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Digital agriculture in Southeast Asia: A bibliometric analysis and research agenda

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Abstract*: Digital technologies are increasingly promoted as a pathway to raise productivity, resilience and sustainability in Southeast Asian agriculture, yet the scientific knowledge base on this topic in the region has not been mapped systematically. This study conducts a bibliometric analysis of 2,386 journal articles and reviews on digital agriculture published between 2010 and 2025 with at least one author affiliated with a Southeast Asian country, retrieved from the OpenAlex database. Performance analysis and keyword co-occurrence mapping (association-strength normalisation and modularity-based clustering) were used to examine publication dynamics, national contributions and thematic structure. The results show that output was marginal before 2018 and then expanded rapidly, with 93.3% of all documents published in 2020–2025. Production is highly concentrated: Indonesia accounts for 54% of documents, followed by Malaysia, Thailand and Vietnam, while Cambodia, Laos and Myanmar together contribute fewer than 30 documents. Research impact is distributed very differently from research volume, with Malaysia and Singapore achieving the highest citations per document. Six thematic clusters are identified, dominated by engineering-oriented work on IoT sensing, smart irrigation and AI-based crop monitoring; the cluster on technology adoption, digital literacy and policy is the most recent, and socio-economic themes receive fewer citations per document than the IoT and UAV clusters. The paper concludes with a research agenda emphasising inclusive adoption by smallholders, rigorous impact evaluation, data governance, and regional collaboration involving the less-represented ASEAN members.*

Keywords: digital agriculture; smart farming; precision agriculture; bibliometric analysis; Southeast Asia; ASEAN; OpenAlex

1. Introduction

Agriculture remains a pillar of livelihoods across Southeast Asia. It employs a large share of the labour force in Cambodia, Laos, Myanmar, Vietnam, Indonesia and the Philippines, and it underpins food security for a region of more than 680 million people. At the same time, the sector faces mounting pressures: small and fragmented farms, ageing rural populations, rising input costs, land and water degradation, and growing exposure to climate shocks such as droughts, floods and saline intrusion. Against this background, governments, development agencies and the private sector increasingly present digital technologies as a means of transforming agriculture. The Internet of Things (IoT), remote sensing, drones, artificial intelligence (AI), mobile platforms and e-commerce are expected to raise productivity, cut waste, improve traceability and connect smallholders to markets.

The concept that brings these technologies together is usually called *digital agriculture*, with closely related labels such as smart farming, precision agriculture and Agriculture 4.0 (Wolfert et al., 2017; Klerkx et al., 2019). Policy interest in the region is strong. Vietnam's National Digital Transformation Programme to 2025, with an orientation to 2030, lists agriculture among its priority sectors. Indonesia, Thailand and Malaysia have launched their own smart-farming and agritech initiatives, and the ASEAN Digital Masterplan 2025 places digital inclusion on the regional agenda. Yet the extent to which this policy momentum is matched by a coherent body of scientific evidence remains unclear.

The international literature on digital agriculture has grown quickly, and several reviews have synthesised its technical and social dimensions (Wolfert et al., 2017; Klerkx et al., 2019; Shepherd et al., 2020). However, these reviews are dominated by evidence from North America, Europe, China and, increasingly, Sub-Saharan Africa. Southeast Asia has distinct features: a dominance of rice and tree-crop smallholdings, rapid mobile-internet penetration, large differences in development levels between member states, and an active but uneven research system. Region-specific reviews are scarce, and most existing work covers a single technology or a single country. As a result, there is no systematic picture of who produces knowledge on digital agriculture in Southeast Asia, which themes dominate, how the field has evolved, and where the main gaps lie.

