
EXTENDING THE BUSINESS MODEL CANVAS FOR SUSTAINABLE SMALLHOLDER COFFEE FARMING: INTEGRATING DIGITAL MARKETING, GREEN FINANCE, AND CIRCULAR ECONOMY

Masyadi¹, Mukhlis Abbas², Andi Zulfayani³

*Corresponding author E-mail: masyadi@unipol.ac.id

ARTICLE INFO

Original Article

Received: 17 September 2025

Accepted: 19 December 2025

doi:10.59267/ekoPolj2602391M

UDC 005.511:633.73]:
[336+502.171.1

Keywords:

Business Model Canvas, digital marketing, green finance, circular economy, smallholder coffee

JEL: Q13, O13, M31, Q56

ABSTRACT

This study develops and validates an Extended Business Model Canvas (BMC) integrated with the Triple Bottom Line (TBL) principles, focusing on digital marketing, green finance, and circular economy practices for smallholder coffee farming in Soppeng Regency, Indonesia. Using a mixed-methods explanatory sequential design, the study combined exploratory fieldwork, participatory model development, and pilot testing with 100 farmers. The results showed a 44% increase in gross monthly income, a 26% increase in sales volume, a 14% rise in average selling prices, and significant environmental benefits such as 47% waste recycling and 32% reduced chemical fertilizer use. Regression analysis indicated that digital readiness, cooperative networks, and institutional support were key drivers of adoption, while limited capital and poor infrastructure remained persistent barriers. This study highlights integrated approaches to smallholder farming that promote positive social, environmental, and economic impacts, contributing to the achievement of sustainable development goals and advancing Sustainable Business Model Innovation (SBMI) literature.

Introduction

Smallholders continue to be indispensable to agricultural production in developing nations. Rural farmers continue to encounter obstacles such as inadequate infrastructure, low capital, reduced negotiating leverage, and susceptibility to climate shocks (Ma'wah et al., 2023).

-
- 1 Masyadi, Lector, Lamappapoleonro University, Soppeng, Sulawesi, Indonesia, Phone: +6282314084446, E-mail: masyadi@unpol.ac.id, ORCID ID (<https://orcid.org/0000-0001-8299-099X>)
 - 2 Muchlis Abbas, Associate Professor, Lamappapoleonro University, Soppeng, Sulawesi, Indonesia, Phone: +6281241945719, E-mail: muchlisabs@gmail.com, ID ORCID (<https://orcid.org/0009-0007-0004-6518>)
 - 3 Andi Zulfayani, Lektor, Universitas Lamappapoleonro, Soppeng, Sulawesi, Indonesia, Phone: +6285299639457, E-mail: andi.zulfayani@unipol.ac.id, ORCID ID (<https://orcid.org/0009-0009-9045-7947>)

Coffee is a very important product and a big source of wealth in Indonesia, especially in places like Soppeng. But there are still problems with the environment, restricted market links, and different manufacturing systems (Jacobi et al., 2024)(Guambi et al., 2024). These circumstances underscore the pressing necessity for sustainable business methods that enhance environmental conservation and the economic resilience of smallholders.

The circular economy and zero-waste practices have been suggested as strategies to enhance soil fertility and resource efficiency (Barbhuiya et al., 2024)(Bocken et al., 2019), green finance to reduce production costs and promote eco-innovation (Bachmann et al., 2025)(Eshbayev et al., 2024), and digital marketing to increase market penetration (Yang et al., 2024)(Uçar et al., 2020). The majority of these research concentrate on a singular aspect of the systemic challenges confronting smallholder agriculture, leading to disjointed strategies for addressing these challenges (Lorinkova & Perry, 2019) (Rossi & Srai, 2024). At this time, there isn't a comprehensive framework for smallholder agriculture that brings together the notions of digital marketing, green finance, and the circular economy.

Bringing these things together is especially important in two areas: sustainable agriculture and the global development agenda. To meet the United Nations' Sustainable Development Goals (SDGs), especially Goals 2, 12, 13, and 15, it is necessary to put into action agroecology, diversification, and soil-health programs (Himshikha et al., 2024); (Philip & G., 2024). Even though organic and integrated farming methods make better use of resources (Philip & G., 2024) (SHEN et al., 2020), they are still not widely used because of problems with technology, governance, and social and economic factors (Duarte et al., 2021)(da Silva et al., 2023). Policy-supported strategies from Spain, Kenya, India, and Africa illustrate the implementation of solutions that simultaneously increase soil production, alleviate poverty, and improve climate resilience.

