

for Food Security. These initiatives emphasized coordinated strategic actions supported by strong commitments from all ASEAN Member States. In 2020, ASEAN agreed to extend the AIFS Framework and the Strategic Plan of Action on Food Security (SPA-FS) until 2025 to strengthen regional cooperation in addressing emerging food security challenges (ASEAN, 2020).

Despite these regional efforts, the realization of food security remains vulnerable to global and domestic disruptions. One major challenge was the COVID-19 pandemic, which negatively affected agricultural productivity, access to farming inputs, and the availability of agricultural information, particularly for small-scale farmers. Evidence from developing countries shows that restrictions on mobility and supply chain disruptions limited farmers' access to seeds, fertilizers, and extension services, weakening food production systems (Mutegi et al., 2024). In addition to pandemics, climate change has emerged as a structural threat to food security, increasing the frequency of floods, droughts, extreme weather events, and plant diseases that disrupt agricultural productivity (Fiorini et al., 2024).

In Indonesia, policies related to high-quality seed and seedling management are strongly shaped by the legacy of a highly centralized agricultural governance system during the Orde Baru period. Between the 1970s and 1990s, government programs such as Bimas and Inmas functioned as key instruments for distributing agricultural resources, including seeds, which were fully controlled by Kementerian Pertanian Republik Indonesia. Although political reforms in 1998 introduced decentralization and transferred certain authorities to regional governments, the governance of high-quality seeds remains largely coordinated at the central level. This condition has created persistent gaps between national policy directions and the technical capacity of local governments, particularly in seed certification, distribution, and quality control.

From a political perspective, the post-reform period in Indonesia has been characterized by frequent cabinet reshuffles that often shift agricultural development priorities. These priorities have ranged from increasing agricultural productivity and commodity diversification to strengthening national food security. The legal framework governing seed management is primarily based on Undang-Undang Nomor 12 Tahun 1992 tentang Sistem Budidaya Tanaman, along with various Peraturan Menteri Pertanian related to seed certification and supervision. However, the implementation of these regulations continues to face challenges, especially in ensuring equitable access to high-quality seeds across Indonesia's vast territory and diverse agroecological conditions, which require adaptive and region-specific distribution approaches.

In contrast, Malaysia's high-quality seed management policy is rooted in the National Agrofood Policy 2011-2020, which was subsequently continued under the National Agrofood Policy 2021-2030. Seed quality management is positioned as a strategic component for achieving a minimum rice Self-Sufficiency Level (SSL) of 70 percent (KPKM, 2023). Institutional arrangements play a central role, with the Ministry of Agriculture and Food Security Malaysia and the Malaysian Agricultural Research and Development Institute jointly responsible for the entire seed production chain, including varietal research, seed production, certification, and distribution to farmers.

Malaysia's policy implementation operates within a relatively stable parliamentary system that supports continuity in technical agricultural policies despite changes in political coalitions at the national level. The centralized and streamlined structure of Malaysia's agricultural bureaucracy allows seed policies to remain consistent over time, reducing uncertainty for farmers and private sector actors. As a result, cabinet changes do not significantly alter the core structure of seed management policies, enabling long-term planning and sustained investment in agricultural research and innovation (Nodin, Mustafa, & Hussain, 2022).

These different institutional foundations shape distinct policy learning dynamics between Indonesia and Malaysia. Indonesia's decentralized governance system, which distributes authority widely to regional governments, faces limitations in fully adopting Malaysia's centralized seed management model due to differences in institutional capacity and local political dynamics. Nevertheless, Indonesia can derive important policy lessons from Malaysia, particularly in seed quality regulation, tiered certification

systems, and the digitalization of seed distribution, which could be adapted to Indonesia's decentralized governance context. Conversely, Malaysia may benefit from Indonesia's experience with a wider diversity of local seed varieties and the potential development of new generations of farmers to strengthen the resilience of national seed systems.

The implementation of food security policies can be broadly divided into three interconnected stages: on farm, off farm, and resilient. The on-farm stage focuses on food production processes, including fertilizer management, agricultural technology, high-quality seeds, and input assistance. The off-farm stage emphasizes food distribution, accessibility, and price stability, while the resilient stage addresses food surplus management, food reserves, nutrition, and food storage policies. Among these stages, the on-farm stage plays a particularly critical role because it directly determines production capacity and resilience to external shocks (Abdallah, Abdul-Rahaman, & Issahaku, 2021).

Climate-related risks further underline the importance of the on-farm stage. Floods, droughts, and shifting weather patterns caused by climate change have disrupted agricultural production by limiting access to water and damaging agricultural land. Evidence from Bangladesh demonstrates that such climate-induced events significantly reduce crop yields and threaten farmer livelihoods (Alam et al., 2024). These risks emphasize the need to strengthen on-farm inputs, especially high-quality seeds.

