

Waste Bank Innovation Management Using Digital Innovation System Management in Cicadas Village, Gunung Putri District, Bogor Regency

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ABSTRACT

Urbanization has led to a concomitant rise in population, giving rise to various socioeconomic and environmental issues. Consequently, trash problems frequently arise in numerous developing nations like Indonesia. Several cities in Indonesia continue to grapple with their deteriorating garbage issues due to heightened output. Therefore, to establish an optimal waste management framework in a given area, developing a comprehensive plan or strategy that becomes the standard for waste management practices is imperative. Waste professionals deem Indonesia needs to be more accurate, reliable, and unreliable in terms of amount and composition. These findings have significance for the appropriate planning and decision-making processes in dealing with waste problems at the national, provincial, and city/regency levels. The waste issue in Bogor Regency has once again garnered attention following the inability to transfer 2,400 tons of waste. The escalating nature of this scenario is becoming more worrisome due to the projected rise in trash generation by 2023.

This study aims to assess and appraise the operations of a waste bank by implementing novel advancements at the Green Cikeas waste bank, which serves as a trailblazing waste bank in Cigales Village. Efficient administration of digital innovation systems can enhance waste management activities, thereby contributing to community satisfaction. This innovation has the potential to become a standard for digitalization since it introduces a digital innovation system management idea that can be used in any location and significantly enhance job efficiency. One of the primary objectives of managing digital innovation systems is to attain efficiency and optimization in various areas, such as the management procedures of the bank. This study also considers other viewpoints, encompassing management, human resources, economics, social, and environmental dimensions.

Keywords: Waste Bank, Digital Innovation System Management, Urban Household Waste

INTRODUCTION

The exponential increase in urbanization has significant ramifications on the expansion of the population, ultimately leading to the emergence of many social and environmental challenges. Governments, whether developed or developing, are actively implementing rigorous measures to mitigate garbage, including plastic waste, within their territories. The Global Community, including Indonesia, should adhere to the triple bottom line principle, which entails balancing governance, environmental stewardship, human resources, and profitability to prevent further harm and protect the environment. Waste is widespread in Indonesia, particularly in metropolitan areas, and has emerged as a significant environmental issue. The management of household garbage in Indonesia has emerged as a significant concern due to the expanding population, resulting in a surge in waste quantity. Most prominent cities in Indonesia have adopted diverse waste management systems to mitigate trash production, influencing environmental well-being. (Zainal, Rambey & Rahman, 2021) By implementing this principle, the government enables communities to enhance their environmental awareness and responsibility. Community governance, which prioritizes communities' authority and decision-making power over individual services, is widespread in various public sector operations. (Papagiannis, Gazzola, Burak & Pokutsa, 2021; Smol, Duda,

Czaplicka-Kotas & Szoldrowska, 2020; Azevedo, Scavarda, Caiado & Fuss, 2021)

Digital transformation encompasses the convergence of two influences, namely digital1 and digital transformation, together with three primary elements: innovative digital technology, innovative digital solutions, and digital business concepts. Digitalization encompasses recognizing, embracing, implementing, enhancing, and overseeing sophisticated digital technologies. Digital technology encompasses the advent of current SMAC technology, comprising social, mobile, analytics, and cloud technologies. (Acharya, Bastola, Modi, Marhatta, Belbase, Lamichhane & Dahal, 2021; Camilleri, 2021)

Digital solutions are indicative of the fact that digital transformation is significantly dependent on the utilization of cutting-edge IT components. The notion of digital business demonstrates that the advancement of digital technology gives rise to novel business ideas and concepts founded on innovative IT solutions. Innovation is commonly perceived within the framework of alterations in behavior. Innovation is commonly linked to a dynamic and ever-changing setting. Innovation originates from a term denoting altering or introducing novel elements to enhance worth. Three distinct categories of innovation exist. Product innovation refers to the process of modifying existing items in order to enhance their functionality or utility, hence creating more value.

