

Food Security Education Based on the Circular Economy: CIPP Evaluation of the Ecpesantren Model

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ABSTRACT

This study evaluates circular economy-based food security education at Miftahul Huda Al-Musri Ecpesantren using the CIPP framework, which includes Context, Input, Process, and Product. The study addresses the limited evaluative research on how *pesantren*-based food security programs integrate circular economy principles, Islamic educational values, and Education for Sustainable Development. A sequential explanatory mixed methods design was employed. The quantitative phase involved 178 students selected through total sampling with inclusion criteria, using a 20-item Likert-scale questionnaire based on the CIPP dimensions. The qualitative phase used purposive sampling involving *pesantren* leaders, program coordinators, technical assistants, and selected students to deepen the survey findings through interviews, participatory observations, and documentation. The findings show that the program was perceived to be highly effective, with an overall mean score of 4.26. The Context dimension indicated strong relevance to students' needs, Islamic values, and sustainability goals. The Input dimension showed adequate facilities, curriculum integration, and learning resources, although facilitator competence still required strengthening. The Process dimension reflected structured planning, active student involvement, supervision, and follow-up, while formal monitoring and evaluation remained limited. The Product dimension indicated positive outcomes in harvest production, student innovation, discipline, responsibility, ecological awareness, and independence. This study concludes that circular economy-based food security education can serve as a contextual, experiential, and value-based model for sustainable Islamic education when supported by stronger facilitator capacity and systematic evaluation mechanisms.

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1. INTRODUCTION

The phenomenon of global food crises and environmental degradation shows that the world's food system is in a fragile condition. Rapid population growth, urbanization, and unsustainable consumption patterns exacerbate the pressure on natural resources. Based on the Global Report on

Food Crises released by UNICEF, in 2023 282 million people experienced acute hunger (GNAFC, 2024). Meanwhile, in Indonesia, data from the World Resources Institute (WRI) in 2024 shows that as many as 23 million people experience a deficit in daily nutritional intake (Panggabean, Chalidah, Karina, & Haniy, 2024). This condition confirms that food security does not only need to be seen as an economic issue, but is a multidimensional issue involving ecology, social, education, and governance. In the West Java region, this challenge is increasingly complex due to the conversion of agricultural land, dependence on imported products, and the low interest of the younger generation in the world of agriculture (Tranggono et al., 2023). In addition, consumptive lifestyles and lack of awareness of the importance of sustainability contribute to weakening food self-sufficiency at the local community level. This fact presents the urgent demand for innovation for the birth of an alternative education model that is able to change people's mindset and behavior towards sustainability based food independence.

In the context of Islamic education, eco-eco-trends are beginning to emerge as an innovative approach that synergizes religious values, ecological awareness, and circular economy practices (Nuryana et al., 2025). *Ecopesantren* not only produces religious students, but also equips them with relevant life skills to face the challenges of the 21st century. Learning food security in eco-schools through organic farming practices, fisheries, waste management, and independent food production is a means of internalizing concrete and applicable sustainability values (Mandra & Ismail, 2022). This integration encourages a paradigm shift in *pesantren* education from just a religious institution to a spirituality-based socio-ecological empowerment center.

Although various circular economy practices have been implemented in a number of Islamic boarding schools, such as composting, wastewater utilization, maggot cultivation, and agriculture-livestock integration, their implementation is still partial and has not been institutionalized in the formal education curriculum (Bakri, 2021). The Miftahul Huda Al-Musri Islamic Boarding School is an example of the success of the food independence model, but this success does not yet represent the condition of the majority of Islamic boarding schools. Most Islamic boarding schools still face obstacles in the form of lack of infrastructure, low human resource competence, and the absence of curriculum standards that systematically integrate the circular economy and food security (Kejora, 2025). This gap shows the need for in-depth research to map good practices, obstacles, opportunities, and patterns of food security education development in *ecopesantren*.

The urgency of the research is getting stronger, considering that *pesantren* has strategic potential as a social institution that is close to grassroots communities. *Pesantren* are able to become agents of ecological behavior change through a widely accepted approach to religious values (Purnomo, Anantanyu, Saptaningtyas, & Mangunjaya, 2024). However, this potential has not been optimally utilized due to the absence of a tested conceptual and operational model in integrating circular economy principles into food security learning. Without a scientific foundation and implementing guidelines, efforts towards food-independent Islamic boarding schools risk being sporadic, unsustainable, and difficult to replicate.

