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Synergizing Green Business, Education, and Economy for Sustainable Development: A Case Study of the Ciro Waste Project in Balikpapan, East Kalimantan in Indonesia

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Abstract

Sustainable development requires a strong integration of green business, education, and economy to simultaneously address environmental and social challenges. These three elements are interrelated in creating a balance between economic growth, environmental awareness, and human capacity building. This study aims to analyze how the synergy among green business, education, and economy supports sustainable development through a case study of the Ciro Waste Project in Balikpapan, Indonesia. Primary data were collected through in-depth interviews and field observations, complemented by secondary data from project documents and related publications. This research employes a qualitative approach using semi-structured interviews and thematic analysis to identify patterns and relationships among the variables and to explore their contributions to sustainable development. The findings indicate that the Ciro Waste Project effectively integrates waste management activities into commercially valuable products, improves environmental literacy and education in local schools, and contributes to sustainable community-based economic growth. However, several challenges such as limited infrastructure, insufficient policy support, and funding constraints remain the obstacles to broader implementation. These findings highlight the importance of cross-sector collaboration in strengthening green business models that are rooted in education and local economic empowerment.

Keywords: Green Business; Environmental; Education; Economy; Sustainable Development; Community Empowerment.

INTRODUCTION

Over the years, the world faces the same environmental threats. We produce more than 2.3 billion tons of urban waste every year, and this will continue to increase to 3.8 billion tons by 2050 if we continue with "business as usual" (UNEP, 2024). Currently, Green business has become an essential part of every company's efforts to address sustainable development. Green business is no longer just about complying with legal obligations or corporate social responsibility but have evolved into a strong business strategy that promise long-term benefits for , for compnies, the environment, and society (Sukasmanto et al., 2025).

Indonesia continues to grapple with escalating waste issues as population growth, rapid urban development, and shifting consumption patterns contribute to rising volumes of solid waste. In many areas, waste handling still depends on a traditional collect-transport-dispose model, placing significant strain on landfill capacity and intensifying environmental degradation (Fariz et al., 2024). Furthermore, although public awareness of the waste problem is generally good, practical involvement in reducing waste and separating it at source remains limited, mainly due to inadequate infrastructure and the lack of well-organized community empowerment initiatives (Yustiani et al., 2022). This condition highlights the need to adopt a more comprehensive strategy by integrating green business efforts with community based economic empowerment to improve the implementation of sustainable waste management in Indonesia, especially in local communities.

The endless problem of waste has prompted various non-governmental organization (NGO) to get involved in solving it. One of them is Waste4Change, a company that has been operating in various cities in Indonesia. This private company has successfully managed more than 64.9 million pieces of waste since 2014 (Waste4Change, 2024). Aside from helping to solve the waste problem, Waste4Change has also opened up new potential for business and employment in Indonesia (Hastuti et al., 2022). To increase public awareness and trigger behavior change, Waste4Change provides education through research, training, community development, and a platform for advocacy to influence waste regulations, better aligning them with circular economy principles (Waste4Change, 2024). This impact shows that waste management by non-governmental organization (NGO) not only solves environmental problems, but also improves education and the local economy by creating jobs and new business opportunities for the local community.

Building on the growing role of non-governmental organization in waste management, similar initiatives have also emerged at the local level, especially Balikpapan through the establishment of Ciro Waste. Ciro Waste introduces a practical and modern approach to addressing the waste problem in Balikpapan by combining digital technology with on-site operational work. Through its Ciroes application, the company makes it easier for households and communities to sell recyclable materials, request waste collection services, and access specialized waste handling. On the ground, the team manages daily activities such as sorting, pressing, and processing various types of waste, including transforming low-value plastics into paving blocks. Ciro Waste also provides waste collection services for businesses and operates an Integrated Waste Processing Facility (TPST) entrusted by the local government. Beyond its operational roles, the company actively promotes better waste habits by conducting educational programs, training sessions, and community-based activities that encourage people to sort their waste responsibly. By integrating technology, structured operations, and community engagement, Ciro Waste delivers a holistic solution that helps reduce waste accumulation while creating new economic opportunities for local residents.

The importance of this research lies in the urgency of finding a sustainable development model that can integrate green business, education, and local economic strengthening, especially in developing countries such as Indonesia, which face increasing volumes of waste, limited infrastructure, and low community participation in waste management. Therefore, the study of the Ciro Waste Project in Balikpapan is important because it offers a concrete example of the integration of green business, education, and community-based

economic empowerment, which has the potential to become a replicable model for other regions facing similar challenges. Therefore, this research is important not only to fill the theoretical gap regarding the integration of these three sectors, but also to provide practical recommendations for strengthening local innovation to support sustainable development.