This paper addresses that gap through a bibliometric analysis, a method suited to mapping large and fast-growing literatures in an objective and replicable way (Zupic & Čater, 2015; Donthu et al., 2021). It is guided by four research questions:

- **RQ1.** How has scientific output on digital agriculture in Southeast Asia evolved between 2010 and 2025?
- **RQ2.** Which countries contribute most to this literature, and how do they differ in impact and collaboration?
- **RQ3.** What are the main thematic clusters, and which themes are emerging?
- **RQ4.** What research agenda follows from the gaps identified?

The study contributes in three ways. First, it provides the first region-wide quantitative map of digital agriculture research for Southeast Asia, covering all eleven countries. Second, it uses the open bibliographic database OpenAlex, which has broader coverage of regional and non-English journals than the commercial indices commonly used, making the analysis fully reproducible at no cost.

Third, it links the bibliometric findings to the economic and policy debate, highlighting a mismatch between the engineering-driven research front and the socio-economic questions that matter most for smallholder-based agricultural systems.

The remainder of the paper is structured as follows. Section 2 outlines the conceptual background. Section 3 describes the data and methods. Section 4 presents the results. Section 5 discusses the findings and proposes a research agenda, and Section 6 concludes.

2. Conceptual background

2.1. Defining digital agriculture

Digital agriculture refers to the use of digital technologies to collect, transmit, analyse and act on data along the agri-food value chain, from input supply and on-farm production to processing, marketing and consumption. Several overlapping terms are used in the literature. *Precision agriculture* originally described site-specific management of fields based on GPS, yield monitors and variable-rate application. *Smart farming* broadens this to include connected sensors, automation and decision-support systems. *Agriculture 4.0* frames the change as part of the fourth industrial revolution, stressing cyber-physical systems, big data and AI (Rose & Chilvers, 2018). Klerkx et al. (2019) argue that these labels share a common core: the datafication of farming and the reorganisation of agricultural knowledge, power and value around data flows. Following this view, the present study treats digital agriculture as an umbrella term and includes all of these labels in its search strategy.

2.2. Technology clusters

The technologies covered by digital agriculture can be grouped into four broad families. The first is **sensing and connectivity**: soil and weather sensors, wireless sensor networks, IoT devices and low-cost microcontrollers that monitor field conditions in real time (Elijah et al., 2018). The second is **remote sensing and robotics**, including satellite imagery, unmanned aerial vehicles (UAVs) and field robots used for crop monitoring and input application. The third is **data analytics and AI**, such as machine learning models for yield prediction, disease detection and irrigation scheduling. The fourth is **digital services and platforms**: mobile advisory services, digital extension, e-commerce, digital finance and traceability systems that connect farmers to information and markets (Aker, 2011; Deichmann et al., 2016). The first three families focus mainly on production efficiency. The fourth is closer to the economic questions of market access, transaction costs and inclusion.

2.3. Adoption and impact in smallholder contexts

The benefits of digital agriculture depend on adoption, and adoption has repeatedly proved uneven. Reviews of precision agriculture identify farm size, human capital, cost, perceived usefulness, infrastructure and institutional support as key determinants (Tey & Brindal, 2012; Pathak et al., 2019). These constraints are particularly binding in smallholder systems, where fixed costs of equipment are spread over small areas and where digital literacy and access to credit are limited. Deichmann et al. (2016) argue that digital technologies in developing countries are most likely to create value by reducing information and transaction costs rather than by replacing labour with capital. This perspective shifts attention from devices to institutions: extension systems, farmer groups, cooperatives and data governance arrangements.

Digital agriculture is also linked to the climate agenda. Climate-smart agriculture, which seeks to raise productivity, strengthen adaptation and reduce emissions at the same time (Lipper et al., 2014), increasingly relies on digital tools such as weather advisories, index insurance and precision input management. Shepherd et al. (2020) warn, however, that technical promises often run ahead of evidence on social and economic outcomes. A key question for Southeast Asia is therefore whether its research base reflects these socio-economic and institutional dimensions or remains concentrated on technical prototypes.

