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INTEGRATION OF LOCAL WISDOM AND INFORMATION TECHNOLOGY IN THE CIRCULAR ECONOMY IN THE ERA OF CLIMATE CRISIS AT THE ISLAMIC BOARDING SCHOOL IN JEMBER

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Abstract: This study examines the implementation of circular economy principles at the microeconomic level through the integration of local wisdom and digital technology at the Jalaludin Ar-Rumi Islamic Boarding School in Jenggawah. The novelty of this research lies in the development of an integrative model that combines circular economy practices based on local wisdom of Islamic boarding schools with the use of digital platforms (YouTube) as instruments for education, documentation, and expansion of social and environmental impact—an approach that has been limited in its study in the context of community-based Islamic educational institutions. The research uses a phenomenological qualitative approach with data collection techniques through participatory observation, in-depth interviews, and documentation analysis. The analysis focused on practices based on local wisdom that are in line with the 3R (reduce, reuse, recycle) strategy, particularly in organic waste management. A 70% reduction in waste was measured by comparing the volume and weight of daily organic waste before and after the program's implementation during a six-month observation period, with systematic recording and verification of the pesantren's internal documentation. The results show that the integration of circular economy practices, local values, and digital technology significantly improves resource management efficiency, strengthens the ecological awareness of santri, and expands the dissemination of environmental education to the wider community through digital media. The results show that the integration of circular economy practices, local values, and digital technology significantly improves resource management efficiency, strengthens the ecological awareness of Islamic boarding school students, and expands the dissemination of environmental education to the wider community through digital media. These findings confirm that an Islamic-based circular economy is not only normatively relevant, but also operationally and measurably relevant, contributing to the transition towards a low-carbon, resource-efficient, and socially inclusive economy.

Keywords: *Circular economy; Local wisdom; Digital technology; Islamic boarding schools; Sustainability.*

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1. Introduction

Climate change is a global challenge that demands the transformation of production and consumption systems towards a more sustainable model. One approach that has grown rapidly in recent decades is the circular economy, a system that emphasizes resource efficiency through waste reduction and optimization of material cycles in a closed-loop system (Liu & Bai, 2014). Unlike the linear economic model, which is oriented towards a take-use-dispose pattern, the circular economy seeks to minimize residues while increasing the added value of resources through reduce, reuse, and recycle (3R) strategies.

Circular economy studies have so far focused on large industrial sectors and urban areas, particularly in the context of industrial waste management, material efficiency in the manufacturing and construction sectors, and sustainable production technology innovation (MacArthur, 2019; Korhonen et al., 2018; Ghisellini et al., 2015). Although contributing significantly to the development of a green economy, this approach has relatively neglected community-based practices on a micro scale, particularly in religious educational institutions such as Islamic boarding schools.

In Indonesia, Islamic boarding schools have unique socio-cultural characteristics and local wisdom traditions that are in line with the principles of sustainability. Local wisdom has long been recognized as a traditional knowledge system that is effective in maintaining ecosystem balance (Berkes, 2017; Geertz, 2008). Practices such as organic waste management through composting (Latifah, 2020), water conservation based on traditional irrigation systems such as Subak in Bali (Wilson, 2015), and simple lifestyles that emphasize resource efficiency (Martiningsih et al., 2024) show that sustainability values are embedded in local culture.

In the context of Islamic boarding schools, this potential is reflected in the practices of organic waste management, reforestation, and the implementation of an energy-efficient lifestyle. Organic waste such as food scraps and leaves can be processed into compost that supports organic farming, while also contributing to the reduction of greenhouse gas emissions and increasing soil fertility (MacArthur, 2019). Several Islamic boarding schools have adopted simple technologies such as biopores and biodigesters to reduce waste volume and produce organic fertilizer that can be reused.

One example is the Jalaluddin Ar-Rumi Islamic Boarding School in Jenggawah, Jember, which has developed the “Santri Peduli Lingkungan” (Students Care for the Environment) program through waste sorting, reforestation, waste bank management, and river pollution education activities. This program involves collaboration with environmental communities and village governments in addressing domestic waste issues. These practices show the beginnings of community-based circular economy implementation integrated with local values.

On the other hand, the development of digital technology has opened up new opportunities to expand the impact of sustainability practices. Social media and digital platforms such as YouTube have proven to be effective tools for environmental education and awareness campaigns (Martiningsih et al., 2024). In fact, digital technology and the Internet of Things (IoT) have been used in monitoring resource and waste management to improve environmental efficiency (Brous et al., 2020). However, the use of digital media in the context of Islamic boarding schools is generally still communicative in nature and has not been studied as an integral part of a community-based circular economy model (ST Setiawan et al., 2023; Ertando et al., 2025).

