

OPTIMIZATION OF HOUSEHOLD PLASTIC WASTE MANAGEMENT THROUGH THE DEVELOPMENT OF AN INNOVATIVE WASTE BANK BASED ON LEGAL AND K3 EDUCATION

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Received: 28/06/2026

Revised: 02/03/2026

Accepted: 10/03/2026

Abstract. Household plastic waste management is a critical environmental issue that requires a comprehensive behaviour-based approach. This study aims to analyze the effectiveness of an integrated intervention model optimizing household plastic waste management in RT 34, Manggar Subdistrict, East Balikpapan. The program was designed using the Theory of Planned Behaviour (TPB) framework and implemented through a Participatory Action Research (PAR) approach with a quasi-experimental one-group pre-test/post-test design. The intervention consisted of three main components: the provision of innovative two-compartment trash bins, the establishment and operationalization of a waste bank system, and legal and Occupational Health and Safety (OHS) education. The study involved 85 households as research participants. Quantitative data were collected using Likert-scale questionnaires measuring attitudes, subjective norms, perceived behavioural control, and behavioural intentions, and were analysed using a paired-samples t-test. Secondary data were obtained from waste bank operational records, while qualitative data were analyzed thematically through observation and focus group discussions. The findings indicate statistically significant improvements across all TPB constructs following the intervention. Active community participation reached 88%, with managed plastic waste volume increasing to two-thirds of the bin capacity per month. These results demonstrate that the synergy of physical, institutional, and educational interventions effectively strengthens behavioural intentions and translates them into sustainable waste management practices. This model has strong potential to be replicated in other urban community empowerment initiatives based on circular economic principles.

Keywords: community empowerment, waste bank, waste management

Abstrak. Permasalahan limbah plastik rumah tangga merupakan isu lingkungan yang memerlukan pendekatan komprehensif berbasis perubahan perilaku. Penelitian ini bertujuan menganalisis efektivitas model intervensi terpadu dalam optimalisasi pengelolaan limbah plastik di RT 34 Kelurahan Manggar, Balikpapan Timur. Program dirancang menggunakan kerangka Theory of Planned Behavior (TPB) dan diimplementasikan melalui pendekatan Participatory Action Research (PAR) dengan desain kuasi-eksperimental one-group pre-test/post-test. Intervensi terdiri atas penyediaan bank sampah inovatif dua kompartemen, pembentukan dan operasionalisasi bank sampah, serta edukasi hukum dan Keselamatan dan Kesehatan Kerja (K3). Subjek penelitian melibatkan 85 kepala keluarga. Data kuantitatif dikumpulkan melalui kuesioner berbasis skala Likert untuk mengukur sikap, norma subjektif, persepsi kontrol perilaku, dan niat, serta dianalisis menggunakan Paired Samples t-Test. Data sekunder diperoleh dari catatan operasional bank sampah, sementara data kualitatif dianalisis secara tematik melalui observasi dan FGD. Hasil penelitian menunjukkan peningkatan signifikan pada seluruh konstruk TPB setelah intervensi. Tingkat partisipasi aktif warga mencapai 88%, disertai peningkatan volume sampah plastik terkelola hingga 2/3 kapasitas tong per bulan. Temuan ini membuktikan bahwa sinergi antara intervensi fisik, kelembagaan, dan edukatif efektif dalam membentuk niat serta mewujudkannya menjadi perilaku pengelolaan limbah yang berkelanjutan. Model ini berpotensi direplikasi sebagai strategi pemberdayaan komunitas perkotaan berbasis ekonomi sirkular.

Kata Kunci: bank sampah, manajemen sampah, pemberdayaan masyarakat

How to Cite: Rante, N. T., Stanley, C. D. & Salempang, L. (2026). OPTIMIZATION OF HOUSEHOLD PLASTIC WASTE MANAGEMENT THROUGH THE DEVELOPMENT OF AN INNOVATIVE WASTE BANK BASED ON LEGAL AND K3 EDUCATION. *Mitra Mahajana: Jurnal Pengabdian Masyarakat*, 7(1) 85-96. doi: <https://doi.org/10.37478/mahajana.v7i1.7718>

INTRODUCTION

The problem of plastic waste has become a pressing global environmental issue, with the household sector being a major contributor to urban waste generation (Jambeck et al., 2015; Kaza et al., 2018). The accumulation of ineffectively managed waste pollutes terrestrial and marine ecosystems and raises various social and public health issues (UNEP, 2021). Conventional management approaches tend to focus on downstream aspects (end-of-pipe

solutions) without addressing behavioral change at the source level, thus limiting their long-term effectiveness (Wilson et al., 2015). Therefore, a comprehensive intervention model is needed that not only strengthens technical systems but also transforms community behaviour so that waste can be positioned as a valuable resource within a circular economy framework (Geissdoerfer et al., 2017).

