Bumping Road to Waste Management in Serang City Based on Swat Analysis

Rahmawati[1]*; Anisa Farhaeni[2]

[1] Lecturer of Public Administration, Sultan Ageng Tirtayasa University, Jl. Raya Palka Km. 3 Sindangsari, Serang, Indonesia

[2] Members of the Environmentalist Community, Indonesia

Correspondent author Email: rahmawati@untirta.ac.id

Abstract

The increasing population and community activities have contributed to an increase in the volume of waste. Waste management is a systematic, comprehensive, and continuous activity. This study aims to analyze the challenges of waste management in Serang City, the capital of Banten Province, where the amount of waste continues to increase daily, contrary to the capacity of the final waste disposal site in Cilowong. This study uses the IFAS and EFAS methods to assess the waste management strategies of the Serang City Environmental Agency. The method used is quantitative descriptive. The study involved 26 respondents from government agencies, the community, and waste bank managers. The results indicate that, based on the IFAS and EFAS matrix calculations, strengths and opportunities outweigh weaknesses and threats, with a total internal factor score of 0.45 and a total external factor score of 0.43. Therefore, this strategy adopts an aggressive (growth) approach in waste management. The recommended waste management strategy for Serang City is a collaborative one, which aims to maximize government support and strengthen the involvement of environmental activists and the community, leverage support by establishing strong partnerships with external parties and utilizing technology for waste processing, optimize and strengthen supporting facilities for waste reduction in the community to enhance waste innovation, and educate the community through community-based waste management.

*Keyword: Waste Management; SWOT Analysis*

Introduction

A healthy and good living environment is one of the basic needs of every human being. Humans need to understand that the environment is a valuable asset that must be preserved. Environmental development is a pillar that supports the vision and mission of the SDGs to create a sustainable environment (Nurdiani & Muslim, 2022). Waste management aligns with SDG target 11, which aims to substantially reduce waste generation by 2030 through prevention, reduction, recycling, and reuse. Sustainable waste management is a form of responsibility for consumption and production. The increase

in the volume of waste produced shows a trend of consumerism in society (Manik et al., 2024) and an increase in population (Sukadaryati & Andini, 2022).

In daily life, human activities are inseparable from the presence of waste. Data from the Ministry of Environment and Forestry in the National Waste Management Information System (SIPSN, 2024) shows that the total national waste production reached 37.45 million tons in 2023. This means that approximately 106,882 tons of waste are generated daily by Indonesia's 278 million inhabitants. The volume of waste in Indonesia reaches 106,000 tons daily, but only 5.2 million tons (13.6%) of this waste is reduced at the source before being disposed of downstream. Similarly, the volume of waste in Serang City has increased in line with community activities (see Table 1), as shown in Utari's (2022) research findings that massive population growth and community activities have an impact on domestic waste in Cipare Village, Serang City (Utari et al., 2022).

Table 1 Annual Waste Volume Percentage in Serang City 2019-2023

	2019	2020	2021	2022	2023
Series1	170,200	190,440	209,672	215,464	217,525
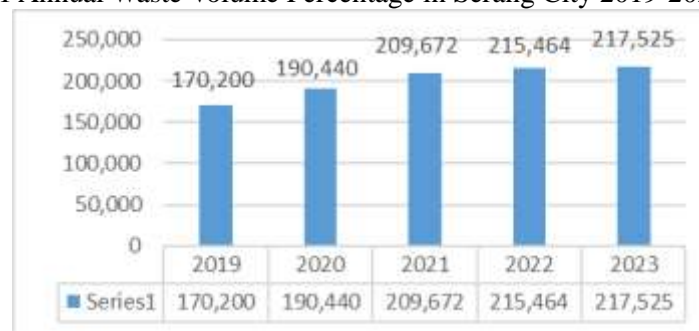
Sources : Serang City Environment Agency, 2025

The table shows that from 2019 to 2023, there has been an average increase in waste generation of 48,064 tons/year. The volume of waste produced by a city is directly proportional to its development and population growth (Abdillah et al., 2014); In 2019, Serang City managed only 51% of municipal waste out of 155,490 tons waste/per year, including the contribution from the waste banks (Pratama et al., 2023).

Initial observations of the study identified several waste management issues in Serang City, including: First, waste collection is still low and uneven compared to the volume of waste generated in a day. Data shows that the Serang City Environmental Agency has 35 dump trucks, six-wheeled vehicles, with 22 in good condition, three slightly damaged, and 10 severely damaged. There are 15 operational vehicles, all six-wheeled, with 11 in good condition, one slightly damaged, and three severely damaged. Additionally, there are 45 cator units. Meanwhile, the daily waste volume generated in 2024 reaches 91,081.75 m³. This means that the residents of Serang City produce waste from household waste and similar household waste amounting to 253 m³/day. Meanwhile, the capacity of the Serang City Environmental Agency to handle waste in Serang City can only manage 128.31 m³/day.

