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FROM POLICY TO SUSTAINABLE OUTCOMES: THE ROLE OF INTEGRATED AGROFOOD HUBS IN MALAYSIA'S AGROFOOD TRANSFORMATION

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ABSTRACT

Malaysia's agrofood sector is at a crossroads, facing persistent challenges of land fragmentation, weak institutional coordination, and limited smallholder inclusion despite decades of policy reform. The National Agrofood Policy 2.0 (NAP 2.0) marks a shift toward sustainability, climate resilience, and digital transformation, yet implementation gaps continue to undermine food system resilience and environmental outcomes. This study critically examines the evolution of Malaysia's agrofood policies and situates them within broader debates on sustainable land use and environmental governance. Drawing on policy review and comparative insights from global agrofood hubs in the Netherlands, South Korea, Thailand, and Singapore, it introduces the Integrated Agrofood Hub (IAH) as a fit-for-purpose model tailored to Malaysia's socio-ecological context. Grounded in the Policy Integration and Value Chain Development (PIVCD) framework, the IAH consolidates production, processing, distribution, and governance within a coordinated spatial system. In doing so, it promotes sustainable land use, enhances digital adoption, and empowers smallholders while reducing systemic inefficiencies. The study's novelty lies in linking NAP 2.0 objectives with a hub-based, PIVCD-informed framework, offering a practical blueprint for advancing environmental sustainability and resilient agrofood transformation in emerging economies.

Keywords: Agrofood Policy, Agricultural Transformation, Food Security, Integrated Value Chain, Environmental Governance

INTRODUCTION

Agriculture remains one of the most fundamental sectors in human civilization, as it underpins food security, supports livelihoods, and contributes directly to economic stability. Beyond its economic function, agriculture plays a critical role in shaping social structures, sustaining rural communities, and ensuring national resilience against global shocks. The agricultural sector has historically played a central role in Malaysia's socio-economic development, serving as both a foundation for rural livelihoods and a pillar of national food security (Arshad et al. 2008). Since independence, successive policy initiatives, beginning with the First National Agricultural Policy (NAP1) in 1984 have sought to modernize farming practices, reduce rural poverty, and diversify the economy (Bakar et al. 2012). Over time, these policies evolved through NAP2 and NAP3, reflecting a strategic shift away from land expansion and commodity-based growth toward commercialization, value addition, and sustainability.

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In recent decades, however, Malaysia's agricultural landscape has grown increasingly complex, shaped by intersecting global and domestic pressures. Climate variability, land degradation, and shrinking arable land continue to constrain production (Siwar et al. 2009), while rapid urbanization and competing land use have further reduced agricultural space, deepening food security risks (Chamhuri and Mohamed 2013). With food demand projected to rise by up to 70% by 2050, these structural constraints are expected to intensify (Ali et al. 2023). Malaysia's reliance on food imports, coupled with an aging farming population and heightened vulnerability to climate shocks, positions the country among Asia's more food-insecure nations (Dobberstein and Peyyeti 2023). Institutional fragmentation, limited investment in agri-technology, and the absence of localized, context-sensitive policy responses further exacerbate these vulnerabilities (Zulkifli et al. 2025).

Despite decades of policy interventions, Malaysia continues to face persistent gaps between agricultural policy ambitions and real outcomes. The progression from the early National Agricultural Policies (NAP1-3) to the more comprehensive National Agrofood Policy 2.0 (NAP 2.0) reflects a more mature and future-oriented framework. Yet, systemic barriers continue to impede meaningful sectoral transformation. A major concern lies in the persistent income disparity between agricultural and non-agricultural households. Smallholders remain disadvantaged due to low productivity, reliance on traditional farming systems, limited access to finance, and the inability to achieve economies of scale. These challenges are compounded by fragmented value chains, where weak infrastructure, limited institutional coordination, and inconsistent market access restrict producers from moving into high-value markets. Malaysia's heavy reliance on food imports, particularly rice, further illustrates the disjuncture between national food security goals and actual performance (Zakaria et al. 2019).

Technological adoption also remains uneven. Although NAP 2.0 emphasizes digital agriculture and smart farming, uptake has been slow due to infrastructural limitations, weak policy support, and demographic constraints such as an aging farming population and low levels of digital literacy (Adnan et al. 2019; Zulkifli et al. 2011). Climate change intensifies these challenges, with Malaysia's food system increasingly vulnerable to climate shocks and fragmented governance. Mohd Azman et al. (2023) highlight the absence of integrated frameworks linking agrofood strategies with climate adaptation, limiting systemic resilience. Another critical gap is the lack of integrated agrofood hubs that could connect stakeholders, consolidate resources, and streamline value chain activities. While national food availability remains relatively stable, disparities in access and nutritional quality persist, especially among rural and low-income groups (LPPKN n.d.). These inequities, coupled with fragmented implementation, underscore the need for transformative platforms capable of localizing and scaling policy agendas. Without such mechanisms, Malaysia risks continued dependence on imports and further erosion of agrofood resilience.

To address these challenges, Malaysia introduced the National Agrofood Policy (2011–2020) and its successor, the National Agrofood Policy 2.0 (NAP 2.0), launched in 2021. NAP 2.0 reflects a more holistic and future-oriented vision, embedding sustainability, climate resilience, and digital transformation at the heart of agrofood governance. However, implementation gaps remain evident. Weak inter-agency coordination, inadequate digital infrastructure, and the limited participation of smallholders in high-value markets continue to undermine policy effectiveness (Arshad et al. 2008; Dobberstein and Peyyeti 2023). Small-scale farmers are the backbone of Malaysia's agrofood system which particularly disadvantaged due to restricted access to adaptive technologies, modern production systems, and institutional support (Shamshiri et al. 2012).

