Terbit *online* pada laman web jurnal : https://jes-tm.org/index.php/jestm/index

Journal of Engineering Science and Technology Management

| ISSN (Online) 2828 -7886 |

Article

Solid Waste Management System Analysis (Case Study Bangkinang City Subdistrict)

Wilki Andrian[1], Hanantatur Adeswastoto[2], Lailatul Syifa Tanjung[3]

[1,2] Civil Engineering Study Program, Faculty of Engineering, Universitas Pahlawan Tuanku Tambusai

[3] Industrial Engineering Study Program, Faculty of Engineering, Universitas Pahlawan Tuanku Tambusai

DOI: 10.31004/jestm.v6i1.356

E-mail: [a]Wilkyand@gmail.com (Corresponding author)

ARTICLE INFORMATION

Volume 6 Issue 1
Received: 29 December 2025
Accepted: 01 January 2026
Publish *Online*: 01 March 2026
Online: at https:JESTM.org/

Keywords

Waste Management
System Evaluation
Community Participation
Operational Techniques
Bangkinang Kota

A B S T R A C T

Waste management is a crucial issue in sustainable development, particularly in areas with high population growth and economic activity. This study aims to evaluate the waste management system in Bangkinang Kota District, Kampar Regency, which faces various challenges, including inadequate infrastructure, low public awareness, and a suboptimal management system. The research method used is a Mixed Method approach, combining quantitative and qualitative data collection techniques simultaneously in one study. The results indicate that the waste management system in Bangkinang Kota is still not effectively integrated, particularly in operational techniques, community participation, and institutional aspects. The lack of storage facilities, unscheduled transportation, and the habit of littering are the main challenges. Recommendations from this study include improving waste infrastructure, providing ongoing community education, and strengthening regulations and coordination between relevant parties to create a sustainable and community-based waste management system.

1. Introduction

Waste management is the process of moving waste from collection points to disposal sites. Effective waste management requires a proper handling system to avoid reducing environmental aesthetics and to prevent health threats to the community. One collaborative waste management system that can encourage community contribution is the waste bank (Unilever). Several factors influencing the waste management process include the population density in the area, socio-economic characteristics and physical environment, as well as the local community's culture. According to the Regulation of the Minister of Public Works of the Republic of Indonesia Number 3 of 2013, a Temporary Waste Disposal Site or TPS functions as a temporary waste disposal site before the waste is sent to a processing facility to be processed and recycled. Meanwhile, an Integrated Waste Disposal Site or TPST is a location where waste management processes are carried out through to the final stage.

In Indonesia, the Ministry of Environment and Forestry (KLHK) reported that the national waste accumulation in 2024 reached 33.98 million tons, with a reduction of 4.49 million tons, although other data indicated a figure of 69.9 million tons in 2023, with 33.72% remaining unmanaged, reflecting significant challenges in waste management. In Riau Province, population growth and economic activities, especially in cities like Pekanbaru, have increased waste volume, with plastic waste and domestic waste often being disposed of improperly, leading to water, soil, and air pollution, as well as risks of flooding and disease.

Bangkinang Kota Subdistrict, as a developing area in Kampar Regency, faces similar issues, with household waste and agricultural waste being the main sources of trash accumulation. The scarcity of waste management infrastructure, low public awareness of segregation and recycling, and the habit of dumping waste in rivers or vacant land exacerbate environmental and health conditions, such as increasing cases of skin diseases and respiratory disorders. Although initiatives like the "Lapor Sampah Riau" platform and Bank Sampah have been introduced, their effectiveness is limited by the low level of community participation.

Therefore, this research aims to evaluate the waste management system in Bangkinang Kota District to identify weaknesses, potential improvements, and community-based strategies to support sustainable waste management.

2. Literature Riview

2.1 Definition of waste

Waste is essentially a material that is discarded or discarded from a source of human activity or natural processes that has no economic value, and can even have negative economic value because in its handling, whether to dispose of or clean it up requires a large enough cost.

According to the Library of the Ministry of Environment (2005), waste is material that has no value or is not valuable for the usual or primary purpose in its making or use, damaged or defective goods in manufacturing, or excess, rejected, or discarded material. Based on (Law of the Republic of Indonesia No. 18 of 2008 on Waste Management, 2008), the definition of waste is as the residue of activities.