Process innovation refers to implementing specific techniques or strategies that enhance the efficiency and effectiveness of work processes. Qualitative innovation refers to enhancing the quality of products or services. Innovation is inherently linked to creativity. In order to be innovative, one must possess creativity. The two concepts vary fundamentally: creativity is confined to the realm of thought, whereas innovation progresses to the realm of action. Creativity is a proficiency employed in the process of innovation. (Cheng, Tan, Wong, Koo & Amir Sharji, 2022; Gunartin, Mulyanto & Sunarsi, 2020; Wan, Qu, Huang & Huang, 2020)

Garbage management is the deliberate and methodical effort to reduce and dispose of garbage sustainably, in compliance with the regulations outlined in Law No. 18 of 2008, "Waste Management." One can take measures such as segregating waste and implementing the 3R principle (Reduce, Reuse, Recycle) or Reduce, Reuse, and Recycle waste to minimize waste. As per Minister of Environment Regulation No. 13 of 2012, a waste bank refers to a facility where recyclable waste is sorted, collected, and repurposed for its economic value. A trash bank can operate efficiently with the presence of supervisors, cashiers, and collectors. The objective of the trash bank encompasses three facets: health considerations, pedagogical dimension, and socio-economic factors.

Table 1. Amount of waste generation based on city classification

No	City Classification	Amount of Weight Gain (Kg/Person/Day)
1	Medium City	0.70-0.80
2	Small Town	0.625-0.70

Cicadas Gunung Putri, a hamlet in Bogor Regency, serves as a partner city and supports other cities in the region. However, it also encounters challenges in effectively managing household garbage. Cicadas Gunung Putri, located in Bogor Regency, is characterized by its substantial population and the consequential production of a considerable volume of garbage. The Central Statistics Agency (Badan Pusat Statistik) estimates that the population of the Bogor region in 2023 will be 5,427,068 individuals. The daily output of household garbage is projected to be 2,900 tons, with an expected collection time of 2,900 units. Household waste is the primary contributor, accounting for 62% of the total waste. The Government of the Village of Cikadas Gunung Putri in Bogor Regency is currently confronted with several waste management difficulties, such as rising waste volume, high operational expenses, and inadequate infrastructure. (Kazancoglu, Ozbiltekin, Ozkan Ozen & Sagnak, 2021; D'Amico, Arbolino, Shi, Yigitcanlar, & Ioppolo, 2021)

The Bogor Regency Government has implemented various waste management policies in line with Law Number 18 of January 2008 on Waste Management (Ministry of Environment, 2008). These policies are designed to assist the parent company in resolving its trash-related challenges. An innovative concept offered by the organization is community-based trash Management (CBMS), which aims to empower trash banks in every neighborhood/village through the RW system in Bogor Regency. The Scrap Bank is a waste management method implemented in the banking sector to facilitate the deposit of used goods by the Community. This condition uses account numbers and memo sheets, as the items kept are not monetary. The Green Cikeas Waste Bank is situated in the Cikadas Village, within the Bogor Regency. Additionally, Green Cikeas has initiated training programs focused on waste recycling and sorting, enabling several households to reduce waste and generate supplementary income easily converted into cash. At present, Green Cikeas has provided training to over 100 individuals. (Zhou, Jiang, Yang & Liu, 2021; Xiao, Dong, Geng, Francisco, Pan & Wu, 2020; Oyinlola, Schröder, Whitehead, Kolade, Wakunuma, Sharifi & Abolfathi, 2022)

This research aims to advance innovation for the Green Cikeas Waste Bank. We have implemented a type of innovation by optimizing the process of registering new trash bank users using Google Forms. (Cheela, Ranjan, Goel,

John & Dubey, 2021; Kurniawan, Maiurova, Kustikova, Bykovskaia, Othman & Goh, 2022)

Previously, the registration process relied solely on human bookkeeping and did not result in time savings for waste collection. This innovation can serve as a benchmark for implementing digitalization in any location and can optimize workflow. One of the primary purposes of digitalization is to attain enhanced efficiency and optimization.

METHOD

The research methodology utilized in this study is a form of descriptive research employing a qualitative approach. The objective is to adhere to the SNI 19-2454-2002 requirements for waste management, which encompass five key areas: institutional, operational, financial, legal, and social participation. Additionally, the focus is on implementing innovative approaches in waste management practices. The Maemi Village Trash Bank in Gunung Puteri District, Bogor Regency, employs feedback on three categories of urban trash management technologies: Product innovation in manufacturing, manufacturing processes, and Quality innovation (Quality Innovation).

The data in this study consist of information obtained from eight sources, namely the Head of Cleanliness Division of the Bogor Regency Environment Agency, the Village Chief of

Jangkrik, Community Leaders involved in establishing the waste bank, the chairperson of PBS, the management of BS in RW 022, 024, 045, the head of PKK in RW 028, as well as relevant documents and the study location. Methods for collecting data encompass interviews, observation, and note-taking. Data analysis employs the reduction, presentation, and validation paradigm that was suggested. The triangulation method is employed to guarantee precision.