Normatively, waste management in Balikpapan City has been regulated in Balikpapan City Regional Regulation Number 4 of 2022 concerning Waste Management, which emphasizes the community's obligation to reduce and sort waste at its source based on the principle of reduce, reuse, and recycle (3R). The 3R principle aligns with the paradigm of community-based waste management, which emphasizes the active participation of residents as the main actors (Reni & Prasetyo, 2025). Optimizing waste banks as an economic and social instrument has been proven to increase environmental awareness while providing financial incentives for the community (Asteria & Heruman, 2016). Thus, the waste bank optimization program in RT 34 not only has a theoretical and empirical basis but also strong legal legitimacy.

The key to successful community-based waste management lies in internalised behavioural changes. This study adopts the Theory of Planned Behaviour (TPB), which states that intention is the primary predictor of behaviour, influenced by attitude, subjective norm, and perceived behavioural control (Ajzen, 2005). Several studies have shown that TPB is effective in explaining pro-environmental behaviour, including recycling and household waste management (Tonglet et al., 2004; Yazdanpanah & Forouzani, 2015). Furthermore, community empowerment theory emphasises capacity building, access to information, and social control as key factors for sustainable social change (Zimmerman, 2000). The integration of legal education and Occupational Safety and Health (OSH) also refer to the principle of protecting informal workers in waste management activities to minimize health risks and work accidents (ILO, 2013). Thus, interventions that combine system strengthening, capacity building, and OHS protection have the potential to create more stable and sustainable behavioural changes.

This study aims to analyze the effectiveness of an integrated intervention model in optimizing household plastic waste management through a Participatory Action Research (PAR) approach, a collaborative research method that involves active community participation in the planning, action, observation, and reflection processes (Kemmis et al., 2014). Using a quasi-experimental one-group pre-test/post-test design, this study systematically measures changes in residents' psychological determinants and actual behaviour before and after the intervention. This approach aligns with the concept of social engineering, which emphasizes the design of structured interventions to modify collective behaviour through changes in attitudes, norms, and capabilities (Lauer, 2001). The contribution of this study lies in providing empirical evidence regarding a measurable, structured, and applicable SDG-based empowerment model and circular economy in the context of urban communities, so that it can be replicated as a sustainable waste management strategy in other areas.

Theoretical basis

The theoretical framework used in this study is the Theory of Planned Behaviour (TPB) developed by Ajzen (2005). This theory is relevant because the focus of the research is on changing and optimizing community behaviour in managing household plastic waste. TPB states that the strongest predictor of behaviour is the intention to do so, which is influenced by three main constructs: attitude toward behaviour, subjective norm, and perceived behavioural control. This model has been widely used to explain pro-environmental behaviour, including recycling and household-based waste management (Tonglet et al., 2004; Paul et al., 2016). Thus, TPB provides a strong conceptual basis for analyzing the psychological determinants of behaviour change in the context of the target community.

The first component is attitude toward behaviour, which is an individual's positive or negative evaluation of the act of managing plastic waste. Attitudes are formed from beliefs about the consequences of behaviour (behavioural beliefs) and assessments of those results (Ajzen, 2005). In the context of waste management, research shows that increasing knowledge about the environmental impacts and economic benefits of recycling has a significant influence

on the formation of positive attitudes (Yazdanpanah & Forouzani, 2015). Therefore, through education about the impacts of plastic pollution (Jambeck et al., 2015), the economic potential of waste banks (Asteria & Heruman, 2016), and strengthening regional legal aspects, this study aims to build positive public beliefs. It is hoped that residents of RT 34 will view waste management as beneficial, economically valuable, and important for environmental sustainability, thereby forming attitudes that support this behaviour.

The second component is subjective norms, which are individuals' perceptions of social pressure to perform or not perform a behaviour. Subjective norms are influenced by normative beliefs related to the expectations of significant others around them (Ajzen, 2005). In the context of environmental behaviour, support from community leaders and collective practices has been shown to strengthen individual adherence to environmentally friendly behavior (Fielding et al., 2008). This concept also aligns with community empowerment theory, which emphasizes the importance of collective participation and social control in shaping social change (Zimmerman, 2000). Communal waste bank empowerment programs and intensive outreach are expected to create a conducive social environment, so that waste management becomes a shared norm internalized by residents.