2.2 Waste source

The following are the sources of waste:

a. Residential waste.
   Waste in a settlement is typically generated by one or several families living in a building or dormitory located in a village or city. The type of waste produced is usually food scraps and leftover materials from food processing, or wet waste (garbage).
b. Public Places and Business Places
   Public places are locations that allow many people to gather and engage in activities, including commercial areas. The types of waste generated from such places can include food scraps (garbage), dry waste, ash, construction debris, special waste, and sometimes hazardous waste.
c. Public Services Facilities Owned by the Government
   The public service facilities referred to here include, among others, entertainment and public places, public roads, parking lots, healthcare facilities (e.g., hospitals and community health centers), military complexes, meeting buildings, holiday beaches, and other government facilities. These places typically generate specific waste and dry waste.
d. Heavy and Light Industry

In this context, it includes food and beverages, wood, chemical, metal industries, wastewater and drinking water treatment facilities, and other industrial activities, whether distributive or only processing raw materials. The waste generated from these places is usually wet waste, dry waste, building residue, special waste, and hazardous waste.

e. Agriculture
Waste is produced from plants or animals. Agricultural locations such as gardens, fields, or rice fields produce waste in the form of spoiled food materials, agricultural waste, fertilizers, or plant pest control materials (Manalu & Sumantri, 2018).

2.3 Factors causing the accumulation of waste.

According to Manalu and Sumantri (2018), waste generation is significantly influenced by demographic factors and the socio-economic conditions of the community. An increase in population size and density, coupled with intensified activities in development, trade, and industry, is directly proportional to the volume of waste produced. Furthermore, behavioral aspects—such as lifestyle, educational levels, and specific consumption habits—play a crucial role in determining both the characteristics and the total volume of waste. Economic factors also contribute through the recovery of materials with market value; when the resale value of certain waste materials is high, the amount of residual waste left at disposal sites tends to decrease.

On the other hand, technical factors, environmental conditions, and technological advancements determine the dynamics of waste management in a specific region. The efficiency of collection systems, which is affected by the type of transport fleet and the geographical location—such as mountainous, coastal, or lowland areas—greatly impacts the effectiveness of waste distribution. Additionally, waste volume fluctuates based on temporal and seasonal factors, where peak activities during the day or the onset of the rainy season often present greater challenges for waste management systems. Finally, technological progress contributes to a shift in waste composition, which is increasingly dominated by inorganic and electronic waste—such as plastics, cardboard, and discarded appliances—that are more difficult to decompose.

2.4 Waste management

Waste management is the effort to regulate or manage waste from the processes of collection, separation, transportation, to final management and disposal. Waste management consists of two types: on-site (individual) management and centralized management for communities.

Based on the Indonesian National Standard (SNI, 2002) regarding Urban Waste Operational Procedures, waste management is fundamentally viewed as a set of mutually supporting and interacting components aimed at achieving a clean, healthy, and orderly city. These components include:

1. Technical Operational Aspect
2. Institutional Aspect
3. Legal and Regulatory Aspect
4. Community Participation Aspect
5. Financial Aspect

Since an urban solid waste system must be integrated without breaking its ecosystem chain, it requires coordinated, synchronized, and simplified actions. To improve waste management, several factors must be reviewed, including collection operations, transportation, final disposal, and the equipment utilized. Furthermore, the organizational and management aspects play a vital role in the overall administration of the system.

2.5 Validity test

Validity is the degree of accuracy between the data that occurs in the research object and the data that can be reported by the researcher (Sugiyono, 2017). A valid instrument means the measurement tool used to obtain the data is valid. Valid means the instrument can be used to measure what it is supposed to measure.

The validity testing in this research uses Pearson's Product Moment correlation. A questionnaire item is considered valid if the calculated r value > the table r value at a 5% significance level. If the calculated r is greater than the table r and has a positive value, then that item or variable is declared valid.