Research on CIPP has been widely carried out focusing on the evaluation of educational programs in general through systematic literature review (Citariyani, Santi, & Riawan, 2025), evaluation of the Islamic Religious Education curriculum based on values and character (Aristya, Zurqoni, & Khojir, 2026), and analysis of the effectiveness of e-learning through a regression quantitative approach (Prayogo, 2022). However, this research proposes a novelty that has not been researched by integrating Islamic education, food security, and circular economy principles in a single CIPP evaluation framework based on empirical studies on the *ecopesantren* model. This approach transforms CIPP from just a curriculum evaluation to an evaluation of an education system based on sustainable food production. This research fills this gap by using the CIPP (*Context, Input, Process, and Product*) evaluative approach to comprehensively analyze how circular economy-based food security education is applied in *ecopesantren*. The CIPP approach allows researchers to assess the suitability of context, readiness of inputs, process effectiveness, and achievements of educational products. Through this holistic evaluation, the research not only describes the phenomenon, but also produces problematic diagnoses that can be used to formulate strategies for strengthening and developing educational models (Rukajat,

Taufik, & Kejora, 2025). This also strengthens the theoretical contribution of research in the field of Islamic education with an environmental perspective and circular economy.

The novelty of the research lies in the unification of three components that have been studied separately: Islamic values (Ilmi, 2015), circular economy approaches (Taufik, Kejora, Komariah, & Herawan, 2025), and food security education (Taufik, Kejora, Komariah, Herawan, & Sudarsyah, 2025), into a single CIPP-based integrative model. This approach places students as the main actors in the sustainable food production system, not just the object of learning. By exploring good practices from successful *pesantren* and mapping gaps in many other *pesantren*, this research offers an educational model that is applicable, contextual, and replicable. The resulting strategic recommendations are expected to make a real contribution to the development of *pesantren* as a resilient socio-environmental transformation center in facing the threat of future food crises.

2. METHODS

2.1 Research Design

This study uses a mixed method sequential explanatory, which is a design that begins with the collection and analysis of quantitative data, then continues with qualitative exploration to explain and deepen the initial findings (Creswell & Creswell, 2018). The research flow was carried out in two successive stages. The first phase aims to map the effectiveness of the program through an evaluative survey based on the CIPP model. The second stage aims to contextually explain quantitative results that require deepening, especially on aspects that show variations in scores or indications of program weaknesses. Thus, quantitative results directly guide the focus of qualitative exploration, especially on the input dimension (companion competence) and monitoring and evaluation mechanisms.

2.2 Participants

At the quantitative stage, this study used total sampling with inclusion criteria. This technique was selected because the population of students actively involved in the *ecopesantren* food security program was limited and accessible to the researchers. Therefore, all students who met the predetermined inclusion criteria were included as survey respondents. The inclusion criteria were: (1) being an active student at Miftahul Huda Al-Musri *Ecopesantren* for at least one year; (2) being over 15 years old; (3) being directly involved in food security education activities; and (4) participating in at least two types of circular economy-based production activities, such as organic farming, hydroponic cultivation, waste processing into compost, integrated farming, local food production, fisheries, maggot cultivation, or *pesantren* entrepreneurship. Based on these criteria, 178 male and female students were included as quantitative respondents.

At the qualitative stage, this study used purposive sampling to select informants who were considered capable of providing deeper explanations of the quantitative findings. The qualitative informants consisted of one *pesantren* leader, two food security program coordinators, two technical assistants, and eight students representing high, medium, and low score categories based on the survey results. This selection was intended to obtain varied perspectives on the implementation, strengths, weaknesses, and sustainability of the circular economy-based food security program. Thus, the quantitative stage used total sampling with inclusion criteria, while the qualitative stage used purposive sampling for explanatory deepening in accordance with the sequential explanatory mixed methods design.