3. Methodology

3.1. Data source

The data were retrieved from OpenAlex, an open catalogue of the global research system that indexes more than 250 million scholarly works (Priem et al., 2022). OpenAlex was chosen over Scopus and Web of Science for three reasons. First, it covers many regional and national journals in Southeast Asia, including Indonesian, Malaysian and Thai outlets that are poorly indexed in commercial databases; comparative studies show that open and inclusive databases capture substantially more documents than the established indices (Visser et al., 2021). Second, every record carries institution-level country codes, which allows the regional filter to be applied directly. Third, OpenAlex is free and its API is public, so the full dataset can be reproduced by any reader.

3.2. Search strategy and screening

The search combined a topic query with a geographical filter and document-type restrictions, as summarised in Table 1. The topic query searched titles and abstracts for ten synonyms of digital agriculture. The geographical filter retained documents with at least one author affiliated with an institution in one of the eleven Southeast Asian countries. Only journal articles and reviews published between 2010 and 2025 were included. The search was run on 14 October 2026 and returned 2,386 documents (2,328 articles and 58 reviews).

Table 1. Search protocol

Step	Criterion	Setting
Database	Source	OpenAlex API (accessed 14 October 2026)
Topic query	Title and abstract	"digital agriculture" OR "smart farming" OR "precision agriculture" OR "smart agriculture" OR

Step	Criterion	Setting
		"agriculture 4.0" OR "digital farming" OR "e-agriculture" OR "precision farming" OR "agricultural digitalization" OR "agritech"
Geography	Author affiliation country	Vietnam, Thailand, Indonesia, Malaysia, Philippines, Singapore, Myanmar, Cambodia, Laos, Brunei, Timor-Leste
Period	Publication year	2010–2025
Document type	OpenAlex work type	Article; review
Records retained	Final dataset	2,386 documents (2,328 articles; 58 reviews)
Analysis units	Keywords	40 most frequent author/indexed keywords (≥ 45 occurrences)

The screening followed the logic of the PRISMA 2020 statement (Page et al., 2021). Because the search terms are specific, the share of off-topic records is small, but a manual check of the most-cited documents revealed a few records that mention precision or smart agriculture only in passing (for example, veterinary or macro-environmental studies). Such noise is typical of large bibliometric datasets and has little effect on aggregate patterns. Nonetheless, a final version of the study should screen titles and abstracts manually before publication.

3.3. Bibliometric techniques

The analysis combined two standard components of science mapping (Donthu et al., 2021). The first is **performance analysis**, which describes annual output, the contributions of countries and journals, citation counts and collaboration patterns. International collaboration was measured as the share of a country's documents co-authored with at least one institution outside Southeast Asia, and intra-regional collaboration as the share co-authored with another Southeast Asian country.

The second is **keyword co-occurrence analysis**, which reveals the conceptual structure of the field. The 40 most frequent keywords were retained. Co-occurrence counts were normalised with the association strength measure, which divides the number of co-occurrences of two keywords by the product of their total occurrences (van Eck & Waltman, 2010). Clusters were then identified by maximising a modularity function with a Louvain-type algorithm (Blondel et al., 2008), following the unified mapping and clustering approach of Waltman et al. (2010) used in VOSviewer. A resolution parameter of 1.3 was selected because it produced clusters that were both stable across 300 random starts and substantively interpretable. For each cluster, the number of documents, the mean publication year and the mean citations per document were calculated. The mean publication year serves as an indicator of how recent a theme is, and citations per document as an indicator of its influence. All calculations were carried out directly on the records exported from the OpenAlex API.

4. Results

4.1. Publication trend

Scientific output on digital agriculture in Southeast Asia was marginal for most of the 2010s and has grown explosively since 2018 (Figure 1). Between 2010 and 2017, the region produced fewer than 15 documents per year. Output then rose from 33 documents in 2018 to 478 in 2024, a compound annual growth rate of about 54% over 2019–2024. The year 2025 alone accounts for 998 documents, more than double the previous year, and 93.3% of all documents in the dataset were published in 2020–2025.