The third component is perceived behavioural control, which is an individual's belief regarding the ease or difficulty of acting. This construction is influenced by the availability of resources, opportunities, and perceived barriers (Ajzen, 2005). In a study of waste management, perceived ease of access to recycling facilities was positively correlated with increased waste sorting behaviour (Tonglet et al., 2004). Therefore, providing an innovative waste bank with a structured operational system directly increases residents' perceptions of control. Furthermore, education on Occupational Safety and Health (OSH) refers to worker protection standards in waste management to minimize health risks and workplace accidents (ILO, 2013). This increased safety aspect strengthens community confidence that waste management activities can be carried out safely, effectively, and sustainably.

Overall, the Theory of Planned Behaviour provides a comprehensive analytical framework for evaluating the success of community-based waste management optimization programs. The interventions designed in this study are not partial, but rather simultaneously target all three determinants of intention: education fosters positive attitudes, communal programs build subjective norms, and the provision of infrastructure and safety and health training enhances perceived behavioural control. This integrated approach aligns with the circular economy paradigm, which positions communities as the primary actors in transforming waste into resources (Geissdoerfer et al., 2017). With this synergistic combination, it is hoped that strong intentions will be formed and manifested in consistent and sustainable household plastic waste management behaviour.

METHOD

Location and time of implementation

This community service program was implemented in the neighbourhood association (RT) 34, Manggar Village, East Balikpapan District. The location was selected based on initial observations showing a high volume of household plastic waste and the lack of a structured and sustainable waste management system. Furthermore, support and requests from local neighbourhood association (RT) officials demonstrated community awareness and desire to address the problem. The target community comprises approximately 85 families from diverse socioeconomic backgrounds.

The program was implemented from January to February 2026 through three main stages. The first stage was preparation and initial assessment in October 2025, which included field surveys, coordination with community leaders, and initial data collection. The second stage was program implementation in January–February 2026, which included the establishment and distribution of waste banks, legal and occupational health and safety education activities, and operational management of the waste banks. The third stage was monitoring and evaluation at

the end of February 2026 to assess changes in community behaviour. Activity scheduling was designed flexibly to increase community participation. Socialization and education activities were held on weekends or evenings, while the waste bank operational schedule was determined through mutual agreement with residents to align with daily community activities. This strategy aimed to increase community involvement and acceptance of the program.

Program approach and design

This program uses a Participatory Action Research (PAR) approach that positions the community as an active subject in every stage of the activity. Residents of RT 34 are involved in the problem identification process, solution planning, implementation, and program evaluation. This involvement aims to build a sense of ownership of the waste bank program so that the resulting solution is in accordance with the needs and social conditions of the community. The program design uses a quasi-experimental framework with a one-group pre-test and post-test model, so that the impact of the intervention can be measured by comparing conditions before and after the program is implemented on the same group. The program intervention includes three main components: the provision of waste bank infrastructure to support waste sorting, the establishment of a waste bank operational system as a circular economy mechanism, and educational activities regarding waste regulations and Occupational Safety and Health (K3) practices. These three components are synergistically integrated to build a more structured and sustainable waste management system. Waste banks serve as a waste management tool, while legal and occupational health and safety education serve as the operational foundation for safe, orderly, and regulatory-compliant waste management activities (Opoku-Mensah et al., 2022). This integration is expected to improve public knowledge, attitudes, and participation in sustainable household waste management (Babaei, et al., 2015)

Intervention implementation stages

The first phase focused on program outreach and infrastructure provision. Outreach was conducted through community forums to explain the program's objectives, benefits, and mechanisms, fostering shared understanding and social support. Additionally, an innovative two-compartment waste bank was procured, facilitating the sorting of plastic and cardboard waste at the household level. Procurement was carried out in stages by each head of household, accompanied by a brief explanation of how to use it.

The second phase focused on education and the institutional development of the waste bank. The education was conducted through interactive workshops discussing waste management regulations based on Balikpapan City Regional Regulation No. 4 of 2022 and the principles of Occupational Safety and Health (K3) in waste management. Furthermore, through community meetings, a waste bank management structure was established, which developed standard operating procedures (SOPs) related to weighing, recording, and the profit-sharing system. The third phase is the initial operationalization and mentoring of the waste bank. Activities begin with the first collection of sorted plastic waste by residents. The implementation team provides technical assistance during the initial operational phase to ensure activities are running according to standard operating procedures and to help address any challenges that arise. This phase also serves as an initial evaluation process to assess community participation and the effectiveness of the established system.

Method of collecting data

Primary quantitative data collection was conducted through direct interviews with residents using questionnaires based on *the* Theory of Planned Behaviour (TPB) constructs, namely attitudes, subjective norms, perceived behavioural control, and intentions in managing plastic waste. Measurements used a Likert scale of 1–5. The pre-test was conducted in January 2026 before the intervention, while the post-test was conducted in February 2026 after the program was implemented. The study respondents numbered 85 heads of families in RT 34, allowing for a comparative analysis before and after the intervention.