2.3 Instruments

The quantitative instrument was in the form of a 20-item closed questionnaire based on the CIPP model with a Likert scale of 1–5. The questionnaire measures four dimensions: context (alignment of vision and needs), inputs (resources and competencies), process (implementation and participation), and product (learning outcomes and impact). The validity of the content was tested through expert judgment by three Islamic education experts and program evaluation. The construct validity test was carried out using item-total correlation, with all items having a coefficient of >0.30. Reliability was

measured using Cronbach's Alpha and yielded a value of 0.89 indicating a highly reliable category. The interpretation of the score uses the following criteria (Kejora, 2021):

Table 1. Research Questionnaire Score Assessment Criteria

No	Score	Criteria
1.	1.00 – 1.80	Not Good
2.	1.81 – 2.60	Less
3.	2.61 – 3.40	Enough
4.	3.41 – 4.20	Good
5.	4.21 – 5.00	Excellent

Qualitative instruments in the form of semi-structured interview guidelines and participatory observation sheets focused on circular economy practices, integration of Islamic values, and program evaluation mechanisms.

2.4 Data Analysis Procedure

Quantitative data were analyzed using descriptive statistics to obtain average scores, score distribution, and program effectiveness categories. The results of the analysis were used to identify dimensions that require further deepening at the qualitative stage. Qualitative data were analyzed using Miles and Huberman's interactive model which included data reduction, data presentation, and conclusion drawing and verification (Thoifah, Yusuf, Heriyudanta, Jamil, & Sulthani, 2021). Triangulation of sources and methods is carried out to ensure the credibility and consistency of findings. The integration of the two stages is carried out at the final interpretation stage. Quantitative data provides an overview of program effectiveness, while qualitative data describes institutional dynamics, educational practices, and the internalization of circular economy principles. This approach increases methodological transparency and allows for the replication of research in the context of other Islamic boarding schools with similar characteristics.

3. FINDINGS AND DISCUSSION

3.1 Findings

3.1.1 Quantitative

Explanatory research on food security education based on the circular economy in *ecopesantren* began with the collection of quantitative data through a survey of 178 female and male students. Respondents were selected purposively, namely students over 15 years old and actively involved in *ecopesantren* activities, because they have direct experience in agriculture, fisheries, waste management, and food production activities, so that they are able to provide more accurate empirical data. The instrument used was in the form of 20 closed questionnaires that integrated the CIPP evaluation model with *pesantren* food security practices. The survey results are presented as follows:

Table 2. Results of the CIPP Food Security Survey Based on Circular Economy at the Miftahul Huda Al Musri *Ecopesantren*

No	Components CIPP	Aspects	Closed Inquiry Statement	Score Achievement	Category
A. CONTEXT – Program Relevance & Needs					
1	Context	Relevance	The <i>pesantren</i> food security program is felt to be relevant to the living needs of students and the surrounding environment.	4.05	Good
2	Context	Educational Value	Agricultural, fishery, and waste management activities reflect Islamic educational values and food independence.	4.56	Excellent
3	Context	Circular Economy	<i>Pesantren's</i> circular economy activities help reduce dependence on food from outside the <i>pesantren</i> .	4.34	Excellent

4	Context	Sustainability	The food security program supports the vision of Islamic boarding schools to create a sustainable learning environment.	4.46	Excellent
B. INPUT – Resources, Facilities, and Curriculum					
5	Input	Food Facilities	Agricultural facilities (gardens, rice fields, greenhouses) are available and can be used optimally.	4.13	Good
6	Input	Integrated Facilities	Fisheries, farming, and maggot cultivation facilities are managed regularly for learning.	4.23	Excellent
7	Input	Curriculum	The learning curriculum clearly includes food security and circular economy materials.	4.26	Excellent
8	Input	Human Resources Instructors	The supervisor or accompanying ustadz has adequate competence in the field of food and the environment.	3.94	Good
C. PROCESS : Planning, Implementation, Monitoring & Follow-up					
9	Process	Planning	Planning of agricultural, fishery, and waste management activities is carried out in a structured manner and involves students.	4.38	Excellent
10	Process	Implementation	Food security activities are carried out routinely, disciplinedly, and according to the <i>pesantren</i> schedule.	4.22	Excellent
11	Process	Involvement of Santri	Santri are actively involved in cultivating land, planting vegetables, raising fish, or managing maggots.	4.19	Good
12	Process	Supervision	Each agricultural and fishing activity is supervised by a supervisor to ensure the quality of the practice.	4.89	Excellent
13	Process	Circular Implementation	<i>Pesantren</i> applies circular economy principles such as making compost or maggot feed.	3.88	Baik
14	Process	Monitoring	Monitoring and evaluation are carried out routinely in the process of agriculture, fisheries, and waste management.	3.77	Good
15	Process	Evaluation	The monitoring results are used as a basis for improving the <i>pesantren</i> food security program.	4.12	Good
16	Process	Follow-up	Follow-up repairs are carried out when obstacles are found in the cultivation process.	4.45	Excellent
D. PRODUCT : Hasil Program (Output dan Outcome)					
17	Product/Output	Harvest	Food security activities produce harvests, processed products, or innovations that are beneficial to Islamic boarding schools.	4.33	Excellent
18	Product/Output	Santri Innovation	This program encourages the emergence of students' work or innovations in agriculture, fisheries, or waste management.	4.11	Good
19	Outcome	Character	Food security activities form the character of discipline, responsibility, and environmental concern in students.	4.56	Excellent