International experience demonstrates that integrated agrofood hubs, multifunctional facilities that cluster production, processing, innovation, and distribution, can help overcome structural inefficiencies while promoting sustainable land use and resource efficiency. Building on this insight, this study introduces the Integrated Agrofood Hub (IAH) as a strategic intervention tailored to Malaysia's socio-ecological context. The IAH is envisioned as a transformative platform that consolidates fragmented land use, promotes digital agriculture, strengthens value chain connectivity, and empowers rural producers. By situating the IAH within Malaysia's evolving policy framework and aligning it with international best practices, this paper proposes a context-specific model that advances sustainable agrofood transformation and strengthens food system resilience. The novelty of this study lies in demonstrating how the IAH can operationalize NAP 2.0 by linking policy, land-use planning, and environmental governance in a comprehensive framework that enhances smallholder inclusion, accelerates digital adoption, and supports climate-adaptive development.

METHODS

This study employed a qualitative review of agricultural and agrofood policy documents to trace the evolution of Malaysia's policy landscape, identify persistent implementation gaps, and develop the concept of an Integrated Agrofood Hub (IAH) aligned with the objectives of the National Agrofood Policy 2.0 (NAP 2.0). Data were collected primarily from official government documents spanning from the First National Agricultural Policy (NAP1) in 1984 to NAP 2.0 (2021–2030), supplemented with peer-reviewed articles, sectoral reports, and case studies obtained from Scopus, Web of Science, and publications by recognised organisations. Only sources published between 1984 and 2024 in English or Bahasa Malaysia and authored by credible institutions were considered, with search terms such as "Malaysian agricultural policy," "smart farming," and "integrated value chains." To provide comparative insights, four international hubs were selected as case studies, Food Valley (Netherlands), Smart Farm Innovation Valley (South Korea), Eastern Economic Corridor of Innovation (Thailand), and Singapore's "30 by 30" strategy, based on their relevance to policy–technology integration, agrofood clustering, and stakeholder coordination. The analysis followed a structured thematic approach organised around four dimensions: policy goals (sustainability, productivity, inclusivity), institutional frameworks (governance and inter-agency collaboration), strategic interventions (digitalisation, RandD, value chain development), and implementation challenges (fragmentation, capacity limitations, market access). Thematic analysis was conducted manually, refined literatively through repeated readings, and validated through peer checks, while triangulation across policy documents, academic literature, and international cases ensured analytical rigour.

RESULTS AND DISCUSSIONS

The results reveal five interconnected themes that capture Malaysia's agrofood transformation trajectory. First, 'Global Models and Regional Benchmarks' provide comparative lessons from international experiences that can inform Malaysia's policy and institutional design. Second, the 'Evolution of Agricultural and Agrofood Policies in Malaysia' demonstrates the shift in national strategies from a narrow focus on land productivity toward broader goals of sustainability, innovation, and inclusivity. Third, the 'Role of Integrated Agrofood Hubs' highlights their

potential to empower smallholders by strengthening value chain participation, fostering digital adoption, and expanding market access. Fourth, the 'Policy Integration and Value Chain Development (PIVCD) Framework' provides an analytical lens for linking policy ambitions with systemic implementation. Finally, 'Environmental Governance and Sustainable Land Use', reinforced by insights from global hub models, presents a forward-looking blueprint for translating NAP 2.0 into practical, scalable outcomes that are both context-sensitive and sustainability-driven. These themes are elaborated in the sections that follow.

Global Models and Regional Benchmarks

International experiences provide valuable insights for shaping Malaysia's proposed Integrated Agrofood Hub (IAH), particularly in terms of institutional coordination, innovation, and the clustering of related activities. The Netherlands' Food Valley illustrates how strong linkages between research institutions, agri-tech firms, and logistics providers can create a dynamic cluster that drives competitiveness. By fostering close collaboration between government and industry and maintaining an export-oriented outlook, Food Valley has established itself as a global leader in agro-innovation (Hoenen et al. 2017). Similarly, South Korea's Smart Farm Innovation Valley demonstrates the potential of blending digital farming technologies with skills training and start-up support. While the initiative has strengthened the country's high-tech farming capacity, its dependence on costly advanced technologies presents challenges for scalability and smallholder inclusion (Lee and Kim 2022). Within ASEAN, Thailand's Eastern Economic Corridor of Innovation (EECi) highlights the benefits of embedding agri-biotechnology and supply chain development within a dedicated innovation zone. Supported by both foreign investment and strong institutional backing, EECi shows how agro-industrial clusters can stimulate regional growth (Asvathitanont et al. 2025). Singapore's "30 by 30" strategy offers another relevant example, leveraging vertical farming and aquaculture to overcome land scarcity. Its rapid adoption of agri-technologies in an urbanized setting provides important lessons for countries like Malaysia, where agriculture increasingly intersects with urban development (Lazim et al. 2020). Collectively, these cases demonstrate that integrated agrofood hubs can enhance value chains, foster resilience, and strengthen food security, provided they are adapted to local contexts.