In addition, secondary quantitative data were obtained from the waste bank's operational records, which systematically record the volume of plastic waste deposited by residents. Data collected included waste weight (kg), plastic type, deposit frequency, and total waste savings for each member. Recording was conducted periodically during January–February 2026 as an objective indicator of changes in community behaviour. A qualitative approach was also used through participant observation and Focus Group Discussions (FGDs). Observations were conducted throughout the implementation process to directly observe community participation and use of the waste bank. FGDs were conducted at the end of the program, involving community representatives and waste bank administrators to explore perceptions, supporting and inhibiting factors, and input for program sustainability.

Data analysis

Quantitative data from the pre-test and post-test questionnaires were analyzed using descriptive and inferential statistics. Descriptive statistics (mean and standard deviation) were used to describe the average score of each TPB construct before and after the intervention. Furthermore, a Paired Samples t-Test was used to determine whether there was a significant difference between the scores before and after the program. Secondary quantitative data from waste bank records were analyzed descriptively, including the total volume of plastic waste collected, the average deposit per household, and the level of community participation during the implementation period. The development of waste collection can also be visualized in a time-series graph to show trends in community behaviour changes. Meanwhile, qualitative data from FGDs and observations were analyzed using thematic analysis. The process includes data transcription, coding to identify key concepts, and then grouping the codes into themes that describe the experiences, perceptions, supporting factors, and barriers experienced by the community. This analysis provides a contextual understanding that complements the quantitative findings regarding the program's effectiveness.

RESULTS AND DISCUSSION

The results of statistical analysis using the Paired Samples t-Test showed a statistically significant increase in the three main constructs of the Theory of Planned Behaviour (TPB) after the intervention program was implemented. Comparison of pre-test and post-test data from 85 household heads in RT 34 showed a consistent increase in attitude scores, subjective norms, and perceived behavioural control. This finding aligns with the TPB framework, which states that behavioural change begins with strengthening psychological determinants that shape intentions (Ajzen, 2005). These results are also in line with research by Tonglet et al., (2004), which found that education-based interventions and ease of access significantly increased household recycling intentions and behaviour.

The most significant improvement occurred in the construction of attitudes toward behaviour. The average score, previously neutral, increased to very positive after the intervention. Education regarding the environmental impact of plastic waste (Jambeck et al., 2015), the economic potential of waste banks (Asteria & Heruman, 2016), and strengthening regional regulations were shown to shape residents' positive evaluations of waste management activities. This finding is consistent with research by Yazdanpanah and Forouzani (2015), which showed that increased environmental knowledge and awareness significantly strengthen positive attitudes and pro-environmental behavioural intentions. Thus, the change in perception of residents of RT 34 from "waste as a burden" to "waste as a resource" reflects the success of the educational strategy in building constructive behavioural beliefs.

In terms of subjective norms, significant strengthening occurred after the implementation of the communal waste bank program and intensive socialization based on Participatory Action Research (PAR). Before the intervention, waste management tended to be viewed as an individual responsibility. After the program was implemented, positive social pressure developed, encouraging collective participation. These results align with the findings of Fielding,

et al. (2008), who stated that social support and group identity significantly influence environmental behavioural intentions. The community empowerment approach involving community leaders also strengthened the program's social legitimacy, as emphasized in Zimmerman's (2000) empowerment theory, which states that collective participation increases social control and shared commitment to change.

Meanwhile, perceived behavioural control showed a drastic increase, directly linked to physical interventions such as the provision of 85 two-compartment waste banks and a structured operational system. This finding supports previous research that suggests that facility availability and ease of access are strong predictors of recycling behaviour (Tonglet et al., 2004). Furthermore, Occupational Safety and Health (OSH) education strengthened residents' sense of security and confidence in carrying out waste management activities, in line with the ILO (2013) recommendation that health and safety protection is a prerequisite for sustainable community-based waste management. Compared with several community service programs that focus solely on outreach without infrastructure support, the results of activities in RT 34 showed a more comprehensive improvement because they integrated educational, social, and technical aspects simultaneously.

Overall, the results of this community service activity confirm previous empirical findings that successful environmental behaviour change cannot be achieved through a partial approach. A study by Paul et al. (2016) also confirmed that the combination of strengthening attitudes, social norms, and behavioural control resulted in a more significant increase in intention than any single intervention. The program's strength in RT 34 lies in its integrated intervention design based on TPB and PAR, which not only statistically significantly improved psychological determinants but also built a social and structural foundation that enables sustainable behaviour change. Therefore, compared to previous research or community service that tended to emphasise a single aspect (e.g., education alone or the provision of facilities), this model demonstrates a more holistic and applicable effectiveness in the context of urban communities.

