Integration of Agricultural Education into the Merdeka Curriculum to Support the Project for Strengthening the Pancasila Student Profile at *SMP PGRI 2 Somagede*, Banyumas Regency

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ABSTRACT

The community service program at *SMP PGRI 2 Somagede*, Banyumas Regency, involves the integration of agricultural education into the Merdeka curriculum as part of the efforts to support *Projek Penguatan Profil Pelajar* Pancasila/P5 (the Project for Strengthening the Pancasila Student Profile) and the development of school gardening potential. This activity takes a holistic approach by integrating practical agricultural education into the curriculum so that students are directly involved in soil preparation activities, such as preparing planting materials, planting, harvesting, and managing agricultural products. In addition, this project promotes strengthening Pancasila values such as cooperation and social justice. In addition to being equipped with agricultural skills, students are encouraged to understand their role in building character by national values. This community service activity aims to enhance students' practical skills in agriculture and enrich their understanding of moral and social values. The methods used in this activity include counseling, training and direct support to students and teachers of *SMP PGRI 2 Somagede* on cultivation techniques and the application of integrated farming. The results of this activity show that the application of drip irrigation technology and the processing of agricultural waste supports P5 and the development of the potential of school gardens. This activity not only improves the knowledge and skills of students but also supports the optimization of school gardens in implementing integrated farming. It indicates that the success of this program serves as a model for schools and villages in implementing the establishment of Agroeduwisata in Kemawi village, Somagede district, and Banyumas local government area.

1. Introduction

Agricultural education in junior high schools is pivotal in supporting the implementation of the *Merdeka* curriculum (the national curriculum). Agricultural education provides students with practical

knowledge about agriculture and encourages experiential learning activities to enhance their skills [1]. Students are encouraged to develop their potential and interests as part of independent learning. Therefore, agricultural education strategically explores students' talents and interests in agriculture and agribusiness [2]. Food sustainability, agricultural innovation and natural resource management are important aspects that can be integrated into agricultural education in secondary schools [3].

Agricultural education at the secondary school level can promote students' understanding of the importance of sustainable agriculture and provide a basis for choosing a career in this field [4]. Agricultural education at the secondary school level contributes significantly to improving students' agricultural knowledge and life skills [5]. Greater relevance of the curriculum to the needs of the agricultural sector can be achieved through project-based learning, which can be implemented already in secondary schools to provide students with extensive hands-on experience [6].

In today's era of independent learning, where flexibility and personalization of education are key, agricultural education in secondary schools can be an important pillar in allowing students to develop creativity, leadership skills and critical thinking. [7]. A deeper understanding of agriculture provides basic scientific knowledge and shapes the students' personalities as future-ready individuals [8].

SMP PGRI 2 Somagede is a private secondary school in Kemawi Village, Somagede District, Banyumas Regency, owned by the *Yayasan Pembina Lembaga Pendidikan Dasar dan Menengah Persatuan Guru Republik Indonesia Jawa Tengah* (YPLP DM PGRI JT). This secondary school has been licensed to operate since March 18, 1986, and has nine teachers, four educational staff and 147 students. The facilities and infrastructure of *SMP PGRI 2 Somagede* consist of 6 classrooms, one laboratory, one management office, one teacher office, one prayer room, one medical center, four toilets, one storage room, one administrative affairs office, one counseling room, and one student organization office, all of which are grouped into eight buildings [9].

Kemawi is a village in Somagede Subdistrict, Banyumas District, Central Java, Indonesia. This village is located 4.2 km from the center of Somagede Subprovince or 26 kilometers from Purwokerto, the capital of Banyumas Local Government Area. Kemawi village is located entirely in the hills and has special raw materials such as cloves, coffee, cardamom, brown sugar (Javanese sugar), and nutmeg. This village is famous for its tourist attractions, such as Curug Gemawang, Tapak Bima, and Bulu Lawang. It is also a pilgrimage site for Wali Songo, Kanjeng Sunan Kalijaga.