Within the on-farm stage, multiple management components are involved, including agricultural land governance, seed and seedling programs, national fertilizer management, livestock feed production, food infrastructure development, farmer capacity building, and pest and disease control. Among these components, seed and seedling management represents the most critical entry point in food production systems. High-quality seeds determine crop resilience, productivity, and resistance to pests and diseases. Numerous studies highlight that genetic improvement and innovation in seed development play a vital role in enhancing crop resilience to climate change and biological threats (Atlin, Cairns, & Das, 2017; Shafik, Tufail, De Silva Liyanage, & Apong, 2024).

Land degradation and land-use conversion further threaten agricultural productivity. Pathirana and Carimi (2022) argue that effective seed development and management can mitigate productivity losses caused by declining land quality. By improving seed performance, agricultural systems can maintain yields despite environmental constraints, reinforcing the strategic role of seed policy in food security.

A growing body of literature examines food security from the on-farm perspective. Studies show that increasing domestic food production, promoting crop and livestock diversification, adopting modern technologies, and strengthening farmer capacity are essential for improving household food security (Amaza, 2018; SILA & PELLOKILA, 2007). Research on Malaysia's Rice Self-Sufficiency (RSS) policy emphasizes production maximization through irrigation modernization, efficient agrochemical use, and improved farming practices (Nodin et al., 2022). Other studies identify land-use conversion as one of the most significant factors undermining agricultural productivity and food security (Makbul, Faoziyah, Ratnaningtyas, & Kombaitan, 2019; Martanto, 2021; Sholikah et al., 2021; Živanović Miljković, Popović, & Gajić, 2022). Meanwhile, increased agricultural productivity has been shown to improve food access and availability at the community level (Vansant et al., 2024).

Research focusing on the off-farm dimension highlights persistent weaknesses in food distribution systems, particularly where supply chains remain traditional and poorly coordinated. Comparative studies indicate that limited government involvement and weak institutional frameworks reduce food accessibility and price stability (Dwiartama, Kelly, & Dixon, 2023). Policy learning from countries with more advanced food distribution systems has therefore been proposed as a strategy for strengthening national food supply institutions (Widiana, Wijaya, & Atmoko, 2022).

Studies on the resilient dimension of food security emphasize the role of social protection, food quality, and nutrition. Evidence suggests that food availability alone does not necessarily improve human development outcomes unless accompanied by adequate food safety and quality standards (Jakaria & Lutfi, 2022). Other research highlights the contribution of food security initiatives in reducing

malnutrition, stunting, and child mortality (Budiawati, Natawidjaja, Sarwo Utomo, Perdana, & Karmana, 2024; Walton et al., 2024).

From a governance perspective, effective food security policies require strong institutional foundations, including accountability, transparency, and regulatory oversight. Weak governance structures often result in gaps between policy design and implementation (Aassouli, Akande, & Jureidini, 2023). Furthermore, evidence-based policymaking and collaboration among public institutions, private actors, and civil society are essential to achieving food security and reducing food loss (Medialdia, Salamat, & Jr, 2024).

Despite extensive research on food security, significant gaps remain. Previous studies have rarely examined high-quality seed and seedling management as a primary driver of agricultural productivity and resilience to pests and diseases. Moreover, comparative analyses of seed management policies between Indonesia and Malaysia remain limited. This study addresses these gaps by comparing the implementation of seed and seedling management policies in Indonesia and Malaysia using policy implementation and policy maturity frameworks. Through this comparison, the study aims to generate policy lessons that can be adapted to strengthen Indonesia's agricultural productivity, enhance resilience to climate and biological threats, and support the successful implementation of national food security policies.

### ***1.1 Research Questions***

1. How is the implementation of high-quality seed and seedling management policies in Malaysia and Indonesia in achieving food security?
2. What are the characteristics of the implementation of high-quality seed and seedling management policies in Malaysia and Indonesia in achieving food security?
3. What factors drive the success and failure of high-quality seed and seedling management policy implementation in Malaysia and/or Indonesia?

## **2. Literature Review and Conceptual Framework**

### ***2.1 Policy Implementation***

Policy implementation refers to the process of applying public policies formulated by governments or decision-making institutions through a series of actions undertaken by actors at the operational level to achieve policy objectives. It represents a critical stage in the public policy cycle because it determines whether a policy produces the intended outcomes (Sabatier & Mazmanian, 1989). Many studies identify field level actors such as government officials, local implementers, and relevant stakeholders as key determinants of implementation success since they interpret and execute policies within specific social and institutional contexts (Van Meter & Van Horn, 1975).

Policy implementation is not merely the execution of formal instructions but involves interpretation and adaptation to real world conditions. Hill and Hupe (2002) emphasize that implementation consists of interactions among actors across different levels of government and organizations at both central and local levels. In the context of food security policy in Indonesia, effective coordination and synergy among these actors have been identified as essential for achieving policy objectives (Akbar, Alwi, Susanti, & Nahrudin, 2022).

Furthermore, policy implementation is strongly influenced by local political and economic contexts. Nkhoma, Bosman, and Eduful (2019) demonstrates that political contestation and socio-economic conditions shape both policy design and implementation, often encouraging the adoption of populist instruments such as subsidies to enhance political legitimacy. Recent studies on policy implementation increasingly emphasize contextual factors and support integrated approaches that combine central policy direction with local participation, highlighting the involvement of actors across governance levels as a key condition for effective implementation.