Across these cases, a few common factors stand out: co-located infrastructure, research-driven networks, and strong government backing all help these hubs deliver real impact. Together, they show how integrated approaches can close gaps in supply chain efficiency, spread new ideas faster, and link farmers more directly to markets all of which are critical if Malaysia's IAH is to succeed on local terms. A brief comparison of these international examples is provided in Table 1, highlighting how different strategies point to shared themes of sustainability, innovation, and resilience, underpinned by smart planning and partnerships.

Table 1. Key Features of Selected Agrofood Hub Models

Feature/Model	Netherlands' Food Valley	South Korea's Smart Farm Innovation Valley	Thailand's Eastern Economic Corridor (EECi)	Singapore's 30 by 30 Strategy
Location	Wageningen, Netherlands	Jeju, South Korea	Chachoengsao, Thailand	Singapore

Key Focus	Food innovation, logistics, RandD integration	Digital agriculture, smart farming technology	Agritech, biotechnology, logistics integration	Urban farming, vertical farming, aquaculture
Infrastructure	Research centres, technology firms, RandD labs	High-tech farms, demonstration farms, training centres	Innovation parks, agritech facilities	Urban agriculture, vertical farms
Public-Private Collaboration	Strong public-private partnerships, research-commercialisation focus	Collaboration among farmers, start-ups, and researchers	Public-private sector collaboration	Government-industry collaboration
Key Technologies	Food technology, supply chain optimisation, export competitiveness	Greenhouse automation, AI, sensor-based farming	Agritech RandD, biotechnology, advanced logistics	Urban farming techniques, aquaculture systems
Policy Facilitation	Government facilitation, policy incentives for innovation	Government-led smart farming promotion	Policy incentives for agritech RandD, investment	Regulatory agility, innovation grants
Training and Development	Focus on knowledge sharing and research	Focus on technology diffusion and workforce development	Focus on agritech training and workforce development	Focus on innovation and local food production
Outcome Goals	Food security, competitiveness in global markets	Digital transformation in agriculture, tech adoption	Value-added agro-industrial production, investment	30% local food production by 2030

While each global model offers valuable lessons, their applicability to Malaysia varies. The Netherlands' emphasis on research–industry collaboration and Thailand's clustering of supply chain infrastructure are particularly transferable, given Malaysia's institutional landscape and regional development strategies. In contrast, South Korea's advanced greenhouse systems and Singapore's capital-intensive vertical farming may be less feasible for smallholders without substantial state support. The proposed Integrated Agrofood Hub (IAH) therefore adopts a selective approach, integrating transferable elements such as collaborative governance, inclusive clustering, and scalable digital tools while tailoring them to Malaysia's policy environment and socio-economic conditions. Importantly, the IAH is designed not only to improve economic outcomes but also to address environmental challenges by reducing ecological degradation, supporting sustainable land consolidation, and enhancing resilience to climate shocks. By consolidating fragmented land use and embedding climate-smart practices within a coordinated hub system, the IAH provides a practical, context-sensitive pathway for advancing both agrofood transformation and environmental sustainability in Malaysia.

Evolution of Agricultural and Agrofood Policies in Malaysia

Malaysia's agricultural policy has undergone significant transformation over the past four decades, shifting from land-centric development to a more integrated, innovation-driven agrofood system. This trajectory can be traced across five major policy phases. NAP1 (1984–1991) emphasized land utilization and rural income enhancement through crop diversification and productivity gains. While these measures delivered modest improvements, the policy's limited attention to market

dynamics and environmental sustainability created a need for further reform (Murad et al. 2008). NAP2 (1992–1997) pivoted toward agro-industrialization, encouraging downstream processing and private sector participation (Zakaria et al. 2018). Although this stimulated industrial growth, benefits were unevenly distributed and supply chain inefficiencies persisted (Abu Dardak, 2015). NAP3 (1998–2010) introduced sustainability principles, market liberalization, and RandD investment, fostering partnerships and competitive production. However, fragmented governance and the continued marginalization of smallholders limited its effectiveness (Murad et al. 2008). The National Agrofood Policy (2011–2020) placed food security and import substitution at the forefront, embedding initiatives such as traceability systems, youth entrepreneurship, and Good Agricultural Practices (GAP). Yet, dependence on imports remained high and smallholder access to resources largely unchanged (Zakaria et al. 2017). Finally, NAP 2.0 (2021–2030) reflects a holistic, technology-oriented approach, prioritizing climate resilience, digital agriculture, and inclusive participation. While ambitious in aligning with global sustainability goals, its success ultimately depends on overcoming institutional fragmentation, infrastructural gaps, and environmental pressures (Shariff et al. 2025).

This progression illustrates a maturing policy ecosystem that has gradually expanded from a narrow focus on productivity and land optimization to broader objectives of sustainability, innovation, and integrated agrofood development. At the same time, persistent structural inefficiencies underscore the need for context-specific mechanisms—such as the Integrated Agrofood Hub (IAH)—to consolidate fragmented land use, reduce ecological degradation, and operationalize the resilience objectives envisioned under NAP 2.0. A comparative summary of these policy shifts is presented in Table 2.

