

Ecological Citizenship in Agricultural Extension: Strengthening Local Wisdom for Sustainable Food Security toward SDG 2 (Zero Hunger)

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Abstrak

Pencapaian Tujuan Pembangunan Berkelanjutan (Sustainable Development Goals/SDGs) 2 (Tanpa Kelaparan) tidak hanya bergantung pada inovasi teknologi dan peningkatan produktivitas pertanian, tetapi juga memerlukan penguatan aspek sosial, lingkungan, dan budaya dalam pembangunan pertanian. Penyuluh pertanian memiliki peran strategis dalam mentransfer pengetahuan, mendorong penerapan praktik pertanian berkelanjutan, serta memberdayakan masyarakat pedesaan. Namun, kajian mengenai peran penyuluh sebagai agen yang membangun kesadaran ekologis dan memperkuat kearifan lokal masih relatif terbatas. Penelitian ini bertujuan mengkaji konsep kewargaan ekologis (ecological citizenship) dalam penyuluhan pertanian serta kontribusinya terhadap penguatan kearifan lokal untuk mendukung ketahanan pangan berkelanjutan. Penelitian menggunakan metode studi literatur dengan menganalisis berbagai publikasi ilmiah yang membahas kewargaan ekologis, penyuluhan pertanian, kearifan lokal, pertanian berkelanjutan, dan ketahanan pangan. Hasil kajian menunjukkan bahwa penyuluh pertanian berpotensi berperan sebagai warga ekologis melalui penguatan tanggung jawab lingkungan, peningkatan partisipasi masyarakat, pengelolaan sumber daya alam secara berkelanjutan, serta pelestarian pengetahuan lokal. Praktik kearifan lokal, seperti sistem pertanian tradisional, nilai-nilai lingkungan masyarakat, dan pengelolaan sumber daya berbasis komunitas, terbukti mendukung keberlanjutan produksi pangan dan meningkatkan ketahanan masyarakat. Integrasi konsep kewargaan ekologis dalam kegiatan penyuluhan dapat memperkuat dimensi sosial dan lingkungan dalam sistem ketahanan pangan sekaligus mendukung pencapaian target SDG 2, khususnya sistem produksi pangan berkelanjutan dan praktik pertanian yang tangguh. Kajian ini memberikan kerangka konseptual yang memperluas peran penyuluh pertanian dari sekadar penyedia bantuan teknis menjadi agen perubahan yang mendorong kesadaran ekologis, pelestarian kearifan lokal, dan pembangunan pertanian berkelanjutan.

Kata kunci: Ekologis, Ketahanan Pangan, Kearifan Lokal, Pertanian Berkelanjutan, Penyuluhan Pertanian, SDG2

Abstract

Achieving Sustainable Development Goal 2 (Zero Hunger) requires not only technological innovation and agricultural productivity improvement but also the strengthening of social, environmental, and cultural dimensions within agricultural development. Agricultural extension agents play a strategic role in facilitating knowledge transfer, promoting sustainable farming practices, and empowering rural communities. However, existing studies predominantly emphasize the technical and economic functions of extension services, while the ecological and civic dimensions of agricultural extension remain underexplored. This study examines the concept of ecological citizenship within agricultural extension and its contribution to strengthening local wisdom for sustainable food security. Using a literature-based approach, this study synthesizes previous research on ecological citizenship, agricultural extension, local wisdom, sustainable agriculture, and food security. The analysis demonstrates that agricultural extension agents can function as ecological citizens by encouraging environmental responsibility, community participation, sustainable resource management, and the preservation of local agricultural knowledge. Local wisdom practices such as traditional farming systems, indigenous environmental values, and community-based resource management contribute significantly to sustainable food production and resilience. The findings suggest that integrating ecological citizenship into agricultural extension can enhance the social and environmental dimensions of food security while supporting several targets of SDG 2, particularly sustainable food production systems and resilient agricultural practices. This study proposes a conceptual framework that positions agricultural extension agents as key actors in promoting ecological awareness, local wisdom, and sustainable food security. The study contributes to literature by expanding the role of agricultural extension beyond technical assistance toward a more holistic approach that integrates environmental citizenship and sustainable development.