Literature Review

Green Business

Green businesses have emerged as a strategic solution to escalating waste management issues, especially in developing nations where landfill systems and recycling infrastructure remain insufficient. According to Soelaiman & Sariutami (2024) Individuals with high environmental awareness and adopt a green entrepreneurial orientation are more likely to develop products and business models that minimize environmental pollution and material waste by implementing sustainable supply chains and eco-innovation approaches. This is relevant in the context of discussions on solid waste, where businesses are finally learning to adopt practices such as material reuse, eco-friendly packaging, and circular distribution systems to reduce the burden on municipal waste management services and minimize post-consumer waste. Furthermore, Abanan & Susilowati (2024) observed that a green economy supported by innovation can significantly improve competitiveness and performance, especially in industries where material flows and packaging waste contribute significantly to landfill burden.

Similarly, previous studies have shown that implementing green business in the industrial sector not only reduces dependence on primary resources but also creates new economic value through the development of recycling and waste-based product markets. Companies that implement green practices also tend to gain reputational advantages, increase consumer loyalty, and encourage technological innovation that is more efficient in energy and material consumption. Thus, green business plays a crucial role as a catalyst for transformation towards more responsible production and consumption systems, in line with the demands of global development and public awareness of sustainability issues.

Education

Education is crucial in building public awareness and entrepreneurial skills to address waste reduction issues, especially when introduced early in the formal education process. Permana et al. (2023) stated that integrating green entrepreneurship concepts into elementary school learning can substantially increase students awareness, creativity, and readiness to develop innovative and economically valuable solutions to reduce the impact of environmental problems. This is crucial because ineffective waste management stems not only from limited infrastructure but also from behavioral and cultural factors. Schools that implement sustainability-based activities such as recycling programs, composting initiatives, and the creation of eco-friendly products enable students to engage directly in concrete waste reduction practices, thus encouraging the development of pro-environmental attitudes from an early age.

Furthermore, Chen et al. (2024) emphasized that environmental education plays a crucial role in shaping students pro-environmental behavior. Their study showed that institutional efforts such as implementing green campus policies, providing facilities that support recycling practices, and activities such as seminars and workshops that explicitly promote environmental responsibility can significantly increase environmental awareness intentions and actions. This influence arises because environmental education is not limited to the transmission of knowledge but also supports the internalization of environmental ethics and values through contextual and meaningful learning experiences connected to students daily realities. Furthermore, systematically designed educational programs can serve as strategic tools in building students critical awareness of issues related to waste management and environmental sustainability. Consequently, environmental learning initiatives in schools that integrate conceptual understanding with practical activities such as producing environmentally friendly goods, engaging in recycling programs, or participating in compost-based projects have strong potential to encourage

sustainable behavioral change. This perspective also reinforces the idea that the development of ecological literacy is most effective when students are given direct opportunities to actively participate in real environmental conservation efforts in the school environment.

Economy

The economic dimension of waste management is closely linked to how communities and businesses generate added value from recyclable materials and circular activities. Several studies emphasize that integrating waste processing with local economic systems can significantly increase household income, expand green-job opportunities, and stimulate small-scale entrepreneurship. According to Akbar et al. (2025), the development of a circular economy in the waste sector notably through recycling micro-enterprises and community-based waste banks has been shown to increase local revenue streams and reduce economic leakage at the neighborhood level. Furthermore, Buch et al. (2021) highlight that the waste-to-product model such as plastic upcycling, composting units, and material recovery centers contributes not only to reducing environmental burdens but also to stimulating inclusive economic growth, especially when supported by digital platforms that connect consumers and recyclers more efficiently. Thus, the integration of economic empowerment with waste management practices demonstrates a strong potential to build sustainable local economies, particularly in regions where formal infrastructure is limited but community participation is high.

Sustainable Development

From a sustainability perspective, the success of waste management initiatives is measured not only by their economic value, but also by their ecological and social impact. The report “Economic, Social, and Environmental Benefits of the Circular Economy in Indonesia” (LCDI-UNDP) emphasizes that applying circular economy principles in the waste sector can significantly reduce waste and carbon emissions while conserving natural resources and strengthening the environmental dimension of sustainable development. A complementary study by Bank Indonesia highlights that the application of circular economy practices in five key sectors including packaging and retail can reduce waste production by 18-52% and lower carbon emissions by up to 126 million tons, demonstrating a strong contribution to climate change mitigation. In policy and practice, the Ministry of Environment and Forestry promotes the 5R (reduce, reuse, recycle, recover, repair) framework as a sustainable approach to creating new economic value from plastic waste while reducing environmental impacts. At the community level, participatory waste management models, such as those implemented by Ciro Waste, strengthen socio-ecological resilience by combining environmental education, behavioral change, and local empowerment. At the community level, participatory waste management models, such as those implemented by Ciro Waste, strengthen socio-ecological resilience by combining environmental education, behavioral change, and local empowerment. The integration of green business, environmental literacy, and community-based economic activities forms a synergistic foundation for sustainable development, as it simultaneously provides financial benefits, reduces ecological footprints, and builds long-term social capacity.