Table 2. Comparison and Evolution of Malaysia's Agricultural and Agrofood Policies (1984–2030)

Policy	Implementation Period	Main Focus	Key Strategies	Expected Outcomes
First National Agricultural Policy (NAP1)	1984–1991	Land optimization and income generation	Crop diversification, modernization of production systems, rural development	Increase farmers' income and optimize land use for agriculture
Second National Agricultural Policy (NAP2)	1992–1997	Agro-based industrial development	Strengthening private sector involvement, promoting export-oriented agriculture, downstream processing	Enhance agro-industrial development and value-added activities
Third National Agricultural Policy (NAP3)	1998–2010	Sustainable agriculture and market liberalization	Sustainable resource management, market orientation, RandD investment	Achieve a balance between productivity, sustainability, and competitiveness
National Agrofood Policy (NAP)	2011–2020	Food security and self-sufficiency	Enhancing supply chain efficiency, production intensification, food safety assurance	Strengthen national food security and reduce reliance on imports
National Agrofood Policy 2.0 (NAP 2.0)	2021–2030	Sustainable, resilient, and tech-driven agrofood system	Climate resilience, digital agriculture, inclusive participation, integrated value chains	Ensure long-term food security, sustainability, and economic inclusiveness

Malaysia's agricultural policies have consistently placed farmers' livelihoods at the heart of rural development since the introduction of the First National Agricultural Policy (NAP1) in 1984. Early efforts focused on crop diversification and productivity gains, with the aim of narrowing income disparities between farming households and urban workers (Ministry of Agriculture 1984a). Yet, despite successive policy reforms and considerable investment, entrenched structural challenges in the rural economy have kept income gaps wide and, in some cases, even worsened. As Abu Dardak (2019) observes, higher production levels have not translated into equitable income distribution, underscoring that increased output alone cannot resolve rural inequality.

The subsequent policies, NAP2 and NAP3, shifted emphasis from basic farm support toward agro-industrialisation and stronger value chains (Ministry of Agriculture and Agro-Based Industry 1998; Ministry of Agriculture 1992). However, their implementation was constrained by fragmented landholdings, limited inter-agency coordination, and poor access to finance, leaving smallholders at a disadvantage. Nipo et al. (2024) further highlight that low technology adoption and weak rural infrastructure reduced opportunities for cooperatives in remote areas to engage in higher-value activities.

The National Agrofood Policy (2011–2020) attempted to address income gaps through initiatives such as contract farming and premium branding, yet scaling these programmes across regions proved difficult. The successor policy, National Agrofood Policy 2.0 (2021–2030), reflects a stronger emphasis on digital agriculture, youth participation, and inclusive growth (Ministry of Agriculture and Food Industries 2021). Still, its success remains dependent on fundamental enablers, including reliable infrastructure, digital access, and effective governance.

Recent studies affirm these concerns. Maspan and Halimoon (2024) demonstrate that digital tools and improved logistics can reduce post-harvest losses and enhance profitability, but only if value chains are fully integrated. Nor et al. (2024) similarly argue that fragmented supply chains and limited farmer cooperatives weaken bargaining power, exposing smallholders to volatile market conditions. At the same time, Malaysia's growing integration into global trade has increased farmers' vulnerability to external price shocks.

Against this backdrop, this paper proposes an Integrated Agrofood Hub (IAH) as a practical mechanism to close structural gaps. By consolidating farming, processing, storage, logistics, training, and marketing, such hubs can deliver economies of scale, fairer value distribution, and greater market access. Features such as cooperative procurement, digital traceability, and built-in financial support could help smallholders move beyond subsistence and participate more effectively in modern value chains. International models such as the Netherlands' Food Valley and South Korea's Smart Farm Innovation Valley illustrate how integrated hubs can enhance farmer incomes and rural competitiveness.

Transitioning from fragmented interventions to a connected agrofood platform like the IAH would strengthen the objectives of NAP 2.0 resilience, inclusivity, and competitiveness. More than a physical cluster, the IAH represents a strategic approach to empowering smallholders, fostering innovation, and enhancing national food security. Its success, however, will hinge on strong governance, robust infrastructure, and equitable digital access to ensure that all farmers, regardless of scale, benefit from Malaysia's agrofood transformation.

Policy Integration and Value Chain Development Framework

To make the Policy Integration and Value Chain Development (PIVCD) framework workable on the ground, this study outlines three connected ideas that serve as practical drivers for transforming Malaysia's agrofood sector through the Integrated Agrofood Hub (IAH) approach.

i. Policy–Technology Alignment

The first part of this framework is about making sure that the big goals set out in NAP 2.0 actually translate into the real-world use of modern farming tools. This covers things like precision equipment, IoT sensors, smart irrigation systems, and digital tracking for crops and livestock (Klerkx et al. 2019). Here, the IAH works as a local anchor point which is a place where these technologies can be tested, adjusted, and rolled out in ways that make sense for the farmers who will use them. By doing this, the IAH helps bridge the all-too-common gap between policy ideas and what really happens on the ground. It makes it more likely that good intentions on paper turn into practical tools and results in the field.

ii. Institutional Integration and Governance Synergy

For the IAH model to deliver real impact, it needs a way of working that brings together different people and organisations instead of keeping them in separate silos. This means building a flexible system of shared responsibility that connects national agencies, state governments, the private sector, researchers, and farmer groups (Ostrom 2010). When these players can plan and act together, they're better able to break through red tape and keep each other on track. This part of the framework highlights the value of talking things through and making decisions together. In this way, the IAH is more than just a site or a facility and it becomes a shared space for people to share ownership of what happens next and to steer agrofood projects in a way that fits local needs (Termeer et al. 2010).

iii. Inclusive Value Chain Structuring

At the core of the PIVCD framework is the idea of building agrofood value chains that are not only efficient but also fair and better connected. By bringing together production, processing, transport, and marketing under one roof through the IAH model, the aim is to cut extra costs, tap into economies of scale, and help local producers compete more effectively (Ruben et al. 2016; 2024; Zhang et al. 2021). Research shows that setting things up this way, much like what happens in food hubs and cooperatives, can help keep operating costs lower and make the food supply chain more resilient over time (Sgroi et al. 2024).