Figure 1-1. Implementation as a Political and Administrative Process

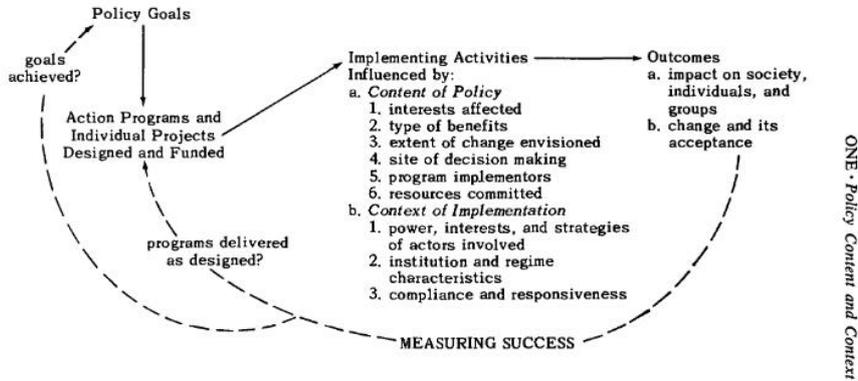


Figure 1. Grindle’s policy implementation framework

Figure 1 illustrates Grindle’s policy implementation framework, which explains implementation as a political and administrative process linking policy goals to real outcomes. The framework shows that policy success depends not only on policy design but also on policy content (benefits, actors, resources, decision-making) and the implementation context (power relations, institutional characteristics, and compliance). These factors shape how programs are executed and ultimately determine their social impacts, public acceptance, and whether policy objectives are achieved.

**2.2. Policy Pyramid Framework**

The policy pyramid developed by Mayers, Bass, and Macqueen (2005) provides a diagnostic and planning framework for governance analysis, with the primary aim of encouraging participatory assessment, improvement planning, and continuous monitoring. This framework was originally designed to address the governance gap between field-level practices and broader policy objectives, and it can be adapted to different contexts and research needs while maintaining its analytical relevance (Mayers et al., 2005).

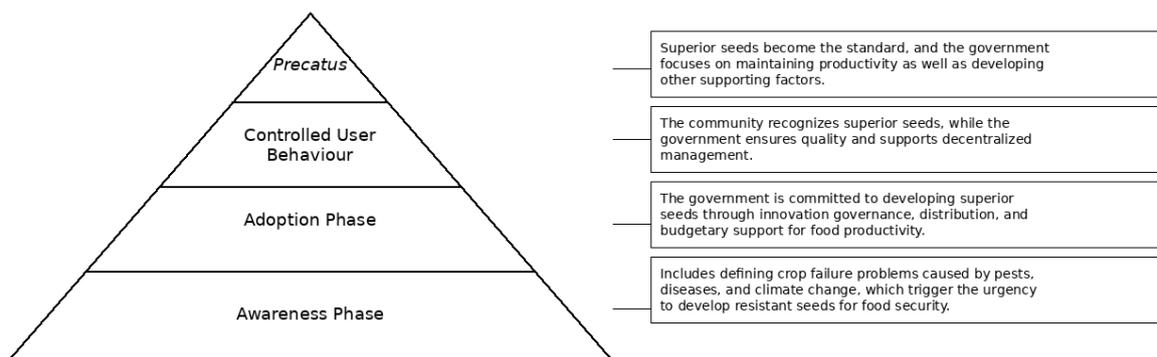


Figure 2. Policy pyramid model of high-quality seeds in Indonesia and Malaysia

Figure 2 illustrates the policy pyramid used to analyze the sequential stages of policy implementation in food security, namely awareness, adoption, controlled user behaviour, and pre-catus. In the context of high-quality seed and seedling management, the pyramid framework helps assess the extent to which policies respond to farmers’ needs, improve distribution systems, and strengthen institutional governance. It also enables the identification of gaps between policy design and implementation outcomes in Indonesia and Malaysia, thereby providing a basis for comparative analysis and policy learning. The Mayers et al. (2005) pyramid is applied to explain the maturity of policy implementation,

while the Grindle (2017) framework is used at each stage to identify key indicators and to provide a deeper understanding of factors that support or hinder implementation.

The awareness phase begins when policy problems are recognized by government institutions and society. At this stage, the analysis focuses on the context of implementation, particularly the power, interests, and strategies of involved actors, as well as institutional characteristics and leadership structures (Grindle, 2017). From the content of policy perspective, attention is given to affected interests, the extent of change envisioned, and the site of decision making. This combined analysis allows for an early evaluation of both the substance of policy objectives and the feasibility of implementation.

The adoption phase is characterized by increasing government commitment to the development and management of high-quality seeds. Within the context of implementation, analysis emphasizes actor strategies, institutional roles, and compliance and responsiveness in policy execution, including the involvement of non-governmental actors where relevant. From the content of policy perspective, this phase focuses on the type of benefits generated, the identification of program implementors, and the allocation of committed resources. This stage reflects the transition from policy intent to structured action.