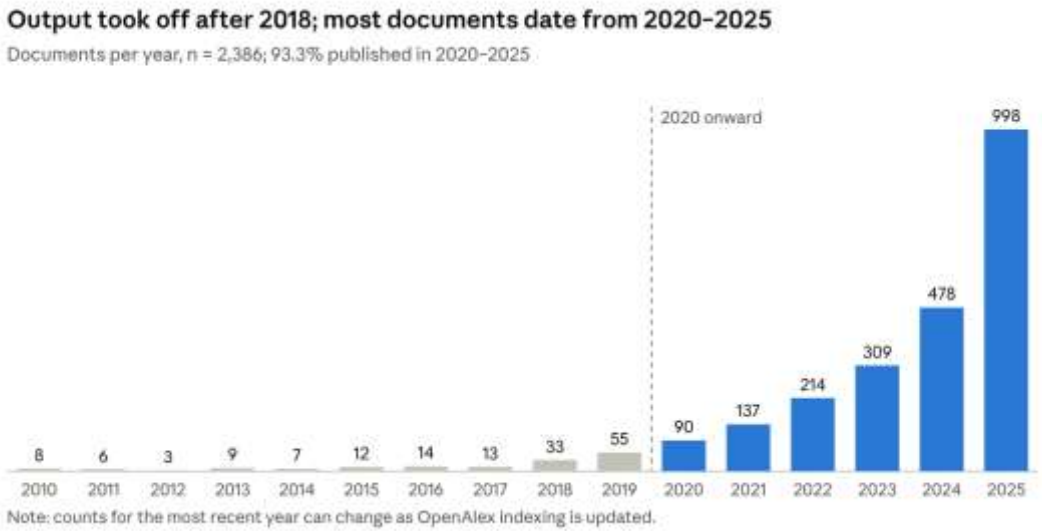


Figure 1. Annual number of documents, 2010–2025.

Source: author's calculation from OpenAlex (n = 2,386; accessed 14 Oct 2026).

Three factors are likely to explain this acceleration. First, the diffusion of low-cost sensors, microcontrollers and drones has lowered the entry cost for experimental research in universities across the region. Second, national digital transformation and Industry 4.0 strategies adopted after 2018 have directed research funding towards agricultural applications. Third, the COVID-19 pandemic and the subsequent focus on food-system resilience increased attention to digital solutions in supply chains and farm management. The 2025 figure should be read with caution, since counts for the latest year are sensitive to database updates; however, the upward trend is robust across all preceding years.

4.2. Country contributions and collaboration

Research production is highly concentrated (Table 2). Indonesia alone contributes 1,289 documents, or 54.0% of the total, followed by Malaysia (23.3%), Thailand (11.0%) and Vietnam (7.1%). The Philippines and Singapore contribute smaller volumes, while Brunei, Cambodia, Myanmar and Laos together account for fewer than 50 documents. No document with an author from Timor-Leste was found.

Table 2. Productivity, impact and collaboration of Southeast Asian countries

Country	Documents	Share of total (%)	Citations	Citations per document	International collaboration (%)	Intra-regional collaboration (%)	Published 2023–2025 (%)
Indonesia	1,289	54.0	4,521	3.5	8.0	3.7	83.6
Malaysia	556	23.3	20,309	36.5	42.4	9.4	64.4
Thailand	262	11.0	3,453	13.2	26.7	8.8	69.5
Vietnam	169	7.1	4,654	27.5	43.2	10.7	59.2
Philippines	103	4.3	2,002	19.4	42.7	16.5	58.3
Singapore	54	2.3	2,396	44.4	74.1	13.0	70.4
Brunei	22	0.9	992	45.1	40.9	13.6	72.7
Cambodia	11	0.5	87	7.9	45.5	18.2	54.5
Myanmar	10	0.4	257	25.7	60.0	50.0	30.0
Laos	4	0.2	5	1.3	50.0	25.0	100.0

Notes: Full counting; a document co-authored by two countries is counted for both, so shares sum to more than 100%. International collaboration = co-authorship with at least one country outside Southeast Asia. Citations as recorded in OpenAlex on 14 October 2026. Country counts come from the full record export (2,389 records) and may differ by one or two from the aggregate count.

