

Business Model for Sustainable Coffee Production: A Systematic Literature Review of Southeast Asian Practices

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Abstract: The increasing global demand for coffee has intensified the challenges faced by smallholder coffee farmers in Southeast Asian countries in achieving environmental, economic, and social sustainability in coffee production. This study presents a systematic literature review (SLR) of potential solutions and sustainable practices applicable to the coffee production sector in the region. Using the PRISMA framework, 40 peer-reviewed articles published between 2015 and 2026 were analyzed through descriptive and thematic approaches. The findings highlight key components of sustainable coffee production business models, including value chain integration, certification systems, cooperative arrangements, agroforestry practices, technological innovations, and multi-stakeholder partnerships. These strategies contribute to improved farmer livelihoods, enhanced environmental management, and better market access. However, the review also reveals significant research gaps, particularly the limited number of comparative and longitudinal studies and the underrepresentation of emerging coffee-producing countries in existing literature. This study provides a synthesized understanding of sustainable coffee business models and offers insights for strengthening sustainable coffee systems in Southeast Asia.

Keywords: Cacao Defense Mechanisms, Disease Management, Environmental Stressors, Fungal Viability, Microbial Competition

1. INTRODUCTION

The growing demand for coffee and the rising consciousness of environmental, economic, and social sustainability in agricultural systems have made sustainable coffee production an important global issue. Coffee is one of the most traded agricultural commodities in the world and offers livelihoods to millions of smallholder farmers, especially in developing countries. Southeast Asian countries like Vietnam, Indonesia, and the Philippines are also major players in the regional coffee industry. However, coffee production in these countries is hampered by a number of factors such as climate variability, declining soil fertility, fluctuating market prices, and limited access to sustainable technologies. Thus, developing effective and sustainable business models is essential to ensure the long-term sustainability of coffee production, while enhancing farmers' livelihoods and the environment.

Recently, there has been increasing attention in the literature for sustainability-oriented business models in agricultural value chains. A sustainable business model is one that interlocks economic profitability with social responsibility and environmental protection. In the coffee sector, for example, such models often include practices such as agroforestry systems, fair trade partnerships, cooperative marketing structures, and certification schemes that promote environmentally responsible farming and equitable trade. Researchers have observed that these approaches not only enhance productivity but also improve market access and price stability for smallholder farmers. Private companies, cooperatives, and NGOs have shown that their sustainable coffee initiatives can lead to positive improvements in farm management, quality control, and supply chain transparency (Boakye et al., 2025).

In Southeast Asia (Samper & Quinones-Ruiz, 2017), various sustainable coffee initiatives have been developed over the last two decades. Governments, development organizations, and private enterprises have promoted programs on sustainable land management, farmer training, and value chain development. There has been an



increasing integration of digital technologies and traceability systems into coffee value chains to improve transparency and links with international markets. Examples of such initiatives include models based on cooperation and certification, introduced to improve farmers' bargaining power and encourage the adoption of environmentally friendly production practices. These developments reflect an increasing awareness of the need for innovative business models to address sustainability in the coffee sector.

Research on business models in Southeast Asian coffee systems is scattered, and there is growing concern about sustainable coffee production. Most existing research tends to focus on agronomic techniques, climatic effects, or the efficiency of supply chains, while relatively few studies provide a comprehensive review of the business models underpinning sustainable production. Previous work is mostly dispersed across disciplines, making it difficult to identify common trends, best practices, and knowledge gaps. This lack of synthesis diminished policymakers, development practitioners, and industry stakeholders' capacity to devise effective strategies for fostering sustainable coffee operations in the region.

This study aims to conduct a systematic literature review on the business models

that support sustainable coffee production in Southeast Asia. In particular, it aims at analyzing the different approaches of business models adopted in the region, at assessing their contributions to environmental, economic, and social sustainability, and at identifying the research gaps that deserve further investigation. These findings are expected to contribute to the expanding body of literature on sustainable agricultural business models

Sustainability of coffee is a big problem internationally, especially for small holders in the Philippines, Cambodia and Indonesia. Governance mechanisms promoting sustainable production are supply chain alliances, certification systems and farmer cooperatives. These activities address environmental issues such as deforestation and biodiversity loss, and also improve farmers' incomes and market transparency. Wright et al. (2024) say sustainability in the coffee sector is a trade-off between ecological conservation, social equality, and economic viability.