The controlled user behaviour phase indicates that seed innovations have achieved broad recognition and acceptance among users. At this stage, implementation analysis highlights compliance and responsiveness to ensure that policies align with farmers' needs. From the policy content perspective, the role of implementors and the adequacy of committed resources are central, as these factors determine the sustainability and effectiveness of the program in practice.

The final phase, pre-catus, represents policy maturity, where high-quality seeds are widely adopted and serve as a reference in agricultural practice. Policy analysis at this stage emphasizes the sustainability of program implementors, particularly in research and development activities and seed distribution systems. Continued resource commitment remains essential to ensure long-term policy effectiveness and ongoing innovation (Grindle, 2017; Mayers et al., 2005).

### ***2.3 Food Security Implementation***

Previous studies show that food security implementation generally involves cross-sectoral collaboration among multiple stakeholders, including food agencies, agricultural offices, local governments, agricultural extension workers, farmer groups, and economic actors (Akbar et al., 2022). However, such collaboration often remains ineffective due to the absence of integrative coordination mechanisms that can align internal and external government stakeholders. Power imbalances among stakeholders and limited involvement of local communities further constrain decision-making processes in food security policies, resulting in policy outcomes that are frequently misaligned with local needs and dominated by political and economic elites (Tjilen et al., 2024).

Similar challenges have been observed in other contexts. In Ghana, youth-oriented food security policies have insufficiently involved young people in policy formulation, implementation, and evaluation, reflecting weak coordination between local stakeholders and central government institutions (Boadu, 2024). In the ASEAN context, delayed government responses to disasters have also been identified as a critical weakness in maintaining food security resilience (Dwiartama et al., 2023).

At the on-farm level, food security implementation faces complex challenges that have attracted growing research attention. Many farmers remain unaware of the impacts of climate change and continue to rely on traditional farming practices, despite evidence that climate forecasting and adaptive agricultural techniques can significantly improve productivity (Wandera, Dindi, Jaoko, & Koech, 2024). The adoption of Climate-Smart Agricultural Practices offers substantial potential to mitigate climate change impacts, reduce greenhouse gas emissions, enhance productivity and farmer incomes, and strengthen agricultural resilience (Wahab, Taiwo, Diallo, Bishoge, & Samoura, 2024).

Plant diseases represent another major constraint on food security. Recent studies introduce advanced detection models, including integrated neural network approaches and visualization techniques, to improve early identification and treatment of plant diseases, thereby supporting more effective farm-level decision-making (Shafik et al., 2024; (Karim et al., 2024). In addition to technological solutions, the use of ethnobotanical knowledge and local plant resources has proven effective in managing pests and diseases in several regions, including Mpumalanga Province in South Africa (Gillani et al., 2024; Shai, Materechera, Amoo, & Aremu, 2024).

The development and management of high-quality seeds and seedlings are increasingly recognized as strategic solutions to climate and pest-related challenges. Rapid plant breeding and continuous varietal replacement are essential for addressing climate-induced stress in developing countries (Atlin et al., 2017). Genetic resources, particularly crop wild relatives, play a crucial role in developing climate-tolerant varieties, while perennial crops contribute to soil carbon enhancement and erosion reduction (Pathirana & Carimi, 2022). Advances in genetic breeding and biotechnology further strengthen crop resilience under adverse environmental conditions (Shafik et al., 2024).

Despite extensive technical and agronomic research on superior seeds, limited attention has been given to seed and seedling management from a comprehensive policy implementation perspective. This gap underscores the importance of examining how seed-related policies are implemented in practice. Therefore, this study seeks to generate policy learning that can support more effective seed and seedling management in Indonesia by adapting proven practices from Malaysia while aligning them with Indonesia’s local institutional and socio-political context. Such learning is expected to enhance agricultural productivity and strengthen long-term food security resilience.