One of the extracurricular activities that interest most students of *SMP PGRI 2 Somagede* is agricultural cultivation activities, implemented by optimizing the potential of the school garden. Taman Tani is a school garden designed by *SMP PGRI 2 Somagede* in collaboration with the village government as a space for agricultural education and nature laboratories useful to students and the wider community. Taman Tani aims to create agricultural learning spaces that support the character strengthening of students through cultivation activities therein. This facility is also a catalyst for the character-building of students, which is implemented through agriculture-based activities that encompass aspects of character-building, skills and knowledge. Activities that can be undertaken to enhance this school garden include garden teachers, student plant cultivation, educational trips, and agricultural laboratories. Agricultural education in Indonesian secondary schools still faces the challenge of integrating technologies and innovations integral to modern agriculture development [10]. The lack of clarity about the role of agricultural education at the secondary school level often acts as a barrier to developing agricultural skills among students and results in low student interest in topics in this field [11].

The agricultural education provided at *SMP PGRI 2 Somagede* has a rather demanding background, along with the dynamics of agriculture and the need for skilled workers in this sector. These challenges include limited facilities and infrastructure and a lack of attention to developing a curriculum that meets the real needs of the agricultural sector. Rural schools' lack of facilities and digital literacy also contributes to the agricultural education gap between urban and these schools. Therefore, an in-depth understanding of the background of the state of agricultural education in secondary schools is key to developing a holistic and relevant improvement strategy to promote the agricultural sector in Indonesia.

This community service integrates education into the Merdeka curriculum supporting the Project for Strengthening the Pancasila Student Profile (P5) at *SMP PGRI 2 Somagede*. Agricultural activities are closely related to efforts to strengthen the student profile of Pancasila because through agricultural practices, students can develop the noble values of Pancasila, such as cooperation, independence and care for the environment. In the agricultural process, students are encouraged to plan, manage and harvest agricultural products together, which reflects the values of cohesion and shared responsibility. In addition, introducing modern and environmentally friendly agricultural technologies can instill in students a critical and innovative attitude consistent with the dimension of critical thinking in the Pancasila student profile. Thus, this activity enhances practical skills and strengthens students' character as the next generation who love their homeland and care about the nation's sustainability. The community service activity aims to support the optimization of school gardens through agricultural training or educational activities for students, teachers and educational staff by supporting agricultural facilities and infrastructure, such as the procurement of fruit and vegetable seeds/seedlings, fertilizers and pesticides, and agricultural tools or technologies to support the development of the potential of school gardens through the involvement of students, teachers, educational staff and the surrounding community.

The objectives of this community service activity are to enhance the character building, skills and knowledge of the students, teachers and educational staff of *SMP PGRI 2 Somagede* through the integration of agricultural education into the Merdeka curriculum in support of P5, facilities and infrastructure for the agricultural sector. Cultivation system applied in the school garden of *SMP PGRI 2 Somagede*, using current agricultural technology to develop the potential of the school garden for agro-edutourism and to strengthen the collaboration between *SMP PGRI 2 Somagede* and external parties who wish to visit the school garden.

2. Method

The methods used in this charity activity are presented as follows:

1. Provision of materials consisting of:
   a. Hydroponics and conventional cultivation of vegetables and fruits for students, teachers and educational staff in the Merdeka curriculum in support of P5.
   b. Application of drip irrigation in the cultivation areas of school gardens.
   c. Harvesting and post-harvest techniques for horticultural products.
   d. Production of compost and liquid organic fertilizer from household and agricultural waste.
   e. Preparation of a school garden plan.
   f. Integrated agro-edutourism in agriculture.
2. Method of collecting data

   In this activity, data collection was conducted using different methods, namely surveys, observations, interviews and documentation. The research was conducted by distributing questionnaires to students, teachers and the community to understand the needs, perceptions and level of knowledge about agricultural practices and Pancasila values. Observations were used to monitor agricultural activities directly, interactions among community members and the application of values such as cooperation during the activity. In-depth interviews were conducted with students, teachers and community leaders to delve deeper into their experiences and obstacles during the activity. Meanwhile, the entire flow of the activity was documented, including photographs, videos and field notes to provide concrete evidence to support the data analysis. This combination of methods ensures that the data obtained are comprehensive, valid and relevant to the activity's objectives.
3. Practice (Participatory Action Research)

   The Participatory Action Research (PAR) method is highly relevant to agricultural activities and is aimed at strengthening the Pancasila Student Profile Project, as this method actively involves students and the community in problem identification, planning, implementation, and evaluation of agricultural activities. Through PAR, students can learn directly from the community about agricultural practices while developing the values of cooperation, responsibility and environmental awareness. Furthermore, this method enables students to become critical and solution-oriented change agents so that the activities' results not only impact agricultural productivity but also strengthen students' character through the values of Pancasila.