20	Outcome	Independence	Involvement in the program increases the independence of students in managing sustainable food needs.	4.37	Excellent
Average				4.26	Excellent

The results of quantitative evaluation through a survey using the CIPP model showed that the circular economy-based food security program at *Ecopesantren* Miftahul Huda Al-Musri was in the very good category with an average score of 4.26. In the context aspect, the program is considered very relevant, reflecting the value of Islamic education, supporting the circular economy, and in line with the vision of sustainability of Islamic boarding schools. The input aspect is also considered very good, as seen from the availability of agricultural facilities, integrated facilities, curriculum integration, and supervisor competence. In the Process aspect, activities are planned in a structured manner, carried out routinely, involve students, be closely supervised, and apply circular economy principles, although monitoring still needs to be improved. The Product aspect shows that the program produces harvests, processed products, and student innovation, while the Outcome aspect reflects the formation of a strong character of discipline, responsibility, environmental concern, and independence. Thus, based on the perception of respondents, the program has been well implemented for food security and character education of students.

3.1.2 Qualitative

The results of the observation show that food security at the Miftahul Huda Al-Musri *Ecopesantren* not only functions as a production activity but also as an experiential learning strategy that forms the cognitive, affective, and psychomotor competencies of students. The integration of programs in the non-formal curriculum, particularly through the *ancub* or "*nyebur*" model, shows that the learning process is designed in the form of contextual and project-based learning. Students not only understand the concept of food security theoretically, but also experience the cycle of food production, management, and distribution. This pattern reinforces conceptual understanding through real-world practice and improves learning retention.

Interviews with *pesantren* leaders show that the use of agricultural land is not just an economic decision, but part of an educational design that is relevant to the local context. The learning focus on the geographical potential of the region provides a contextual and meaningful learning experience. Students learn to recognize local resources, understand agricultural ecosystems, and develop food literacy based on the surrounding environment. This relevance contributes to increasing ecological awareness and adaptive ability to the socio-economic conditions of the community. This is also strengthened by interviews with students who are PIC of the food security program:

*"As a student who was given the mandate to become a PIC of the food security program, I feel that agricultural activities in Islamic boarding schools are not just planting and harvesting. We learned to understand soil, water, seasons, seeds, and how to care for plants according to the conditions of the surrounding environment. From that process, we realized that the *pesantren* land is a learning space that is very close to people's lives. Students not only get theory, but directly experience how food is produced and why protecting nature is important. The program also trains us to be cooperative, responsible, and find solutions when faced with obstacles, such as unpredictable weather or pest attacks. In my opinion, learning like this makes students better prepared to face social and economic challenges in society. We have become more sensitive to local potential and are encouraged to develop food independence that is beneficial for Islamic boarding schools and local residents."* (WS: 03,kl 05).

Observations of integrated management systems including agriculture, fisheries, livestock, and waste treatment show that the *pesantren* environment functions as a laboratory of sustainability education. Students not only practice cultivation techniques, but also understand the relationships between components in a sustainable production system. The treatment of waste into compost and maggot feed, for example, shows how circular economy principles translate into concrete learning experiences. From this process, students develop a systemic mindset, namely the ability to see the relationship between production, consumption, and environmental sustainability.