Coffee shows how smallholder systems may be both profitable and weak. Businesses in Rwanda and Indonesia show that Gayo Arabica is a key export that brings in money from other countries and helps people in rural areas (Ma'wah et al., 2023). Coffee is the principal source of income for millions of smallholder farmers in Latin America, Africa, and Asia. Speciality coffee markets in Bolivia, Ecuador, and Colombia are opening up new markets (Jacobi et al., 2024)(Guambi et al., 2024). But illnesses, pests, changes in the weather, and structural financial shortages still threaten sustainability (Smith et al., 2022) (Ma'wah et al., 2023). Integrated value chains and collaborative breeding are two new yet promising technologies (Ngure & Watanabe, 2024)(Smith et al., 2022).

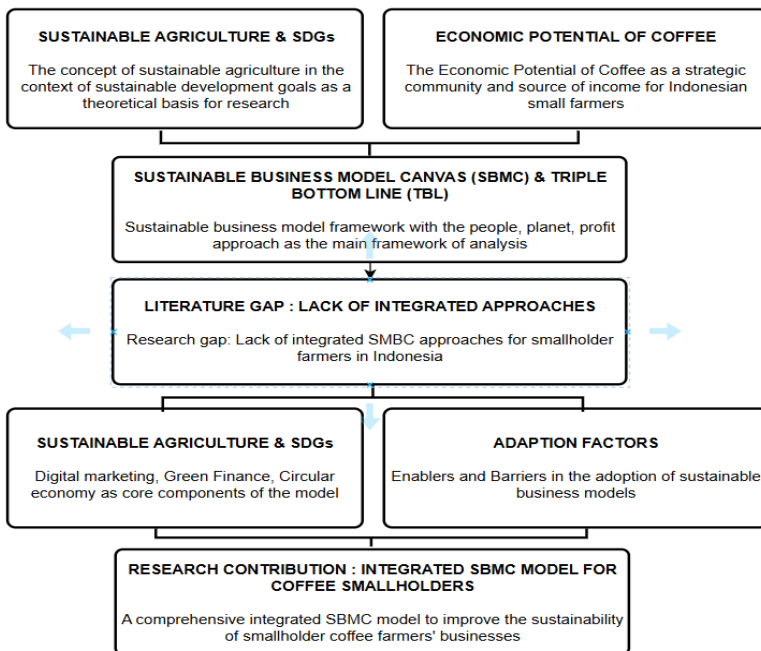
To address these concerns, the Sustainable Business Model Canvas (SBMC) was developed by integrating the Triple Bottom Line (TBL) components of economic, social, and environmental value creation into the Business Model Canvas (BMC) (Duarte et al., 2021) (da Silva et al., 2023) (Zybareva et al., 2022). The SBMC's programs can assist agribusinesses find a balance between making money and doing good for people and the environment. Governance instruments like B Corps encourage stakeholder involvement and responsibility, but cooperatives and extension services have been used in smallholder settings to solve environmental problems and problems with getting to

markets (Muafi & Hadi, 2023) (Zybareva et al., 2022). But SBMC is still not widely used in developing nations since there isn't enough money, the implementation isn't well-organised, and people don't know how to use digital tools.

Digital marketing, green finance, and the circular economy together offer smallholder coffee systems revolutionary potential that empirical study has not yet proved. Digital platforms enhance visibility and marketing avenues (Yang et al., 2024)(Uçar et al., 2020) (Trajkovska Petkoska et al., 2025), while green finance instruments such as bonds and sustainability-linked loans reduce the cost of capital for environmentally friendly innovation (Castrillón et al., 2021)(Lv et al., 2023). However, adoption frequently necessitates institutional and cooperative endorsement. Composting, trash reduction, and nutrient cycling are examples of circular economy activities that enhance resource productivity but are underutilised in the absence of financing and enabling laws (Islam et al., 2024) (Srisathan et al., 2025).

In conclusion, research on smallholder coffee systems underscores the advantages and disadvantages of sustainable development. However, an integrated model with empirical support is still required (Pretty et al., 2020) (Khan & Mahajan, 2025). This research fills this knowledge void by formulating and validating an enhanced SBMC framework that integrates digital marketing, green financing, and circular economy concepts. This research implements the TBL strategy in rural coffee growing in Indonesia, enhancing alignment with the SDGs, fostering socioeconomic transformation, and bolstering smallholder (da Silva et al., 2023) (Ma'wah et al., 2023).

Figure 1. Literature Review Framework



Source: Author's modification based on Osterwalder & and field data

Materials and methods

This study utilized a mixed-method approach, weaving quantitative and qualitative data in an explanatory sequential manner in order to understand the nuanced complexities of sustainable agribusiness in smallholder coffee farms and develop, implement and assess a novel integrated business model harnessing socio-economic resilience through digital marketing, green finance, and circular economy in Soppeng Regency, South Sulawesi, Indonesia.

Research included five steps: first, an exploratory phase to evaluate the model barriers and opportunities, which commenced with the Business Model Canvas (BMC) and geometrically expanded to include the Triple Bottom Line (TBL) principles to formulate the model, the integration of the model with farmer organizations, value chain assessment and iterative refinement of the model assessment and iterative refinement of the policy model with recommendations.