2.6 Reliability Test

Reliability is a tool to measure a questionnaire that is an indicator of a variable or construct. A questionnaire is considered reliable

or reliable if a person's answer to a statement is consistent or stable over time. According to Ghozali (2018), a construct or variable is considered reliable if it gives a Cronbach Alpha value > 0.60.

3. Research Methodology

3.1 Research Design

The approach used in this research is the Mixed Method approach. The Mixed Method is a research approach that combines quantitative and qualitative methods simultaneously in a single study to gain a deeper understanding of a phenomenon.

3.2 Data Source

a. Primary Data

Primary data is data directly obtained from survey results on performance used in waste management and final waste processing at landfills. To collect primary data, researchers conduct activities such as field observations, interviews, and image documentation. Field observations are conducted to obtain direct information from informants.

b. Secondary Data

Secondary data is data obtained or collected by researchers from various existing sources. Secondary data is used as supporting data to increase understanding of Waste Management System Evaluation. Secondary data also comes in the form of a study of documents against literature, government regulations, government policies, and other written sources. In addition, the data obtained in the form of documents and official records from several related institutions such as the Kampar Regency Environmental Agency.

3.3 Research Location

The research location is in two villages and two sub-districts located in Bangkinang Kota Sub-district. The villages have ethnic diversity, including Javanese, Batak, Malay, Minang, and Flores tribes, which can affect the behavior and participation of the community in the waste management program.

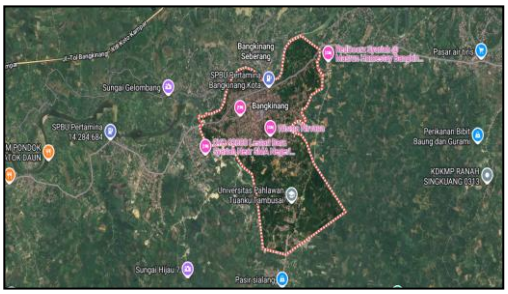

Figure 1. Research Location

3.4 Data Collection

The stages in this process are carried out to obtain the validity of the data by examining all the data available from various sources obtained from the field and private documents, official documents, images, photos and others through the interview method supported by a documentary study.

3.5 Data Processing Method

Data analysis techniques are a research process that is very difficult to carry out because it requires hard work, creative thinking, and high knowledge capabilities. In his view, in data analysis techniques, one research cannot be equated with another researcher, especially regarding the methods used. The analysis used in this research is qualitative analysis. Qualitative analysis is one of the types of research included in qualitative research.

4. Results and Discussion

4.1 Administrative region

Bangkinang City District is one of the districts located in Kampar Regency, with a population of 40,451 people in 2024, covering an area of 177.18 km², and consists of 2 villages and 2 rural villages in Bangkinang City District.

4.2 Geographical conditions

The boundaries of Bangkinang Kota Subdistrict:

a. West is bordered by Salo and Kuok Subdistricts.
b. East bordering with Kampar District and Kampar Kiri Subdistrict.
c. The southern border is adjacent to Kampar Kiri District, Gunung Sahilan, and Bangkinang Barat (Kuok).
d. Located on the north is bordered by Tapung Subdistrict and Bangkinang Seberang Subdistrict.

4.3 Analysis of Waste Production in Bangkinang District City

The large production of waste in Bangkiang Subdistrict can be calculated based on the number of residents multiplied by the average amount of waste generated per person per day. The average daily waste generated per person according to SK SNI S-04-1993-03 on waste generation for small cities and medium-sized cities in Indonesia is 2.5-2.75 liters/person/day. Bangkinang Subdistrict in 2024 has a population of 40,451 people, so assuming an average daily waste generation of 2.5 liters/person/day, the waste production in Bangkinang Subdistrict originating from residential areas reaches 101,128 liters/day or 101 m3/day.

4.4 Technical Operational Aspects Analysis of Waste Management

a. Water distribution pattern

Sorting out the trash according to the types that have been separated, namely:

1. Organic waste, such as fallen leaves, vegetable scraps, soft fruit peels, and food leftovers, placed in dark-colored containers.
2. Inorganic waste, such as glass, plastic, metal, and similar materials, placed in light-colored containers.
3. Household Hazardous and Toxic Waste (B3 waste), consisting of B3-type waste as listed in Appendix B, placed in red containers equipped with special hazard labels in accordance with applicable regulations.