The involvement of male students in the management of rice fields and fisheries and female students in the management of horticulture and processed products shows that learning takes place in a participatory and collaborative manner. Role differences do not indicate learning segregation, but enrich the variety of learning experiences. Students gain technical competence according to their fields while learning to work together across roles. This contributes to strengthening social skills, communication, and collective responsibility.

Another important finding is the development of a peer tutoring system. The senior students who guide junior students show the existence of a horizontal knowledge transfer process. This model not only improves technical understanding, but also forms leadership, empathy, and pedagogical ability among senior students. Guiding activities strengthen their confidence and moral responsibility, while junior students receive more personalized and contextual learning support. This process shows that learning does not only take place between teachers and students, but also between students in the learning community.

The results of the documentation show that most of the harvest is used for the internal needs of the *pesantren*. However, from an educational perspective, a more significant finding is the increased understanding of students about the food production cycle and resource management. Students understand the process from planting to distribution, so that learning does not stop at the production stage, but includes planning, management, and evaluation of results. This experience formed simple entrepreneurial and management literacy that is relevant to real life.

The philosophy of "plant what you eat and eat what you plant" serves as the basic value of self-reliance education. This value is internalized in the mindset of students about the importance of effort, patience, and responsibility for resources. An interview with the head of the Miftahul Islamic boarding school Huda Al-Musri explained:

"For us, the food security program at Islamic boarding schools is not only about meeting the food needs of students, but also part of independence education. We instil a simple philosophy, which is to plant what we eat and eat what we grow. From there, students learn that every food has a process, requires effort, patience, discipline, and responsibility. When they go directly to cultivate the land, take care of the crops, and understand the environmental conditions, they learn to appreciate nature and realize that food production should not damage the ecosystem. Indeed, pesantren are not yet completely independent in all commodities, but the process of getting there becomes an important learning space. Students began to understand the limitations of production, dependence on external parties, and the need for a gradual strengthening strategy. In our opinion, this kind of awareness forms the character of students who are critical, reflective, hardworking, and care about the sustainability of people's lives." (WPP: 07, cl.02).

Based on interviews, food security is understood as a process of character education that fosters discipline, hard work, and concern for the environment. Students not only learn to produce food, but learn to appreciate the process and understand the ecological consequences of every production action. Although, *pesantren* are not yet fully independent in all commodities, the ongoing learning process shows a gradual increase in awareness of the importance of reducing external dependence. Students understand the limitations of production capacity and learn to design a gradual strengthening strategy. This awareness shows the development of the ability to reflect and think critically about real conditions.

Thus, the findings of the study show that food security is an integrated learning program that connects land, students, curriculum, and *pesantren* production facilities. The process includes the practice of planting, caring for, harvesting, processing waste, raising livestock, managing fish ponds, and distributing crops. The output appears in the form of productive rice fields, vegetable gardens, fish ponds, livestock, compost, maggot feed, and food products for internal needs. However, the main impact is more profound, namely the formation of the character of students who are independent, disciplined, environmentally caring, collaborative, critical, and reflective. This program makes food a socio-ecological educational medium that strengthens the capacity for sustainable living in Islamic boarding schools, while fostering a culture of hard work and collective responsibility in the daily *pesantren* community.

3.1.3 CIPP Evaluation

The results of CIPP's evaluation of the circular economy-based food security program at *Ecopesantren* Miftahul Huda Al-Musri show that the program is in the very good category with a quantitative average score of 4.26. These quantitative findings are strengthened by qualitative data through observations, interviews, and documentation that show that food security programs not only function as food production activities, but also as an integrated learning ecosystem that shapes students' knowledge, skills, character, and self-reliance culture.

In the context aspect, the quantitative results show that the program is considered relevant to the needs of students and the *pesantren* environment. The value of Islamic education, circular economy, and sustainability obtained the category of very good. Qualitative findings corroborate this through interviews and observations that show that agricultural land use is not just an economic decision, but part of a contextual educational design. Students learn to recognize local potential, understand soil, water, seasons, seeds, and agricultural ecosystems. Thus, this program is relevant to the socio-ecological needs of Islamic boarding schools and strengthens students' awareness of the environment and food independence.