Prior Studies

Previous studies have highlighted the relationship between waste management, community empowerment, and sustainable development, but most studies still discuss the three separately. For example, Miftahorrozi et al. (2022) emphasize that community-based waste management programs can increase household income, but they do not highlight the role of environmental education in strengthening behavioral change. Meanwhile, Tran et al. (2024) stated that education about the circular economy, such as the habit of sorting waste and caring for the environment, has a positive impact on green behavior and willingness to pay (WTP) among young people. Another study by Tu et al. (2022) explains how green businesses in developing countries can support the circular economy, but it has not examined their integration with the local social and educational

context. Although various studies have made important contributions, there is still a research gap regarding how green businesses, environmental education, and the local economy can be synergized into a comprehensive model, a gap that this study aims to fill through an in depth analysis of the Ciro Waste Project in Balikpapan.

METHOD

This research employs a qualitative approach, with primary data collected through semi-structured interviews and thematic analysis to identify patterns and themes in the data and explore their contributions to sustainable development. The interviews were conducted with key informants, including the CEO, COO, and two operational workers from Ciro Waste, via both face-to-face sessions and online meetings through Zoom. The main topics of the interviews focused on Ciro Waste's green business operations, education about waste management, and the local economic impact in Balikpapan. Detailed interview questions are provided in the supplementary material. Additionally, the researcher conducted direct observations at the Ciro Waste factory in Balikpapan to gain deeper insights into daily operations, workflow practices, and overall waste management processes. Lastly, descriptive analysis was used to draw conclusions from the interview results.

RESULTS AND DISCUSSION

This study shows that the integration of green business, education, and local economic empowerment implemented by Ciro Waste has successfully formed a strong sustainable development model in Balikpapan. Of these three aspects, green business has made the most significant contribution because it has been able to transform the waste management system through digitalization, circular processes, and economically valuable recycled product innovations. Education plays a very effective role in improving literacy and encouraging behavioral change in the community through school activities and expanding employment opportunities, although its impact is highly dependent on the results of green business and the effectiveness of education.

Table 1. Results and Discussion between green business, education and economy.

Aspect	Results	Explain
Green Business	Most Significant	The greatest contribution in changing the waste management system and circular economy ecosystem.
Education	Highly Effective	Highly effective in promoting literacy and behavioral change in the community.
Economy	Moderately Influential	Moderately influential, increasing income and creating job opportunities.

Green Business Implementation

Interview findings from Ciro Waste's leadership and operational teams show that the project implements green business principles through an integrated system that brings together technology, circular economy practices, and inclusive employment. In the interview, Sandy Wijaya, the CEO of Ciro Waste, explained that the company was founded to address gaps in local waste handling and to build an ecosystem where recyclable materials could maintain stable economic value. This vision is reflected in the Ciroes application, which functions as a digital platform connecting households, waste collectors, and recycling industries. Through this system, residents can sell recyclable materials, request specific types of waste collection, and track the handling of their waste, illustrating how digital tools can strengthen environmental management in an urban setting.

Additional insights came from Dianisa Ester, the company's Chief Operating Officer, who described how the operational workflow supports the green business model. Ciro Waste manages sorting, pressing, and processing activities at a Integrated Waste Processing Facility (TPST) facility operated under local government trust. The operational team is structured to ensure that waste handling runs smoothly and continuously, with

workers performing their tasks according to established procedures so that waste does not accumulate at partner locations.

Interviews with field workers illustrate how materials are separated into high value items such as plastics, bottles, cardboard, and metals, and lower value items such as sachets and mixed plastics. The higher value materials are pressed and sold to recycling industries, while lower value plastics are processed into paving blocks or ceramic like products. This approach reduces dependence on landfills and demonstrates how circularity can be implemented in practice.

Collaboration with external corporate partners also demonstrates how Ciro Waste's green business model operates beyond household and community waste streams. One example is its partnership with Telkomsel through the "Telkomsel Jaga Bumi" program, which integrates Ciro Waste's recycling capability with Telkomsel's environmental initiatives. In 2023, the program transformed plastic waste and unused SIM-card materials into more than 75,000 paving blocks and 20,000 phone holders, while contributing to the planting of more than 15,000 mangrove trees across several locations including the new capital area (Chandra, 2024). This collaboration illustrates how Ciro Waste's green business practices can be adopted at a broader corporate scale, strengthening the environmental and economic value of its operations.