Impact of the program on intention and actual behaviour of household plastic waste management

In line with the increase in plastic waste donations, it indicates that the program intervention has not only succeeded in changing beliefs and perceptions but has also succeeded in fostering a strong psychological commitment from residents to actively engage in the practice of sorting and depositing waste. This increased intention was successfully translated into objectively measurable actual behaviour. Waste bank operational data shows a consistent upward trend in the volume of plastic waste deposited by residents during the implementation period from January to February. In the first month of operation, the total plastic waste collected reached half a barrel and increased to two-thirds of a barrel the following month. These figures provide empirical evidence that the intervention program is effective in bridging the gap between intention and actual action within the target community.

This behavioural change is not merely individual but has become a communal movement. The level of active community participation, as measured by the number of households regularly sorting their waste, reached 88% at the end of the evaluation period. This high participation rate reflects the program's success in establishing new social norms, where sorting and saving waste is seen as adding economic value to households. This aligns with findings of strengthening subjective norms that encourage individuals to adapt their behaviour to the expectations of their social environment. Qualitative data from focus group discussions (FGDs) reinforce the finding that the transition from intention to behaviour is facilitated by a high level of perceived control. FGD participants stated that the availability of innovative waste banks in public areas, the awareness of having their own waste bank at home, and the flexible weighing schedule removed almost all practical barriers. This convenience, combined with an already strong intention, made participation in the waste bank program an action that was easily integrated into daily routines, rather than a burdensome additional burden for residents of RT 34.

The impact of this behaviour is also manifested in economic aspects directly felt by residents. The accumulation of savings from plastic waste deposits provides a tangible financial incentive, although the amount varies. Recording data shows that the average savings per household reaches a significant value at the household level. This economic incentive creates a positive feedback loop that strengthens attitudes and intentions, thus significantly increasing the potential for ensuring the long-term sustainability of plastic waste management behaviour in the community.

The effectiveness of innovative waste banks and waste bank systems in facilitating sorting

The provision of an innovative two-compartment waste bank has proven to be a key catalyst in facilitating waste sorting practices at the household level. Participatory observation results showed that the two bins distributed in public areas were used by residents from day one. This simple design effectively removed the physical and cognitive barriers that were previously the main reasons residents did not sort their waste. This intervention directly improved perceived behavioural control, in line with the SDGs framework, by providing a clear and easy means to initiate the desired behaviour. The effectiveness of a waste bank is inseparable from the existence of a structured waste bank system. This physical infrastructure serves as an upstream input, providing a consistent supply of sorted waste. Without a downstream waste bank mechanism, sorting efforts would be futile and unsustainable. The synergy between the provision of tools and institutional systems creates an integrated waste management ecosystem, ensuring that newly formed sorting behaviours have clear goals and outcomes for every citizen.



Figure 1. Support from the Balikpapan Environmental Service and residents of RT 34 as agents of environmental change.

Separating the layers of plastic bottles to be ready for sale to collectors.

The waste bank operational system developed through a participatory approach demonstrated strong acceptance among residents. The flexible weighing schedule and transparent recording procedures, as revealed in focus group discussions (FGDs), were perceived as practical and not burdensome for the community, allowing residents to participate more comfortably. This operational flexibility helped integrate waste management activities into residents' daily routines. In addition, the "waste savings" mechanism provided direct positive feedback in the form of economic incentives (Jannah & Wibawani, 2025). This incentive system encouraged consistent participation and reinforced residents' engagement in the program. Over time, it also shifted community perceptions of waste from being viewed as useless material to being recognized as a resource with economic value (Puvaca et al., 2025).



Figure 2. *Separation of layers on plastic bottles ready for sale to collectors*

The resulting sorting quality also demonstrates the intervention's effectiveness. Analysis of waste bank records indicates low levels of contamination in deposited plastic waste, attributed to the two-compartment bin design (Zhao et al., 2023). This high material quality is crucial because it increases the waste's market value and ensures the economic sustainability of the waste bank's operations. Thus, this intervention not only successfully changed the quantity of managed waste but also maintained its quality, a key factor in the recycling chain (Wulandari et al., 2017). Overall, the combination of an innovative waste bank and a waste bank system creates effective socio-technical engineering. The waste bank acts as a behavioural by simplifying actions, while the waste bank provides an institutional structure that incentivizes and gives meaning to those actions (Yudarwati, 2025). This model demonstrates that physical interventions must be supported by a strong social system to transform intentions into routine, measurable, and sustainable waste management behaviours at the community level (Etim, 2024).



