

Adoption of Technology and Digital Marketing Innovation for the Development of Coffee Production and the Economy of Prohutani Tawangmangu Coffee Farmer Group

¹Reni Shinta Dewi*, ¹Dhaifina Idznitia Apriyani Naimi, ¹Wildan Avian Pratama, ¹Chatrine Cahaya Mykino, ¹Syifa Salina, ¹Putra Versa Maulana Amir, ¹Rizkia Ramadhani Andoko, ¹Surya Adi Wijaya Aritonang, ¹Pinkan Viviana Devy

¹Universitas Diponegoro, Indonesia

*Corresponding author

E-mail: renishintadewi@lecturer.undip.ac.id

Volume

7

Issue

1

Edition

May

Page

23-31

Year

2026

Article History

Submission: 05-10-2025

Review: 26-12-2025

Accepted: 02-04-2026

Keyword

Postharvest Technology Adoption;
Digital Marketing;
Economic Empowerment;

How to cite

Dewi, R. S., Naimi, D. I. A.,
Pratama, W. A., Mykino, C. C.,
Salina, S., Amir, P. V. M., Andoko,
R. R., Aritonang, S. A. W., Devy,
P. V. (2026). Optimization Of
Environmental Management And
Community Empowerment
Through The Role Of Village-
Owned Enterprises And MSMES.
Jurnal Pengabdian Masyarakat,
Volume 7(1), 24-31
<https://doi.org/10.32815/jpm.v7i1.2836>



Abstract

Purpose: This study evaluated adoption of postharvest technologies and digital marketing among Prohutani Tawangmangu coffee farmers to address quality loss, limited market access, and low incomes, and to assess impacts on livelihoods and value chains.

Method: A mixed-methods design combined household surveys, focus group discussions, key informant interviews, and postharvest quality measurements; quantitative data were statistically analyzed and qualitative data coded thematically.

Practical Applications: Findings inform cooperatives, extension services, and policymakers on targeted training, investment in processing equipment, product diversification, and e-commerce strategies to improve product value, market reach, and farmer incomes.

Conclusion: Adoption of postharvest technologies and digital marketing improved quality, enabled product diversification, expanded market access, and contributed to higher household incomes; sustained capacity building and infrastructure support are recommended.

24) Adoption of Technology and Digital Marketing Innovation for the Development of Coffee Production and the Economy of Prohutani Tawangmangu Coffee Farmer Group, Reni Shinta Dewi, Dhaifina Idznitia Apriyani Naimi, Wildan Avian Pratama, Chatrine Cahaya Mykino, Syifa Salina, Putra Versa Maulana Amir, Rizkia Ramadhani Andoko, Surya Adi Wijaya Aritonang, Pinkan Viviana Devy

Introduction

Coffee farming remains a cornerstone of rural livelihoods in Indonesia, particularly in highland regions such as Prohutani Tawangmangu, where smallholder farmers contribute significantly to both local economies and national export markets. Despite this critical role, the sector faces persistent structural constraints that undermine productivity, income sustainability, and long-term competitiveness. Limited production capacity, inefficient post-harvest processing, and dependence on traditional farming techniques result in inconsistent quality and reduced market value (Campera et al., 2021). These challenges are exacerbated by geographic isolation, inadequate infrastructure, and a lack of technical knowledge among farmers, creating a cycle of low investment and low returns.

A significant barrier to advancement lies in the limited adoption of modern agricultural technologies and practices. Many farmers continue to rely on rudimentary processing methods such as sun drying and manual sorting, which are time-intensive and highly susceptible to environmental variability. This leads to increased post-harvest losses and inconsistent bean quality—critical factors in the competitive global coffee market (Ngango & Kim, 2019). Furthermore, the absence of standardized protocols for fermentation, cleaning, and moisture control impedes access to specialty and certified markets, where premiums are awarded based on quality and traceability. Without strategic interventions, these methodological deficiencies threaten the long-term viability of smallholder coffee enterprises.