### 2.4 Conceptual Framework

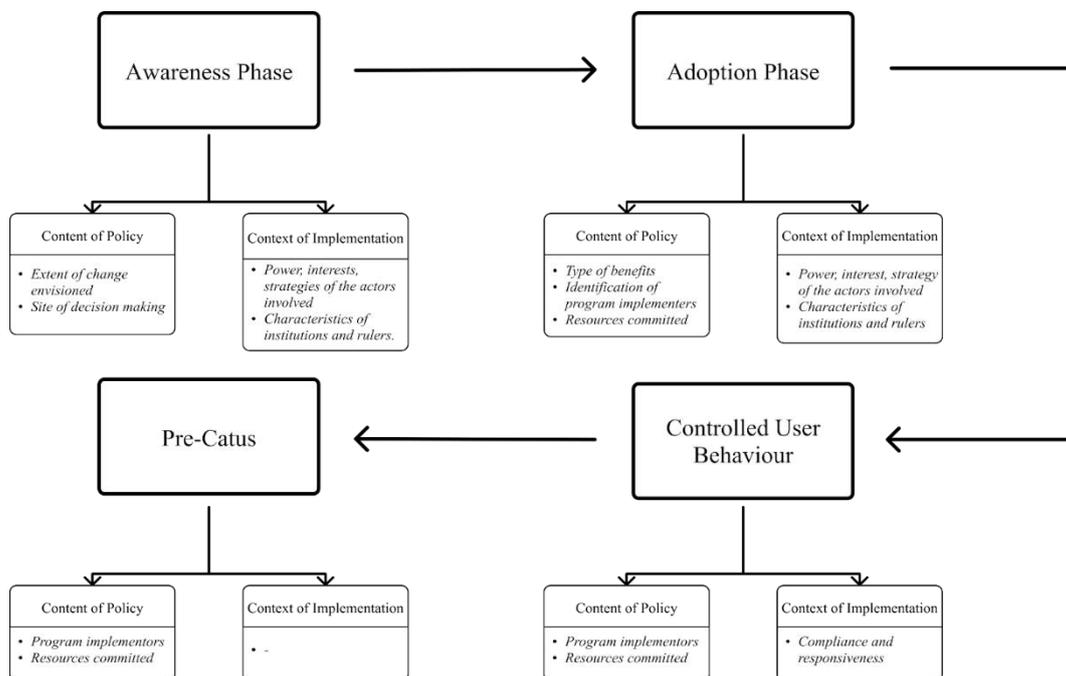


Figure 3. Conceptual framework

Figure 3 applies a policy implementation perspective to examine how high-quality seed and seedling management policies support food security. The conceptual framework integrates Grindle’s policy implementation framework (2017) and the policy pyramid model by Mayers et al. (2005) to analyze both policy design and implementation processes. Grindle’s framework is used to assess the content of policy and the context of implementation, including policy objectives, implementers, resource allocation, institutional characteristics, actor roles, and compliance. The Mayers et al. (2005) pyramid is employed to evaluate the maturity of policy implementation through the stages of awareness,

adoption, controlled user behaviour, and pre-cultus. By combining these frameworks, the study identifies gaps between policy formulation and practice in Indonesia and Malaysia and supports comparative analysis and policy learning to improve seed and seedling management and food security outcomes.

### **3. Methodology**

#### ***3.1 Research Approach and Type***

This study employs a qualitative approach to examine the implementation of high-quality seed and seedling management policies in Malaysia and Indonesia. Qualitative research relies on the identification of textual and visual data, applies specific protocols for data recording, and analyzes information through systematic analytical steps to reflect the meanings conveyed by the data and interpreted by the researcher for the reader (Creswell & Miller, 2000). The qualitative approach is chosen because this study seeks to comprehensively explore the content and context of policy implementation in both Malaysia and Indonesia, identify patterns, conduct comparisons, and examine key factors influencing policy implementation.

Within the qualitative approach, this study adopts document analysis as the primary research type. Document analysis is selected because policies related to seed and seedling management in Indonesia and Malaysia are documented in various regulations, policy reports, and national strategies that can be systematically examined. This method enables the study to understand policy backgrounds, compare policy content and implementation across both countries, and identify factors that support or hinder policy effectiveness. In addition, document analysis is resource-efficient, cost-effective, and does not require direct interaction with respondents, thereby reducing potential bias commonly associated with interviews or surveys (Cardno, 2018).

#### ***3.2 Types and Sources of Data***

The data required for this study consist of secondary data related to the implementation of high-quality seed and seedling management policies in Malaysia and Indonesia. These include data on seed procurement, coverage and distribution of high-quality seeds, budget allocation for research and development of seeds and seedlings, and other relevant information. The data are obtained from official government websites, such as ministries and related agencies, and include various written sources, such as official policy documents, policy evaluation reports, academic journal articles, and media publications. Given these data requirements, document analysis is employed to collect, screen, and analyze all relevant sources in order to generate a comprehensive understanding of seed and seedling management policy implementation in Malaysia and Indonesia.

#### ***3.3 Data Collection Technique***

As explained previously, this study relies heavily on secondary and tertiary data; therefore, document analysis is used as the primary data collection technique. Document analysis is a qualitative research method used to examine, understand, and interpret the content of written documents, both official and unofficial, in order to extract relevant information for analysis. This method aims to identify patterns, themes, and meanings within documents to enhance understanding of the phenomenon under investigation, namely the implementation of high-quality seed and seedling management policies in Malaysia and Indonesia (Bowen, 2009).

#### ***3.4 Data Analysis Method***

The data analysis process begins with data collection using the methods and approaches described above. All collected data and information are then analyzed in accordance with the theoretical frameworks proposed by Mayers et al. (2005) and Grindle (2017). This stage includes data cleaning or data reduction to eliminate sources that may be unreliable or irrelevant. After the data cleaning process, the remaining data are analyzed using the Mayers et al. (2005) and Grindle (2017) frameworks to conduct a comparative analysis of seed and seedling management policy implementation in Malaysia and Indonesia.

The analysis seeks to identify patterns and relationships within the data. Subsequently, data presentation is conducted descriptively, followed by in-depth analysis to clearly illustrate the comparative conditions

between Indonesia and Malaysia. Based on this analysis, conclusions are drawn regarding the implementation of high-quality seed and seedling management policies in both countries, the key factors influencing policy effectiveness, and the policy lessons that can potentially be adapted in Indonesia to improve seed and seedling management practices.