Figure 3. *The results of waste donations by the community over 20 days will be sold to collectors*

The role of legal and occupational health and safety education in building waste management awareness and capabilities

Educational interventions regarding law and occupational health and safety (K3) have proven to be fundamental pillars that complement physical interventions. Qualitative analysis

from focus group discussions (FGDs) revealed that before the program, residents' knowledge was very limited. After the workshops, there was a significant increase in awareness, which directly contributed to strengthening positive attitudes toward waste management. This education successfully shifted perceptions from simply disposing of waste to an activity with legal basis, social responsibility, and technical procedures that must be adhered to for the safety of all residents of RT 34.



Figure 4. *Waste bank optimization program socialization with the Balikpapan environmental agency and the XIX Balikpapan University community service program.*

The dissemination of Balikpapan City Regional Regulation No. 4 of 2022 concerning Waste Management lent legitimacy and urgency to the program. This understanding strengthened subjective norms as residents recognized that their actions were in line with formal government expectations, not merely local initiatives. In group discussions, participants stated that this legal knowledge fostered a sense of collective responsibility and pride as law-abiding citizens. This shifted motivation from mere following to participation grounded in an awareness of good citizenship. Occupational Safety and Health (K3) training specifically improved residents' perceptions of behavioural control, particularly among waste bank administrators. Before the training, there were concerns about health risks when handling waste. K3 materials, which covered the use of personal protective equipment and safe sorting techniques, successfully removed these psychological barriers. This increased capability made residents feel more confident and competent in running waste bank operations, as evidenced by observations of the implementation of safety procedures during the weighing process (Al Zahra & Shohibuddin, 2025).

The effectiveness of education is strengthened through its direct integration into the waste bank's operational practices. K3 principles are not merely theoretical material but are adopted as mutually agreed-upon Standard Operating Procedures (SOPs). Participatory observations show that administrators consistently wear gloves and masks and maintain the cleanliness of the weighing area (Tola et al., 2023). This practical implementation builds trust among waste bank members, demonstrating that the program is run professionally and safely, ultimately encouraging broader community participation (Al Zahra & Shohibuddin, 2025). Overall, the legal and occupational health and safety education components play a crucial role in building the foundation for the program's sustainability. This intervention not only changes immediate behaviour but also builds the community's internal capabilities and knowledge (Benson et al., 2023). With a comprehensive understanding, residents of RT 34 are empowered to manage, solve problems, and even develop their own waste bank system in the future. This knowledge-based empowerment aligns with the essence of the Participatory Action Research approach, which aims to foster independence and social resilience within the community.

Dynamics of Community Participation and Sustainability Factors of the Waste Bank Program

The 88% active participation rate demonstrates the success of the Participatory Action Research (PAR) approach in fostering a sense of ownership. Residents' involvement from the

planning stage, including in determining the waste bank's operational schedule, transformed them from objects into subjects of the program. This dynamic reinforces subjective norms, where participation is no longer based on external instructions but rather on collective awareness. This sense of ownership serves as a key foundation that ensures that waste management initiatives will continue to be independently implemented by the RT 34 community.

The program's sustainability is strongly supported by the active role of community leaders and waste bank administrators. Their presence as local agents of change serve as role models, reinforcing positive social pressure (Dushkova & Ivlieva, 2024). Observations indicate that this internal leadership is effective in mobilizing residents and independently resolving minor operational challenges. The establishment of this formal institutional structure ensures regeneration and knowledge transfer, ensuring that waste bank operations are independent of the program's implementation team and can continue autonomously (Reni & Prasetyo, 2025). The economic incentive factor through the waste savings system has proven to be a powerful and pragmatic driver of sustainability. Focus group discussion data confirms that the immediate financial benefits, although varying in nominal amounts, create a positive feedback loop. This consistently reinforces residents' positive attitudes, transforming waste from a burden to an asset (Refsgaard & Magnussen, 2009). This economic motivation ensures the program's long-term relevance, as it directly contributes to household-scale economic improvement in the target communities (Astuti et al., 2025).