The distribution of impact differs sharply from that of volume. Malaysia, with less than half of Indonesia's output, received 20,309 citations, more than half of the 36,791 citations in the dataset. Singapore and Brunei achieve the highest citations per document (44–45), followed by Malaysia (36.5) and Vietnam (27.5). Indonesia's average is only 3.5 citations per document. This gap partly reflects timing, since 83.6% of Indonesian documents were published in 2023–2025 and have had little time to accumulate citations. It also reflects publication channels: a large share of Indonesian output appears in national journals with limited international visibility.

Collaboration patterns reinforce this divide. Countries with high impact also show high rates of international co-authorship: 74.1% for Singapore, 43.2% for Vietnam and 42.4% for Malaysia, compared with only 8.0% for Indonesia. Intra-regional collaboration is

weak everywhere, ranging from about 4% to 17% for the main producers. Overall, 25.2% of documents involve authors from more than one country. The most frequent external partners are India, China, the United States, Saudi Arabia, Australia, Japan and the United Kingdom. This indicates that the region is linked to the global research network mainly through bilateral ties with extra-regional partners rather than through ASEAN-level cooperation.

4.3. Disciplines, journals and influential documents

The literature is dominated by the natural and technical sciences. Using OpenAlex's classification of each document's primary topic, 68.6% of documents fall under Agricultural and Biological Sciences, followed by Environmental Science (7.6%), Engineering (6.2%) and Computer Science (5.9%). Business, management and accounting accounts for 4.2%, the social sciences for 2.2% and economics, econometrics and finance for only 1.1%. Economic and institutional questions are therefore strikingly underrepresented.

Publication outlets are dispersed. The fifteen most frequent sources together publish only about 9% of documents. The leading international outlets are *IEEE Access* (39 documents), *International Journal of Advanced Computer Science and Applications* (22), *Sensors* (17), *Computers and Electronics in Agriculture* (17), *Sustainability* (14) and *Agriculture* (14). A large majority of the documents (89.4%) are open access, which reflects both the growth of open-access publishing and the weight of national journals.

The most cited documents with Southeast Asian co-authors are broad surveys of enabling technologies. They include a survey of civil applications of UAVs (Shakhatreh et al., 2019; about 2,500 citations), an overview of IoT and data analytics in agriculture (Elijah et al., 2018; about 1,470 citations), and a review of energy-efficient wireless sensor networks for precision agriculture (Jawad et al., 2017). An early review of the factors influencing adoption of precision agricultural technologies (Tey & Brindal, 2012) is the most influential socio-economic contribution. A Vietnamese-led review of IoT-enabled smart agriculture (Quy et al., 2022) is among the most cited recent works. Regionally specific studies, such as the potential of UAV-based remote sensing in Indonesia (Rokhmana, 2015) and a review of paddy-rice smart farming (Alfred et al., 2021), are fewer but well cited.

4.4. Thematic structure

The keyword co-occurrence analysis identifies six thematic clusters (Table 3). Four of them are mainly technological and two are mainly socio-economic.