The adoption of trash management technologies in Maemi Village, Gunung Puteri District, and Bogor Regency provides an exemplar for tackling waste management difficulties in both urban and suburban regions. The participation of diverse stakeholders, such as local government officials, community leaders, and waste bank personnel, highlights the significance of cooperative endeavors in waste management programs.

Moreover, applying cutting-edge techniques such as manufacturing, process, and quality advances showcases a holistic strategy for minimizing waste and promoting recycling. By integrating input from many stakeholders and employing data-driven methodologies, waste management procedures can be adjusted to address the changing requirements of communities effectively.

The research findings emphasize the need for community involvement and institutional backing

in fostering sustainable waste management methods. By engaging in productive cooperation and embracing cutting-edge strategies, communities can alleviate waste production's negative environmental and social consequences.

Ultimately, the study highlights the significance of inventive strategies in waste management and stresses the necessity for ongoing research and advancement in this domain. By cultivating a climate of ingenuity and cooperation, societies can strive to construct a more pristine and enduring environment for future progeny.

RESULTS and DISCUSSION

Jangkrik Village, located in Gunung Puteri Sub-district, Bogor Regency, is a sub-district within Gunung Puteri Regency. It covers an area of 665,486 hectares and consists of 17 neighborhoods (RW), 68 community units (RT), and five villages. The present population comprises a total of 16,786,100 individuals, with 8,916,531 being males and 7,870,468 being females.

Maemi Village in Gunung Puteri Sub-district, Bogor Region, Cigales Gunung Putri Village, Bogor Region has a designated authority responsible for managing garbage and other environmental concerns, including wastewater, trees, city parks, and environmental services. The

waste management coverage of Cigadas Gunung Putri Village, Bogor Regency, extends over an area of approximately 127,388 hectares, which accounts for almost 61% of the whole Gunung Putri area. In 2022, Cikaden Gunung Putri Village in Bogor Province produced 6,750 cubic meters of waste per day, equivalent to around 1,500 tons per day, including residential waste. The system processes 800 tons of waste daily, accounting for 53% of the total waste generated.

The landfill area in Cigadas Gunung Putri Village, Burangkeng Village, Burangkeng Setu Sub-district, Bogor Regency is 11.6 hectares, now exceeding its capacity. Thirty-five hectares of land have been designated in the regional medium-term development plan for 2022-2024 to expand the landfill. The trash management system currently in place at the landfill is an open landfill. There are a total of 10 trucks in the fleet. The Bogor Regency Environmental Agency (DLH) predicts that the community will produce approximately 2,400 tons of garbage daily in 2023, which is higher than the 1,500 tons/day recorded in 2022. At now, our inventory consists of a pair of bulldozers and a pair of excavators. Residential refuse is collected biweekly. The rubbish being hauled to the dump is 850 tons, representing only 35%. The daily estimated value of recyclable materials recovered by scavengers is 3 cents. Currently, the composting process yields a daily output of 2 tons. Our monthly production consists of 50 tons and 10 tons,

respectively. The waste collection mechanism employed is Door to Door.

This text presents a comprehensive analysis of trash management in Cigadas Gunung Putri Village, located in Bogor Province. The focus is primarily on urban waste management, including various factors such as physical infrastructure, institutional framework, operational procedures, costs, regulations, and social considerations. Aspects of Participation and Institutions The Local Implementation Unit (UPTD), in charge of Cikaden Gunung Putri Village, Bogor Regency, is responsible for waste management in the village. Cikada Gunung Putri Village in Bogor Regency functions as a platform for coordinating the interests of inhabitants, relevant agencies, and private companies/institutions. Before establishing the garbage Bank (WB), garbage management in Cikaden Gunung Putri Village RT/RW was conducted through predetermined routes in collaboration with the local sanitation agency. Following the WB, two paths are employed: the standard and general waste management routes. The Waste Bank Association (PBS) has a membership of 37 Waste Banks (WBs), the largest in Cigadas Gunung Putri Village, Bogor Regency.