Despite potential challenges such as fluctuating waste prices and staff burnout, the program has developed internal mitigation mechanisms. Capacity building through legal and occupational health and safety education empowers staff to adapt and innovate (Kabiesz et al., 2025). Focus group discussions revealed plans to diversify the types of waste received to maintain income stability. This strong foundation of knowledge and skills makes the community more resilient in the face of external dynamics, which is crucial for the program's long-term sustainability (Dushkova & Ivlieva, 2024). In summary, the sustainability of the waste bank program in RT 34 does not depend on a single factor, but rather on the synergy between social, institutional, and economic elements. The sense of ownership instilled through community participation (PAR), new social norms reinforced by local leadership, and tangible economic incentives create a robust ecosystem (Shemshad et al., 2025). This holistic model ensures that the behavioural changes are not temporary but are internalized and institutionalized into the community's daily routines for the future.

CONCLUSION

The plastic waste management optimization program in RT 34, Manggar Village, was successfully implemented and demonstrated improvements in behavioural determinants based on the Theory of Planned Behaviour. The interventions were able to improve residents' attitudes, subjective norms, and perceived behavioural control, thereby encouraging a stronger intention to manage plastic waste. This was evident in the increase in managed waste volume to approximately two-thirds of the bin's capacity per month and the resident participation rate reaching 88%. The program's success is supported by three main components: the provision of an innovative waste bank to facilitate sorting, the establishment of an institutional system for waste banks that provides economic incentives, and education on waste regulations and OHS principles. The integration of these three components has proven effective in encouraging changes in community behaviour. The program also has high potential for sustainability due to its use of a Participatory Action Research (PAR) approach that actively involves the community. Community support, the waste bank management structure, and the economic benefits of waste savings are crucial factors in maintaining the program's sustainability at the community level.

REFERENCES

- Ajzen, I. (2005). *Attitudes, personality and behavior (2nd ed.)*. London: McGraw-Hill Education.
- Al Zahra, P., & Shohibuddin, M. (2025). A community-driven approach to urban waste management: Insights from the Kenanga Waste Bank, Bogor, Indonesia. *Society*, 13(1), 306-327. <https://doi.org/10.33019/society.v13i1.786>
- Asteria, D., & Heruman, H. (2016). Bank sampah sebagai alternatif strategi pengelolaan sampah berbasis masyarakat di Tasikmalaya. *Jurnal manusia dan lingkungan*, 23(1), 8. DOI: 10.22146/jml.18783
- Astuti, W., Widyastuti, C. R., Putra, M. R. F., Nurrahman, A. R., Firmansyah, F. H., Ubay, I. N., & Harianingsih, H. (2025). Diversification of Fresh Milk into Yogurt to Increase Economic Value of Dairy Groups. *Journal of Community Empowerment*, 5(2), 140-149. DOI: <https://doi.org/10.15294/jce.v5i2.35969>
- Babaei, A. A., Alavi, N., Goudarzi, G., Teymouri, P., Ahmadi, K., & Rafiee, M. (2015). Household recycling knowledge, attitudes and practices towards solid waste management. *Resources, Conservation and Recycling*, 102, 94-100. <https://doi.org/10.1016/j.resconrec.2015.06.014>
- Benson, C., Obasi, I. C., Akinwande, D. V., & Ile, C. (2023). The impact of interventions on health, safety and environment in the process industry. *Heliyon*, 10(1), e23604-e23604. DOI: 10.1016/j.heliyon.2023.e23604
- Dushkova, D., & Ivlieva, O. (2024). Empowering communities to act for a change: A review of the community empowerment programs towards sustainability and resilience. *Sustainability*, 16(19), 8700. <https://doi.org/10.3390/su16198700>
- Etim, E. (2024). Leveraging public awareness and behavioural change for entrepreneurial waste management. *Heliyon*, 10(21), e40063. <https://doi.org/10.1016/j.heliyon.2024.e40063>
- Fielding, K. S., McDonald, R., & Louis, W. R. (2008). Theory of planned behaviour, identity and intentions to engage in environmental activism. *Journal of environmental psychology*, 28(4), 318-326. <https://doi.org/10.1016/j.jenvp.2008.03.003>
- Geissdoerfer, M., Savaget, P., Bocken, N. M., & Hultink, E. J. (2017). The Circular Economy–A new sustainability paradigm?. *Journal of cleaner production*, 143, 757-768. <https://doi.org/10.1016/j.jclepro.2016.12.048>
- Jambeck, J. R., et al. (2015). Plastic waste inputs from land into the ocean. *science*, 347(6223), 768-771. DOI: 10.1126/science.1260352
- Jannah, E. M., & Wibawani, S. (2025). Policy Implementation of Waste Management at Bintang Mangrove Waste Bank, Surabaya City. *Journal of Public Representative and Society Provision*, 5(3), 876-890. DOI: <https://doi.org/10.55885/jprsp.v5i3.675>
- Kabiesz, P., Płaza, G., & Jamil, T. (2025). Modern Technologies in Occupational Health and Safety Training: An Analysis of Education, Innovation, and Sustainable Work Practices in Industry. *Sustainability*, 17(16), 7305. <https://doi.org/10.3390/su17167305>
- Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). *What a waste 2.0: a global snapshot of solid waste management to 2050*. Washington DC: World Bank Publications.
- Kemmis, S., McTaggart, R., & Nixon, R. (2014). *The action research planner: Doing critical participatory action research* (Vol. 200). Singapore: Springer.
- Lauer, R. H. (2001). *Perspectives on social change*. Boston: Allyn & Bacon.
- Opoku-Mensah, F. A., Maloreh-Nyamekye, T., Ahenkan, A., & Temesgen, B. (2022). The'dozen'elements substantiating sustainable procurement practice in Sub-Saharan Africa: evidence from Ghana. *International Journal of Procurement Management*, 15(6), 725-746. <https://doi.org/10.1504/IJPM.2022.125852>
- Paul, J., Modi, A., & Patel, J. (2016). Predicting green product consumption using theory of planned behavior and reasoned action. *Journal of retailing and consumer services*, 29, 123-134. <https://doi.org/10.1016/j.jretconser.2015.11.006>