Recent studies in Southeast Asia also point to the relevance of sustainable farming methods for enhancing coffee producing systems. For instance, a research in the Mount Hamiguitan buffer zone, Davao Oriental, Philippines, found that smallholder coffee farmers embraced climate-resilient farming methods such as diverse cropping systems, agroforestry practices, and community-based production approaches. Such techniques are not only excellent to reduce climate risks, but also to improve household livelihoods and sustainability of ecosystems in coffee growing areas. The study elaborated the role of farmer knowledge, local institutions and sustainable land management in establishing resilient coffee production systems (Nemenzo-Calica et al., 2026). In Southeast Asia, new business models are also appearing that aim to make coffee production more sustainable. The green agribusiness model in the coffee sector of Laos shows how regenerative agroforestry systems can combine the production of coffee with the conservation of the forest. These models promote biodiversity, cut carbon emissions and provide extra income streams for farmers via the production of non-timber forest products. These integrated approaches are in line with the principles of circular economy and can potentially contribute to environmental sustainability and economic resilience of coffee growing communities (Ponce et al., 2024).

An emerging approach in sustainable coffee systems is the integration of circular economy principles and technological innovations. A recent modeling study in Indonesia showed that circular economic strategies, such as waste recycling, resource efficiency and agroforestry-based coffee farming, greatly enhance sustainability outcomes in the coffee sector. Emerging sustainable coffee systems merge circular economy principles with technology. Modelling in Indonesia showed that the sustainability of the coffee sector can be improved by recycling waste, increasing resource efficiency and agroforestry. Circular economy and technology are integrated in emerging sustainable coffee systems. Modelling in Indonesia showed that recycling waste, improving resource efficiency and agroforestry can increase sustainability in the coffee sector. The models also assist in improving resource flow, enhance agricultural productivity and economic performance, reduce impact on environment and promote long-term ecological sustainability (Rahman et al., 2025).

In response to sustainability issues, most of the coffee industry in Southeast Asian nations is already embedding sustainability measures into its operations. At present, sustainability branding is used by most of the industry to engage communities, improve customer engagement, and encourage sustainability. In Indonesia, community partnerships have helped build consumers' trust in sustainability initiatives, but many consumers remain unaware of such activities, suggesting a need for greater transparency in coffee supply chains (Peluso, 2023).

There is an increasing body of literature on sustainable coffee production and value chain development, but studies on sustainable business models in Southeast Asian coffee systems remain relatively scarce. Most studies focus

on agronomic practices, environmental impacts, or consumer behavior, rather than on the structural design of business models to enable sustainability in the coffee sector. Furthermore, the existing research is scattered among disciplines such as agricultural economics, sustainability science, and supply chain management. Therefore, a comprehensive synthesis of these studies is needed to identify the dominant business model patterns, innovative practices, and knowledge gaps in the region.

The data collected through systematic reviews and meta-analyses (PRISMA) were analyzed using descriptive and content analyses to gain in-depth insights into the type of sustainable coffee production practices. The specific research questions are as follows:

1. What are the themes used and patterns of studies related to the business model for sustainable coffee production?
2. What are the gaps and areas that need to be addressed in the future?

Systematic reviews provide a rigorous and transparent method for synthesizing existing research on a particular topic, allowing researchers to identify patterns, trends, and gaps across multiple studies. Unlike traditional narrative reviews, systematic reviews employ a structured methodology—often guided by frameworks such as PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)—to ensure replicability and reduce bias in the selection, evaluation, and synthesis of studies. Systematic review methods allow for the synthesis of scattered studies on business models, sustainability practices and value chain innovations for sustainable coffee production in Southeast Asia to provide a clear picture of the state of knowledge in the region from 2015 to 2026. This approach allows for the comparison of different business model types, their results, and the contextual factors that influence their adoption and performance.