On top of that, digital tools and cooperative setups bring clear benefits by making prices more transparent, helping profits get shared more evenly, and giving small farmers a better safety net when prices shift (Manda and Miti 2024; Mishra et al. 2024). Digital platforms, for instance, can link farmers straight to buyers, cutting out unnecessary middlemen and giving producers a better deal and a clearer view of where their goods go (TraceX 2025). Cooperatives work in a similar way — by joining forces, smallholders can negotiate stronger deals together, which often means fairer prices and steadier incomes for farming families (Elder and Sarmiento 2024).

The PIVCD framework is designed to adapt, using feedback loops to keep policies grounded and effective. Its IAHs are not just static centers for processing and logistics; they are active hubs for policy learning and experimentation (Pahl-Wostl, 2009). By constantly gathering real-time data, stakeholder insights, and performance metrics, the system allows for the steady, iterative improvement of its strategies. This cultivates an environment of institutional learning and builds a truly responsive form of governance—one that ensures decisions remain effective and relevant to the community's actual needs (OECD 2023).

The PIVCD framework brings together a broad, connected approach for spotting structural gaps and shaping practical reform steps within Malaysia's agrofood sector (Candel and Biesbroek

2016). By combining infrastructure investment, stronger coordination among institutions, and more inclusive value chain development, it helps lay the groundwork for agrofood systems that are fair, sustainable, and able to grow at scale (Kaplinsky and Morris 2001; Hospes and Brons 2016). In this study, using the framework makes it possible to pinpoint where real changes can happen to turn Malaysia's often fragmented agrofood landscape into a more joined-up, innovative, and smallholder-friendly model that fits with what NAP 2.0 aims to achieve (Ministry of Agriculture and Food Industry 2021).

Global Agrofood Hub Models and Lessons for Malaysia

Global agrofood hub models provide valuable lessons that can inform Malaysia's agrofood transformation agenda under the National Agrofood Policy 2.0 (NAP 2.0). Successful examples such as the Netherlands' Food Valley, South Korea's Smart Farm Innovation Valley, Thailand's Eastern Economic Corridor of Innovation (EECi), and Singapore's 30 by 30 Strategy demonstrate the importance of public–private collaboration, technological integration, and supportive policy environments. These hubs illustrate how innovation ecosystems thrive when governments, private industries, and research institutions work together to mobilize resources, deploy advanced technologies like IoT and AI, and ensure that infrastructure and logistics are co-located to enhance market accessibility and economies of scale (OECD 2023). Sustained investment in research and development, combined with flexible regulatory frameworks, has been central to their ability to achieve both productivity growth and resilience.

Building on these insights, this study employs the Policy Institution Value ChainDynamic Feedback (PIVCD) framework to design an Integrated Agrofood Hub (IAH) tailored to Malaysia's context. The proposed IAH emphasizes four interrelated dimensions: aligning policy with technology adoption, fostering institutional integration and governance synergy, structuring inclusive value chains, and embedding real-time monitoring for adaptive policy learning. This design not only seeks to operationalize NAP 2.0 but also to overcome structural inefficiencies that have long constrained Malaysia's agrofood sector. By clustering production, processing, and distribution functions within localized hubs, the IAH reduces transaction costs, improves competitiveness, and ensures that smallholders gain equitable access to market opportunities.

The IAH model directly advances key objectives of NAP 2.0, including smallholder income enhancement, agri-tech diffusion, and food system resilience. It provides small farmers with fairer access to value-added activities, while simultaneously serving as a platform for experimenting with and scaling climate-smart and data-driven agricultural practices. Strategically implemented, the IAH can also strengthen Malaysia's food security by reducing waste, enhancing supply chain coordination, and improving adaptability in the face of disruptions. To translate the concept into practice, several policy measures are recommended: rolling out pilot hubs in agro-economic zones such as Cameron Highlands or Muar, strengthening public–private partnerships, investing in rural digital infrastructure, and building targeted capacity for smallholders. A phased, modular pilot approach monitored through evidence-based dashboards would provide the foundation for scaling up the IAH model nationally.