Keywords: Agricultural Extension, Ecological Citizenship, Food Security, Local Wisdom, SDG2, Sustainable Agriculture

INTRODUCTION

Achieving Sustainable Development Goal (SDG) 2 (Zero Hunger) requires a comprehensive approach that extends beyond increasing agricultural productivity to encompass environmental sustainability, social resilience, and inclusive food governance. Contemporary discussions on sustainable agriculture emphasize that food security depends not only on technological innovation but also on community participation, environmental stewardship, and ethical responsibility in managing natural resources (Gordon, 2019; Mungai et al., 2024; Xu et al., 2024). Consequently, sustainable agricultural development has evolved from a production-oriented paradigm toward an integrated framework that recognizes the interconnectedness of ecological conservation, local institutions, and community empowerment.

Agricultural extension agents occupy a strategic position within this transformation because they serve as intermediaries between scientific innovation, government policies, and farming communities. Modern agricultural extension is no longer limited to disseminating agricultural technologies but increasingly functions as a participatory educational process that facilitates knowledge exchange, farmer empowerment, and sustainable behavioral change (Dewi et al., 2024). Previous studies have demonstrated that successful adoption of sustainable agricultural practices depends not only on technical knowledge but also on farmers' perceptions, social values, institutional support, and opportunities for collaborative learning (Han & Niles, 2023). These findings suggest that agricultural extension should integrate social and environmental dimensions alongside productivity enhancement.

One theoretical perspective that offers a broader understanding of this expanded role is ecological citizenship. Unlike conventional citizenship, which primarily emphasizes legal rights and political participation, ecological citizenship highlights the moral responsibility of individuals and communities to protect ecological systems and contribute to environmental sustainability (Damanik & Kedhaton, 2026; Silvast & Valkenburg, 2023; van Harskamp et al., 2024). Recent scholarship argues that ecological citizenship encourages collective stewardship, civic participation, and shared responsibility in addressing environmental challenges through everyday practices and collaborative governance (Debourdeau et al., 2024; Zhan, 2024). Within agricultural contexts, these principles position farmers and extension agents as active contributors to sustainable food systems rather than passive recipients of agricultural innovations.

The implementation of ecological citizenship becomes particularly relevant when combined with local wisdom, which represents generations of accumulated knowledge regarding environmental management, biodiversity conservation, and sustainable farming practices. Food sovereignty literature consistently demonstrates that locally grounded agricultural knowledge strengthens community autonomy, ecological resilience, and sustainable food production while preserving cultural identity (Farfán et al., 2023; Pimbert & Claeys, 2024). Integrating local wisdom into agricultural extension therefore enables extension agents to facilitate innovation while maintaining community-based ecological values that support long-term food security.

Despite the growing literature on agricultural extension, sustainable agriculture, and ecological citizenship, these areas have largely developed independently. Existing research predominantly focuses on extension performance, technology adoption, institutional capacity, or digital extension services (Dewi et al., 2024; Thi Hoa Sen et al., 2024; Mungai et al., 2024), whereas studies examining agricultural extension agents as ecological citizens who integrate environmental responsibility, local wisdom, and food security remain limited. Likewise, the relationship between ecological citizenship and the achievement of SDG 2 (Zero Hunger) has received relatively little conceptual attention, particularly in the context of agricultural extension systems.

Therefore, this study synthesizes current literature to develop an integrated conceptual understanding of ecological citizenship in agricultural extension. It argues that positioning agricultural extension agents as ecological citizens expands their traditional role from technology transfer toward fostering environmental ethics, community participation, and locally grounded food governance (Damanik et al., 2025). Such an approach strengthens sustainable agricultural development while contributing to the achievement of SDG 2 (Zero Hunger) through environmentally responsible, socially inclusive, and culturally embedded food systems (Han & Niles, 2023; Pimbert & Claeys, 2024).