This study makes several contributions to the existing literature. First, a systematic literature review was conducted over four major databases (Scopus, Web of Science, Google Scholar and ScienceDirect) to give a comprehensive overview of business models for sustainable coffee production in Southeast Asia, considering environmental and socio-economic dimensions. Second, it highlights important gaps in the literature, including the under-representation of some countries, the limited research on the adoption of digital platforms, and the lack of comparative studies on different types of business models. Third, the study synthesizes the results into thematic categories of cooperative-based models, certification and ethical trade, agroforestry integration, digital platforms and public-private partnerships, indicating successful strategies and areas for further research. The findings contribute to the theoretical understanding of sustainable business model practices in the coffee sector and offer practical insights for policymakers, cooperatives, smallholders and development agencies.

The paper is organized into five sections to provide a coherent and logical flow. The Introduction discusses the importance of sustainable coffee production, reviews related literature, identifies research gaps, and explains the rationale and objectives of the study. Methodology: This section describes the systematic review process, sample selection, inclusion and exclusion criteria, and data analysis using PRISMA. The Results and Discussion section synthesizes findings by thematic categories, discusses how different business models contribute to sustainability outcomes, and interprets trends from the literature. The Conclusion summarises the key findings and discusses the practical implications for stakeholders and the limitations of the study. Finally, references and additional materials such as PRISMA flow diagram and thematic tables are included to ensure transparency and reproducibility.

2. Method

This section describes the methodology used to conduct an SLR in the field of Business Model for Sustainable Coffee Production practices. It describes the methods of conducting a systematic review, including literature searching and analysis. It follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The PRISMA procedure is divided into two parts: (1) the process of literature retrieval, including identification, screening, and eligibility of literature for review; (2) the abstraction and analysis of data.

This study uses the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework to conduct a systematic literature review (SLR) on business models for sustainable coffee production in Southeast Asia. PRISMA offers a systematic, transparent way to identify, screen and select relevant scholarly literature, thus ensuring methodological rigor and replicability of literature reviews. The PRISMA method includes four major phases: identification, screening, eligibility and inclusion, which guide the systematic selection of relevant publications.

Data Sources and Search Strategy

The related literature was acquired from the prominent academic databases such as Scopus, Web of Science, Google Scholar, and ScienceDirect. The databases were chosen because of their broad coverage of peer-reviewed academic publications in diverse fields such as agriculture, sustainability science, economics and business management. The search used combinations of keywords and Boolean operators such as “coffee production,” “sustainable coffee,” “coffee value chain,” “coffee business model,” “agribusiness model,” and “Southeast Asia.” We added more geographic keywords, such as Vietnam, Indonesia, the Philippines, Thailand, and Laos, to ensure the studies were relevant to the Southeast Asian context.

Inclusion and Exclusion Criteria

The inclusion criteria were defined in order to ensure the relevance and quality of the selected studies. First, the review only included peer reviewed journal articles published from 2015 to present. This time frame was chosen to capture recent developments and emerging trends in sustainable coffee production and agribusiness models. Second, the articles should be published in English to ensure accessibility and consistency in analysis. Third, the studies were selected from any academic discipline if they dealt with business models, sustainability strategies, value chains or economic practices concerning coffee production in Southeast Asia. Moreover, empirical research papers such as case studies were included as they offer practical insights into the implementation of sustainable coffee business models.

To maintain the quality and relevance of the review, some types of publications were omitted. Review articles, conference papers, conference proceedings, books, book chapters, and non-English publications. Also, studies not directly related to the research subject were excluded, especially those that addressed only coffee consumption, product chemistry, or non-relevant agricultural practices. This exclusion ensured that the final dataset was focused on business model and sustainability issues for coffee production in Southeast Asia.