Second, there is still a low level of public understanding regarding community-based waste reduction programs. Third, the waste management system at the Cilowong Final Waste Processing Site (TPAS) is inadequate due to the increasing volume of waste being disposed of, as well as the limited infrastructure and facilities that do not yet support the needs of the Cilowong TPAS. Fourth, the waste management system at the Cilowong TPAS uses a landfill system, which causes environmental pollution for the community around the Cilowong TPAS, especially residents living within a distance of ± 1 km from the Cilowong TPAS.

The waste problem is not only occurring in Serang City. Waste management systems that prioritize final waste disposal are found in most cities in Indonesia (Wikurendra et al., 2023). There is still a low

level of public understanding of household waste reduction in Medan City (Koilola et al., 2024), and TPS3R management has not yet been established (Firmansyah et al., 2023).

This study aims to address the research gap identified by Mubarakh (2021), which states that the implementation of the Serang City Environmental Agency's waste management strategy is still suboptimal due to budget constraints and low public awareness of household waste management (Mubarakh et al., 2021). A strategy is an integrated plan that connects an organization's strengths to achieve its objectives. Strategies are closely tied to the use of Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis. This method is considered capable of identifying key issues and providing recommendations based on the organization's strengths and weaknesses, which can then be developed into policy plans and programs (Rangkuti, 2021). SWOT analysis has been used to address waste issues in Semarang City (Abdillah et al., 2014), at the Lubuk Terentang Landfill (Muliyadi et al., 2023). In addition, SWOT analysis on waste management in Galuga Village, Bogor (Setiawan et al., 2022); also SWOT analysisi to determine waste management strategy di Tenggilis Mejoyo District Surabaya (Rachmawati & Wilujeng, 2023). SWOT analysis is used to measure community participation in waste management in Iran (Afshar et al., 2019).

Methods

The research method used is quantitative with a descriptive approach and uses SWOT analysis. The quantitative methods used are Internal Factor Analysis Summary (IFAS) and External Factor Analysis Summary (EFAS) (Rangkuti, 2021). Calculations in IFAS and EFAS are carried out by weighting and rating each internal and external environmental factor based on the respondents' answers. SWOT analysis is a systematic identification of various factors to formulate company strategies. This analysis is based on logic that can maximize strengths and opportunities while simultaneously minimizing weaknesses and threats (Rangkuti, 2021).

Data collection uses a closed questionnaire with a Likert scale scoring system as a tool to measure attitudes, perceptions, and opinions regarding social phenomena (Sugiyono, 2017). Based on this, the SWOT Analysis consists of an Internal Factor Test comprising Strengths and Weaknesses, which are included in the IFAS (Internal Strategic Factor Analysis Summary). In contrast, the SWOT Analysis external factor test consists of Opportunities and Threats, which are part of the EFAS (External Strategic Analysis Summary). In this test, the researcher will use Microsoft Excel to calculate the weights and ratings as well as the assessment scores from the questionnaire results.

Sampling technique is a method of selecting samples. In this study, Non-Probability Sampling was used, which is a technique where not all elements (members) of the population have an equal chance of being selected as samples in a study. In this sampling technique, the researcher used Purposive Sampling, where samples are selected based on specific considerations. The research respondents included the Head and Staff of the Waste Management, Hazardous Waste, and Capacity Building Division of the Environmental Agency, the Chair of the Waste Bank and TPS3R Management, and the community in Serang City, totaling 26 respondents, as the sample criteria because they are more knowledgeable about waste management implementation in Serang City.

Tabel 2 Expert Sample Criteria

No	Position	amount
1.	Head of waste management, hazardous waste and capacity building, Serang City environment Agency	1
2.	Head of waste management section, serang city environment agency	1
3.	Head of environment capacity building section, serang city environment Agency	1
4.	Head of Cilowong TPAS waste management technical implementation unit, serang city environment agency	1
5.	Deputy head of administration at the Cilowong TPAS waste management unit, Serag city environment agency	1
6.	Head of pasir gadung wadas neighborhood association	1
7.	Cleaning staff at the Cilowong TPAS waste management unit	1
7.	Head of waste bank management board	17
8.	Head of the TPS3R management board	2
	Total	**26**