## **4. Results and Discussions**

### **4.1 High-Quality Seeds and Food Security Policy**

High-quality seed and seedling management is a strategic foundation of agricultural development and national food security. Both Indonesia and Malaysia have established progressive policy frameworks through national plans, technical regulations, and production targets. However, policy effectiveness depends on how these frameworks are implemented at the field level and translated into tangible benefits for farmers.

In Indonesia, seed management policies are embedded in national frameworks such as the *Rencana Strategis Badan (2023)* and sectoral regulations under the Ministry of Agriculture. Efforts to develop local superior varieties, including IPB 3S and IPB Prima rice, demonstrate policy commitment to productivity improvement (Husaini, 2023). Nevertheless, implementation remains uneven. Certified seed usage varies significantly, with adoption rates of 69 percent for rice, 75 percent for maize, and only 40 percent for sugarcane, reflecting persistent access and capacity gaps, particularly in marginal regions.

Malaysia has adopted a more centralized and standardized seed management system. Through coordination between the Ministry of Agriculture and Food Security and MARDI, Malaysia implements a tiered seed production system supported by ISO 9001 certification and annual production targets to strengthen food self-sufficiency (Mardi, 2025; Rosli, 2023). Despite these strengths, certified seed supply met only about half of national demand in 2023, causing planting delays in major rice-producing areas (AZIZ, 2023; Zaf, 2023).

Malaysia's adaptive innovations, including the development of MR326 (Kesidang) for rainfed areas and the introduction of digital distribution through BBShoppe, enhance distribution efficiency and transparency (Mardi, 2025). In contrast, Indonesia faces challenges related to weak inter-institutional coordination. Seed subsidy programs often experience bureaucratic delays, uneven distribution, and limited quality monitoring, resulting in regional disparities. Overall, Malaysia demonstrates stronger institutional integration and distribution efficiency, while Indonesia's decentralized system limits implementation consistency but offers advantages in varietal diversity and production scale. These contrasting experiences highlight opportunities for policy learning to strengthen high-quality seed management as a foundation for national food security.

### **4.2 Institutional Dynamics, Distribution, and Policy Effectiveness at the Grassroots Level**

The implementation of high-quality seed and seedling management policies in Indonesia and Malaysia is strongly influenced by institutional structures, distribution systems, and socio-economic conditions at the grassroots level. In Indonesia, policy implementation involves multiple actors, including the Ministry of Agriculture, BRIN, and higher education institutions, which contribute to research, production, and information dissemination. However, limited coordination between institutions and weak integration between central and local governments reduce implementation effectiveness across regions (Febrinastri & Firmansyah, 2023).

Malaysia applies a more centralized and standardized institutional approach. The Ministry of Agriculture and Food Security oversees policy direction, while MARDI plays a central role in research, production, and quality control through a tiered seed system supported by ISO 9001 certification (Mardi, 2025). This structure ensures greater consistency in seed quality and regulatory enforcement.

Seed distribution remains a major challenge in Indonesia. Despite high certified seed production, uneven logistics, delivery delays, and limited digitalization hinder timely farmer access, forcing many to rely on uncertified local seeds (Pardede, 2023). Malaysia has improved distribution efficiency

through digital platforms such as BBShoppe and regulatory frameworks under the Plant Variety Protection Act 2004, although supply shortages in 2023 still caused planting delays in key regions (AZIZ, 2023).

Socio-economic factors further shape policy outcomes. Small landholdings, limited access to credit, and low trust in certified seeds constrain adoption in Indonesia (BPS, 2023; Yuliana, 2022). Malaysia addresses these barriers through integrated subsidies, strict regulation, and transparent certification, strengthening farmer confidence and access. Overall, Indonesia faces greater implementation constraints due to fragmented institutions and distribution inefficiencies, while Malaysia demonstrates stronger performance through centralized governance and digital systems. Nevertheless, both countries continue to face challenges in ensuring equitable access and supply stability, highlighting the importance of institutional capacity, effective distribution, and farmer-centered support in strengthening food security.

#### ***4.3 Policy Stages Analysis***

Policy implementation aims not only to assess whether a policy is executed, but also to explain why it succeeds or fails. This section analyzes the implementation of high-quality seed management policies in Indonesia and Malaysia using the Policy Pyramid framework by Mayers et al. (2005), which categorizes policy development into four stages: Awareness, Adoption, Controlled User Behaviour, and Pre-Catus. This analysis is complemented by Grindle (2017) framework, emphasizing the role of actors, institutional characteristics, resource allocation, and implementation capacity in shaping policy outcomes. The combined framework allows this study to identify both the position of each country within the policy cycle and the structural factors influencing policy performance.

##### ***4.3.1 Awareness***

At the awareness stage, policy effectiveness depends on the ability of governments to communicate policy objectives and build institutional support (Grindle, 2017). Indonesia has demonstrated early awareness of the importance of high-quality seeds through national strategic documents and certification campaigns. However, awareness remains uneven at the local level due to limited coordination, project-based initiatives, and weak integration between central and local institutions. Policy decision-making remains centralized, while local governments and non-state actors play limited roles.