The study disenfranchised smallholder coffee farmers since Soppeng Regency was an advantageous highland with a long-standing tradition of cultivating coffee and possessing active farmer cooperatives. For the qualitative phase, purposive sampling targeted and selected fifteen farmers, cooperative heads, and government bureaucrats as key informants. Additionally, two focus group discussions (FGDs) were conducted with cohorts of 8-10 participants. In the quantitative phase and the pilot stage, the population was aligned stratified purposively with 50 farmers, expanded in the evaluation phase to 100 farmers. Respondents with land, education, cooperative membership, and age diversity were included.

The data collection procedures were comprised of both qualitative and quantitative methods. Qualitative information was obtained via semi-structured interviews and focus group discussions (FGDs), participant observation and engagement, and ongoing interaction. Quantitative data was collected through structured pre-and post-surveys measuring variables of income, market access, digital financial access, financial literacy and waste management, and perceived well-being. The survey instruments were adapted from peer-reviewed sustainability studies, with contextual purchase, to ensure reliability and congruence to local settings.

The independent variables were adoption of digital marketing, access to green finance and zero waste practices, and dependent variables were farmer income, market access, and cost as well as environmental efficiency. Control variables were age, level of education, size of land, and membership to a cooperative.

Data were analyzed qualitatively using grounded theory through open, axial, and selective coding, using NVivo 12 software. Credibility was established through triangulation and member checking. Quantitative data was analyzed and processed using SPSS v28, and employed descriptive statistics and multiple linear regression with t-tests and Wilcoxon tests for non-parametric data. Instrument validity and reliability tests were conducted and all Cronbach's alpha results exceeding 0.7, regression assumptions were tested and confirmed including normality, homoscedasticity, and absence of multicollinearity.

The local government, as well as farmer cooperatives, have provided their ethical approval. No one was forced and all participants signed statements of consent. Identification of respondents and private details was omitted, and the information was only used for scholarly purposes, thus, anonymity and confidentiality was protected.

Soppeng Regency was selected for the location of the study because of its reputation as a highland producing coffee as well as socio-ecological problems like market dependence, poor finances, and environmental issues. The active involvement of cooperatives in the area made it an ideal area for implementing and improving the tested sustainable business model.

Results

The preliminary stage of research detected three key obstacles to smallholder coffee farming in Soppeng Regency. First, 86% of farmers in Soppeng Regency, considered to be digital illiterate, have never used e-commerce and have no experience employing it. Farmers predominantly market to and sell their coffee to middlemen. Second, 74% of smallholder farmers did not have access to appropriate finance, through no fault of their own. Sustainable finance was mostly inaccessible because the farmers could not meet the collateral stipulations set for formal loans. Third, 90% of the coffee by-products, namely, pulp and grounds, were not treated, and proper waste management was inefficient by default