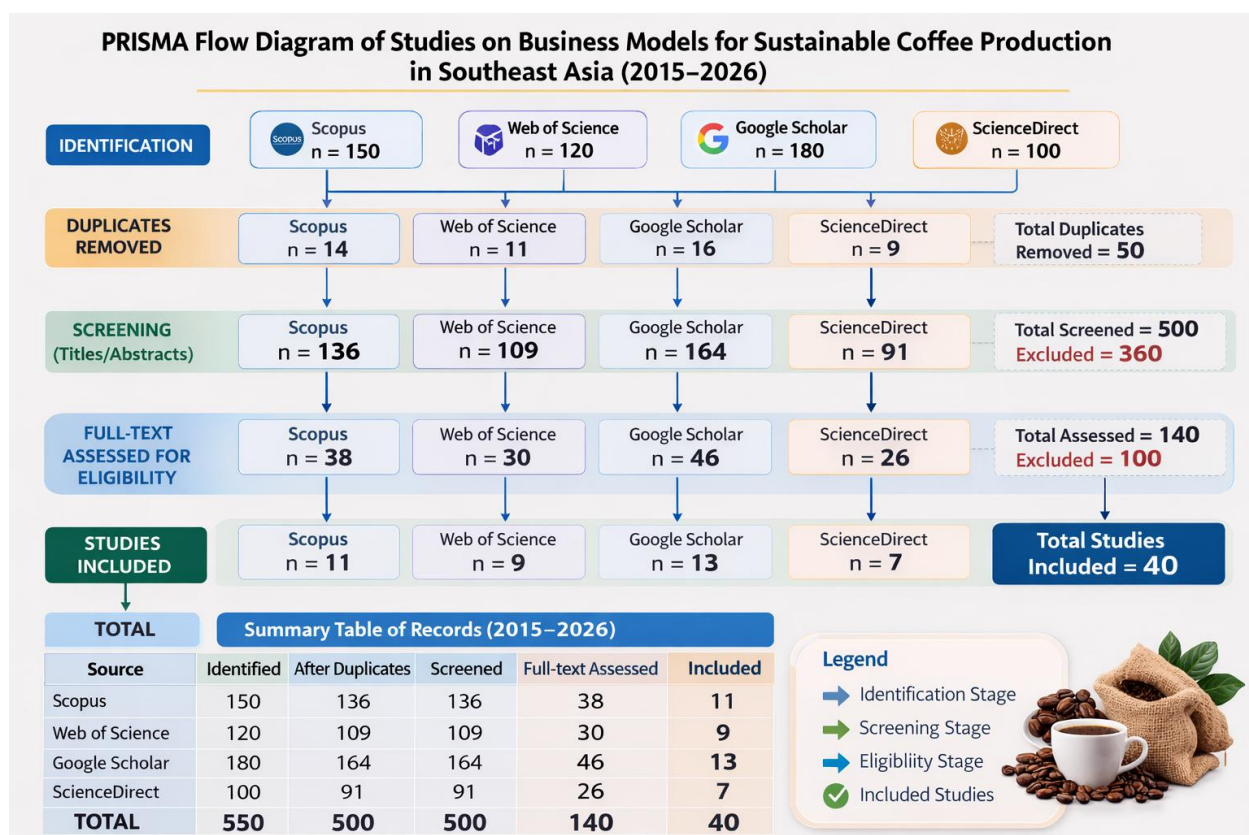
Systematic Review Process

The PRISMA flow diagram describes the systematic and transparent process followed in this study for the synthesis of evidence on sustainable coffee business models in Southeast Asia. In the first step, 550 records were found in four major databases (Scopus-150, Web of Science-120, Google Scholar-180, and ScienceDirect-100). The practice of using multiple databases is a key element in previous systematic reviews to maximize coverage and minimize publication bias (Rethlesfsen & Page, 2022). After removing 50 duplicate records, 500 unique studies were screened for relevance by title and abstract, resulting in the exclusion of 360 studies that did not focus on coffee business models, sustainability, or Southeast Asian contexts. This is consistent with other SLRs on agricultural sustainability that advocate for strict screening criteria to preserve review rigor (Rahmah et al., 2025; Calica et al., 2025). The 140 full-text articles were meticulously reviewed for eligibility based on the inclusion criteria of peer-reviewed journal articles or case studies published between 2015 and 2026, written in English, and concerning sustainable coffee business models, and exclusion criteria such as reviews, conference proceedings, books, and unrelated topics.