The practical experience of agricultural field exercises for *SMP PGRI 2 Somagede* students offers significant benefits, especially contextual learning and enhancement of practical skills. Through this activity, students can directly apply the theories they learned in the material exposure activities to practical situations, such as land management, crop cultivation, care and harvesting, and marketing. This helps them understand the agricultural process as a whole, strengthens critical thinking skills, and increases awareness of the importance of sustainable agriculture. In addition, the field practice builds problem-solving and collaborative skills that support the development of the Profil Pelajar Pancasila, such as cooperation, independence, and a sense of responsibility for the environment.

3. Results and Discussion

This activity is motivated by the need to strengthen the character building, skills and knowledge of the *SMP PGRI 2 Somagede* students by integrating agricultural education into the Merdeka curriculum. Through the Pancasila Student Profile Strengthening Project (P5), we hope students can develop attitudes, values and competencies consistent with the Pancasila philosophy. In this context, agricultural education becomes an important medium for providing students with real, relevant, contextual learning experiences.

Fig. 1. Coordination of plan activity

The main objective of this activity is to enhance the character development, skills and knowledge of students, teachers and educational staff at *SMP PGRI 2 Somagede*, an implementation of the Pancasila Student Profile Strengthening Program. Another objective is to improve the facilities and infrastructure of the agricultural cultivation system in schools by using the latest agricultural technologies and to strengthen the collaboration between *SMP PGRI 2 Somagede* and external parties interested in visiting the school garden. The school can translate the potential of the school garden into agro-edutourism, which can attract the wider public's interest through this charitable activity. This activity was attended by 30 students and three teaching staff members who are the actors of this extracurricular programme.

This activity was carried out using two main methods: material supply and practice. The material supply covered topics such as hydroponics and conventional vegetable and fruit production, application of drip irrigation to cultivated land, harvesting and post-harvest techniques in horticulture, compost and liquid organic fertilizer, and preparation of a school garden plan. The Community Service Team conducted the extension activity, attended by several teachers and 25 *SMP PGRI 2 Somagede* students.

The counseling activity to integrate agricultural education into the Merdeka curriculum at *SMP PGRI 2 Somagede* was conducted enthusiastically among the participants, students and teachers. This counseling started with a presentation of material on hydroponics and conventional vegetable and fruit production, followed by a short demonstration of the practical application of drip irrigation and hydroponic production systems. Students enthusiastically attended each session as they gained new knowledge on agriculture that is relevant to daily life and has the potential to become a business opportunity in the future. The importance of agricultural activities for secondary school students lies in their role in forming independent character, protecting the environment and developing practical skills that can be used outside school [12], in line with the objectives of the Pancasila Student Profile Strengthening Project.

Fig. 2. Socialization of the entire activity plan, drip irrigation and cultivation in the hydroponic system

In addition to consultations, the community service team and participants (students and teachers) also conducted field visits. Field visits for the community service organization team were conducted as a first step before launching a series of community service activities at *SMP PGRI 2 Somagede*. The purpose of this visit was to survey the state of the school garden, assess the readiness of the facilities and infrastructure and gain insights into the local potential that can be developed in the agro-edu-tourism project. The team also visited different integrated farming sites to gain inspiration and best practices relevant to the purpose of community service. This field visit activity is very important as it provides more concrete insights into the local needs and challenges, which will allow the extension program to be tailored to the specific context of the school and ensure the effectiveness of the implementation and sustainability of the activities [13]. This experience will broaden their horizons regarding the potential of school garden development and encourage innovation in the agricultural sector [14].