Table 1. Barriers to Coffee Farming in Soppeng

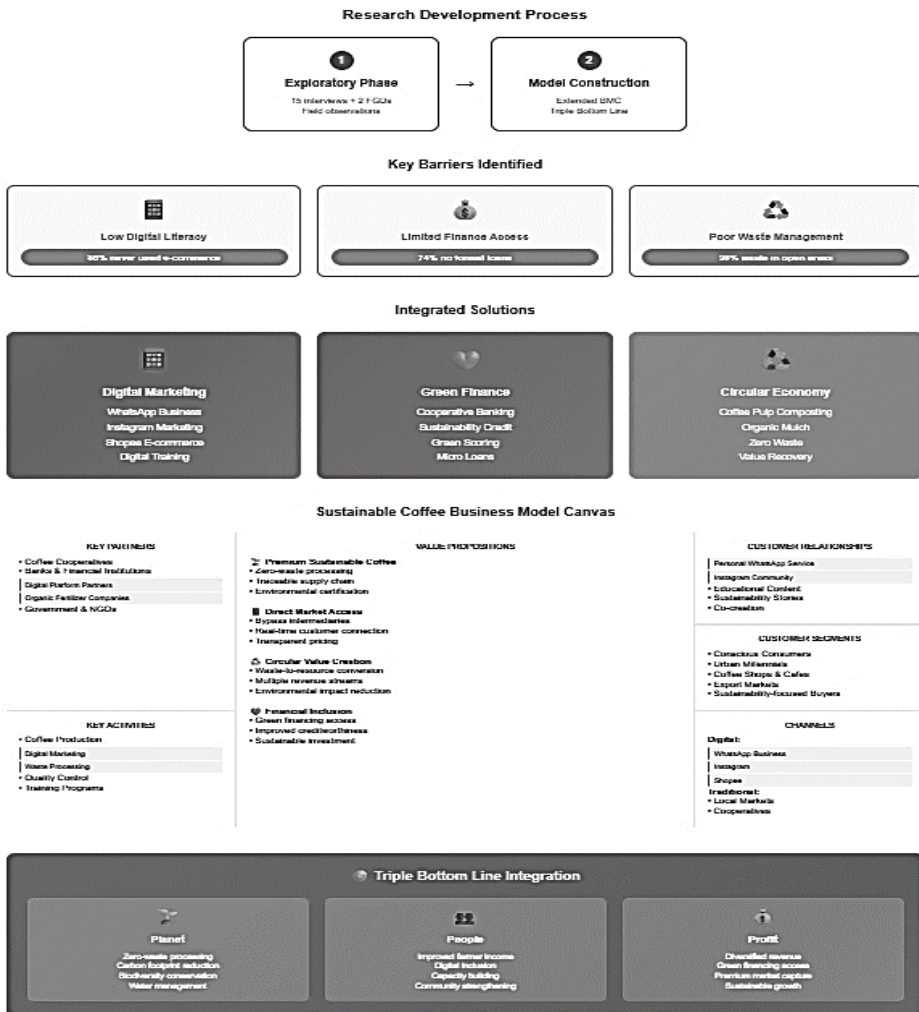
Identified Barriers	Description	Evidence from the Field
Low Digital Literacy	Farmers rely heavily on traditional intermediaries and have limited knowledge of online marketing platforms.	86% of respondents reported never using e-commerce for sales.
Limited Access to Sustainable Finance	Absence of financing schemes linked to sustainable practices; high collateral requirements from banks.	74% of respondents stated they had no access to formal loans.
Inefficient Waste Management	Coffee pulp and spent coffee grounds are discarded without processing, contributing to environmental degradation.	Observations confirmed 90% of the waste was disposed of in open areas.

Source: Field Survey

The findings attest to structural deficits that, in comparative terms, are no different than those exhibited in Latin America and Africa where smallholders have defined and deeply-rooted challenges in the adoption of market-based technologies (Dibbern et al. 2025, Bashiru et al. 2024).

With the adoption of participatory workshops, the Extended Business Model Canvas (BMC) was created incorporating TBL principles. The Extended BMC did promote economic, social and environmental sustainability through the marketing of digital platforms, composting coffee waste, and the production of organic coffee at premium prices. The proposed framework is shown in Figure 1 and the TBL impacts are detailed in Table 2.

Figure 2 Extended Business Model Canvas for Coffee Farmers



Source : Adapted from Osterwalder & Pigneur

Table 2. Triple Bottom Line Impacts of the Proposed Model

BMC Block	Proposed Strategy	Triple Bottom Line Impact
Customer Segments	Specialty coffee buyers, eco-conscious consumers, domestic and export markets.	Economic: Premium price. Social: Stronger community branding. Environmental: Support for eco-certified products.
Value Proposition	High-quality organic coffee; transparent sourcing; zero-waste processing.	E: Increased income. S: Farmer empowerment. Env: Waste reduction.
Channels	Digital platforms (WhatsApp Business, Instagram, Shopee), local coffee shops, and cooperatives.	E: Wider market access. S: Inclusion of youth & women. Env: Reduced carbon footprint via direct sales.

BMC Block	Proposed Strategy	Triple Bottom Line Impact
Customer Relationships	Direct buyer engagement via storytelling, traceability labels, and community tours.	E: Loyalty. S: Cultural preservation. Env: Awareness building.
Revenue Streams	Coffee sales, compost sales, eco-tourism packages.	E: Income diversification. S: Local job creation. Env: Circular income loop.
Key Resources	Coffee farms, composting facilities, trained farmer groups, digital tools.	E: Sustainable productivity. S: Capacity building. Env: Organic inputs.
Key Activities	Training in digital marketing, composting, and green finance literacy.	E: Skills enhancement. S: Social capital. Env: Regenerative farming.
Key Partnerships	Cooperatives, local government, microfinance institutions, NGOs.	E: Financing channels. S: Institutional trust. Env: Policy support.
Cost Structure	Digital tools, training programs, waste processing equipment.	E: Efficient resource allocation. S: Inclusive budgeting. Env: Investment in sustainability.

Source: Author's Calculations

Pilot testing involved 50 farmers belonging to three farmer clusters. The adoption rates were favorable: 78% of the farmers on Instagram and WhatsApp Business utilized them for direct sales, 71% of the farmers engaged in composting and mulching, and 62% of farmers were able to access sustainability-linked cooperative loans. These results suggested the possibility of integrating digital, financial, and circular economy practices within smallholder systems.