Environmental Governance and Sustainable Land Use

Environmental governance and sustainable land use are central to transforming agrofood systems, particularly in countries like Malaysia where agricultural expansion, land fragmentation,

and competing land uses pose critical challenges to long-term sustainability. Conventional farming practices often drive soil degradation, biodiversity loss, and excessive reliance on chemical inputs, all of which threaten both ecological resilience and food security. Embedding sustainability into agrofood policies therefore requires integrated governance frameworks that balance ecological protection with food production and economic viability. Malaysia's National Agrofood Policy 2.0 (NAP 2.0) already emphasizes sustainability and climate resilience, but its successful implementation depends on bridging institutional silos, strengthening cross-agency coordination, and supporting smallholders in adopting sustainable practices (Arshad et al. 2008; Dobberstein and Peyyeti 2023).

i. Agroecological Practices and Policy Integration

Agroecological practices such as organic farming, regenerative agriculture, and climate-smart agriculture offer practical pathways for reducing environmental degradation while enhancing productivity (Zhang 2024). These approaches not only contribute to carbon sequestration and biodiversity conservation but also ensure the supply of healthier and safer food (Kirechev 2021). However, smallholders often lack the technical and financial capacity to adopt such practices. Policy innovations and governance support are therefore essential to enable farmers' transition towards sustainability. Integrated governance models that incorporate local knowledge and align national and regional policies can strengthen resilience and create enabling conditions for sustainable land use (Du et al. 2024; Jónsdóttir and Gísladóttir, 2023). In this context, the IAH framework can serve as a spatial and institutional platform to consolidate fragmented land use, facilitate knowledge transfer, and promote the adoption of climate-smart practices within Malaysia's agrofood system.

ii. Innovative and Holistic Governance Approaches

Beyond promoting sustainable practices, innovative governance mechanisms are needed to align agrofood transformation with broader environmental objectives. Quantity-based governance models, such as livestock-to-land ratios or cap-and-trade schemes for high-emission agricultural products, illustrate how food production can be managed in line with climate targets (Weishaupt et al. 2020). Holistic frameworks, such as the 4-P approach such as planet, people, profit, and policy that provide further guidance for aligning sustainability goals with socio-economic realities (Bilali et al. 2021). For Malaysia, the adoption of an IAH model provides a unique opportunity to operationalize such governance innovations by integrating production, processing, and market access within a coordinated land-use system. This not only advances NAP 2.0 objectives but also contributes to global debates on sustainable agrofood systems by showing how fit-for-purpose land consolidation can reconcile environmental, social, and economic priorities in emerging economies.

CONCLUSION

This study has traced the evolution of Malaysia's agrofood policies from NAP1 (1984) to NAP 2.0, highlighting both achievements and persistent gaps in implementation. While policy goals have expanded beyond productivity to emphasize sustainability, innovation, and inclusivity, systemic barriers such as land fragmentation, weak governance integration, and slow adoption of climate-smart technologies remain pressing challenges. To address these gaps, the study proposes the Integrated Agrofood Hub (IAH) as a fit-for-purpose approach that unites land use, governance, and market functions within a coordinated framework. Unlike previous models that treat land consolidation or value chain development in isolation, the IAH integrates spatial clustering,

institutional collaboration, and agroecological practices to deliver both economic and environmental outcomes. By aligning with NAP 2.0 and informed by global case studies, the IAH advances sustainable land use, empowers smallholders, and strengthens resilience to climate and market shocks. The novelty of this study lies in systematically linking Malaysia's agrofood policy with a hub-based, PIVCD-informed model for environmental governance. Beyond Malaysia, the findings contribute to global debates on sustainable agrofood transformation, offering a context-sensitive, scalable framework that supports food security, equity, and ecological resilience in the face of accelerating global change.

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REFERENCES

Abu Dardak, R. 2015. Transformation of the agricultural sector in Malaysia through agricultural policy. Food and Fertilizer Technology Center for the Asian and Pacific Region (FFTC-AP). Available at: https://ap.fftc.org.tw/article/818 [Accessed 10 Jul. 2025].

Adnan, N., Nordin, S.M., Bahruddin, M.A., and Tareq, A.H. 2019. A state-of-the-art review on facilitating sustainable agriculture through green fertilizer technology adoption: Assessing farmers' behavior. *Trends in Food Science and Technology* 86: 439-52. https://doi.org/10.1016/j.tifs.2019.02.040

Ali, N., Ab. Ghani, A.A., and Md Tahir, I. 2023. Literature review on Malaysia national food security: Challenge and strategy in meeting population rise. *Journal of Echohumanism* 4 (1): 1876-93. ResearchGate. Available at: https://www.researchgate.net/publication/388295521 [Accessed 10 Jun. 2025].

Arshad, F.M., Bach, N.L., and Latiff, I.A. 2008. Food production strategies for improving household food security amidst rising food prices: Sharing the Malaysian experience. ResearchGate. *International Food Research Journal* 15 (3). Available at: https://www.researchgate.net/publication/228813058 [Accessed 10 Jun. 2025].

Asvathitanont, C., Tangjitprom, N., and Peungchuer, A. 2025. Fostering innovation: A case study of Eastern Economic Corridor of Innovation in Thailand. *Journal of Design, Management and Technology Innovation* 2 (1): 18-28. Available at: https://so07.tci-thaijo.org/index.php/innovation/article/view/4012/4471 [Accessed 15 Sep. 2025].

Bakar, B.H. 2012. The role of agriculture in the Malaysian economy. Regional Conference on Agriculture and Rural Development. Available at: https://doi.org/10.13140/RG.2.1.3171.5686 [Accessed 10 Jun. 2025].

Bilali, H. E., Strassner, C., and Hassen, T. B. 2021. Sustainable Agri-Food Systems: Environment, Economy, Society, and Policy. *Sustainability* 13 (6260): 1-27. https://doi.org/10.3390/SU13116260

Candel, J.J.L., and Biesbroek, R. 2016. Toward a processual understanding of policy integration. *Policy Sciences* 49: 211-31. https://doi.org/10.1007/s11077-016-9248-y

Chamhuri, N. and Mohamed, Z. 2013. Food security in Malaysia: Challenges and opportunities for Malaysia of present and in 2050 for maintaining food security. *University of Alberta*. 10.13140/2.1.2707.7923

Dobberstein, N and Peyyeti, H. 2023. Transforming Malaysia into a more food-secure nation. *Kearney*. Available at: https://www.kearney.com/industry/consumer-retail/article/transforming-malaysia-into-a-more-food-secure-nation [Accessed 10 Jun. 2025].