In the input aspect, the quantitative results show that the availability of agricultural facilities, integrated facilities, curriculum, and supervisory resources is in the good to very good category. The qualitative findings clarify that the main inputs of the program include agricultural land, rice fields, fish ponds, livestock, horticultural gardens, waste treatment, compost, maggots, students, *pesantren* leaders, peer tutors, as well as a non-formal curriculum based on the *ancub* or "*nyebur*" model. This qualitative data corroborates the results of the survey because it shows that program resources are not only available physically, but also used as direct learning spaces for students.

In the Process aspect, the quantitative results show that the planning, implementation, student involvement, supervision, evaluation, and follow-up of the program are going well. The highest score is in the supervision aspect, while monitoring is still an aspect that needs to be strengthened. Qualitative findings support these results by showing that the learning process takes place through hands-on practice, such as planting, caring for plants, harvesting, raising fish, managing livestock, processing waste, composting, and developing maggot feed. This process is also strengthened by participatory learning, collaboration between male and female students, and a peer tutor system between senior and junior students. Thus, the program process is not only technical, but also educational, reflective, and based on real experience.

In the Product aspect, the quantitative results show that the program produces harvests, processed products, student innovation, and real benefits for the internal needs of the *pesantren*. Qualitative findings corroborate these results through documentation that most of the harvest is used for the needs of Islamic boarding schools. The output of the program appears in the form of productive rice fields, vegetable gardens, fish ponds, livestock, horticultural products, processed food products, compost, maggot feed, and crop distribution activities. These outputs are tangible or visible results, because they can be observed directly as evidence of production activities and field learning.

Meanwhile, in the Outcome aspect, the quantitative results showed that the program was very good in shaping the character of discipline, responsibility, environmental concern, and independence of students. The qualitative findings strengthen these achievements by showing that students not only learn to produce food, but also learn to appreciate the process, understand resource limitations, think critically, work together, and realize the importance of reducing dependence on external parties. The philosophy of "plant what you eat and eat what you grow" is the basic value that shapes the culture of independence, hard work, patience, responsibility, and ecological concern. This outcome is intangible because it is related to changes in attitudes, character, mindsets, learning culture, and socio-ecological capacity of students.

Thus, quantitative and qualitative results show a mutually reinforcing relationship. Quantitative data provides an idea that the circular economy-based food security program has been implemented in the very good category, while qualitative data explains in more depth how and why these achievements have occurred. Qualitative findings show that the success of the program does not only lie in crops or production activities, but also in the transformation of students as active learners who

have ecological literacy, technical skills, collaborative skills, leadership, independence, and concern for environmental sustainability. Therefore, the food security program at *Ecopesantren* Miftahul Huda Al-Musri can be understood as a model of food security education that is holistic, contextual, participatory, and oriented towards the formation of character and culture of *pesantren* independence.

3.2 Discussion

Circular economy-based food security education in *Ecopesantren* serves as a holistic ecological learning mechanism (Sjaifuddin, Hidayat, Fathurrohman, Ardie, & El Islami, 2019). This pattern is in line with the concept of *education for sustainability* which emphasizes the integration of knowledge, values, and actions in a single educational praxis unit (Hamid, Kamaruzaman, & Rasul, 2024). The practice of organic agriculture, waste management, and the use of local resources in *pesantren* are not just technical activities, but instruments for transforming students' ecological awareness through the internalization of Islamic values such as caliphate (responsibility to prosper the earth), *amanah*, and *tawazun* (balance) (Fuseini & Lever, 2021). Thus, food security education in *ecopesantren* becomes a meeting space between spirituality and ecology that reinforce each other.

The results of this study are in line with international studies on *Education for Sustainable Development* (ESD) that emphasize the development of sustainable values, attitudes, and behaviors, not just conceptual knowledge (Lagoudaki, Gareiou, & Zervas, 2024). High scores on character and independence indicate affective-action achievement as recommended by UNESCO. These findings are also consistent with experiential learning theory which states that direct involvement in production practices improves learning comprehension and retention (Bayram, 2024). In contrast to many international studies that are still limited to formal school projects, the *ecopesantren* model shows the integration of sustainability practices in everyday culture. In addition, compared to religion-based education which is generally normative, this study shows the transformation of religious values into concrete ecological actions through the circular economy.