Sales in the 6 months after the intervention had grown quite significantly. There was an increase of 145kg to 183kg worth 26% of sales in one month and the kg was significantly worth 0.001. Selling prices worth 0.001 also had an increase of 14% from IDR 42,000 to 47,800. The gross monthly income also had an increase which was about 6.09 million to 8.75 million which is worth 44% and is significant of 0.001. The Entrepreneurs had an increase in confidence which was 1.07 points and there was an engagement from the younger people and women in marketing digitally. There was an increase in the reuse of organic waste which was 47% from 21% to 68%. There was an increase in the organic matter soil which was 0.6% and the chemical use of fertilizers decreased 32% and all of these were statistically significant.

Table 3. Pre- and Post-Implementation Scores of Key Indicators

Model Component / Indicator	Adoption Rate (%)	Pre-Test Mean	Post-Test Mean	Mean Difference	t-value	p-value	Interpretation	Evidence Source
Digital Marketing	78%	Monthly Sales Volume: 145 kg	183 kg	+38	-9.72	<0.001	Significant increase	WhatsApp & Instagram analytics
		Average Selling Price: IDR 42,000	IDR 47,800	+5,800	-8.41	<0.001	Significant increase	
		Gross Monthly Income: IDR 6,090,000	IDR 8,747,400	+2,657,400	-11.56	<0.001	Significant increase	

Model Component / Indicator	Adoption Rate (%)	Pre-Test Mean	Post-Test Mean	Mean Difference	t-value	p-value	Interpretation	Evidence Source
		Market Access Score (1–5): 2.84	4.09	+1.25	-14.22	<0.001	Significant improvement	
		Entrepreneurial Confidence (1–5): 3.05	4.12	+1.07	-13.85	<0.001	Significant improvement	
Green Finance Access	62%	Input Cost Burden	↓ 18%	—	—	<0.001	Substantial decrease	Cooperative loan records
Zero-Waste Practices	71%	Organic Waste Recycling Rate: 21%	68%	+47%	-15.44	<0.001	Significant improvement	Field soil tests
		Reduction in Chemical Fertilizer Use	—	32% decrease	—	—	<0.001	Substantial decrease
		Soil Organic Matter: 2.1%	2.7%	+0.6	-7.83	<0.001	Significant improvement	
Cross-Component Impact	—	—	—	—	—	—	Enhanced negotiation confidence and business planning	Post-intervention interviews

Source: Author’s Calculations

Adoption of new techniques was explained in beta value of recordable change of 0.64 as in Table 4.

Table 4. Regression Results for Factors Affecting Model Adoption

Predictor Variable	Coefficient (B)	Std. Error	t-value	p-value	Interpretation
Strong Cooperative Networks	0.214	0.062	3.45	0.001	Positive, significant
Government & NGO Support	0.198	0.059	3.36	0.001	Positive, significant
Digital Marketing Readiness	0.254	0.071	3.58	<0.001	Strongest positive driver
Cultural Alignment	0.127	0.055	2.31	0.023	Positive, moderate effect
Demonstrated Income Increase	0.183	0.066	2.77	0.007	Positive, significant
Limited Upfront Capital	-0.219	0.058	-3.78	<0.001	Negative, significant
Resistance to Change	-0.141	0.061	-2.31	0.023	Negative, moderate effect
Infrastructure Gaps	-0.176	0.057	-3.09	0.003	Negative, significant
Knowledge Gaps in Green Finance	-0.133	0.056	-2.38	0.019	Negative, moderate effect
Seasonal Production Variability	-0.095	0.052	-1.83	0.070	Negative, marginal significance

Source: Author’s Calculations

Most positively driving adoptions were digital readiness ($\beta = 0.254, p < 0.001$), cooperative networks ($\beta = 0.214, p = 0.001$), and support from government or donor organization ($\beta = 0.198, p = 0.001$) in addition to demonstrated income increases. The negative hindrances to change adoption were, however, limited available capital ($\beta = -0.219, p < 0.001$), infrastructural gaps ($\beta = -0.176, p = 0.003$), and lack of knowledge of green financing ($\beta = -0.133, p = 0.019$). Old farmers’ mentalities, change resistance, and variability in seasonal production were also barriers, but these had weak or marginal effects.

As a whole, these findings reveal that the addition of digital marketing, financing, and green circular economy integrated with developing of a BMC framework previously resulted in improved economic, social, and environmental benefits for smallholder coffee farmers in Soppeng Regency.

Discussions

The integration of digital marketing together with green finance and zero-waste practices enhanced smallholder coffee systems economically and ecologically more than any measures taken individually. This is contrary to previous works that examined these factors in isolation. For instance, in Vietnam, (Nguyen & Vo, 2021) found that digital platforms enhanced market access, but ignored the financing gaps while in Brazil (da Silva et al., 2023) found that the financial advantages of composting were unaccounted for. By integrating these factors, the pairs create further evidence of a more bounded and viable pathway in smallholder agriculture through an integrated Business Model Canvas based on the Triple Bottom Line framework.