The operational aspects of waste management encompass the activities that are directly related to waste and are closely intertwined with the natural environment. These activities include storage, processing, collecting,

transportation, and trash management. The operational issues in Bogor Regency are intricate due to the constrained facilities and infrastructure. Prior to the WB event, the neighborhood indiscriminately disposed of rubbish without using any sorting measures. After the WB incident, waste management commenced, encompassing the collection, categorization, and transportation processes. Executives from WB were taught by the DLH and implemented innovative methods for managing home garbage. The RW PKK Chairperson consistently motivates the community to engage with waste banks with their supporting and proactive approach. The financial aspect is a crucial element that enhances the operational efficiency of the overall system, encompassing financial resources, operating finances, maintenance, and investment. Before establishing the WB, the community depended on maintenance teams to finance waste pickup. Following the World Bank (WB), waste management likewise relies on community self-participation, albeit with reduced financial contributions compared to previous levels. 55,555 PBS members do not get operating funding from institutions, regions, or DLH, except for equipment support and training help for trash banks. The operation is independent of the disparity between the sales of sorted inorganic trash and recycled products. As the association's parent, PBS gathers monthly operations fees from its members. Consequently, PBS and DLH-

supported regions invite business entities and the government to promote CSR initiatives in Cigales Village, specifically aimed at supporting environmental preservation activities in the local school.

Regulation is an active element that efficiently governs the system to achieve its objectives, including environmental health regulations. Normative activities are necessary to establish a legal framework for implementation. The waste management activities in Cicadas Village, Gunung Puteri District, Bogor Province, adhere to the regulations stated in Law No. 18 of 2008 and Minister of Environment Regulation No. 13 of 2012, which provide guidelines for the implementation of the 3R (Reduce, Reuse, Recycle) principles. The legal justification for the presence of PBSBs in Jangkrik Village, Gunung Puteri District, Bogor Regency is the Decree of the Jangkrik Village Chief No. 149/Kep.199/Pem-Bhg/IX/2016. Contract model designation: September 23, 2016, about the Management and Distribution of the Association of Waste Banks "Village des Cigales."

Engagement of the Community in the Management of Garbage Community-based waste management (CBWM), often called community-based waste management (PSBM), is a waste management system organized and implemented by the community itself. It involves community planning, structures, activities, governance, and ownership. This condition

pertains to a community empowerment theory within the government regeneration framework. Before establishing the WB, community involvement was restricted to the payment of waste disposal fees. Indeed, several communities abstain from participation for diverse reasons, such as residing in leased properties due to financial constraints, domestic considerations, or perceiving that neighbors have the liberty to dispose of waste on their premises. Following the World War, individuals possess both positive and negative aspects. Specific individuals, such as inhabitants residing in settlements, express their endorsement for it, but others, such as residents residing outside settlements, choose to disregard it. The community has numerous challenges and barriers when engaging in Sigidas Doctor's Village activities. These include a need for more information regarding environmental health, limited land availability, unsanitary conditions, and restrictions on spouses working idly. Perform the requested action. Regarding sorting, they possess an identical mindset of disposing of waste. Desire a straightforward and effortless solution, and it is most advantageous to delegate the task of disposing of waste to individuals who scavenge, such as Shodaqoh.

Innovations in waste management The Digital Innovation Management System is a practical trash management approach implemented in Cigales City. It has been demonstrated to efficiently handle garbage and minimize it by the

3R principle (reuse, reduce, recycle). In particular, plastic trash. The Cigales Village BS has implemented different innovations in urban waste management, specifically focusing on product innovation, process innovation, and quality innovation. Product innovation is developing and introducing new or improved products to the market.

Product innovations by PBS members are created using benchmarking studies and DLH training outcomes and can be viewed on YouTube. Product innovations are derived from dry (inorganic) waste materials, including bags, flower vases, wallets, rugs, fabric lamps, and other items. Wet waste, which consists of organic materials, can be used as compost to nourish plants or sold for profit. The economic benefits of these product improvements arise from their ability to be sold in markets or exhibits. Creating creative recycled products yields social advantages by fostering camaraderie among communities and curbing waste, leading to diminished cleaning expenses. Waste leads to financial success. Village des Cigales waste banks have implemented several technology advancements in urban waste management, particularly by proposing strategies or concepts to enhance operational efficiency and productivity. This condition includes utilizing PBS as a container for public garbage disposal. Every RW possesses a cigar. This town has been recognized as a hub for all PBS Tablet members,

a system that gathers organic waste from the community and deposits it in designated compost bins. Additionally, the TAMPAH application is available to streamline waste collection and disposal.

The community benefits from obtaining attention from critical authorities and providing a platform to voice their concerns when problems develop by implementing innovative approaches. The employment of collectors ensures that all PBS members are entitled to the identical retail price for ranking products. Scavengers cannot control waste and costs at their discretion. However, bundled collection systems allow households to avoid the odor of decaying rubbish and worry about disposing of organic waste in public composting facilities. The TAMPAH program eliminates households' need to be concerned with selling sorted waste, as they do not need to visit recycling centers that charge higher retail rates. Quality innovation refers to a form of innovation that can enhance the quality of a product or service. Qualitative improvements in PBS include plastic grinding, gold waste storage, bio-pore construction, eco-brick manufacturing, the creation of low-cost daily necessities using waste materials, and involvement in TPA rescue and lending initiatives.