METHOD

This study employed a literature review approach to examine the relationship between ecological citizenship, agricultural extension, local wisdom, and sustainable food security toward achieving Sustainable Development Goal (SDG) 2: Zero Hunger. Relevant literature was collected from Scopus, Google Scholar, and SINTA, focusing on publications published between 2015 and 2025. The search used combinations of keywords

including *ecological citizenship*, *agricultural extension*, *local wisdom*, *food security*, *sustainable agriculture*, and *SDG 2*.

The selected literature consisted of peer-reviewed journal articles, conference proceedings, and scholarly publications that discussed at least two of the main concepts examined in this study. The collected studies were reviewed, compared, and synthesized to identify recurring themes, theoretical perspectives, and the role of agricultural extension agents in promoting ecological citizenship and sustainable food security. The findings were then interpreted to develop a conceptual understanding of how agricultural extension can strengthen local wisdom while contributing to the achievement of SDG 2 (Zero Hunger) (Snyder, 2019).

RESULT AND DISCUSSION

Ecological Citizenship in Agricultural Extension

The shift from conventional agricultural extension toward an ecological citizenship model redefines both farmers and extension agents as environmental stewards rather than merely producers and technology disseminators. Ecological citizenship extends the traditional understanding of citizenship by emphasizing environmental responsibility, collective participation, and ethical stewardship of natural resources (Silvast & Valkenburg, 2023; van Harskamp et al., 2024). Rather than limiting agricultural development to increasing productivity, this perspective encourages farming communities to actively participate in protecting ecosystems while ensuring long-term food security.

Within agricultural systems, extension services represent one of the most effective mechanisms for translating ecological values into everyday farming practices. Modern agricultural extension has evolved beyond the transfer of technical knowledge toward participatory education, collaborative learning, and community empowerment (Dewi et al., 2024). Extension agents therefore function not only as instructors but also as facilitators who encourage farmers to develop environmental awareness and shared responsibility for sustainable resource management.

The literature further suggests that the adoption of sustainable agricultural practices depends on more than technological availability. Farmers' decisions are strongly influenced by social values, institutional support, and local cultural contexts (Han & Niles, 2023). Consequently, integrating ecological citizenship into agricultural extension enables farmers to move beyond passive technology adoption toward continuous behavioral adaptation that balances agricultural productivity with environmental conservation.

Recent bibliometric evidence also demonstrates that sustainable agriculture is increasingly shaped by digital innovation, interdisciplinary collaboration, and participatory governance (Xu et al., 2024). However, technological innovation alone cannot ensure sustainability unless accompanied by ecological responsibility and civic engagement. Therefore, positioning agricultural extension agents as ecological citizens strengthens their role as facilitators of environmental ethics, social learning, and sustainable agricultural transformation.

Strengthening Local Wisdom for Sustainable Food Security

Local wisdom constitutes an essential foundation for sustainable food security because it reflects generations of accumulated knowledge regarding environmental management, biodiversity conservation, and adaptive agricultural practices. Food sovereignty perspectives argue that communities should maintain the autonomy to determine how food is produced while preserving ecological integrity and cultural identity (Pimbert & Claeys, 2024). Consequently, sustainable agricultural development should integrate scientific innovation with indigenous ecological knowledge rather than replacing traditional farming systems.

Agricultural extension provides an effective platform for combining modern agricultural science with community-based knowledge. Through participatory learning and collaborative problem-solving, extension agents facilitate the co-creation of knowledge between researchers and farming communities. This approach enables sustainable innovations to be adapted according to local environmental conditions while maintaining culturally embedded farming traditions.

Empirical studies further indicate that integrating local ecological knowledge enhances farmers' willingness to adopt sustainable agricultural practices. Community-based food systems that preserve indigenous cropping patterns, traditional land management, and local environmental values strengthen both ecological resilience and food sovereignty (Jernigan et al., 2023; Vargas-Canales et al., 2024). Likewise, agricultural ecological efficiency can be improved when local resource management is aligned with environmental sustainability objectives (Ma et al., 2024).

Recent agricultural studies also demonstrate that localized farming practices, including agroforestry systems and crop rotation, contribute significantly to maintaining soil quality, biodiversity, and long-term agricultural productivity (Kumiawan et al., 2024; Lü et al., 2024). Viewed through the perspective of ecological citizenship, these practices

represent forms of collective environmental responsibility that extension agents can preserve and strengthen through participatory extension programs. Therefore, integrating local wisdom into agricultural extension not only enhances sustainable food production but also reinforces the ecological and cultural resilience of rural communities.