Du, R., Cai, H., Xuan, J., Wang, X., Stevanović, M., Li, L., Popp, A., and Lotze‐Campen, H. 2024. Enhancing governance performance in Sub-Saharan Africa can bolster climate mitigation and food security. *Ecosystem Health and Sustainability* 10: 1-11. https://doi.org/10.34133/ehs.0241

Elder, S and Sarmiento, F. 2024. Promoting the Development of Agricultural Cooperatives. *International Institute for Sustainable Development*. Available at: https://www.iisd.org/system/files/2024-11/promoting-development-agricultural-cooperatives.pdf

Food and Agriculture Organization of the United Nations (FAO). 2023. Digital technology and agricultural markets. FAO Knowledge Repository. https://doi.org/10.4060/cb0701en

Hoenen, S., Kolympiris, C., Wubben, E., and Omta, O. 2017. Technology transfer in agriculture: The case of Wageningen University. In N. Kalaitzandonakes, E.G. Carayannis, E. Grigoroudis, and S. Rozakis (Eds.), *From Agriscience to Agribusiness. Innovation, Technology, and Knowledge management*, 257–276. Springer International Publishing. https://doi.org/10.1007/978-3-319-67958-7_13

Hospes, O., and Brons, A. 2016. Food system governance: A systematic literature review. Available at: https://www.researchgate.net/publication/310457890_Food_system_governance_A_systematic_literature_review

Jónsdóttir, S., and Gísladóttir, G. 2023. Land use planning, sustainable food production and rural development: A literature analysis. Geography and Sustainability. *Geography and Sustainability* 4 1: 391-403. https://doi.org/10.1016/j.geosus.2023.09.004

Kaplinsky, R., and Morris, M. 2001. A handbook for value chain research. Institute of Development Studies, University of Sussex. Available at: https://www.fao.org/fileadmin/user_upload/fisheries/docs/Value_Chain_Handbool.pdf

Kirechev, D. 2021. Agri-environmental practices for land use as a prerequisite for building a sustainable agri-food system. *Trakia Journal of Sciences* 19 (1): 207-15. https://doi.org/10.15547/tjs.2021.s.01.031

Klerkx, L., Jakku, E., and Labarthe, P. 2019. A review of social science on digital agriculture, smart farming and agricultural innovation systems. *NJAS - Wageningen Journal of Life Sciences* 90-91 (1): 1-16. https://doi.org/10.1016/j.njas.2019.100315

Lazim, R. M., Nawi, N. M., Masroon, M. H., Abdullah, N., and Iskandar, M. C. M. 2020. *Adoption of IR4.0 into Agricultural Sector in Malaysia: Potential and Challenges* 1(2). https://doi.org/10.36877/AAFRJ.A0000140

Lee, D., and Kim, K. 2022. National investment framework for revitalizing the R&D collaborative ecosystem of sustainable smart agriculture. *Sustainability* 14 (11): 1-30. https://doi.org/10.3390/su14116452

LPPKN. n.d.. Population, food security, nutrition and sustainable development. *Malaysian Population Research Hub*. Available at: https://mprh.lppkn.gov.my/population-food-security-nutrition-and-sustainable-development/ [Accessed 10 Jun. 2025].

Manda, S., and Miti, C. 2024. Does value chain inclusiveness increase smallholder resilience during pandemics? Lessons from the Zambia's sugar-belt. *Journal of International Development* 36 (2): 773-94. https://doi.org/10.1002/jid.3837

Manikas, I., Malindretos, G., and Oustapassidis, K. 2019. A community-based agro-food hub model for sustainable farming. *Sustainability* 11 (4): 1-17. https://doi.org/10.3390/su11041017

Maspan, R., and Halimoon, N. 2024. Adoption of Malaysia Good Agricultural Practices (myGAP) by crop producers in Peninsular Malaysia. *SSRN*. https://doi.org/10.2139/ssrn.4743722

Ministry of Agriculture and Food Industry. 2021. National Agrofood Policy 2021-2030 (DAN 2.0). Putrajaya: Ministry of Agriculture and Food Industry.

Ministry of Agriculture. 1984a. National Agriculture Policy (1984-1991). Kuala Lumpur: Ministry of Agriculture.

Ministry of Agriculture. 1984b. National Agriculture Second Policy (1992-1997). Kuala Lumpur: Ministry of Agriculture.