Malaysia, in contrast, demonstrates a more mature awareness stage. Seed policy is clearly embedded within national frameworks such as the National Agro-Food Policy (NAP 2.0) and Dasar Sekuriti Makanan Negara. Decision-making is centralized but efficient, coordinated primarily by the Ministry of Agriculture and Food Security and MARDI. Strong institutional alignment, long-term funding, and research-driven strategies enable Malaysia to move beyond normative awareness toward operational readiness.

##### ***4.3.2 Adoption***

The adoption stage reflects the extent to which policies are internalized and implemented by actors on the ground. In Indonesia, adoption has occurred through research institutions and regional seed centers, but remains uneven due to weak monitoring systems, fragmented distribution, and limited farmer access to certified seeds. Large public investments and subsidies have not translated into consistent outcomes, largely because farmers remain marginal in decision-making processes and digital distribution systems are underdeveloped.

Malaysia exhibits a higher level of adoption, supported by clear institutional roles, targeted subsidies, and digitalized distribution through platforms such as BBShoppe. Seed policy benefits extend beyond productivity to long-term food security, cost efficiency, and sustainability. Strong coordination between research institutions, regulators, and local governments enables more effective policy uptake and market integration.

##### ***4.3.3 Controlled User Behaviour***

At this stage, user behavior is stabilized through monitoring, incentives, and compliance mechanisms. Indonesia has shown progress, particularly through training programs and infrastructure support, but farmer compliance remains inconsistent. Limited extension capacity, uneven technology adoption, and high seed prices reduce responsiveness, especially among smallholders. The absence of integrated monitoring systems further weakens behavioral control.

Malaysia demonstrates more consistent behavioral outcomes. Programs such as Agropreneur Muda actively engage young farmers, supported by strong financial commitments, digital agriculture training, and performance-based incentives. High levels of compliance and responsiveness are reflected in improved productivity, reduced costs, and increased farmer income, supported by continuous monitoring and peer-based learning systems.

#### 4.3.4 Pre-Catus

The Pre-Catus stage represents policy maturity, where innovations become institutionalized and sustainable practices. Indonesia has not yet reached this stage. Seed policy implementation remains project-based, lacks standardized national systems, and is weakly supported by digital monitoring and private sector participation. Although significant resources have been invested in agricultural infrastructure, institutional consolidation and long-term sustainability mechanisms remain limited.

Malaysia, by contrast, has largely achieved the Pre-Catus stage. A standardized four-stage seed production system, ISO 9001 certification, strong legal frameworks, and mixed funding models involving the state and private sector support long-term policy stability. Integration between research, regulation, and distribution enables Malaysia to institutionalize seed policy within its national food security system.

#### 4.4 Comparative Policy Position of High-Quality Seeds in Indonesia and Malaysia

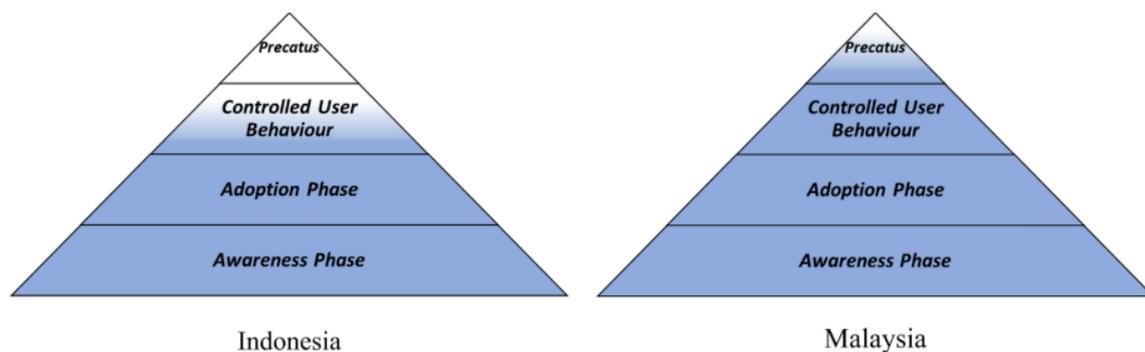


Figure 4. Comparative policy pyramid: Indonesia and Malaysia

The policy pyramid in Figure 4 illustrates the relative positions of Indonesia and Malaysia across four stages of high-quality seed policy adoption: Awareness, Adoption, Controlled User Behaviour, and Pre-Catus. Solid blue indicates stages that have been achieved, while the blue-to-white gradient represents transitional phases. The visualization highlights differing policy trajectories, particularly in institutional capacity, technological integration, and implementation consistency.

Malaysia is positioned in the transition from Controlled User Behaviour toward Pre-Catus, reflecting a high level of institutional consolidation. This is evidenced by its ISO 9001-compliant four-tier certified seed system, the BBShoppe digital distribution platform, and strong human resource development through the Agropreneur Muda program, supported by a RM95 million allocation for digital agriculture in 2024.