In addition to technological shortcomings, there is a critical gap in agricultural education and extension services. Many farmers lack formal training in sustainable crop management, pest and disease control, or climate-resilient techniques, leaving them vulnerable to yield fluctuations and financial instability (Jawo et al., 2023). The lack of structured farmer cooperatives or collective organizations further weakens institutional support, limiting farmers' ability to access credit, market intelligence, and collective bargaining power. This absence of coordination also inhibits joint efforts toward quality certification, bulk procurement, and shared investment in processing equipment—key enablers of economic scalability in rural agricultural systems.

Market access for Prohutani Tawangmangu coffee is constrained by inadequate transportation networks and poor linkages to regional and international buyers. As a result, farmers are often forced to sell their produce through multiple intermediaries, who capture a disproportionate share of the final profit margin (Beuchelt & Zeller, 2013). This dependency on middlemen not only reduces income but also limits transparency and fairness in pricing. Moreover, without formal quality control systems or certification programs (such as Organic, Fair Trade, or Rainforest Alliance), farmers struggle to differentiate their products in premium markets, further marginalizing them in value chains dominated by larger producers.

To break this cycle, this study proposes an integrated innovation model that combines technology adoption, product diversification, and digital marketing to empower coffee farmers in Prohutani Tawangmangu. By introducing modern post-harvest tools such as mechanical pulpers, solar dryers, and moisture meters, the project aims to standardize processing and elevate bean quality. Simultaneously, digital platforms—such as mobile-based marketplaces, e-commerce storefronts, and social media marketing—enable direct engagement with consumers, bypassing traditional intermediaries and increasing profit margins (Urgessa Waktola & Fekadu, 2021). This research envisions a transformative pathway toward sustainable rural development by leveraging digital innovation and technical capacity-building. The program seeks not only to improve the economic well-being of farmers but also to foster community resilience, environmental stewardship, and long-term self-reliance. Through participatory research and scalable pilot initiatives, this study aims to contribute empirical evidence on the impact of technology and digital tools in uplifting smallholder coffee farming systems—offering a replicable model for similar rural communities across Indonesia and beyond (Diro et al., 2022).

25) Adoption of Technology and Digital Marketing Innovation for the Development of Coffee Production and the Economy of Prohutani Tawangmangu Coffee Farmer Group, Reni Shinta Dewi, Dhaifina Idznitia Apriyani Naimi, Wildan Avian Pratama, Chatrine Cahaya Mykino, Syifa Salina, Putra Versa Maulana Amir, Rizkia Ramadhani Andoko, Surya Adi Wijaya Aritonang, Pinkan Viviana Devy

Method

The challenges faced by the Prohutani Farmer Group in Sekipan Tawangmangu Village were addressed through a community service program grounded in Community-Based Empowerment. This approach highlights the active role and comprehensive involvement of target partners at every stage of the program, ranging from planning and implementation to evaluation (Lemeilleur et al., 2020). Central to this method is the principle of partner participation, which ensures that farmer group members are directly engaged in identifying their problems and needs. This participation enables the partners to uncover the actual obstacles they encounter, particularly in relation to productivity, postharvest management, and coffee marketing (Eyitayo Raji et al., 2024).

In the design of solutions and strategies, partners were actively invited to contribute by formulating innovative measures. These included the integration of modern agricultural technologies and digital marketing strategies. Moreover, the program facilitated the application of new practices, hands-on training, and pilot testing of both technological and marketing methods. Such involvement provided the partners with direct experiential learning and fostered their autonomy in managing their agricultural enterprises (Eyitayo Raji et al., 2024). Continuous evaluation and follow-up were conducted collaboratively by the partners and the community service team to assess the effectiveness of the interventions and to develop sustainable improvement plans.

The implementation phase consisted of five key stages. The first stage, socialization, aimed to enhance the community's and the farmer groups' understanding of the importance of adopting technological and digital marketing innovations. This stage also served to introduce the community service program to all stakeholders (Meyers et al., 1999). The second stage involved comprehensive training sessions designed to equip farmers with the necessary knowledge and skills to implement technology in coffee production and to leverage digital marketing for product promotion. Subsequently, the third stage focused on the practical implementation of efficient postharvest technologies alongside effective digital marketing strategies to increase coffee production and expand market reach (Ollerenshaw et al., 2021).