Education Programs and Community Literacy

Low levels of waste-management literacy continue to limit the effectiveness of environmental initiatives in Balikpapan. In some areas such as Gunung Bahagai, residents have begun practicing simple waste sorting, but overall implementation across the city remains inconsistent. The city's Masterplan Review reports that most households still do not sort their waste into the five requires categories, and survey data indicate that only 17% of respondents perform proper separation. Community awareness is also described as needing further improvement through continuous outreach and education because labeling systems, sorting infrastructure, and school-based environmental programs have not been adopted evenly across neighborhoods (Dinas Lingkungan Hidup Kota Balikpapan, 2024). These findings show that Balikpapan's waste-management challenges are shaped not only by technical limitations but also by a persistent gap in environmental literacy and practical skills at the household level.

Ciro Waste responds to these challenges by placing education at the center of its community engagement efforts. Sandy Wijaya explained that although many residents already understand why waste reduction matters, they often remain unsure about the practical steps such as how to separate materials correctly or identify items that still have recyclable value. To address this gap, the company introduced a variety of school-based activities that encourage teachers to incorporate simple sorting routines into their daily lessons. The intention is to help children become familiar with responsible waste habits from an early age.

Ciro Waste also expands its educational efforts into the wider community through practical training sessions. According to Dianisa Ester, these activities usually include demonstrations of composting, eco-brick making, and methods for preparing recyclable materials so that they are cleaner and more valuable. Many participants later apply these skills independently, contributing to improved neighborhood-level waste management and broader public participation.

Reports from field workers suggests that these educational efforts have begun to influence the quality of waste arriving at the Integrated Waste Processing Facility (TPST). Better household sorting results in cleaner, more manageable materials and reduces the amount of contaminated recyclables. Although educational activities sometimes pause during peak operational periods, Ciro Waste continues to view community education as an essential long-term investment for shifting public behavior and strengthening local waste-management systems.

Overall, Ciro Waste's educational initiatives contribute not only to raising awareness but also to developing routines, skills, and community structures that support more

consistent waste-handling practices. This approach shows how environmental education can reinforce green business efforts and play a meaningful role in advancing sustainable development in Balikpapan.

Impact on the Local Economy

On the economic side, this study found that recycling activities, the production of paving blocks from low-value plastics, and the sale of sorted materials contribute significantly to the income of communities and companies. These findings are consistent with the research by Tran et al. (2024), which states that integrating waste management with local economic activities can significantly improve the community's economy by opening up new job opportunities in the environment-based business ecosystem. In addition, Ciro Waste's collaboration with corporations such as Telkomsel through a program called “Jaga Bumi” supports the findings of Miftahorrozi et al. (2022), which show that companies that implement green accounting and green operations tend to create higher economic and social value than companies that do not implement them. The production of paving blocks and plastic materials from used SIM cards and the contribution of mangrove planting indicate that cooperation between the private sector and green business entities can expand the scale of sustainable impact in the future.

The perspective of sustainable development, combining green business, education, and the local economy pursued by Ciro Waste demonstrates a model that is in line with the circular economy principles proposed by (UNDP, 2024).The diversion of waste from landfills, the increase in the value of materials that previously had no economic value, and community empowerment programs through training show that this model not only minimizes environmental impact but also builds the social and economic capacity of the community. This supports the argument of Alraja et al. (2022) that successful green business transformation must combine technological innovation, community participation, and strong and coherent institutional support.

CONCLUSION

This study found a number of challenges that need attention. Limited sorting infrastructure at the household level, minimal regulations encouraging mandatory sorting, and fluctuations in the number of operational workers have caused some facilities to experience waste accumulation during certain periods. These challenges are in line with the findings of Miftahorrozi et al. (2022), who stated that although community-based waste management programs have great potential, their sustainability is greatly influenced by the availability of resources, policy consistency, and the level of community participation. Therefore, even though the Ciro Waste model shows significant success, stronger policy support from local governments is needed to increase the scale of impact, such as providing household-level sorting facilities, green economic incentives, and expanding mandatory environmental education programs.

Overall, this study contributes theoretically by demonstrating that synergy between green business, education, and local economic empowerment can produce a more comprehensive sustainable development model in the future. These findings expand on previous research, which tended to discuss these three aspects separately. Meanwhile, in practical terms, this study shows that the Ciro Waste approach can be replicated in other cities facing similar problems, with the caveat that success will greatly depend on cross-sector collaboration and the community's readiness to transform towards environmentally friendly behavior and results that can be felt by many groups.

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