This research also enhances the emerging literature on Sustainable Business Model Innovation (SBMI) by demonstrating that, contrary to the previous works that focused on certification, market access, and ecological practices in a siloed approach, the variables of profit, social inclusion, and environmental inclusion can all be achieved together. The cooperative interrelations and local integration became central factors to the more beneficial model, supporting the evidence that sustainable business models anchored on trust and cooperative action (Schiavon et al., 2022)(Bemelmans & Maertens, 2025) work best. The effects cross numerous domains. To begin with, the farmers made capital gains while reducing chemical dependencies and embracing composting because digital channels enabled them to sell their goods virtually. Selling online enabled the participation of women and the youth. This indicates generational renewal and gender inclusivity. Cooperatives reinforced their institutional trust by providing the farmers and other stakeholders with training on peer-to-peer learning, indirectly becoming financial intermediaries. This also showed the trust policymakers and financing institutions place on them. These conclusions point to the policymakers and financing institutions digital rural infrastructure, green finance, and digital circular economy enforcement policies strategy gaps.

The model's social and environmental dimensions add on to the previously mentioned economic gains. Cultural practices such as gotong royong fostered community cohesion, traditionally revitalized, alongside improved soil quality and reduced soil erosion because the zero-waste practices and the olden community. These insights align with emerging literature that argues on the enhanced focus of sustainable development and transition on social and cultural wellbeing beyond the economy (Ayeyemi et al., 2023)(Zhu & Wang, 2024).

More focus should be paid to the other literature though. Especially the literature that focuses on the challenges of the model. Reluctance from older farmers, lack of funding,

and poor infrastructure are the most significant gaps, next to the slim range of the sample and short duration the pilot was conducted.

Hence, future research should utilize longitudinal designs to assess the permanence of recorded results, investigate the technologies of mobile banking and blockchain to broaden the availability of green finance, and assess the transferability of the augmented model to additional crops and areas. Integrating on-farm innovations with worldwide value chains and consumer demand would enhance the relevance and effectiveness of smallholder agriculture sustainable business models.

Conclusions

Indeed, the practice of digital marketing, green finance, and zero-waste within the encapsulating framework of the extended Business Model Canvas, abiding by the principles of the Triple Bottom Line, also showed clinically proven enhancement of the resilience and sustainable practice of smallholder coffee farming in Soppeng, Indonesia. The Pilot confirmed substantial economic, social, and environmental benefits, which also verified increased revenue, enhanced market penetration, and improved soil and waste management.

This approach also contributes to literature as sustainable business model innovation within smallholder agriculture has yet to be explored in such vast detail. The extended framework demonstrates that, in contrast to previous, siloed attempts at reaching balance, profit, inclusivity, and ecological protection can be targeted at the same time.

The results of the study also indicate that in order to achieve scaling, there has to be digital infrastructure in place, cooperative-driven finance, and local farming curricular which emphasize the principles of a circular economy. Capacity building, particularly focused on women and youth, is also necessary to achieve greater resistance through intergenerational adoption.

Further research should take other commodities and other regions into account to cross study the model as well as apply a longitudinal approach to more accurately gauge the resilience and scalability of the results across different farming systems.

Acknowledgements

The authors gratefully acknowledge the support provided by the Ministry of Higher Education, Science, and Technology of Indonesia (MoHEST) through Directorate of Research and Community Service (DPPM). This research was funded under the Basic Research Grant scheme, which enabled field implementation, stakeholder engagement, and data collection throughout Soppeng Regency. The authors also extend sincere thanks to the local coffee farmers, cooperative leaders, and institutional partners whose participation and collaboration were critical to the success of this study. Special appreciation is given to Universitas Lamappoleonro for its academic and logistical support during all phases of the research

Conflict of interests

Authors have no potential conflicts of interest to disclose. The study was funded by the Ministry of Higher Education, Science and Technology of Indonesia (MoHEST) through the DPPM Basic Research Grant, and the funders had no influence whatsoever on the study's design, data acquisition, data analysis, data interpretation, or manuscript construction. The authors bear full responsibility for all findings and conclusions.