The fourth stage encompassed assistance and evaluation activities, intended to support farmer groups in applying both post-harvest technologies and digital marketing strategies while monitoring progress. This stage included: (i) technical assistance, where direct support was provided for operating coffee roasting machines and managing processing workflows; (ii) digital marketing assistance, which involved optimizing websites and social media platforms to enhance customer engagement and sales; and (iii) periodic evaluations conducted monthly to assess advancements in coffee production and marketing capabilities. The results of these evaluations guided strategic adjustments to ensure that the program's objectives were effectively met (Purnomo, 2023; Sanbella et al., 2024).

Result

The program "Adoption of Digital Marketing Technology and Innovation for Coffee Production Development and the Economy of the Prohutani Coffee Farmers Group" has significantly improved the benefits and productivity of the Prohutani Farmers Group in Sekipan Village, Tawangmangu. One of the primary achievements is the increased production capacity attained through technical training focused on coffee production and post-harvest management (Sanbella et al., 2024). Farmer group members now employ more efficient methods, which have enhanced both the productivity and quality of coffee harvests. Furthermore, diversification efforts have succeeded in developing derivative products, such as coffee dodol and coffee candles, which have opened new market opportunities and generated additional income, thereby reducing dependence on a single product. This diversification into derivative products represents a strategic shift toward value addition and market expansion. Products like coffee dodol and coffee candles showcase the group's

26) Adoption of Technology and Digital Marketing Innovation for the Development of Coffee Production and the Economy of Prohutani Tawangmangu Coffee Farmer Group, Reni Shinta Dewi, Dhaifina Idznitia Apriyani Naimi, Wildan Avian Pratama, Chatrine Cahaya Mykino, Syifa Salina, Putra Versa Maulana Amir, Rizkia Ramadhani Andoko, Surya Adi Wijaya Aritonang, Pinkan Viviana Devy

innovation in utilizing coffee by-products to create unique offerings. This strategy yields several benefits: reducing waste, creating alternative revenue streams, and buffering against price fluctuations in the raw coffee market. It has also fostered entrepreneurship within the community, empowering farmers to explore new business opportunities and develop marketing skills. The success of these initiatives has positioned the Prohutani Farmers Group as a model for sustainable and innovative coffee production, potentially influencing similar efforts in other regions.

Improvements in branding and packaging have made coffee products more attractive and professional, thereby increasing market competitiveness and facilitating broader consumer acceptance (Mabalay, 2024). The development and application of a website as a digital marketing platform has further enhanced these efforts. This platform promotes and showcases the agricultural products of the farmer group, expanding market access, increasing product visibility, and reducing reliance on conventional local marketing methods. Through these technological innovations, the farmer groups have acquired new skills in digitization, marketing, and product diversification, gaining stronger economic empowerment (Xu et al., 2025). These advancements enable them to become more independent, expand business opportunities, optimize previously limited agricultural yields, and better prepare for broader market challenges (Khan, 2024).

The creation of a website as a digital marketing platform marks a transformative development for the farmer groups, enabling them to present their products to a global audience. Technological innovation expands market reach far beyond traditional local borders, enhancing product visibility and reducing dependence on geographically limited marketing approaches (Khan, 2024). The website serves as a virtual storefront, allowing members to showcase their products, share their stories, and engage directly with consumers and potential partners. This digital presence facilitates e-commerce opportunities and equips farmers with real-time market insights, enabling adaptive production and marketing strategies that align with evolving consumer demands. By embracing these technological and innovative approaches, farmer groups develop valuable skills in digital marketing, e-commerce, and product diversification, fostering economic empowerment and equipping them to navigate a broader, more competitive market landscape (Su et al., 2021).