Table 3. Thematic clusters from keyword co-occurrence analysis

Cluster	Main keywords	Documents	Mean publication year	Citations per document
C1. Climate-smart farming and smallholder adaptation	climate-smart agriculture; climate change adaptation; smallholder farmers; technology adoption; farmer groups; agricultural extension; rice cultivation	511	2023.46	14.8
C2. IoT sensing and smart irrigation	Internet of Things; irrigation automation; wireless sensor networks; soil moisture monitoring and sensors; ESP32 microcontroller; environmental and real-time monitoring; smart irrigation; crop yield; agricultural automation	823	2023.38	18.7
C3. Smart farming and AI-based disease detection	smart agriculture; convolutional neural networks; plant disease detection	1,062	2023.50	12.1
C4. Precision agriculture, UAVs and AI	precision agriculture; crop monitoring;	894	2023.19	19.7

Cluster	Main keywords	Documents	Mean publication year	Citations per document
	unmanned aerial vehicles; artificial intelligence			
C5. Food security and controlled-environment agriculture	food security; hydroponics; urban agriculture	369	2023.56	20.7
C6. Digitalisation, adoption, literacy and policy	sustainable agriculture; digital agriculture; agricultural productivity; agricultural technology adoption; agricultural policy; farmer training; digital literacy; AI in agriculture; agricultural digitalization; Indonesia	703	2023.80	15.9

Notes: A document is assigned to a cluster if it contains at least one of the cluster's keywords; documents can belong to several clusters. Clustering based on the 40 most frequent keywords (association strength normalisation; modularity maximisation, resolution 1.3, best of 300 runs).

C1 – Climate-smart farming and smallholder adaptation. This cluster links digital tools to climate-smart agriculture, adaptation, rice systems and smallholders. Its keywords on extension services and farmer groups show that part of the literature addresses how farmers learn about and adopt climate-related technologies.

C2 – IoT sensing and smart irrigation. This is the core engineering cluster. Its studies typically design and test low-cost systems that combine sensors, ESP32-type microcontrollers and wireless networks to monitor soil moisture, weather and water use and to automate irrigation. Many are prototypes tested on small plots or greenhouses.

C3 – Smart farming and AI-based disease detection. This is the largest cluster in terms of documents, organised around the generic keyword smart agriculture and computer-vision models, notably convolutional neural networks for detecting plant diseases. It has the lowest citation rate (12.1), reflecting a large volume of recent applied studies.

C4 – Precision agriculture, UAVs and AI. This cluster covers remote sensing, drones and AI for crop monitoring. It is the oldest theme (mean year 2023.19) and one of the most cited (19.7 citations per document), consistent with the high citations of the UAV and remote-sensing surveys noted above.

C5 – Food security and controlled-environment agriculture. This small cluster connects food security with hydroponics and urban farming, which are relevant for land-scarce cities such as Singapore and Kuala Lumpur. It has the highest citation rate (20.7).

C6 – Digitalisation, adoption, literacy and policy. This cluster gathers economic and institutional themes: technology adoption, digital literacy, farmer training, agricultural productivity and policy. It is the most recent theme (mean year 2023.80), and its keywords include "Indonesia", which reflects the strong Indonesian contribution to adoption and extension studies.