Based on this literature review, three research gaps can be explicitly identified.
First, circular economy research is still dominated by industrial and urban approaches, resulting in a lack of empirical studies on religious community-based institutions in rural areas.
Second, studies on local wisdom tend to discuss environmental conservation aspects normatively, without integrating them operationally into a measurable circular economy framework.
Third, although digital technology has been extensively researched in the context of environmental campaigns, there has been little research examining the systematic integration of the circular economy, local wisdom, and digital media in a single community-based sustainability model.
Therefore, this study aims to develop and analyze an integrative model that combines circular economy principles, local wisdom, and digital technology within the context of Islamic boarding schools (pondok pesantren). This model is expected not only to strengthen sustainable resource management practices at the micro level, but also to contribute theoretically to the expansion of community-based circular economy studies and to provide a replicable framework for other communities in Indonesia as well as at the global level.

2. Research Method

This study employs a qualitative approach, which is intended to understand phenomena experienced by research subjects—such as behavior, perceptions, motivations, and actions—holistically, through descriptive forms of words and language within a specific natural context by utilizing various naturalistic methods (Miles, 1994). This qualitative approach is used to address the research questions proposed in this study. The type of research applied is phenomenological research.

a. Circular Economy as a Solution to the Climate Crisis

The circular economy is an approach that emphasizes waste reduction and resource optimization through closed-loop cycles (Liu & Bai, 2014). Previous studies have largely focused on large industrial sectors and urban areas (MacArthur, 2019), with particular attention to:

1) Industrial waste management aimed at minimizing environmental impacts through reuse and recycling strategies (Wilson, 2015).
2) The utilization of recycled materials in the construction and manufacturing sectors to improve material efficiency (Ghisellini et al., 2015).
3) Technological innovation in sustainable production, which significantly contributes to the development of a green economy (Korhonen et al., 2018).

Research Gap: Although these studies have demonstrated success at the macro level, the integration of circular economy concepts within local wisdom–based communities remain limited. Community-based circular economy models offer significant potential for creating more inclusive and locally oriented approaches (Martiningsih et al., 2024).

b. Local Wisdom as a Source of Sustainable Knowledge

Local wisdom functions as a source of traditional knowledge that has proven effective in preserving ecosystems and environmental sustainability (Geertz, 2008; Berkes, 2017). In Indonesia, local wisdom practices that support sustainability include:

1) Organic waste management through traditional methods such as composting, which forms part of integrated agricultural systems (Ertando et al., 2025).

2) Water and soil conservation through traditional irrigation systems, such as Subak in Bali, which has been recognized as a UNESCO World Heritage Site (Martiningsih et al., 2024).
3) Energy-saving lifestyles inherited within pesantren communities, focusing on natural resource efficiency and values of simplicity (Muhaimin, 1995).

Research Gap: Studies related to local wisdom are generally limited to anthropological or cultural approaches (Wilson, 2015), without linking them to modern economic concepts such as the circular economy. In fact, the integration of local wisdom with advanced technology has the potential to create more comprehensive sustainability solutions.

c. Advanced Technology as a Support for Sustainability

Advanced technologies, such as the Internet of Things (IoT), social media, and digital platforms, have brought significant transformation to resource management and information dissemination. Several studies indicate that:

1) IoT is used for resource monitoring and waste processing, enabling greater efficiency in environmental management (Brous et al., 2020).
2) Digital media, such as YouTube and other social media platforms, are effective tools for environmental education and awareness campaigns (Latifah, 2020).

Research Gap: However, research addressing the use of digital technology in documenting, disseminating, and strengthening community-based local wisdom practices within the context of the circular economy remains very limited. These technologies have great potential to connect traditional practices with modern approaches (Ertando et al., 2025).

d. Integration Model: Circular Economy, Local Wisdom, and Advanced Technology

This study proposes an integration model that combines three main elements:

1) The circular economy as a framework for sustainable resource management (Korhonen et al., 2018).
2) Local wisdom as a source of traditional knowledge that is effective in environmental conservation (Berkes, 2017).
3) Advanced technologies, such as digital media and IoT, to support the dissemination of best practices and enhance environmental awareness (Brous et al., 2020; ST Setiawan et al., 2023).

2.1 Research Location and Informants

The research was conducted at Pondok Pesantren Jalaluddin Ar-Rumi, located in Jenggawah District, Jember Regency. Research informants were selected using purposive sampling based on the following criteria:

1. Directly involved in the pesantren's environmental management programs.
2. Possessing knowledge or experience in circular economy activities (e.g., waste management or waste bank initiatives).
3. Participating in the use of digital media for environmental education.