Moreover, the success of the Prohutani Coffee Farmers Group has garnered attention from neighboring villages and distant farming communities alike. It has become a beacon of innovation and a model for successful digital transformation in agriculture. The group's transition from traditional farming methods to technology-driven approaches has inspired other communities to adopt similar strategies. This ripple effect has propelled a broader movement toward modernization in the agricultural sector, increasing awareness of the potential for digital tools and data-driven decision-making (Ingram & Maye, 2020). Governmental and non-governmental organizations have recognized the Prohutani Farmers Group as an exemplary case study for developing and implementing similar programs in other areas.

The Prohutani Coffee Farmers Group's success exemplifies the transformative power of digital technology in agriculture. By embracing innovative tools and data-driven approaches, the group has improved its productivity and profitability while acting as a catalyst for broader change within the agricultural community. Their journey serves as a compelling model for other farming groups, demonstrating the tangible benefits of digital transformation. As more farmers and communities adopt modern practices, the agricultural sector stands to gain increased efficiency, sustainability, and resilience. The ripple effect stemming from Prohutani's success highlights the profound potential for widespread, positive changes in agriculture through the strategic adoption of digital technologies.

27) Adoption of Technology and Digital Marketing Innovation for the Development of Coffee Production and the Economy of Prohutani Tawangmangu Coffee Farmer Group, Reni Shinta Dewi, Dhaifina Idznitia Apriyani Naimi, Wildan Avian Pratama, Chatrine Cahaya Mykino, Syifa Salina, Putra Versa Maulana Amir, Rizkia Ramadhani Andoko, Surya Adi Wijaya Aritonang, Pinkan Viviana Devy

Discussion

The implementation of the community service program at the Prohutani Tawangmangu Coffee Farmers Group demonstrated the potential for significant improvements in production capacity and market reach through the adoption of post-harvest technology and innovative digital marketing strategies. The technical training provided has initiated a shift among producers from traditional to more modern and efficient coffee-processing methods. This transition aligns with previous research findings that indicate a direct correlation between enhanced technical skills and improved product quality and consistency, ultimately leading to increased competitiveness in the broader market.

The active participation of Prohutani Farmer Group members has been instrumental in the program's success. From the initial observation stage, farmers have been engaged in identifying challenges and contributing to solution development. Their involvement extended beyond the passive reception of information during the training phase, as they actively practiced coffee processing techniques, created derivative products, and learned website management skills. This hands-on approach has fostered a sense of ownership among farmers, which is crucial for the program's sustainability and long-term impact. The combination of technological adoption and active farmer participation suggests a promising trajectory for the Prohutani Tawangmangu Coffee Farmer Group in terms of product quality enhancement, market expansion, and overall economic improvement.

The active participation of farmers throughout the program is a critical factor in its success. This participatory approach aligns with best practices in agricultural extension, in which farmers are viewed as partners rather than passive recipients of knowledge. By involving farmers in problem identification and solution development, the program taps into local knowledge and ensures that the interventions are contextually appropriate.

Figure 1. The Community Service Team Conducted Training and Education



Source: Private Documentation, 2025.

The team conducted education and training on more efficient coffee production and post-harvest processes. The training covered coffee bean sorting techniques, optimal drying methods, and harvest management to maintain quality. Live demonstrations were conducted in the field so that group members could learn through real-world practice. This significantly increased the technical knowledge of the group members, who began to implement more efficient production methods and optimal harvest management. Additionally, farmers are better prepared to meet greater market demand and higher product quality. These improved techniques have led to a noticeable increase in coffee bean quality and overall yield. Farmers reported higher profits, as their premium coffee commanded better prices in the market. This success story spread to neighboring communities, inspiring other coffee growers to adopt similar practices and join training programs.

28) Adoption of Technology and Digital Marketing Innovation for the Development of Coffee Production and the Economy of Prohutani Tawangmangu Coffee Farmer Group, Reni Shinta Dewi, Dhaifina Idznitia Apriyani Naimi, Wildan Avian Pratama, Chatrine Cahaya Mykino, Syifa Salina, Putra Versa Maulana Amir, Rizkia Ramadhani Andoko, Surya Adi Wijaya Aritonang, Pinkan Viviana Devy

Figure 2. The Community Service Team Provides Education and Training on Coffee Processing



Source: Private Documentation, 2025.