References

1. Ayeyemi, T., Recena, R., García-López, A. M., & Delgado, A. (2023). Circular Economy Approach to Enhance Soil Fertility Based on Recovering Phosphorus from Wastewater. *Agronomy*, *13*(6), 1513. <https://doi.org/10.3390/agronomy13061513>
2. Bachmann, N., Thienemann, A.-K., Tüzün, A., Brunner, M., Tripathi, S., Pöchtrager, S., & Jodlbauer, H. (2025). The Evolution of the Business Model Canvas for Digital Sustainability. *Procedia Computer Science*, *253*, 1012–1023. <https://doi.org/10.1016/j.procs.2025.01.163>
3. Barbhuiya, S., Das, B. B., & Adak, D. (2024). A comprehensive review on integrating sustainable practices and circular economy principles in concrete industry. *Journal of Environmental Management*, *370*, 122702. <https://doi.org/10.1016/j.jenvman.2024.122702>
4. Bemelmans, J., & Maertens, M. (2025). Implementation and effectiveness of corporate-driven smallholder cocoa certification schemes in Indonesia. *Agricultural and Food Economics*, *13*(1), 30. <https://doi.org/10.1186/s40100-025-00375-5>
5. Bocken, N., Strupeit, L., Whalen, K., & Nußholz, J. (2019). A Review and Evaluation of Circular Business Model Innovation Tools. *Sustainability*, *11*(8), 2210. <https://doi.org/10.3390/su11082210>
6. Castrillón, H. D. C., Aguilar, C. M. G., & Álvarez, B. E. A. (2021). Circular economy strategies: Use of corn waste to develop biomaterials. *Sustainability (Switzerland)*, *13*(15), 1–19. <https://doi.org/10.3390/su13158356>
7. da Silva, M. A., Borchardt, M., Pereira, G. M., Cardoso, J., Milan, G. S., & Leite, R. L. (2023). Developing a Sustainable Business Model in the Bioeconomy: A Case Study of an Amazon Rainforest Enterprise. *International Journal of Sustainable Development and Planning*, *18*(9), 2703–2712. <https://doi.org/10.18280/ijssdp.180909>
8. Duarte, K. da S., Lima, T. A. da C., Alves, L. R., Rios, P. A. do P., & Motta, W. H. (2021). The circular economy approach for reducing food waste: a systematic review. *Revista Produção e Desenvolvimento*, *7*. <https://doi.org/10.32358/rpd.2021.v7.572>
9. Eshbayev, O., Xursandov, K., Pulatovna, K. U., Sitora, A., & Jamalova, G. (2024). Advancing Green Technology Systems through Digital Economy Innovations: A Study on Sustainable. *E3S Web of Conferences*, *576*, 02009. <https://doi.org/10.1051/e3sconf/202457602009>

10. Guambi, L. A. D., Solórzano, R. G. L., Avellán, L. F. P., & Corozo-Quiñónez, L. (2024). Organoleptic attributes of 22 robusta coffee clones and potential for specialty coffee production in Ecuador. *Applied Food Research*, 4(2), 100567. <https://doi.org/10.1016/j.afres.2024.100567>
11. Himshikha, Sharma, T., Kaur, T., Singh, A., Mohapatra, A., & Saikia, N. (2024). Regenerative Agriculture and Sustainable Development Goals. In *Regenerative Agriculture for Sustainable Food Systems* (pp. 135–174). Springer Nature Singapore. https://doi.org/10.1007/978-981-97-6691-8_5
12. Islam, N. F., Gogoi, B., Saikia, R., Yousaf, B., Narayan, M., & Sarma, H. (2024). Encouraging circular economy and sustainable environmental practices by addressing waste management and biomass energy production. *Regional Sustainability*, 5(4), 100174. <https://doi.org/10.1016/j.regsus.2024.100174>
13. Jacobi, J., Lara, D., Opitz, S., de Castelberg, S., Urioste, S., Irazoque, A., Castro, D., Wildisen, E., Gutierrez, N., & Yeretian, C. (2024). Making specialty coffee and coffee-cherry value chains work for family farmers' livelihoods: A participatory action research approach. *World Development Perspectives*, 33, 100551. <https://doi.org/10.1016/j.wdp.2023.100551>
14. Khan, M. A., & Mahajan, R. (2025). Exploring factors influencing circular economy adoption and firm-level practices in the agribusiness sector: an exploratory study of Indian firms. *Environment, Development and Sustainability*, 27(4), 9039–9069. <https://doi.org/10.1007/s10668-023-04267-w>
15. Lorinkova, N. M., & Perry, S. J. (2019). The importance of group-focused transformational leadership and felt obligation for helping and group performance. *Journal of Organizational Behavior*, 40(3), 231–247. <https://doi.org/10.1002/job.2322>
16. Lv, W., Zhang, Z., & Zhang, X. (2023). The role of green finance in reducing agricultural non-point source pollution—an empirical analysis from China. *Frontiers in Sustainable Food Systems*, 7. <https://doi.org/10.3389/fsufs.2023.1199417>
17. Ma'wah, S., Iqbal, & Latief, R. (2023). *Coffee development strategy at the center of Banyorang coffee processing industry, Bantaeng Regency*. 040024. <https://doi.org/10.1063/5.0119785>
18. Muafi, & Hadi, P. (2023). Factors Contributing to Sustainable Growth Performance in Indonesian SMEs: The Role of Business Incubators. *International Journal of Sustainable Development and Planning*, 18(10), 3297–3308. <https://doi.org/10.18280/ijstdp.181029>
19. Ngure, G. M., & Watanabe, K. N. (2024). Coffee sustainability: leveraging collaborative breeding for variety improvement. *Frontiers in Sustainable Food Systems*, 8. <https://doi.org/10.3389/fsufs.2024.1431849>
20. Nguyen, H. A. T., & Vo, T. H. T. (2021). The role of the coffee industry in sustainable economic development in Vietnam. *Accounting*, 7(3), 683–690. <https://doi.org/10.5267/j.ac.2020.12.008>