Based on these criteria, 12 key informants were selected, consisting of:

- 2 Islamic Boarding School Caregivers
- 3 Ustadz/Teachers
- 5 Students who are members of the Waste Care Program (PS)
- 2 Managers of Bank Sampah Nusantara (BSN)

In addition, one Focus Group Discussion (FGD) was conducted involving pesantren administrators, environmental program managers, and student representatives.

2.2 Data Collection Techniques

The research data were collected using three primary techniques:

1. Participatory observation, to directly observe organic waste management practices and waste bank activities.
2. Semi-structured interviews, to explore informants' perceptions of the integration of local values and circular economy practices.
3. Documentation, including activity reports, digital content (YouTube), and archives of the pesantren's environmental programs.

2.3 Data Analysis Techniques and Data Validity

Data analysis (Miles & Huberman, 1994) was conducted through the following stages:

1. Data reduction
2. Data display
3. Conclusion drawing/verification

Data validity was tested through source triangulation and method triangulation to ensure the consistency of empirical findings obtained from various data collection techniques. Research on the circular economy, local wisdom, and advanced technology has become a rapidly growing topic over the past few decades, particularly as an effort to address the global climate crisis. The circular economy provides innovative solutions for more efficient resource management, while local wisdom has long been recognized as traditional knowledge that effectively supports environmental sustainability (Ghisellini et al., 2015; Berkes, 2017). To understand the novelty of this study, it is essential to review recent developments as well as existing research gaps.

3. Results and Discussion

Empirical Findings: Thematic Categories of Circular Economy Implementation

Based on the coding process and thematic analysis of interview and FGD results, three main categories of findings were identified regarding the implementation of a circular economy based on local wisdom and digital technology at Pondok Pesantren Jalaluddin Ar-Rumi.

Theme 1: Internalization of Local Wisdom Values as the Basis for Circular Behavior

The values of simplicity (*zuhud*) and the prohibition of excessive behavior (*israf*), which are taught in pesantren life, serve as normative mechanisms in shaping sustainable consumption behavior among students.

As stated by one of the pesantren caregivers:

> "Students are accustomed not to be wasteful; even food leftovers are collected and processed into compost for the pesantren's plants." (Caregiver-1)

A similar statement was also expressed by a student who is a member of the Waste Care Program:

> "We do not immediately dispose of organic waste, but instead separate it to be used as fertilizer in the pesantren's garden." (Student PS-2)

These findings indicate that the *reduce* practice within the 3R strategy is not merely driven by technical environmental awareness, but also by the internalization of religious and local cultural values that have long been embedded in the pesantren educational system.

Theme 2: Transformation of Waste Management Systems from Linear to Circular

The implementation of the Waste Care Program (PS) and Bank Sampah Nusantara (BSN) has transformed waste management patterns from a conventional system into a closed-loop system.

A BSN manager explained:

> "Previously, waste was simply collected and burned; now it is sorted into organic and inorganic categories, and some of it is even sold to support the pesantren's operational needs." (BSN Manager-1)

This change reflects a shift from a linear economic model toward circular economy practices that emphasize resource reuse. In addition, waste bank activities generate additional economic benefits for the pesantren, thereby supporting the principles of social and economic sustainability.

Theme 3: The Role of Digital Technology in Replicating Local Practices

The use of digital platforms such as YouTube functions both as a documentation medium and as a means of disseminating community-based circular economy practices.

An ustadz stated:

> "The waste management videos we uploaded have been viewed by people from outside the community; some have even come to learn directly." (Ustadz-2)

This indicates that digital technology functions not only as a communication tool but also as a knowledge transfer medium that enables the replication of sustainability practices by other communities beyond the pesantren.

Based on the theoretical synthesis of Ghisellini et al. (2015), Berkes (2017), and Hart et al. (2003), this study develops an integrative model that positions:

- Local wisdom as a normative foundation (moral and spiritual values toward the environment),
- Circular economy as an operational mechanism for resource management, and
- Digital technology as an accelerator for the dissemination and replication of sustainability practices.

The integration of these three elements forms a community-based sustainability system that is oriented not only toward resource efficiency but also toward value-based sustainability.