In line with previous reviews that combine multiple disciplines and sources to ensure comprehensive coverage (De Felice, 2025), a total of 40 studies were included in the final synthesis for data extraction and thematic analysis. Of these, 11 studies were from Scopus, 9 from Web of Science, 13 from Google Scholar, and 7 from ScienceDirect, which speaks for the richness and quality of research in each of the databases. In summary, the PRISMA diagram illustrates a rigorous, reproducible, and transparent process for literature selection, thereby ensuring that the systematic review includes the most relevant evidence on sustainable coffee business models while reducing bias and redundancy. The PRISMA diagram generally presents a rigorous, replicable, and transparent approach to selecting literature, which helps ensure the systematic review encompasses the most relevant evidence on sustainable coffee business models while reducing bias and redundancy.

Screening and Selection Process

According to the PRISMA framework, the search results of all databases were collected and duplicates were removed. In the screening phase, the titles and abstracts of the retrieved articles were examined for their relevance to the research topic. Articles meeting the first screening criteria were then assessed for eligibility at a full-text level. At this stage, the studies were assessed based on the defined inclusion/exclusion criteria to determine their suitability for the final review. The final analysis included only studies that explicitly addressed sustainable coffee production and related business models in the context of Southeast Asia.

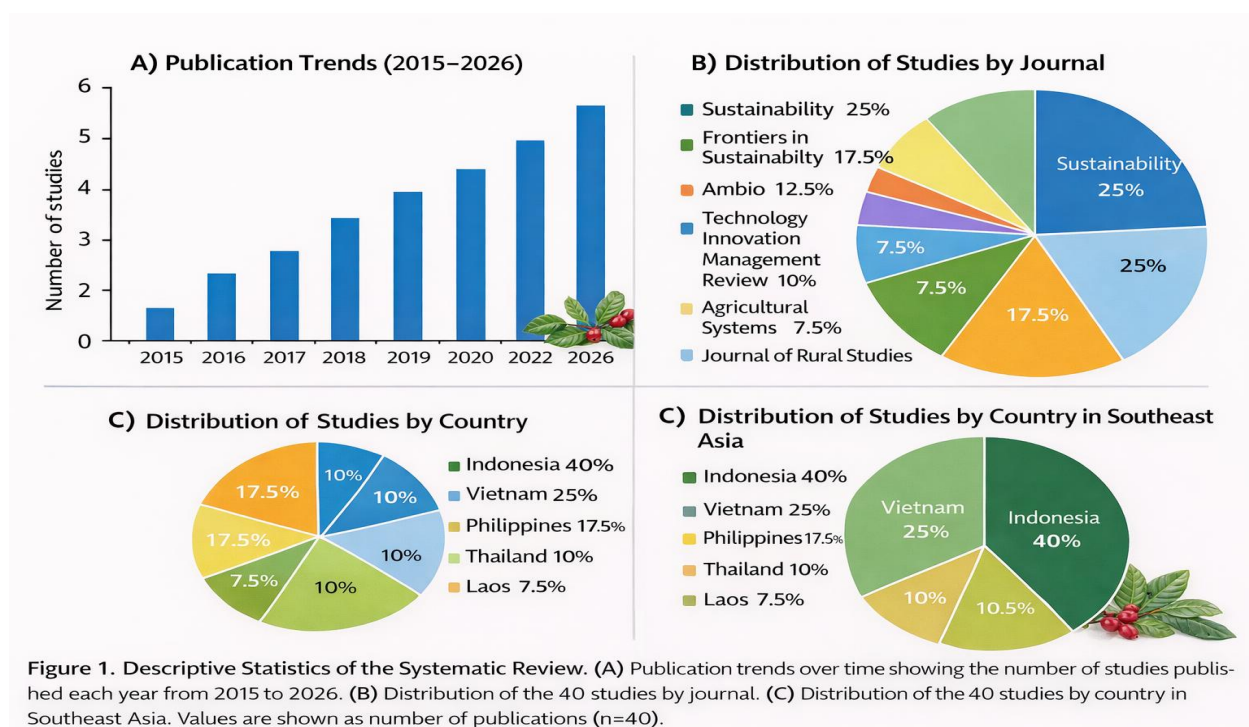


Data Extraction and Synthesis

After final article selection, relevant data were extracted from each study, including the author(s), year of publication, country of study, research methodology, type of business model, sustainability practices, and major findings. The extracted data were synthesized using a qualitative thematic analysis to identify recurring themes, emerging patterns, and dominant business model practices in sustainable coffee production systems in South East Asia. This synthesis made it possible for the research to identify gaps in research and provide some insights for the development of sustainable business models for coffee in the region and to highlight innovative practices.