Fig. 3. Field visit to the school garden site plan

3.1. Site Plan Design

The practical implementation of the technology provided by the Community Service Team is imperative to support the implementation and understanding of efficient and sustainable agricultural cultivation by students and teachers. As a first step, preparing a site plan for the pilot project in *SMP PGRI 2 Somagede* is a strategic step towards optimizing land management, setting up cultivation areas and designing supporting facilities for the development of agro-edutourism [15]. The site plan includes zoning for hydroponic and conventional growing areas, learning areas, and amenities such as visitor trails and open educational spaces. Creating a site plan is important because it ensures efficient land use, facilitates teaching and learning activities, and creates a pleasant and engaging visitor experience [16][17]. Besides being an educational tool, living labs have great potential for development into agro-educational tourism destinations that can attract external visitors and, if well managed, have a positive economic impact on schools and local communities [18][19].

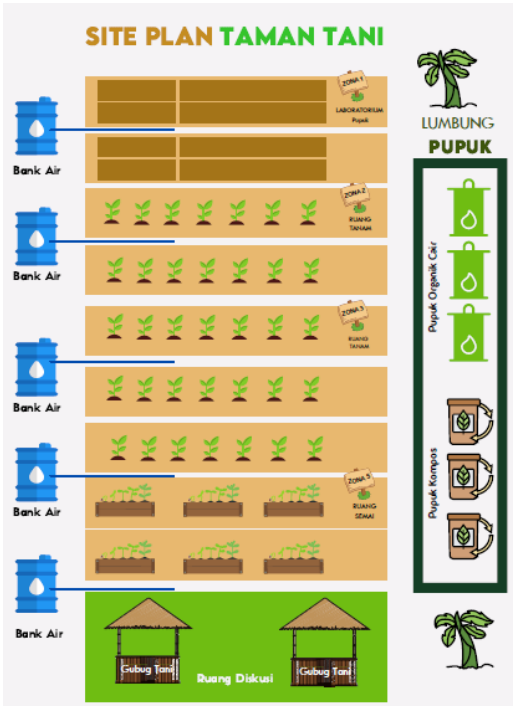
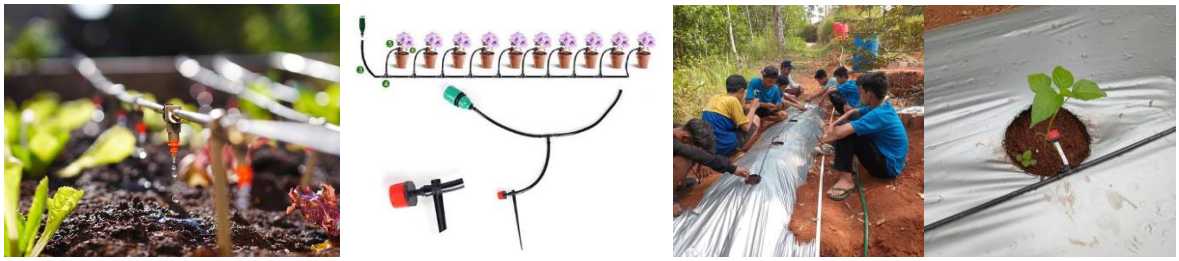


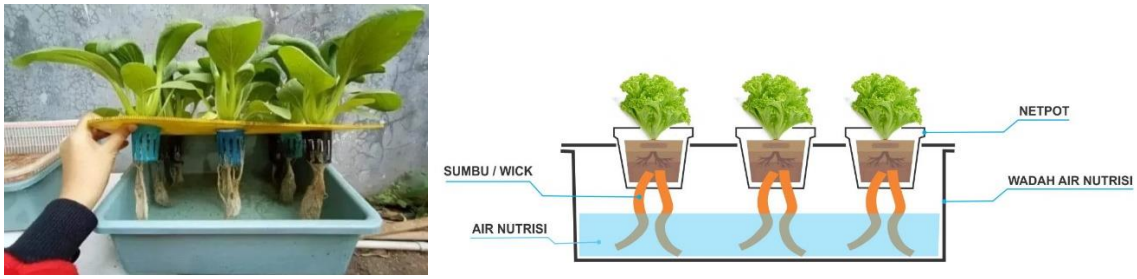
Fig. 4."Taman Tani" Site plan of *SMP PGRI 2 Somagede* school garden