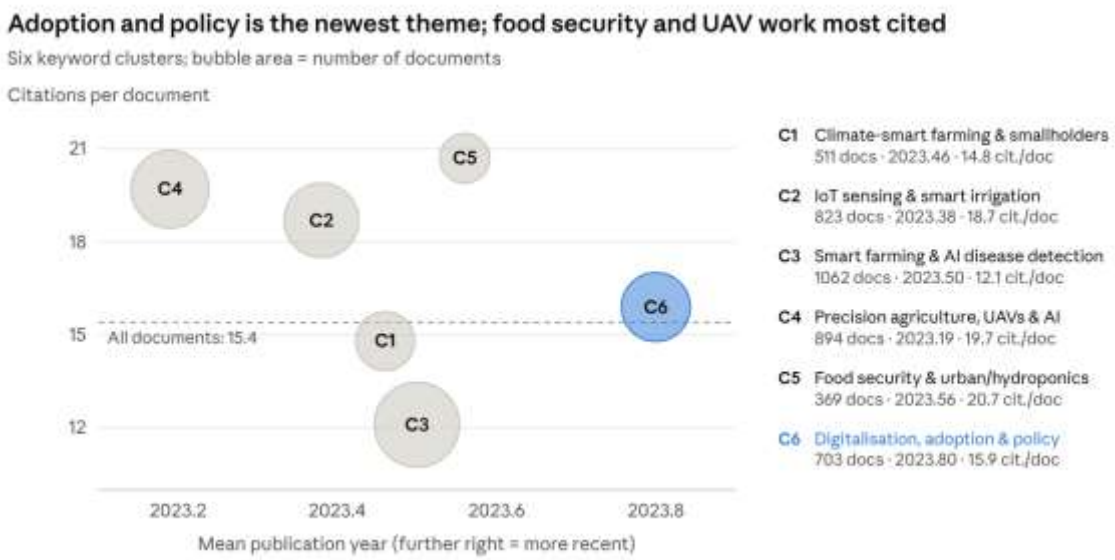


Figure 2. Thematic clusters by recency and influence.

Source: author's keyword co-occurrence analysis of OpenAlex records (40 keywords; association strength; Louvain, resolution 1.3).

Figure 2 plots each cluster by recency and influence. Two patterns emerge. First, the technology-driven clusters C2 and C4 are well established and well cited. Second, the socio-economic clusters C1 and C6 together involve more than 1,200 documents, yet they receive about 15 citations per document, below the IoT and UAV clusters. C6 is the clearest emerging theme. This suggests that research on how digital agriculture is adopted, governed and translated into economic outcomes is growing but has not yet produced a consolidated, widely cited body of evidence.

5. Discussion and research agenda

5.1. Interpretation of the findings

The results reveal a field that is young, fast-growing and unevenly structured. Four features stand out.

First, **growth has outpaced consolidation**. The region's output multiplied many times within six years, but most of it consists of recent applied studies that have not yet been widely cited. Rapid growth in volume is not the same as the build-up of cumulative evidence. Much of the literature reports single-site prototypes, short pilot trials or descriptive surveys, and relatively few studies compare results across locations or over time.

Second, **production and influence are geographically divided**. Indonesia dominates volume but has low citation impact and little international collaboration, while Malaysia, Singapore and, to a lesser extent, Vietnam combine moderate volume with high impact and strong international links. Cambodia, Laos and Myanmar, where agriculture is most important for employment and where digital divides are deepest, are almost absent. This replicates within the research system the same development gaps that digital agriculture is expected to close. Weak intra-ASEAN collaboration also means that lessons from one country are rarely tested in another, despite similarities in crops, farm structures and climate risks.

Third, **the research front is technology-driven**. Engineering and computer-science themes (clusters C2, C3 and C4) account for the largest share of documents, and economics represents only about 1% of the literature. This imbalance is significant because the binding constraints in smallholder agriculture are often economic and institutional rather than technical (Deichmann et al., 2016). A low-cost sensor that works on a test plot may not be profitable for a farmer cultivating less than one hectare, may not fit the capacity of local extension services, or may raise unresolved questions about who owns and benefits from the data.

Fourth, **socio-economic research is emerging**. Cluster C6 on adoption, literacy, training and policy is the most recent theme, and cluster C1 links digital tools with climate adaptation and smallholders. These clusters suggest a gradual shift from "can the technology work?" to "who adopts it, under what conditions, and with what effects?". This mirrors the broader international move towards a social science agenda on digital agriculture (Klerkx et al., 2019; Shepherd et al., 2020).

5.2. A research agenda

Based on these findings, five priorities are proposed for future research on digital agriculture in Southeast Asia.