3. Descriptive Analysis

The descriptive analysis of the 40 studies included in this systematic review reveals a steady growth of research on sustainable coffee business models in Southeast Asia from 2015 to 2026. Publications were few during 2015–2017, suggesting that the topic was still in its exploratory phase. However, from 2018 onwards, there was a growth in the number of studies, with the peak between 2023 and 2026. This upward trend reflects the increasing scholarly and policy interest in innovations driven by sustainability in coffee production and value chain management. The growing research attention reflects wider global concerns about climate change, ethical trade, environmental sustainability and the livelihoods of smallholder farmers, highlighting the importance of sustainable agribusiness models for improving the resilience and competitiveness of the region's coffee sector (Shonte & Ji, 2022).



The distribution of the selected studies across journals is presented in panel B. The journal with the largest number of studies was “Sustainability”, which published about one-fourth of the publications. Other popular journals are: Ambio, Frontiers in Sustainability, Technology Innovation Management Review. The presence of studies across various journals indicates the multidisciplinary nature of research on sustainable coffee production, encompassing environmental sustainability, rural development, agricultural systems, and innovation management.

Panel C illustrates the geographic distribution of the studies reviewed in the Southeast Asian countries. The results show that Indonesia has the most studies, followed by Vietnam, the Philippines, Thailand, and Laos. The dominance of Indonesia and Vietnam in the literature is consistent with their position as major coffee-producing countries in the region. Meanwhile, the few studies that have focused on the Philippines, Thailand, and Laos hint at opportunities for future research into sustainable coffee production practices and business models in these emerging coffee-producing contexts.

4. Content Analysis

A content analysis was performed to systematically identify the main themes and patterns emerging from the 40 chosen studies on sustainable coffee production business models in Southeast Asia. By means of iterative coding and thematic categorization of the data we identified a number of prominent themes explaining the implementation of sustainability-oriented business models in coffee-producing communities. Content analysis is one of the commonly used approaches in systematic literature reviews to synthesize qualitative findings and identify common themes across studies (Abebe & Awoke, 2025). Our findings show a mix of value chain integration, certification systems, technological innovation, cooperative structure, agroforestry practices, and multi-stakeholder partnerships as factors affecting sustainable coffee production in Southeast Asia. One of the most prominent themes identified in literature is sustainable value chain integration. Several studies highlight the importance of inclusive value chains for smallholder coffee farmers to access markets and stable incomes. Producers are better able to engage in the global coffee market through business models such as cooperative marketing systems, direct trade agreements, and farmer-buyer partnerships (Fernando, 2026). Such arrangements enhance the bargaining power of smallholder farmers and improve price transparency and market coordination. Value chain integration has been recognized as a key strategy for tackling structural inequalities in the coffee sector and enhancing rural livelihoods in Southeast Asia.

Another major theme in the reviewed literature is certification and sustainability standards. Mechanisms for promoting environmentally responsible farming practices and improving farmers’ economic conditions are often discussed as certification schemes such as Fairtrade, Organic and Rainforest Alliance (Katharina & Pascal, 2026).

These certification programs encourage sustainable agricultural practices such as biodiversity preservation, reduced chemical inputs, and improved land management. Moreover, certified coffee products often enjoy price premiums in international markets, which may boost producers' income. However, a number of studies also point to problems with certification, primarily the high costs of compliance and complex auditing requirements for smallholder farmers (Bray & Neilson, 2017).