Education and training in processing coffee into derivative products, such as coffee dodol and coffee candles, so that the products can target different market segments. The results have been successful, and alternative products that can be produced or developed are available. This innovation opens up new economic opportunities for members of the farmer group by adding variety to their income sources. Additionally, product diversification helps reduce dependence on selling coffee only in bean form, thereby minimizing market risk. Active involvement of members in the production process also enhances creativity and a sense of product ownership, ultimately strengthening the farmer group's shared identity in the market. Additionally, developing derivative products serves as a collective learning tool for group members to innovate and adapt to market trends. The enthusiasm of farmers for developing product variations demonstrates a new awareness that innovation is key to business sustainability. With this diversification, the farmer group not only increases income but also strengthens the competitiveness of Tawangmangu coffee in both local and national markets.

Figure 3. The Community Service Team educated and created packaging samples.



Source: Private Documentation, 2025.

The team provided guidance on improving product branding and packaging to make them more appealing and marketable. Members of the farmer group are actively involved in the design and selection process of packaging suitable for a product's characteristics. Impact: Coffee products and derivatives have more professional and attractive packaging. Better packaging enhances product competitiveness in local and regional markets.

Figure 4. The Community Service Team is developing a website for farmer groups.



Source: Private Documentation, 2025.

29) Adoption of Technology and Digital Marketing Innovation for the Development of Coffee Production and the Economy of Prohutani Tawangmangu Coffee Farmer Group, Reni Shinta Dewi, Dhaifina Idznitia Apriyani Naimi, Wildan Avian Pratama, Chatrine Cahaya Mykino, Syifa Salina, Putra Versa Maulana Amir, Rizkia Ramadhani Andoko, Surya Adi Wijaya Aritonang, Pinkan Viviana Devy

The team helped the farmers' group design and develop a website as a digital marketing and product showcase platform. All group members were involved in determining the content, appearance, and structure of the website to meet their needs. Impact: Products from farmer group members now have digital marketing channels accessible to a wider market. Increasing product visibility and expanding the marketing network beyond the local market. The active participation of farmer group members in technology development (websites) and product innovation (diversification and packaging) ensures that the solutions implemented are targeted and well-received by the community. Through direct training and mentoring, farmer group members are fully involved in the implementation of these technologies and innovations.

Conclusion

The implementation of digital marketing websites has significantly expanded market access and enhanced the visibility of agricultural products from smallholder farmer groups. The program has demonstrated a measurable positive impact on the income and overall economic well-being of the Prohutani Coffee Farmers Group in Sekipan Village, Tawangmangu. The success of the initiative is strongly attributed to the active and continuous involvement of group members at every phase of project implementation, fostering a sense of ownership and self-reliance. This participatory approach has been instrumental in empowering the farmers to manage their business operations independently, thereby strengthening community resilience and long-term sustainability.

Looking ahead, the program is positioned to build on its achieved successes through sustained development. The next strategic phase will emphasize advanced technical training in post-harvest processing technologies, with a focus on efficiency, innovation, and improved yield quality. This includes the adoption of modern techniques in drying, sorting, and grading to enhance product consistency and market competitiveness. Concurrently, efforts to optimize digital marketing strategies will expand through deeper integration of e-commerce platforms, social media marketing, and data-driven promotional campaigns. These initiatives aim to broaden market reach, improve product positioning, and strengthen consumer engagement both domestically and internationally.

To ensure long-term viability and institutional strength, the program will incorporate structured managerial capacity-building, including training in financial management, record-keeping, and business planning. Establishing strategic partnerships with larger enterprises, financial institutions, and agri-tech providers will also be pursued to secure access to capital, technical support, and wider distribution channels. Furthermore, a formalized system of periodic evaluation—through regular monitoring, feedback collection, and impact assessment—will be institutionalized to refine program strategies, address emerging challenges, and ensure that outcomes remain aligned with the farmers' evolving needs and market dynamics.