3.2. Hydroponics, Application of Drip Irrigation and Compost Production

The material on growing vegetables and fruits, both hydroponically and conventionally, is also presented to provide students, teachers and educational staff with a basic knowledge of agriculture. This knowledge is intended to inspire them to develop farming skills as an attempt at food independence and a sustainable business opportunity. Hydroponic technology is also presented as a modern, efficient and environmentally friendly method of farming [20][21]. One of the innovations introduced as part of this activity is drip irrigation in the school garden. Drip irrigation was chosen because it efficiently uses water and increases crop yields [22][23]. The implementation of this technology is intended to serve as an example to students of the importance of effective and environmentally friendly agricultural technology and to add value to school gardens as a means of learning and educational tourism. This activity also includes training on producing compost and liquid organic fertilizer from household and crop waste to support a sustainable agricultural system. This training will teach students and teachers the importance of using waste to increase soil fertility while reducing negative environmental impacts naturally [24].



(a)



(b)

(c)

Fig. 5. (a) Drip irrigation application; (b) Hydroponic wick system; (c) Composting

Irrigation problems are a major challenge in the school areas, especially during the dry season when water availability is limited. In these areas, there are often problems in distributing water evenly to all plants, as manual irrigation is usually inefficient and energy-consuming. This circumstance causes the junior high school students involved in cultivation activities to face obstacles in maintaining optimal plant growth, which reduces the effectiveness of their learning about good and sustainable agricultural practices.

A drip irrigation system was introduced to solve irrigation problems in the fields. Drip irrigation is a modern method that distributes water slowly and directly to the roots of plants through a network of small pipes, making water use more efficient and effective. With this technology, junior high school students can care for plants easily and learn how to perform efficient and sustainable irrigation. In addition to helping overcome water constraints, drip irrigation on the school areas is part of innovative learning that exposes them to agricultural technology solutions to support productivity and environmental sustainability.

The problem of using the schoolyard at *SMP PGRI 2 Somagede* arises from the limited optimal available area and the lack of optimization of its use for productive activities. Schoolyards that could be used for cultivation are often empty or planted with ornamental plants only, thus not contributing significantly to the food needs of the school environment. In addition, students' lack of knowledge about suitable farming techniques for confined areas is an additional barrier to integrating learning aspects into real farming practices. Hydroponic farming was introduced as a solution to make optimal use of the schoolyard. Hydroponics, as a soilless farming method using nutrient-enriched water media, is very suitable for confined areas because it efficiently uses space and water. By implementing hydroponics, students can learn to grow various vegetables and plants with high nutritional value that can help support food security in the school environment. Additionally, the hydroponic system gives students direct experience with modern agricultural technology that is environmentally friendly and relevant to the small scale and supports project-based learning that reinforces the values of independence and sustainability. This hydroponic cultivation produces quite good production, with 30 available hydroponic wick installations (120 planting holes) capable of producing 60 bunches of kale and spinach each.

In addition to professional cultivation techniques, professional harvest and post-harvest techniques are taught to properly control horticultural cultivation results and achieve the greatest possible economic benefit [25]. Students, teachers, and teaching staff will learn how to harvest properly, package and store horticultural products to remain fresh and have a high sales value. This knowledge will also provide students with practical skills for daily life and enable the formation of an integrated farming system in school gardens. It is hoped that students and teachers can carry out cultivation activities from upstream to downstream, thus creating a pilot system that can be developed as agro-educational tourism.

Collaboration with various external parties is needed to support the development of school gardens as agro-edutourism. This activity is an event to strengthen the collaboration network between *SMP PGRI 2 Somagede* and external parties such as other educational institutions, local governments, farming communities and entrepreneurs in the agricultural sector. This collaboration is intended to support the program's sustainability and promote school gardens as agro-edutourism destinations. This activity also intends to positively impact students, teachers and teaching staff of *SMP PGRI 2 Somagede* in the long term. The integration of the Pancasile Student Profile, implemented through the optimization of this school garden, is intended to enhance the understanding of agriculture, build strong character, increase the sense of responsibility, cooperation and good collaboration, and as a form of implementation of the

Pancasila Student Profile, create new economic opportunities for the school community and the surrounding community.