1. **Inclusive adoption by smallholders.** Studies should examine how farm size, gender, age, education, digital literacy, credit access and membership in cooperatives or farmer groups shape adoption, and whether digital tools widen or narrow gaps between farmers. Collective adoption models, in which cooperatives or service providers own the equipment, deserve particular attention in smallholder-dominated systems.
2. **Rigorous impact evaluation.** The field needs causal evidence on productivity, income, input use, resilience and environmental outcomes. Randomised trials, panel data from national household surveys and quasi-experimental designs (difference-in-differences,

matching, regression discontinuity) can move the literature beyond prototypes and perception surveys. Cost-benefit analyses are needed to assess whether technologies are profitable at the scale of a typical farm.

3. **Value chains, markets and platforms.** Research is scarce on how e-commerce, digital marketplaces, traceability systems and digital finance affect farm-gate prices, market access and the distribution of value along agri-food chains. These questions are directly relevant to export-oriented sectors such as rice, coffee, fruit and seafood, which increasingly face traceability requirements in importing markets.
4. **Data governance and institutions.** Questions of data ownership, privacy, platform power, interoperability and public investment in digital infrastructure are almost absent from the keyword map. Comparative policy research across ASEAN members could identify which regulatory and institutional arrangements support trust and broad participation.
5. **Regional collaboration and under-represented countries.** Research networks that include Cambodia, Laos, Myanmar and Timor-Leste, and cross-country studies using common protocols, would improve the external validity of findings. Regional bodies and donors could support shared datasets, joint calls and capacity building, especially in the social sciences.

5.3. Implications for Vietnam

Vietnam occupies an intermediate position: its output is modest (7.1% of documents), but its citation impact (27.5 citations per document) and international collaboration rate (43.2%) are among the highest in the region. This suggests that Vietnamese research is relatively well integrated into international networks but too small in volume to inform national policy across the full range of crops and regions. Given the government's emphasis on digital transformation in agriculture, there is scope to expand economic and policy research using national statistical data, household surveys and evaluations of public programmes. Priority topics include the digitalisation of agricultural cooperatives, digital marketing of OCOP products and the use of digital tools for climate adaptation in the Mekong Delta.

6. Conclusion

This study provides a region-wide bibliometric map of digital agriculture research in Southeast Asia, based on 2,386 documents published between 2010 and 2025 and retrieved from OpenAlex. The answers to the research questions can be summarised briefly. On RQ1, the field emerged late but has expanded very rapidly, with more than nine in ten documents published since 2020. On RQ2, production is concentrated in Indonesia and Malaysia, impact is highest in Singapore, Brunei, Malaysia and Vietnam, and the least developed member states are nearly absent; intra-regional collaboration is weak. On RQ3, six thematic clusters were identified, four mainly technological and two mainly socio-economic, with adoption, digital literacy and policy forming the most recent theme. On RQ4, the paper proposes an agenda focused on inclusive adoption, rigorous impact evaluation, value chains and platforms, data governance, and regional collaboration.

Policy implications. Three implications follow for governments and regional institutions. First, research funding for digital agriculture should be rebalanced towards socio-economic evaluation, so that public programmes are designed on evidence about who benefits and at what cost. Second, digital agriculture strategies should be linked to extension reform, cooperative development and digital-skills training, since the literature identifies these institutional channels as conditions for adoption. Third, ASEAN-level mechanisms for joint research, open data and capacity building could reduce the knowledge gap between member states and allow lessons to travel across countries.

Limitations. The study has several limitations. It relies on a single database; although OpenAlex offers broad coverage, its subject classification and keyword assignment are automated and may contain errors, and results may differ from those based on Scopus or Web of Science. The search was limited to English-language terms in titles and abstracts, so studies published only in national languages may be missed. Citation counts favour older documents, which penalises the large recent output of countries such as Indonesia. Finally, counts for 2025 may still change as indexing is completed. Future work could combine several databases, apply manual screening to the full dataset, and complement keyword analysis with co-citation analysis and systematic content review of the most influential studies.

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Data: OpenAlex API, https://api.openalex.org (query and filters as in Table 1; accessed 14 October 2026).