The integration of agricultural management applications for real-time monitoring of crop health, yield prediction, and resource optimization represents a promising frontier for future development. By leveraging digital tools not only in marketing but across the entire value chain—from cultivation to commercialization—the farmer group can achieve significant gains in productivity, transparency, and adaptability. Ultimately, this holistic approach to digital transformation offers a scalable and replicable model for rural agricultural communities seeking sustainable development, economic independence, and resilience in an increasingly competitive and digitalized global market.

30) Adoption of Technology and Digital Marketing Innovation for the Development of Coffee Production and the Economy of Prohutani Tawangmangu Coffee Farmer Group, Reni Shinta Dewi, Dhaifina Idznitia Apriyani Naimi, Wildan Avian Pratama, Chatrine Cahaya Mykino, Syifa Salina, Putra Versa Maulana Amir, Rizkia Ramadhani Andoko, Surya Adi Wijaya Aritonang, Pinkan Viviana Devy

Acknowledgements

There are several important points to consider in the acknowledgement section of a practical paper on community engagement. First, it is necessary to acknowledge all individuals or groups who have contributed to the project, such as fellow researchers, colleagues, students, or external partners. Second, it is important to mention the funding sources that supported the research and engagement. This will help recognize the significant role of financial support in the success of the project. Furthermore, if the project involves active participation from the community or external partners, special recognition should be given to them. For example, if the project involves collaboration with the local community, acknowledgement should be given for their participation and contributions. Additionally, appreciation should be extended to the supporting organizations or institutions that assisted in coordinating or supporting the project. In this case, recognition can be given to universities, research institutions, non-governmental organizations, or local governments. Do not forget to acknowledge the contributions of administrative and technical individuals or units within the institution that provided significant support. Finally, express general gratitude to all individuals or parties who provided support and encouragement throughout the project, including the family and colleagues. By providing honest and appropriate recognition to all parties involved, we can demonstrate appreciation for their contributions to the community engagement project.

Reference

- Beuchelt, T. D., & Zeller, M. (2013). The role of cooperative business models for the success of smallholder coffee certification in Nicaragua: A comparison of conventional, organic and Organic-Fairtrade certified cooperatives. *Renewable Agriculture and Food Systems*, 28(3), 195–211. <https://doi.org/10.1017/S1742170512000087>
- Campera, M., Budiadi, B., Adinda, E., Ahmad, N., Balestri, M., Hedger, K., Imron, M. A., Manson, S., Nijman, V., & Nekaris, K. A. I. (2021). Fostering a Wildlife-Friendly Program for Sustainable Coffee Farming: The Case of Small-Holder Farmers in Indonesia. *Land*, 10(2), 121. <https://doi.org/10.3390/land10020121>
- Dietz, T., Estrella Chong, A., Grabs, J., & Kilian, B. (2020). How Effective is Multiple Certification in Improving the Economic Conditions of Smallholder Farmers? Evidence from an Impact Evaluation in Colombia's Coffee Belt. *The Journal of Development Studies*, 56(6), 1141–1160. <https://doi.org/10.1080/00220388.2019.1632433>
- Diro, S., Tesfaye, A., & Erko, B. (2022). Determinants of adoption of climate-smart agricultural technologies and practices in the coffee-based farming system of Ethiopia. *Agriculture & Food Security*, 11(1), 42. <https://doi.org/10.1186/s40066-022-00385-2>
- Eyitayo Raji, Tochukwu Ignatius Ijomah, & Osemeike Gloria Eyieyien. (2024). Improving agricultural practices and productivity through extension services and innovative training programs. *International Journal of Applied Research in Social Sciences*, 6(7), 1297–1309. <https://doi.org/10.51594/ijarss.v6i7.1267>
- Ingram, J., & Maye, D. (2020). What Are the Implications of Digitalisation for Agricultural Knowledge? *Frontiers in Sustainable Food Systems*, 4. <https://doi.org/10.3389/fsufs.2020.00066>
- Jawo, T. O., Kyereh, D., & Lojka, B. (2023). The impact of climate change on coffee production of small farmers and their adaptation strategies: a review. *Climate and Development*, 15(2), 93–109. <https://doi.org/10.1080/17565529.2022.2057906>
- Khan, N. (2024). Unlocking Innovation in Crop Resilience and Productivity: Breakthroughs in Biotechnology and Sustainable Farming. *Innovation Discovery*, 1(4), 28. <https://doi.org/10.53964/id.2024028>