Mishra, V., Ishdorj, A., Tabares Villarreal, E. and Norton, R. 2024. Collaboration in agricultural value chains: a scoping review of the evidence from developing countries. *Journal of Agribusiness in Developing and Emerging Economies*. https://doi.org/10.1108/JADEE-12-2023-0311

Mohd Azman, A.L.N., Abdullah, N.A., Ninam Shah, S.K., and Puteh, F. 2023. Strategic analysis of climate change and food security in Malaysia. *Journal of Administrative Science* 20 (1): 51-77. Available at: https://jas.uitm.edu.my/images/2023_JUNE/3.pdf

Murad, M.W., Mustapha, N.H.N., and Siwar, C. 2008. Review of Malaysian agricultural policies with regards to sustainability. *American Journal of Environmental Sciences* 4 (6): 608-14. https://doi.org/10.3844/ajessp.2008.608.614

Nipo, D. T., Lily, J., Fabeil, N. F., and Jamil, I. A. A. 2024. Transforming Rural Entrepreneurship Through Digital Innovation: A Review on Opportunities, Barriers and Challenges. *Journal of Management and Sustainability* 14(2), 114. https://doi.org/10.5539/jms.v14n2p114

Nor, L. N. E. A, Abd Samad, S and Yusof, R. 2024. Unveiling Malaysia's food security preparedness: A content analysis perspective. *International Journal of Research and Innovation in Social Science (IJRISS)* 8 (6): 646-63. https://dx.doi.org/10.47772/IJRISS.2024.806050

OECD 2023, Agricultural Policy Monitoring and Evaluation 2023: Adapting Agriculture to Climate Change, OECD Publishing, Paris. https://doi.org/10.1787/b14de474-en.

Ostrom, E. 2010. Polycentric systems for coping with collective action and global environmental change. *Global Environmental Change* 20 (4): 550-57. https://doi.org/10.1016/j.gloenvcha.2010.07.004

Ruben, R., M. Slingerland, and H. Nijhoff. 2016. Agro-food chains and networks for development. *Wageningen University and Research* 14. Available at: https://edepot.wur.nl/137747

Sgroi, F., Modica, F., Berti, G., & Fusté-Forné, F. 2024. *Food Hubs and the Role of Small Farmers in Sustainable Agriculture*. https://doi.org/10.1080/08974438.2024.2356599

Shamshiri, R.R., Shariff, A.R.M., Ramli, A., and Wayayok, A. 2012. Farm-level assessment of climate change, agriculture and food security issues in Malaysia. ResearchGate. Available at: https://www.researchgate.net/publication/265785259 [Accessed 10 Jun. 2025].

Shariff, S., Baharudin, S.A., and Ismail, N.A. 2025. A systematic review of the challenges and opportunities of the agriculture economic sector in Malaysia. *Information Management and Business Review* 17 (1): 285-03. https://doi.org/10.22610/imbr.v17i1(I).4350

Siwar, C., Alam, M.M., Murad, M.W., and Al-Amin, A.Q. 2009. A review of the linkages between climate change, agricultural sustainability and poverty in Malaysia. *International Review of Business Research Papers* 5 (6): 309-21. Available at: https://www.researchgate.net/publication/228419957_A_Review_of_the_Linkages_between_Climate_Change_Agricultural_Sustainability_and_Poverty_in_Malaysia

Termeer, C. J. A. M., Dewulf, A., and van Lieshout, M. 2010. Disentangling scale approaches in governance research: Comparing monocentric, multilevel, and polycentric governance. *Ecology and Society* 15(4). http://doi.org/10.5751/ES-03798-150429

TraceX. 2025. Why Smallholder Farmers are the Backbone of Sustainable Food Systems. *TraceX Technologies*. Available at: https://tracextech.com/smallholder-farmers-for-sustainable-food-systems/

Weishaupt, A., Ekardt, F., Garske, B., Stubenrauch, J., and Wieding, J. 2020. Land Use, Livestock, Quantity Governance, and Economic Instruments—Sustainability Beyond Big Livestock Herds and Fossil Fuels. *Sustainability* 12 (5): 1-27 https://doi.org/10.3390/SU12052053

Zakaria, M.B., Che Noh, N., and Ibrahim, A.Q. 2019. Fiqh Awlawiyyat dan Dasar Agromakanan Negara. *Asian Journal of Civilizational Studies* 1 (2): 54-66. Available at: https://eprints.unisza.edu.my/6587/

Zakaria, M.B., Hasan, J., and Wan Abdullah, W.I. 2018. Sumber perundangan pembangunan tanah pertanian menurut perspektif Islam: Dasar Pertanian Negara (DPN). *Jurnal Islam Masyarakat Kontemporari* 19: 33–48. https://doi.org/10.37231/jimk.2018.19.0.281

Zakaria, M.B., Mohd Nor, A.H., Mohamed Said, N.L., Ahmad, M.Y., and Hasan, J. 2017. Dasar Pertanian Negara Ketiga (DPN3) and Dasar Agromakanan Negara (DAN): Analisis terhadap makanan asasi beras dan padi menurut Islam. *Jurnal Islam dan Masyarakat Kontemporari* 14 (1): 28-42. https://doi.org/10.37231/jimk.2017.14.1.195

Zhang J., Luo J., and Li J. 2021. Agricultural co-operatives participating in supply chain integration in China: A qualitative comparative analysis. *PLoS ONE* 16(4): 1-19. https://doi.org/10.1371/journal.pone.0250018

Zhang, Q. F. 2024. From Sustainable Agriculture to Sustainable Agrifood Systems: A Comparative Review of Alternative Models. *Sustainability* 16: 1-24. https://doi.org/10.3390/su16229675

Zulkifli, M.F., Abd Rahman, A.A., Zulkifli, N., Mohamad Yasid, A.F., Mat, B., and Alias, M.S. 2025. Implications due to challenges to food security in Malaysia. *Journal of Ecohumanism* 4 (1): 1894-904. https://doi.org/10.62754/joe.v4i1.6005

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