4.5 Organizational aspect

From the observations and interviews conducted at relevant institutions such as the District Office, the Village Office, and the Environmental Agency, the results obtained indicate that the institution responsible for the management and operational techniques of waste in Bangkinang Kota District is fully handled by the Environmental Agency, headed by Mr. Yusrizal, under the Waste Management Division.

The mission of the Environmental Agency of Bangkinang City is:

1. To undertake efforts to preserve natural resources and the environment in Bangkinang Kota District.
2. To control the negative impacts of development activities on the environment.
3. To enhance public awareness and participation in environmental conservation activities and in the enforcement of environmental laws against environmental violations.

5. Conclusion

Performance Evaluation of Waste Management System: Overall, the waste management system in Bangkinang Kota Subdistrict has not yet reached optimal levels. Although some operational aspects have been running, there are still hurdles in meeting technical standards in accordance with national regulations.

Operational Technical Aspect: Based on the evaluation criteria, the operational technical aspect (containment, collection, and transportation) indicates that the available facilities and infrastructure are still limited. The frequency of transportation has not yet fully and evenly reached all service areas, resulting in the continued accumulation of waste at several points.

Analysis of Waste Generation and Composition: Research results show that the increase in population correlates significantly with the increase in daily waste volume. This requires an increase in service capacity and systematic management to prevent exceeding the existing absorption capacity.

Compliance with Regulations: Current waste management still requires further alignment with the mandate of Law No. 18 of 2008 and SNI 19-2454-2002, particularly regarding waste sorting at the source and optimizing community participation in reducing the waste load entering landfills.

Supporting and Hindering Factors: The success of the waste management system is greatly influenced by the level of community participation and the availability of funds. Lack of community understanding of the importance of independent waste management is the main obstacle to achieving a sustainable system.

References

Azis, R. A., & Makupiola, C. A. (2024). Analisis Faktor-Faktor Kinerja Pengelolaan Persampahan Berbasis Masyarakat di WatamponenKabupaten Bone. 1(7), 565–570.