Sources : Author 2025

The following is a SWOT analysis chart that will form quadrants
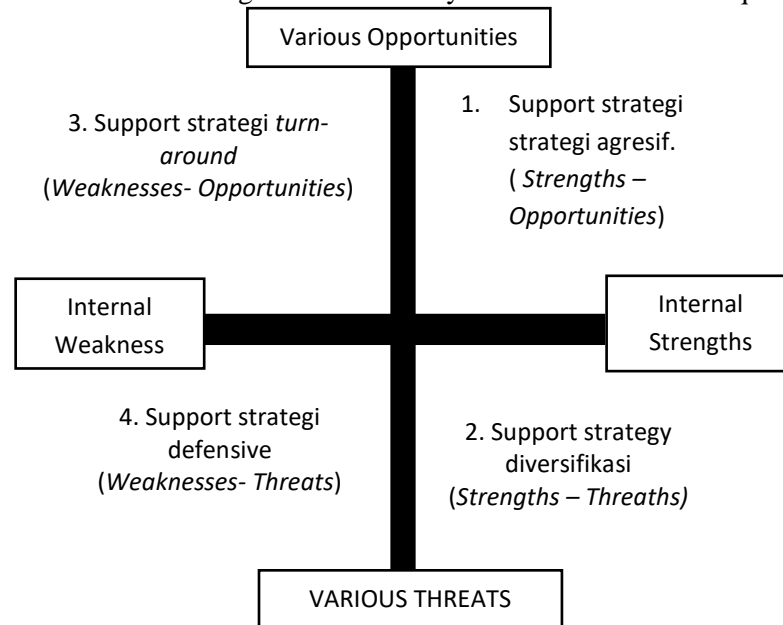
Picture 1: Cartesius Diagram
Sources: Rangkuti 2021

Result and Discussion

Serang City is the capital of Banten Province, comprising six districts. The Central Statistics Agency of Serang City records the population of Serang City at 723,794 people. The following is the volume of waste generated by the people of Serang according to the district in 2024, where the volume of waste production in Serang City in 2024 reached 91,081.75 m³. This means that daily, the residents of Serang City produce household waste and similar waste amounting to 253 m³/day. (Table 3)

Table 3. Amount of waste by district in Serang City

No	District	Total Waste Volume in 2024 (First Semester) (m³)	Total Waste Volume Handled in 2024 (First Semester) (m³)	Presentase
1.	Cipocok Jaya	10.341,50	7.488,76	72,41
2.	Curug	6.514,37	3.971,94	60,97
3.	Kasemen	21.463,43	9.890,56	46,08
4.	Serang	32.778,92	14.999,39	45,76
5.	Taktakan	12.652,84	5.587,99	44,16
6.	Walantaka	7.330,69	4.895,65	66,78
	Total	**91.081,75**	**46.834,29**	**51,42**

Sources : Serang City DLH Waste Data for 2024(Semester I)

A.   Matriks IFAS (*Internal Factor Analysist Strategic*) Waste Management Strategy

The respondents' answers were processed using Microsoft Excel to calculate the IFAS and EFAS matrices. The IFAS matrix was created as a formulation for internal strategic factors, which include strengths and weaknesses as the primary indicators of these internal factors.

Tabel 4 Matriks IFAS (*Internal Factor Analysist Strategic*)

NO	Internal Factor	BOBOT	RATING	SKOR
	STRENGTH			
S1	Government support for community-based waste reduction	0,09	3	0,27
S2	Community-based waste management through waste reduction Waste Banks and Reduce, Reuse, Recycle Waste Processing Facilities (TPS3R) can reduce the volume of waste at the Cilowong Final Waste Processing Facility (TPAS)	0,09	3	0,27
S3	The availability of regulations governing waste management	0,09	3	0,27
S4	The availability of waste management infrastructure at Reduce, Reuse, Recycle Waste Processing Facilities (TPS3R) based on community waste management	0,08	3	0,24
S5	The availability of supporting facilities for waste management to reduce community-based waste through Waste Banks and TPS3R	0,08	3	0,24
S6	The availability of waste processing equipment at the Final Waste Processing Site (TPAS) in Cilowong	0,08	3	0,24
S7	The collaboration between the Environmental Agency of South Tangerang City and the Final Waste Processing Site (TPAS) in Cilowong for the collection of additional fees	0,07	3	0,21
	TOTAL STRENGTH	**0,57**		**1,74**
	WEAKNESS			
W1	Lack of waste transportation infrastructure and distribution of Temporary Waste Storage Sites (TPSS) in Serang City	0,09	3	0,27
W2	Limited human resources in terms of experts or trained personnel for waste management	0,09	3	0,27