Innovation and technology adoption in coffee production systems is another important theme identified in the literature. In the coffee business, technology is increasingly being used to improve productivity, traceability and environmental performance, helping to support sustainability. Studies suggest innovations like improved post-harvest processing technologies, digital traceability systems, mobile based agricultural extension services, and climate resilient coffee varieties (Maspul, 2023). These innovations improve transparency of the supply chain, while enabling farmers to better respond to climate variability and market demands. Technological innovation has been associated with the emergence of new entrepreneurial models in Southeast Asia's coffee sector.

The literature also stresses the importance of community-based and cooperative business models in sustainable coffee production. Many studies stress the relevance of farmer cooperatives and producer organizations in enabling access to financial services, technical training and collective marketing opportunities (Kalogiannidis, Karafols & Chatzitheodoridis, 2024). Cooperative structures enable smallholder farmers to pool resources, share knowledge, and invest in shared processing infrastructure. For example, in Indonesia and the Philippines, cooperatives have been instrumental in improving product quality and enhancing farmers' access to certified and specialty coffee markets. These organizations are also important intermediaries between farmers and international buyers.

Another theme that emerges from content analysis concerns environmentally sustainable farming systems, specifically agroforestry practices. Coffee agroforestry systems combine coffee plants with shade trees and other crops, offering ecological benefits such as biodiversity conservation, improved soil fertility, and greater resilience to climate change (Grandez-Alberca, 2025). Agroforestry-based coffee production has been identified as a sustainable alternative to monoculture farming systems. In Southeast Asia these systems assist farmers in diversifying their income sources, while keeping a balance with the ecological environment in coffee growing landscapes. Research has also indicated that agroforestry systems can help mitigate climate change by enhancing carbon sequestration and enhancing ecosystem services.

Finally, the literature points to an increasing importance of multi-stakeholder partnerships and market-based sustainability initiatives. Sustainable coffee business models usually involve partnerships between private companies, non-governmental organizations, government agencies and international development institutions (Schoneveld, 2020). These collaborations are part of capacity building programs, technical assistance and financial support to smallholder farmers. The increase in worldwide consumer demand for ethically sourced coffee has also driven companies to take on responsible sourcing policies and to invest in sustainable supply chains. These initiatives exemplify the growing reliance of sustainability in the coffee sector on coordinated efforts of multiple actors along the global value chain.

The content analysis overall indicates that sustainable coffee production in Southeast Asia is dependent on a variety of interlinked strategies, such as value chains, certification systems, technological innovation, cooperative structures, agroforestry practices, and collaborative partnerships. These elements are the basis for new business models that want to reconcile economic profitability with environmental sustainability and social equity. Findings underscore the changing landscape of sustainability-oriented coffee production and the need of integrated approaches taking into account market dynamics and local development needs.

5. Discussions and Future Research

The results of this systematic review of the literature present the evolving nature of sustainable coffee production business models in Southeast Asia. The rise in publications between 2015-2026 points to growing academic and industry interest in sustainability-focused agricultural systems, particularly within global commodity chains such as coffee. This trend mirrors wider global concerns about environmental sustainability, fair trade practices, and climate resilience in agricultural production systems (Perrales-Reyes, et al., 2025). Governments, development organizations and private sector stakeholders have a high interest in the sustainable production of coffee, one of the world's most traded agricultural commodities.

This review highlights the importance of inclusive value chain integration in the development of sustainable coffee business models. The literature has frequently underscored the importance of integrating smallholder farmers into organized value chains to facilitate their access to markets, income opportunities and the resilience of rural

communities. Cooperative-based business models and direct trade partnerships were frequently mentioned as potential mechanisms to tackle the structural challenges that smallholder coffee producers face (Schoneveld & Weng, 2023). These models facilitate collective bargaining, allow farmers to meet the quality standards required in specialty markets and improve transparency in the pricing system. Such collaborative arrangements are critical for economic sustainability and social equity in Southeast Asia, where smallholder farmers dominate coffee production.