4. Conclusion

This activity concluded that using hydroponics and applying drip irrigation are innovative solutions to address agricultural challenges, especially to maximize the use of farm space and overcome irrigation problems during the dry season in the *SMP PGRI 2 Somagede* school garden. Hydroponics enables students to utilize limited areas productively and efficiently, while drip irrigation provides an efficient and effective approach to water management for both large and limited areas. These two technologies increase agricultural productivity and efficiency and provide students with practical knowledge of the importance of innovation in sustainable agriculture, which is relevant to addressing future resource management challenges.

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References

[1] S. Manao, S. Manik, L. W. Manurung, and E. Sinambela, "The Implementation of Project-Based Learning and Discovery Learning Models on Students' Writing Narrative of SMA Swabina Karya Medan," *J. Kependidikan*, vol. 13, no. 1, pp. 1191–1200, 2024, [Online]. Available: https://jurnaldidaktika.org

[2] I. Farida, R. Riandi, and R. Riandi, "The implementation of project-based learning in agricultural education to enhance students' critical thinking," *Adv. Soc. Sci. Educ. Humanit. Res.*, vol. 490, pp. 179–183, 2021.

[3] R. Wang, A. Meybeck, and A. Sonnino, "Research and Innovation," *Sustain. Food Agric. An Integr. Approach*, pp. 491–507, 2018, doi: 10.1016/B978-0-12-812134-4.00044-3.

[4] N. L. Sprague, U. C. Okere, Z. B. Kaufman, and C. C. Ekenga, "Enhancing Educational and Environmental Awareness Outcomes Through Photovoice," *Int. J. Qual. Methods*, vol. 20, pp. 1–11, 2021, doi: 10.1177/16094069211016719.

[5] Lina Sudarwati and N. F. Nasution, "Upaya Pemerintah dan Teknologi Pertanian dalam Meningkatkan Pembangunan dan Kesejahteraan Petani di Indonesia," *J. Kaji. Agrar. dan Kedaulatan Pangan*, vol. 3, no. 1, pp. 1–8, 2024, doi: 10.32734/jkakp.v3i1.15847.

[6] H. Yu, "Enhancing creative cognition through project-based learning: An in-depth scholarly exploration," *Heliyon*, vol. 10, no. 6, p. e27706, 2024, doi: 10.1016/j.heliyon.2024.e27706.

[7] N. A. P. Lestari, L. T. S. Wahyuni, I. W. Lasmawan, I. W. Suastra, M. S. A. Dewi, and N. M. I. P. Astuti, "Kurikulum Merdeka Sebagai Inovasi Menjawab Tantangan Era Society 5.0 Di Sekolah Dasar," *J. Ilm. Pendidik. Citra Bakti*, vol. 10, no. 4, pp. 736–746, 2023, doi: 10.38048/jipcb.v10i4.1996.

[8] I. Ismiasih, R. Trimerani, and A. Ika Uktoro, "Edukasi Tanaman Pertanian Sejak Usia Dini Dan Pelatihan Budidaya Tanaman Hortikultura Secara Modern Pada Masa New Normal Di Tpa Sokopuro," *JMM (Jurnal Masy. Mandiri)*, vol. 5, no. 5, pp. 2408–2422, 2021, [Online]. Available: http://journal.ummat.ac.id/index.php/jmm

[9] K. P. K. R. dan T. Direktorat Jenderal Pendidikan Anak Usia Dini Pendidikan Dasar dan Pendidikan Menengah, "Data Pokok SMP PGRI 2 Somagede," 2024. https://dapo.kemdikbud.go.id/sekolah/77A1166DF088D427A42E

[10] H. N. Utami, S. Hadi, and A. Safaat, "Integrating digital technology into agricultural education in Indonesia," *J. Phys. Conf. Ser.*, vol. 14, no. 1, p. 012009, 2020.