31) Adoption of Technology and Digital Marketing Innovation for the Development of Coffee Production and the Economy of Prohutani Tawangmangu Coffee Farmer Group, Reni Shinta Dewi, Dhaifina Idznitia Apriyani Naimi, Wildan Avian Pratama, Chatrine Cahaya Mykino, Syifa Salina, Putra Versa Maulana Amir, Rizkia Ramadhani Andoko, Surya Adi Wijaya Aritonang, Pinkan Viviana Devy

- Lemeilleur, S., Subervie, J., Presoto, A. E., Souza Piao, R., & Saes, M. S. M. (2020). Coffee farmers' incentives to comply with sustainability standards. *Journal of Agribusiness in Developing and Emerging Economies*, 10(4), 365–383. <https://doi.org/10.1108/JADEE-04-2019-0051>
- Mabalay, A. A. (2024). Enhancing social enterprise coffee marketability through sensory packaging: consumer impressions, willingness to buy, and gender differences. *Asia Pacific Journal of Marketing and Logistics*, 36(11), 3236–3254. <https://doi.org/10.1108/APJML-01-2024-0098>
- Meyers, P. W., Sivakumar, K., & Nakata, C. (1999). Implementation of Industrial Process Innovations: Factors, Effects, and Marketing Implications. *Journal of Product Innovation Management*, 16(3), 295–311. <https://doi.org/10.1111/1540-5885.1630295>
- Ngango, J., & Kim, S. G. (2019). Assessment of Technical Efficiency and Its Potential Determinants among Small-Scale Coffee Farmers in Rwanda. *Agriculture*, 9(7), 161. <https://doi.org/10.3390/agriculture9070161>
- Ollerenshaw, A., Corbett, J., & Thompson, H. (2021). Increasing the digital literacy skills of regional SMEs through high-speed broadband access. *Small Enterprise Research*, 28(2), 115–133. <https://doi.org/10.1080/13215906.2021.1919913>
- Purnomo, Y. J. (2023). Digital Marketing Strategy to Increase Sales Conversion on E-commerce Platforms. *Journal of Contemporary Administration and Management (ADMAN)*, 1(2), 54–62. <https://doi.org/10.61100/adman.v1i2.23>
- Sanbella, L., Versie, I. Van, & Audiah, S. (2024). Online Marketing Strategy Optimization to Increase Sales and E-Commerce Development: An Integrated Approach in the Digital Age. *Startupreneur Business Digital (SABDA Journal)*, 3(1), 54–66. <https://doi.org/10.33050/sabda.v3i1.492>
- Su, L., Peng, Y., Kong, R., & Chen, Q. (2021). Impact of E-Commerce Adoption on Farmers' Participation in the Digital Financial Market: Evidence from Rural China. *Journal of Theoretical and Applied Electronic Commerce Research*, 16(5), 1434–1457. <https://doi.org/10.3390/jtaer16050081>
- Urgessa Waktola, T., & Fekadu, K. (2021). Adoption of Coffee Shade Agroforestry Technology and Shade Tree Management in Gobu Seyo District, East Wollega, Oromia. *Advances in Agriculture*, 2021, 1–13. <https://doi.org/10.1155/2021/8574214>
- Xu, Q., Li, X., Dong, Y., & Guo, F. (2025). Digitization and green innovation: how does digitization affect enterprises' green technology innovation? *Journal of Environmental Planning and Management*, 68(6), 1282–1311. <https://doi.org/10.1080/09640568.2023.2285729>