Agricultural Extension as a Catalyst for Achieving SDG 2 (Zero Hunger)

The synthesis of ecological citizenship, agricultural extension, and local wisdom provides an integrated framework for supporting the achievement of Sustainable Development Goal 2 (Zero Hunger). SDG 2 emphasizes not only increasing food production but also establishing resilient agricultural systems capable of ensuring long-term food security while conserving natural resources. Agricultural extension therefore plays a strategic role in translating sustainability principles into practical farming activities that improve productivity without compromising ecosystem health (Mungai et al., 2024).

One major contribution of agricultural extension lies in facilitating the adoption of sustainable agricultural innovations. Farmers who receive continuous mentoring, participatory training, and locally adapted technical support are more likely to implement environmentally responsible practices such as crop diversification, soil conservation, and efficient water management (Han & Niles, 2023). Similarly, global analyses indicate that increasing agricultural yields without expanding cultivated land is essential for meeting future food demands while reducing environmental degradation (Merlos et al., 2024).

Ecological citizenship further strengthens this process by positioning farmers as active participants in environmental governance rather than passive beneficiaries of development programs. Through continuous interaction with extension agents, farmers develop stronger ecological awareness, greater community participation, and increased responsibility for managing local natural resources. These social dimensions are equally important for achieving sustainable food security because resilient food systems depend on cooperation, knowledge sharing, and collective stewardship (Silvast & Valkenburg, 2023; Debourdeau et al., 2024).

Nevertheless, the literature also identifies several barriers that limit the effectiveness of agricultural extension in supporting SDG 2. Institutional fragmentation, unequal access to extension services, limited professional capacity, and digital infrastructure gaps continue to reduce the effectiveness of sustainability-oriented extension programs (Thi Hoa Sen et al., 2024; Dewi et al., 2024). Strengthening partnerships among governments, universities, agricultural institutions, and local communities is therefore

essential to improve extension capacity while integrating ecological citizenship principles into extension policies and practices.

Overall, the reviewed literature demonstrates that agricultural extension agents should be recognized as catalysts for sustainable food security rather than solely as providers of agricultural information. By integrating ecological citizenship, local wisdom, and participatory learning, extension services can strengthen environmental stewardship, improve farmers' adaptive capacity, and support the realization of SDG 2 (Zero Hunger) through resilient, culturally grounded, and environmentally sustainable food systems.

CONCLUSION

This literature review demonstrates that ecological citizenship provides a valuable conceptual foundation for strengthening the role of agricultural extension in promoting sustainable food security. Rather than functioning solely as disseminators of agricultural technologies, agricultural extension agents can serve as civic-ecological facilitators who foster environmental responsibility, participatory learning, and collective action among farming communities. Integrating ecological citizenship into agricultural extension broadens its contribution from improving agricultural productivity to supporting sustainable natural resource management and community resilience.

The review also highlights the importance of local wisdom as an integral component of sustainable agricultural development. By combining indigenous ecological knowledge with scientific innovation, agricultural extension can facilitate culturally appropriate and environmentally responsible farming practices that enhance long-term food security. This integration reinforces community participation while preserving traditional knowledge that contributes to resilient and sustainable food systems.

Furthermore, positioning agricultural extension agents as ecological citizens supports the achievement of SDG 2 (Zero Hunger) by encouraging sustainable agricultural practices, strengthening farmers' adaptive capacity, and promoting collaborative food system governance. Although institutional, technological, and capacity-related challenges remain, the literature suggests that embedding ecological citizenship principles within agricultural extension policies and programs can enhance the effectiveness of extension services in advancing sustainable agriculture and food security.

Future studies should validate this conceptual framework through empirical research involving agricultural extension agents and farming communities across different regional contexts. Such investigations would provide stronger evidence regarding how

ecological citizenship can be operationalized in agricultural extension and contribute to the long-term achievement of sustainable food security and SDG 2 (Zero Hunger).

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