[11] S. Solheri, M. Azhar, and Y. Yohandri, "Analysis of ethnoscience integrated environmental literacy for junior high school," *JPBI (Jurnal Pendidik. Biol. Indones.*, vol. 8, no. 2, pp. 178–188, 2022, doi: 10.22219/jpbi.v8i2.17657.

[12] E. S. Ikuemonisan, A. B. Abass, S. Feleke, and I. Ajibefun, "Influence of Agricultural Degree Programme

environment on career in agribusiness among college students in Nigeria," *J. Agric. Food Res.*, vol. 7, no. November 2021, p. 100256, 2022, doi: 10.1016/j.jafr.2021.100256.

[13] M. Nieuwenhuijsen *et al.*, "The Superblock model: A review of an innovative urban model for sustainability, liveability, health and well-being," *Environ. Res.*, vol. 251, no. February, 2024, doi: 10.1016/j.envres.2024.118550.

[14] A. Jabir, B. Kurniawan, and Wiyudatara, *Dsar-Dasar Usaha Pertanian Terpadu*. Jakarta: Pusat Perbukuan Komplek Kemdikbudristek, 2023.

[15] F. B. Saroinsong, "Supporting plant diversity and conservation through landscape planning: A case study in an agro-tourism landscape in Tampusu, North Sulawesi, Indonesia," *Biodiversitas*, vol. 21, no. 4, pp. 1518–1526, 2020, doi: 10.13057/biodiv/d210432.

[16] A. F. Kaamah, B. Doe, and M. O. Asibey, "Policy and practice: Stakeholders' satisfaction with conventional and participatory land use planning in Ghana," *Urban Gov.*, vol. 3, no. 4, pp. 278–291, 2023, doi: 10.1016/j.ugj.2023.06.002.

[17] G. N. Yuan *et al.*, "A review on urban agriculture: technology, socio-economy, and policy," *Heliyon*, vol. 8, no. 11, p. e11583, 2022, doi: 10.1016/j.heliyon.2022.e11583.

[18] S. Tomasi, G. Paviotti, and A. Cavicchi, "Educational tourism and local development: The role of universities," *Sustain.*, vol. 12, no. 17, 2020, doi: 10.3390/SU12176766.

[19] K. Y. Wang, "Sustainable Tourism Development Based upon Visitors' Brand Trust: A Case of '100 Religious Attractions,'" *Sustain.*, vol. 14, no. 4, 2022, doi: 10.3390/su14041977.

[20] N. Putriani *et al.*, "Pengembangan Sistem Hidroponik Untuk Pertanian Berkelanjutan Di Desa Cipari," *J. Pros. Kampelmas*, vol. 2, no. 2, pp. 1035–1049, 2023.

[21] S. Rajendran, T. Domalachenpa, H. Arora, P. Li, A. Sharma, and G. Rajauria, "Hydroponics: Exploring innovative sustainable technologies and applications across crop production, with Emphasis on potato mini-tuber cultivation," *Heliyon*, vol. 10, no. 5, p. e26823, 2024, doi: 10.1016/j.heliyon.2024.e26823.

[22] M. Dawit, M. O. Dinka, and O. T. Leta, "Implications of adopting drip irrigation system on crop yield and gender-sensitive issues: The case of Haramaya district, Ethiopia," *J. Open Innov. Technol. Mark. Complex.*, vol. 6, no. 4, pp. 1–17, 2020, doi: 10.3390/joitmc6040096.

[23] S. Van der Kooij, M. Zwarteveen, H. Boesveld, and M. Kuper, "The efficiency of drip irrigation unpacked," *Agric. Water Manag.*, vol. 123, pp. 103–110, 2013, doi: 10.1016/j.agwat.2013.03.014.

[24] V. Bathmanathan, J. Rajadurai, and R. Alahakone, "What a waste? An experience in a secondary school in Malaysia of a food waste management system (FWMS)," *Heliyon*, vol. 9, no. 10, p. e20327, 2023, doi: 10.1016/j.heliyon.2023.e20327.

[25] T. Mutiarawati, F. Pertanian, and U. Padjadjaran, "Jurnal artikel tomat," pp. 1–17, 2007.