21. Philip, B., & G., S. (2024). India's Agriculture Sector's Journey towards Sustainable Development Goals: Assessing Governmental Interventions and Sectoral Outcomes. *Universal Journal of Agricultural Research*, 12(2), 332–341. <https://doi.org/10.13189/ujar.2024.120212>
22. Pretty, J., Attwood, S., Bawden, R., van den Berg, H., Bharucha, Z. P., Dixon, J., Flora, C. B., Gallagher, K., Genskow, K., Hartley, S. E., Ketelaar, J. W., Kiara, J. K., Kumar, V., Lu, Y., MacMillan, T., Maréchal, A., Morales-Abubakar, A. L., Noble, A., Prasad, P. V. V., ... Yang, P. (2020). Assessment of the growth in social groups for sustainable agriculture and land management. *Global Sustainability*, 3, e23. <https://doi.org/10.1017/sus.2020.19>
23. Rossi, L. A., & Srari, J. S. (2024). Configuring circular by-product supply networks through public-private partnerships – A case study of rice straw stubble agri-waste in Punjab. *Journal of Cleaner Production*, 468, 143093. <https://doi.org/10.1016/j.jclepro.2024.143093>
24. Schiavon, O. P., May, M. R., & Mendonça, A. T. B. B. de. (2022). Dynamic capabilities and business model innovation in sustainable family farming. *Innovation & Management Review*, 19(3), 252–265. <https://doi.org/10.1108/INMR-07-2021-0136>
25. Shen, J., Zhu, Q., Jiao, X., Ying, H., Wang, H., Wew, X., Xu, W., Li, T., Cong, W., Liu, X., Hou, Y., Cui, Z., Oenema, O., Davies, W. J., & Zhang, F. (2020). Agriculture Green Development: a model for China and the world. *Frontiers of Agricultural Science and Engineering*, 7(1), 5. <https://doi.org/10.15302/J-FASE-2019300>
26. Smith, E., Antoshak, L., & Brown, P. H. (2022). Grounds for Collaboration: A Model for Improving Coffee Sustainability Initiatives. *Sustainability*, 14(11), 6677. <https://doi.org/10.3390/su14116677>
27. Srisathan, W. A., Worrakittikul, W., Rattanapon, K., Hongto, T., Phrommasakha Na Sakhonnakon, A., & Naruetharadhol, P. (2025). Digitalisation to zero-waste: the interplay of open eco-innovation and the circular economy in agricultural enterprises. *International Journal of Sustainable Engineering*, 18(1), 1–21. <https://doi.org/10.1080/19397038.2024.2446771>
28. Trajkovska Petkoska, A., Trajkovska, B., Koraqi, H., Kumar, N., & T. Broach, A. (2025). Sustainable farming practices: nurturing the future of functional foods. In *Unleashing the Power of Functional Foods and Novel Bioactives* (pp. 423–448). Elsevier. <https://doi.org/10.1016/B978-0-443-28862-3.00021-2>
29. Uçar, E., Dain, M.-A. Le, & Joly, I. (2020). Digital Technologies in Circular Economy Transition: Evidence from Case Studies. *Procedia CIRP*, 90, 133–136. <https://doi.org/10.1016/j.procir.2020.01.058>
30. Yang, C., Ji, X., Cheng, C., Liao, S., Obuobi, B., & Zhang, Y. (2024). Digital economy empowers sustainable agriculture: Implications for farmers' adoption of ecological agricultural technologies. *Ecological Indicators*, 159, 111723. <https://doi.org/10.1016/j.ecolind.2024.111723>

31. Zhu, X., & Wang, G. (2024). Impact of Agricultural Cooperatives on Farmers' Collective Action: A Study Based on the Socio-Ecological System Framework. *Agriculture*, 14(1), 96. <https://doi.org/10.3390/agriculture14010096>
32. Zybarena, O., Shylepnytskyi, P., Krylov, D., Arefiev, S., Ozarko, K., & Hryhorkiv, M. (2022). Management of Business Projects of the Enterprise as a Factor of Increasing International Competitiveness in the Conditions of Global Sustainability. *International Journal of Sustainable Development and Planning*, 17(7), 2023–2032. <https://doi.org/10.18280/ijstdp.170703>