Bari, D. N., Poluan, R. J., & Moniaga, I. L. (2019). Evaluasi Sistem Pengelolaan

Persampahan Di Kota Sorong. Jurnal Spasial, 6(2), 521–530.
Damanhuri, E., & Padmi, T. (2010). Pengelolaan Sampah. In 13th Congress of the International Commission for Optics, Optics in Modern Science and Technology, Conference Digest. https://doi.org/10.1364/josaa.1.000711
Dwiyanto, B. M. (2011). Model Peningkatan Partisipasi Masyarakat Dan Penguatan Sinergi Dalam Pengelolaan Sampah Perkotaan *. Jurnal Ekonomi Pembangunan: Kajian Masalah Ekonomi Dan Pembangunan, 12(2), 239. https://doi.org/10.23917/jep.v12i2.196
Eka, R. R., Komariyah, L., & Sandy, A. T. (2021). Evaluasi Peran Masyarakat Dalam Pengelolaan Sampah di Desa Wisata Apung Kampung Malahing Kota Bontang Evaluating The Role Of The Community In Waste Management In The Floating Tourism Village Of The Village In The Village Of Bontang. Geoedusains, 2(1), 53–60.
Febiola, A. N., Zulkarnain, D., Sitio, M., Purba, M., & Anggara, R. (2025). EVALUATION OF WASTE ACCUMULATION SYSTEM AND. 12236–12241.
Islami, R. R., Moelyaningrum, A. D., & Khoiron, K. (2023). Analisis Sistem Pengelolaan Sampah Di Tempat Pemrosesan Akhir (TPA) Di Kabupaten Lumajang. Jurnal Kesehatan Lingkungan Indonesia, 22(2), 179–188. https://doi.org/10.14710/jkli.22.2.179-188
Ismi, N. (2020). Implementasi Konsep Pengelolaan Sampah Ramah Lingkungan (Green Waste). Universitas Hasanuddin.
Kaza, S., Yao, L., Bhada-Tata, P., & Woerdean, and F. Van. (2019). What A Waste 2.0 : a Global Snapshot Of Solid Waste Management To 2050. In Sustainability (Switzerland) (Vol. 11, Issue 1).
Magriaty, R., Murtilaksono, K., & Anwar, S. (2023). Analisis K-Means Cluster untuk Identifikasi Kawasan Pengelolaan Sampah di Kabupaten Tapin Provinsi Kalimantan Selatan. Journal of Regional and Rural Development Planning, 7(1), 79–90. https://doi.org/10.29244/jp2wd.2023.7.1.79-90
Manalu, A. S., & Sumantri, B. (2018). Pendapatan Berdasarkan Status Penguasaan Lahan Usahatani Tembakau dan Pemasarannya Income Based Land Tenure Status of Tobacco Farming and Marketing. 17(1), 63–78. https://doi.org/10.31186/jagrisep.17.1.63-78
Muhammad Reza Kusman, Aswan, M., & Tandina, B. M. (2023). Evaluasi sistem pengelolaan sampah di tempat pemrosesan akhir (TPA) Desa Dehegila Kabupaten Pulau Morotai. Asian Journal Collaboration of Social Environmental and Education, 1(1), 12–17. https://doi.org/10.61511/ajcsee.v1i1.2023.118
Muhelni, L., Teknik, F., Teknik, J., Universitas, L., & Ulama, N. (2024). Evaluasi Sistem Pengelolaan Sampah Di Pasar Raya Kota Padang. 4, 5906–5912.
Murdik, & Ghozali, I. (2002). Analisis Faktor-Faktor Yang Mempengaruhi Tingkat Underpriced di Bursa Efek Jakarta.
Pratama, S. P., & Sururi, M. R. (2023). Evaluasi Teknik Operasional Pengumpulan dan Pengangkutan Sampah dalam Sistem Pengelolaan Sampah di Kabupaten Subang. Envirotek : Jurnal Ilmiah Teknik Lingkungan, 15(2), 186–193.
Purnamasari, S. I., & Sitogasa, P. S. A. (2024). Analisis sistem pengelolaan sampah di TPA Tegalasri Kabupaten Blitar. Envirotek : Jurnal Ilmiah Teknik Lingkungan, 16(1), 25–30. http://envirotek.upnjatim.ac.id/
Shofi, N. C., Auvaria, S. W., Nengse, S., & Karami, A. A. (2023). Analisis Aspek Teknis Pengelolaan Sampah di TPS 3R Desa Janti Kecamatan Waru Sidoarjo. Jurnal Teknik Sipil Dan Lingkungan, 8(1), 1–8. https://doi.org/10.29244/jsil.8.1.1-8
SNI. (2002). Tata Cara Teknik Operasional Pengelolaan Sampah Perkotaan. In ACM SIGGRAPH 2010 papers on - SIGGRAPH '10 (Issue ICS 27.180, p. 1).
Suprihatin, A. (1999). Sampah dan Pengelolaannya.
Thamrin, H., Dunggio, I., & Rahim, S. (2022). Evaluasi Kebijakan Pengelolaan Sampah Di Kota Gorontalo Evaluation of Waste Management in City of Gorontalo. Jambura Edu Biosfer Journal, 4(1), 2656–0526.
Torang Hadomuan, M., & WD Tuti, R. (2022). Evaluasi Kebijakan Terhadap Pengelolaan Sampah Kawasan Dan Timbulan Di Kota Tangerang Selatan. Kebijakan: Jurnal Ilmu Administrasi, 13(Vol. 13 No. 1), 7–14. https://doi.org/10.23969/kebijakan.v13i1.4504

Undang Undang Republik Indonesia No 18 Tahun 2008 Tentang Pengelolaan Sampah, 49 69 (2008).

Wijayanti, A. N., Dhokhikah, Y., & Rohman, A. (2023). Analisis partisipasi masyarakat terhadap pengelolaan sampah di Kecamatan Sumbersari, Kabupaten Jember, Provinsi Jawa Timur. Jurnal Pengelolaan Lingkungan Berkelanjutan (Journal of Environmental Sustainability Management), 7(1), 28–45. https://doi.org/10.36813/jplb.7.1.28-45