Indonesia, by contrast, remains in transition from Adoption toward partial Controlled User Behaviour. Despite high production outputs and substantial input subsidies, policy implementation is constrained by uneven distribution, limited digital integration, and weak behavioural control among farmers.

Although 46.84 percent of farmers have adopted agricultural machinery and technology, insufficient extension capacity and the absence of an integrated digital distribution platform limit nationwide compliance. Overall, the pyramid confirms that Malaysia has achieved a more mature and institutionalized seed policy system, while Indonesia continues to consolidate links between policy design and field-level implementation.

#### ***4.5 Critical Reflection toward Policy Reform***

The findings of this study align closely with existing literature on sustainable agricultural policy, reinforcing the view that effective superior seed policy depends on digital integration, institutional coordination, youth engagement, and standardized quality assurance. The comparison between Indonesia and Malaysia shows that policy success is not determined by production volume or fiscal allocation alone, but by the degree to which policies are institutionalized, technologically supported, and consistently implemented.

Digitalization emerges as a key policy instrument. Studies by Walton et al. (2024) and Zhang et al. (2021) demonstrate that digital platforms enhance transparency, efficiency, and accountability in agricultural input distribution. Malaysia's BBShoppe exemplifies how digital systems function as governance tools that enable real-time monitoring and reduce distribution inefficiencies. In contrast, Indonesia's limited digital integration weakens traceability and restricts the state's ability to control user behavior systematically.

The role of young farmers further supports existing evidence that youth are critical drivers of agricultural modernization (Elias et al., 2018; Luxia, 2024). Malaysia's Agropreneur Muda program illustrates how targeted policy design can transform young farmers into agents of technological change. Indonesia has a growing base of young farmers, but fragmented institutional support limits their transformative potential, indicating that individual readiness must be matched by enabling policy environments.

Institutional coordination is another decisive factor. Consistent with Pathirana and Carimi (2022), this study finds that Malaysia's centralized governance structure enables stronger policy coherence through clear vertical coordination between KPKM and MARDI. Indonesia, by contrast, continues to face fragmentation across ministries and between central and local governments, resulting in inconsistent implementation and weaker institutional consolidation.

Differences in seed certification systems further explain divergent outcomes. Literature emphasizes that standardized and enforceable certification enhances farmer trust and supply consistency (Jaffee & Srivastava, 1992; Janvry & Sadoulet, 2021). Malaysia's ISO 9001-certified four-stage seed system provides regulatory certainty, while Indonesia's absence of a unified national standard leads to regional variation and inconsistent quality control.

Despite Malaysia's stronger performance, direct policy transfer is neither feasible nor advisable. Structural differences in governance, infrastructure, and fiscal capacity require Indonesia to pursue adaptive reform rather than replication. As argued by Rose (1993), policy change is shaped by institutional legacies and must build upon existing structures. Consequently, digital distribution systems, certification reforms, and youth-focused programs in Indonesia should be implemented gradually, beginning in regions with adequate readiness.

Overall, this reflection highlights that reform of Indonesia's superior seed policy must move beyond production-oriented and subsidy-based approaches toward system-based governance. Strengthening local institutional capacity, expanding digital logistics, investing in farmer capability, and fostering public-private collaboration are essential steps. While Malaysia has largely institutionalized these elements, Indonesia remains in a transitional phase but retains strong potential to build a resilient and inclusive seed system to support long-term food security.

## 5. Conclusions

### 5.1. Conclusion

This study concludes that the management of superior seeds and seedlings constitutes a fundamental pillar in strengthening national food security in both Indonesia and Malaysia. Despite their comparable agroecological characteristics, the two countries demonstrate markedly different levels of policy implementation maturity. Indonesia is positioned in the transition from the Adoption phase toward Controlled User Behaviour, where policy frameworks and research initiatives are in place but remain constrained by institutional fragmentation, suboptimal inter-agency coordination, and uneven distribution mechanisms at the farmer level. In contrast, Malaysia has advanced to the Controlled User Behaviour phase and is approaching Pre-Catus, supported by centralized institutional governance, standardized quality certification, and digitally integrated distribution systems. These findings highlight that policy effectiveness is determined not merely by regulatory design or budget allocation, but by institutional integration, technological adoption, and the sustainability of implementation mechanisms.

### 5.2. Research Limitations

Building on the identified limitations and the evolving dynamics of seed policy, several directions for future research are recommended. First, future studies should prioritize field-based primary data collection to address uneven data availability across policy adoption stages through multilevel analysis involving governments and farmers. Second, in-depth field research is needed to explore farmers' perceptions, experiences, and adaptation strategies toward seed policies, particularly at the grassroots level. Third, further research should evaluate digital logistics systems for seed distribution, including pilot adaptations of platforms such as BBShoppe within the Indonesian context. Finally, broader regional comparative studies in Asia would strengthen policy learning by identifying transferable best practices. Expanding research in these areas will support more evidence-based, inclusive, and adaptive seed policies in Indonesia, particularly in response to food security challenges and digital agricultural transformation. This section provides suggestions for further research based on the findings of the study, such as expanding the sample, using new methods, or exploring factors that have not yet been studied. The goal is to deepen understanding of the topic discussed.

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