In terms of context in the CIPP framework, the high relevance of the program that appears in the survey results is strengthened by the objective condition of *pesantren* which has a large land base and a large student community. This is in line with *the theory of contextual education* which asserts that learning will be more meaningful if it is directly linked to the social and ecological reality of students (Rao, Li, Murphy, & Chu, 2023). When students live in a rice field environment and consume their own crops, food security is no longer an abstract concept, but a concrete experience that they feel every day. By utilizing this local potential, *pesantren* succeeds in making food security education an organic part of student life, not just material in the syllabus.

Food security learning in *pesantren* cannot be separated from the religious dimension that binds all daily practices (Rao et al., 2023). The activities of planting, raising fish, processing waste, and harvesting agricultural products are understood as part of worship and a form of obedience to the command to protect the earth. This approach is in line with the eco-Islamic idea of Muhammad et al (2024) who see the human relationship of nature as an ethical and spiritual relationship that demands maintenance, not exploitation. The integration of Islamic values in circular economy practices is what distinguishes the pedagogical *ecopesantren* model from the secular and technocratic environmental education programs.

From an input perspective, the availability of infrastructure facilities and curriculum integration have proven to be an important foundation for the success of the program. The existence of agricultural land, fishery facilities, livestock, greenhouses, and waste treatment units allows the application of *experiential learning* as developed by Kolb (Shaalán, 2020), where students learn through a cycle of concrete experiences, reflection, conceptualization, and experimentation. The *ancub/nyebur* program that requires students to "go directly to the field" reflects the application of *constructivist pedagogy* that places students as active subjects in building knowledge, not just recipients of information from the *ustadz* (Konishi & Chesney, 2024). However, the input analysis also revealed that there are limitations in the competence of human resources, especially the accompanying *ustadz* who are not all from agricultural or circular economy backgrounds. This condition affirms the findings of previous research by Boeve-de Pauw & Van Petegem (2018) that the success of *ecopesantren* programs is greatly influenced by the capacity of facilitators in managing environment-based learning and food production. Within

the framework of CIPP, this weak point shows the need to strengthen capacity through continuous training, partnerships with research institutions or universities, and collaboration with sustainable agriculture practitioners so that the quality of assistance for students increases.

In terms of process, the orderliness of planning and implementation discipline indicate the proper functioning of an effective program management system. Activities that are carried out regularly, scheduled, and continuously supervised form a structured work culture among students. This is in line with *organizational learning theory* which emphasizes the importance of procedures, operational standards, and evaluation mechanisms in ensuring the sustainability of a program (Ademi, Sætre, & Klungseth, 2024). Intensive supervision of *ustadz* and those in charge of the program also shows the function of guided participation, where students learn through direct assistance in real work situations so that technical competencies and work attitudes are formed simultaneously.

The active participation of students in the entire series of food security activities emerged as one of the main strengthening factors for the success of the program. This is in line with the literature on *youth agripreneurship* which emphasizes that the involvement of young people in the food sector should be direct, practical, and provide space for the experience of success (Thephavanh, Philp, Nuberg, Denton, & Alexander, 2022). Male students tend to be more dominant in rice fields and fish ponds, while female students manage vegetables, chilies, greenhouses, and life skills such as product processing and handicrafts. This pattern shows a gendered but still complementary division of roles (Makaudze, 2024), where both contribute significantly to the food security of the *pesantren* community.

The application of circular economy principles in *ecopesantren* is reflected through the processing of organic waste into compost, maggot cultivation as feed, and the design of integrated agriculture, fisheries, and livestock systems (Taufik, Kejora, Komariah, Herawan, et al., 2025). This practice reinforces the concept of *regenerative food systems* that rejects the linear pattern of "take-use-throw away" and replaces it with a cycle that constantly updates resources (El-Sayed & Cloutier, 2022). Students learned firsthand that waste is not the end, but can be reprocessed into new value. Through the "reduce-reuse-recycle" approach, *pesantren* build an ecological lifestyle that strengthens food security and fosters environmental awareness, spirituality, and community independence (Izzati Ramli, Shafee Kalid, & Wan Ahmad, 2021).