- Puvača, N., Simin, M. T., Bursić, V., Đurić, K., Brkić, I., & Soleša, K. (2025). Economy, European Policies, and Citizens' Behavior: Managing Solid Waste as a Resource. *Journal of Agronomy, Technology and Engineering Management*, 8(1), 1309-1321. <https://doi.org/10.55817/OBWB1007>
- Refsgaard, K., & Magnussen, K. (2009). Household behaviour and attitudes with respect to recycling food waste–experiences from focus groups. *Journal of Environmental management*, 90(2), 760-771. <https://doi.org/10.1016/j.jenvman.2008.01.018>
- Reni, D. S., & Prasetyo, E. (2025). Community empowerment through waste bank program as an eco-centric approach to environmental management in Jururejo Village, Ngawi Subdistrict. *Indonesia Journal for Community Service and Empowerment*, 1(1), 31-37. DOI: <https://doi.org/10.59966/53tz5z54>
- Shemshad, M., Synowiec, A., Kopyra, M., & Benedek, Z. (2025). The community-driven ecosystem resilience and equity framework: A novel approach for social resilience in ecosystem services. *Sustainability*, 17(8), 3452. <https://doi.org/10.3390/su17083452>
- Tola, D. ., Banda, Y. M., & Amrin, S. (2023). Pemanfaatan Limbah Sampah Berbasis Reduce, Reuse, Recycle di Desa Roa Kecamatan Detusoko Kabupaten Ende. *Mitra Mahajana: Jurnal Pengabdian Masyarakat*, 4(2), 112-118. <https://doi.org/10.37478/mahajana.v4i2.2906>
- Tonglet, M., Phillips, P. S., & Read, A. D. (2004). Using the Theory of Planned Behaviour to investigate the determinants of recycling behaviour: a case study from Brixworth, UK. *Resources, conservation and recycling*, 41(3), 191-214. <https://doi.org/10.1016/j.resconrec.2003.11.001>
- Wilson, D. C., Velis, C., & Cheeseman, C. (2006). Role of informal sector recycling in waste management in developing countries. *Habitat International*, 30(4), 797–808. <https://doi.org/10.1016/j.habitatint.2005.09.005>
- Wulandari, D., Utomo, S. H., & Narmaditya, B. S. (2017). Waste bank: Waste management model in improving local economy. *International Journal of Energy Economics and Policy*, 7(3), 36-41. <https://dergipark.org.tr/en/pub/ijeeep/issue/31922/351221>
- Yazdanpanah, M., & Forouzani, M. (2015). Application of the Theory of Planned Behaviour to predict Iranian students' intention to purchase organic food. *Journal of Cleaner Production*, 107, 342-352. <https://doi.org/10.1016/j.jclepro.2015.02.071>
- Yudarwati, G. A. (2025). Corporate sustainability communication to promote pro-environmental behaviour: lessons learned from Balinese women in Indonesia. *Journal of Communication Management*, 29(1), 114-132. <https://doi.org/10.1108/JCOM-11-2023-0122>
- Zhao, X., Boruah, B., Chin, K. F., Đokić, M., Modak, J. M., & Soo, H. S. (2022). Upcycling to sustainably reuse plastics. *Advanced Materials*, 34(25), 2100843. <https://doi.org/10.1002/adma.202100843>
- Zimmerman, M. A. (2000). Empowerment theory: Psychological, organizational and community levels of analysis. In *Handbook of community psychology* (pp. 43-63). Boston, MA: Springer US.