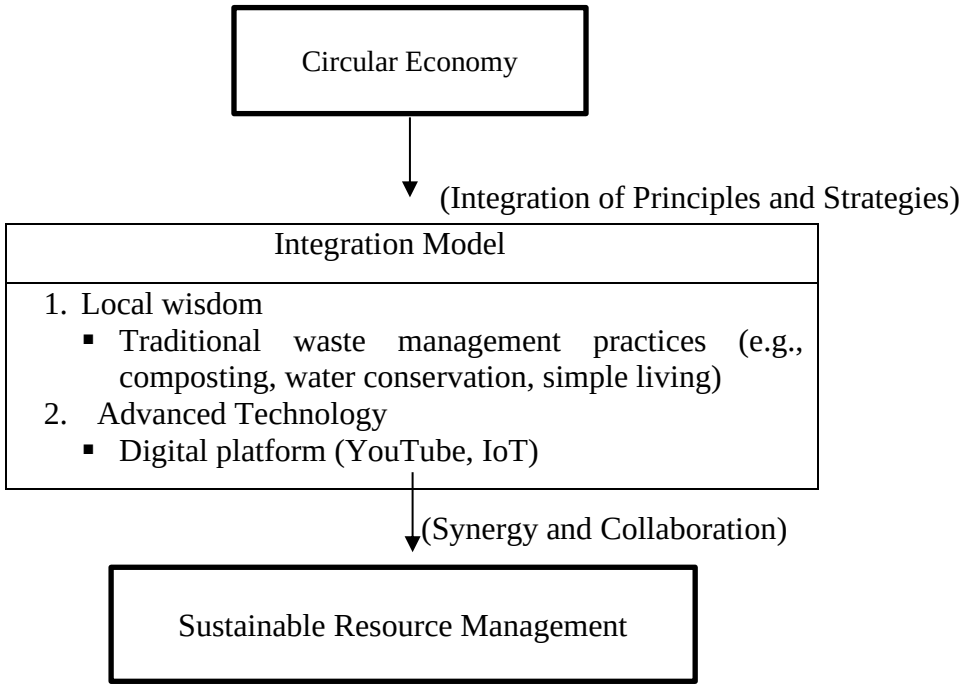

Figure 1. Conceptual Framework

The model developed in this study focuses on strengthening community-based sustainability practices, with the integration of circular economy, local wisdom, and digital technology. This model is expected to be replicated by various other communities in Indonesia and adopted at the international level, thereby contributing to broader sustainable development (Muhaimin, 1995); (Liu & Bai, 2014). The circular economy provides structure and efficiency, while local wisdom provides social legitimacy and spiritual value. The integration of the two gives rise to a sustainability model that not only emphasizes resource efficiency but also value-based sustainability—sustainability rooted in the values, culture, and ecological awareness of the community. Therefore, this study focuses on the object of the Islamic boarding school area in Jember.

Empirical Findings

The thematic analysis generated three main categories of findings:

(1) Internalization of Local Wisdom Values in Circular Economy Practices

The value of simplicity taught in pesantren life contributes to sustainable consumption behavior among students.

One informant stated:

> "We are taught not to waste food and to utilize organic leftovers as fertilizer for the pesantren's plants." (Student PS-3)

This practice reflects the implementation of the *reduce* principle within the 3R strategy of the circular economy (Ghisellini et al., 2015).

(2) Transformation of the Waste Management System

Prior to the implementation of the Waste Care Program (PS) and Bank Sampah Nusantara (BSN), waste management was carried out individually and in an unstructured manner.

A BSN manager stated:

> "Previously, waste was simply collected and burned; now it is sorted and has economic value." (BSN Manager-1)

This transformation indicates a shift from a linear model toward a closed-loop waste management system.

(3) The Role of Digital Technology in Replicating Local Practices

Digital media platforms such as YouTube are utilized to document community-based waste management practices.

An ustadz explained:

> "Through the videos we upload, communities outside the pesantren have begun to replicate our waste management practices." (Ustadz-2)

This demonstrates that digital technology functions as a medium for the diffusion of social innovation in sustainability practices (Brous et al., 2020).

4. Conclusion

This study provides empirical contributions to the development of a circular economy implementation model at the micro level through the integration of local wisdom and digital technology within a community-based educational institution, namely the Islamic boarding school (pesantren). The main findings indicate that the application of circular economy principles aligned with local wisdom values—such as living simply and avoiding excessive consumption—can shape collective ecological behavior that supports resource-use efficiency.

The integration of these values with waste management practices based on the 3R strategy (*reduce*, *reuse*, *recycle*) has proven effective in reducing organic waste volume by up to 70% through systematic sorting, reuse, and waste processing mechanisms at the institutional level.

In addition, the utilization of digital technology, particularly video-sharing media, serves as a catalyst for expanding the reach of environmental education and for continuously documenting community-based circular economy practices. The digitalization of local practices not only enhances internal ecological awareness among students but also facilitates the dissemination of knowledge to the broader community, thereby strengthening the social impact of circular economy implementation.

Practically, the results of this study imply that an integrative model combining circular economy principles, local wisdom (Traditional Ecological Knowledge), and digital technology can be replicated in other Islamic educational institutions as a strategy for sustainable, low-carbon, and socially inclusive resource management. This approach also has the potential to serve as an operational framework for supporting the transition toward sustainable development based on contextual and applicable Islamic values at the community level.

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