In the aspect of monitoring and evaluation, the program shows a pattern of routine supervision of cultivation activities and waste management, which is used as the basis for improvement. However, qualitative findings indicate that most of the monitoring mechanisms are still informal and depend on the experience and intuition of the managers. This is in line with the general character of community-based educational institutions that often rely on an organic rather than a procedural approach. Monitoring and evaluation of programs are essential to ensure the effectiveness and sustainability of the initiatives carried out, especially in the context of food security based on a circular economy (Izzati Ramli et al., 2021). By conducting regular monitoring, related parties can identify problems and challenges that arise in cultivation and waste management activities, so that they can take timely corrective steps. Systematic evaluation allows for an assessment of the program's impact, both environmentally, socially, and economically, and provides the data needed for better decision-making in the future. To ensure the scalability and replication of the model, it is necessary to develop a more structured documentation, recording, and evaluation system without eliminating the flexibility typical of Islamic boarding schools.

In terms of products, the success of harvesting rice, vegetables, fruits, as well as various processed products and handicrafts of students shows that food security education not only leaves a pedagogical impact, but also an economic impact. The concept of *school-based enterprise* appears here, where *pesantren* are not only learning institutions, but also production units that are able to provide some of their own food needs and generate added value. *School-Based Enterprises* (SBEs) provide hands-on experience to learners through involvement in real business activities that bridge theory and practice. Collaboration between schools and businesses enables shared innovation, including the integration of digital technologies to strengthen communication, training, and skills development. Through this approach, SBEs effectively improve students' technical competence, soft skills, and job readiness holistically (He, Xie, & Li, 2017). The resulting product becomes a learning artifact as well as

concrete evidence that the learning carried out is relevant, useful, and has a direct impact on the life of the community.

In the outcome aspect, the formation of student character is the most prominent finding. Discipline, a sense of responsibility, cooperation, and concern for the environment are formed through work routines in rice fields, ponds, gardens, and waste treatment units. This strengthens the view that *pesantren* are unique ethical character formation institutions, where ecological habitus is formed through repeated practices in an environment full of religious values (Davy, 2023). The example of ustadz who are directly involved in food security activities strengthens the internalization of values, in line with the concept of hidden curriculum which emphasizes the role of educator behavior as the most effective educational message.

Overall, this discussion places the circular economy-based food security education model at the Miftahul Huda Al-Musri *Ecopesantren* as a significant innovation in the discourse of sustainable Islamic education. The integration between religious values, ecological practices, and circular economy logic makes *ecopesantren* not only a center for religious learning, but also a socio-ecological laboratory that prepares students to face food and environmental crises. Theoretically, these findings enrich the development of the concept of green Islamic education, while practically, it offers a model of food independent *pesantren* that can be replicated and developed in various regions as an adaptive strategy to face the global food crisis.

4. CONCLUSION

The circular economy-based food security program at *Ecopesantren* Miftahul Huda Al-Musri shows that sustainability education can be fully integrated into a value-based learning system. The main educational insight from this study is that food security is not just a production activity, but a pedagogical strategy that shapes ecological literacy, social responsibility, and student independence. Through practice-based learning, students not only understand the concept of sustainability, but also experience firsthand the production process, resource management, and value reflection, so that there is a transformation of attitudes and behaviors. Theoretically, this research enriches the study of Islamic education by showing that religious values can be operationalized through systemic circular economy practices. The integration of the CIPP model with food security education expands the evaluation function from mere program measurement to analysis of socio-ecological learning ecosystems. In practical terms, these findings provide an implementable example of how the curriculum can combine contextual learning, hands-on experience, and character building in one integrated system. The policy and curriculum implications of this study emphasize the importance of including food security and circular economy education as part of sustainability education strategies in community-based educational institutions. Strengthening educator competencies, a more structured monitoring system, and integrating project learning in the curriculum are important steps to ensure the sustainability of the program. This model shows that educational institutions can play a role as agents of social and environmental transformation.

However, this study has limitations in the context of a single location and the typical characteristics of Islamic boarding schools that have large land and a strong communal culture. Future research can test this model in the context of public schools, madrasas, or urban educational institutions with limited resources, as well as develop longitudinal evaluation instruments to measure long-term impacts. This *ecopesantren* model can be adapted outside the context of *pesantren* through a community-based approach, small-scale land use or urban farming, and the integration of sustainability projects in the formal curriculum. With adjustments to the local context, the principles of value integration, ecological practices, and the circular economy remain relevant as the foundation of sustainable education.

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