The implementation of high-quality advancements brings significant advantages to the community. If the plastic shredder is operational, the market price for shredded plastic

waste will exceed the price offered to collectors due to its intended usage in supplying industries. Biokol offers advantages such as the utilization of organic waste and the provision of water storage capabilities. Furthermore, Eco Brick is an exemplary advancement aimed at mitigating plastic waste, exhibiting remarkable efficacy by utilizing commercially non-viable plastic waste as its primary material and avoiding the generation of additional plastic trash that could contaminate the environment. The benefits of affordable everyday essentials and the availability of loans from savings and loan institutions, along with trash management services, enhance the quality of life in communities and encourage more efficient home garbage sorting.

CONCLUSION

A digital innovation management system can facilitate the introduction of trash bank innovation to the community in managing municipal waste in Cicadas Village, Gunung Puteri District, Bogor Regency. Three distinct forms of innovation, specifically product innovation, process innovation, and quality, are efficiently and intentionally executed. The resultant novel goods and initiatives exhibit consistency across all forms of innovation. Despite encountering barriers and problems, the waste bank innovation in managing municipal garbage in Cigales Village des Cigales has yielded significant benefits for the

communities it serves. However, not all PBS members have equally benefited from this innovation. The outcome is contingent upon desired objectives. This condition entails establishing an environment that is free from pollution, promotes good health, and minimizes the generation of trash.

In addition, challenges and limitations are encountered in implementing innovative waste bank management: This innovation has demonstrated the effectiveness of employing a cutting-edge digital system to manage urban waste in Maemi Village, located in the Gunung Puteri District of Bogor Regency. Every category has distinct difficulties and barriers. Presently, problems and constraints commonly arise.

The general comprehension of the fundamental issues of waste management is primarily the reduction of waste production at its origin due to excessive consumption.

Germination. The households in Village des Cigales are unprepared to carry out the home waste management process due to issues such as traffic congestion, time wastage, a mindset that does not prioritize waste sorting, limited space or land availability, and a lack of waste sorting technologies and knowledge. We engaged in discussions with most inhabitants regarding the methods for managing and decomposing their waste and the techniques for producing ecologically sustainable bricks and biopores. Efforts to address current obstacles and

challenges involve many approaches, such as utilizing the local authority and collaborating with DHL. Bogor Regency, PBS aims to promote the adoption of Corporate Social Responsibility (CSR) by private and state-owned firms in Jangkrik Village to secure more funding for employment initiatives.

Environmental protection personnel actively participate in promotional initiatives to enhance public awareness of the significance of environmental management and sustainable waste disposal. These efforts are carried out through engagement in PKK RW Forum events and other external environmental events.

Germination. PBS remains committed to pursuing innovative advancements that provide advantages for its members and facilitate garbage sorting for residents. This condition includes utilizing the TAMPAH digital application and participating in diverse training programs to enhance waste management practices.

Develop a concise instructional module for academics detailing the process of constructing compost pits and bio pits. This module will equip academics with the knowledge necessary to effectively educate individuals in adequately disposing of organic waste, thereby maximizing its utility independently. Thus far, all conservation activists have yet to successfully implement their knowledge, share it, and engage with other stakeholders, even after undergoing training and returning to their professional duties.

The author proposes that the Chairman of the KPK implement a streamlined procedure for choosing a single collector to oversee all KPK members. This condition would involve creating a concise employment agreement for specific categories of collectors, outlining their respective rights and responsibilities. Legal recourse and remedies are available for violations. The objective is for each partner to prevent unscrupulous scavengers from disrupting activities associated with the BS waste management process in the event of technological issues at the site. The primary purpose of Regulation No. 13 of 2012, which pertains to the Guidelines for Implementing Reduction, Reuse, and Recycling (3R) through garbage Banks (Permen et al. Bank), is to establish garbage banks as a social intervention. Both government representatives and social actors must engage in this practice. Comply with the requirements. The user's text is "3R." Timetable. The author asserts that waste bank management necessitates support from the government and regional administration (Pemda), namely the Bogor Regency through DLH, to allocate resources per the requirements—operational budget for waste bank.

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