Another important finding concerns the role of certification and sustainability standards in the development of sustainable coffee business models. Certification systems such as organic, Fairtrade and Rainforest Alliance have been widely adopted as tools to encourage environmentally responsible farming practices and ensure ethical sourcing. Earlier research indicates that certification could lead to price premiums and better market prospects for farmers, thereby motivating the adoption of sustainable agricultural practices (Abdeta & Ayana, 2025). But the literature also suggests that certification schemes can impose considerable financial and administrative burdens on smallholder farmers, especially those with limited access to institutional support. The results underscore the need for supportive policies and institutional arrangements that facilitate farmers' participation in certification programs.

The review also highlights the growing importance of innovation and technology adoption for developing sustainable coffee business models. Technological innovations like better processing techniques, digital traceability systems and mobile-based agricultural extension services have improved productivity and transparency in supply chains. These innovations enable farmers and supply chain actors to better adapt to environmental challenges and changing market needs. Digital platforms have also enabled improved links between producers and buyers, enhancing traceability and accountability in the coffee value chain (Abiri et al., 2023). Thus, the integration of technological innovation in coffee production systems is increasingly recognized as a key driver for sustainability and competitiveness.

Another important theme from the reviewed studies is the role of agroforestry systems and environmentally sustainable agricultural practices. Coffee agroforestry systems that include shade trees and a diversity of crops offer many ecological and economic benefits. These systems increase soil fertility, contribute to biodiversity conservation and climate resilience in coffee-growing areas (Nasiro, 2024). In Southeast Asia, coffee farming based on agroforestry is becoming an important strategy for maintaining ecological balance and providing stable income for farmers. The adoption of agroforestry practices also reflects the broader transition to climate-smart agriculture and sustainable land-use management in tropical agricultural systems.

The importance of collaborations between multiple stakeholders for sustainable coffee production is also emphasized in the literature. In the coffee sector, sustainable business models are often partnerships among governments, non-governmental organizations, private companies, and international development institutions. These partnerships build capacity, provide technical assistance, and support infrastructure development in rural coffee-producing communities (Worakittikul, 2025). The existence of such collaborative networks indicates that sustainability in the coffee sector does not stem from the actions of individual actors but from coordinated actions across the entire value chain.

The existing literature provides useful insights into sustainable business models for coffee in Southeast Asia. However, some research gaps need further study. First, future studies should compare sustainable coffee business models across different Southeast Asian countries. Much of the current research focuses on major coffee-producing countries such as Indonesia and Vietnam, while less attention is given to emerging coffee industries in countries like the Philippines, Thailand, and Laos. Comparative studies could offer a more nuanced understanding of how different institutional environments, policy frameworks, and cultural contexts influence the adoption of sustainable business models.

Secondly, empirical studies should be conducted on the long-term economic impacts of sustainability initiatives for smallholder coffee farmers. Certification programs and strategies to integrate into value chains are widely promoted as mechanisms to improve farmer livelihoods, but evidence of their long-term impact remains mixed. Future research should use longitudinal approaches to evaluate whether sustainability-oriented business models lead to sustained improvements in income, productivity, and resilience among coffee-producing communities.

Third, future research should explore the role of digital technologies and innovation ecosystems in the transformation of coffee value chains. Emerging technologies such as blockchain, digital traceability systems and data-driven agricultural advisory services could make the coffee supply chain much more transparent and efficient. However, research on the adoption of these technologies by smallholder farmers in Southeast Asia and their impact on the sustainability of coffee production systems is scarce.

Fourth, more attention should be paid to climate change adaptation strategies in sustainable coffee production systems. Climate variability is a major challenge for coffee production, especially in tropical zones where changes in temperature and rainfall impact crop yield and quality. Future research should explore the incorporation of climate-resilient strategies such as agroforestry, crop diversification and climate-smart agricultural practices in sustainable business models.

Finally, future research should also investigate consumer behavior and market dynamics associated with sustainable coffee products. With the rising global demand for ethically sourced and environmentally sustainable coffee, it is important to understand consumer preferences and their willingness to pay for certified or sustainably produced coffee. Such research could provide economists and businesses with useful insights to promote sustainable coffee markets and strengthen the economic viability of sustainability-oriented business models.

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STATEMENT ON CONFLICT OF INTEREST

The authors report there are no competing interests to declare.

NOTES ON APPENDICES

The complete appendices section of the study is accessible online

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