		Bobot	Rating	SKOR
W3	Insufficient improvements in leachate treatment at the Cilowong Final Waste Processing Site (TPAS)	0,08	3	0,24
W4	Decreasing capacity of the Cilowong Final Waste Processing Site (TPAS) (overload)	0,08	3	0,24
W5	Insufficient socialization and education regarding waste management and reduction in Serang City	0,09	3	0,27
TOTAL WEAKNESS		**0,43**		**1,29**
TOTAL INTERNAL FACTOR		**1,00**		**3,03**

Sources: data process research field, 2024

The results of the IFAS Waste Management Strategy table above show that the total internal factors with strength and weakness indicators are 3.03, which indicates that the internal position of the Serang City Environment Agency is quite strong.

B.   Matriks EFAS (*Eksternal Factor Analysist Strategic*)

The EFAS matrix was created as a formulation of external strategic factors, which include opportunities and threats that serve as key indicators of the organization's external environment.

No.	EXTERNAL FACTOR	Bobot	Rating	SKOR
	OPPORTUNITIES			
P1	Potential to increase innovation in waste utilization through community-based waste management programs	0,10	4	0,4
P2	Potential for community-based waste management to utilize the environment to become cleaner.	0,09	3	0,27
P3	It can increase the potential for waste to be converted into economic value from the waste management process	0,10	3	0,4
P4	Application of new technology in waste processing to improve waste processing	0,09	3	0,27
P5	The government has received support from environmental activists to handle waste	0,09	3	0,27
P6	Potential for increased cooperation with external parties for the development of waste management	0,09	3	0,27
TOTAL OPPORTUNITIES		**0,55**		**1,88**
THREATS				
A1	The community's inconsistent response to waste management programs	0,09	3	0,27
A2	The community's perception that waste management is difficult	0,09	3	0,27
A3	The private sector's role in waste management is still limited	0,09	3	0,27
A4	Illegal actions that damage the environment, such as littering due to a lack of public awareness, have led to the emergence of illicit dumpsites.	0,09	3	0,27
A5	Existing regulations do not fully support	0,09	3	0,27
TOTAL THREATS		**0,45**		**1,35**
TOTAL INTERNAL FACTOR		**1,00**		**3,23**

Sources: data process research field, 2024

The results of the calculations in the EFAS Waste Management Strategy table above show that the total external factors with opportunity and threat indicators amount to 3.13, indicating that the external position of the Serang City Environmental Agency is powerful.

Based on the above calculations, the coordinates for the IFAS matrix along the X-axis are (0.45), and the coordinates for the EFAS matrix along the Y-axis are (0.43). The following is the location of the coordinates on the Cartesian diagram:
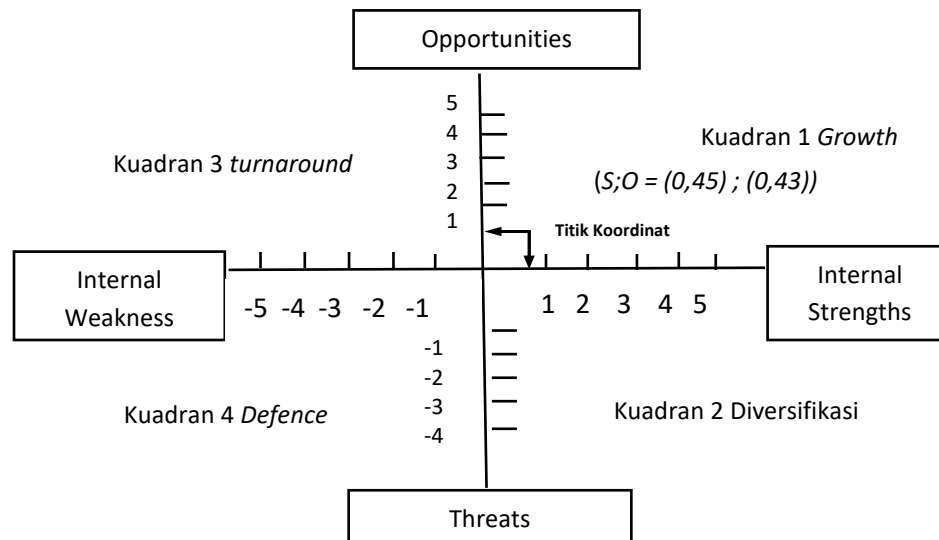

Diagram 2 Diagram Cartesius
sources: process data, 2024

Based on the Cartesian diagram above, the assessment of alternative strategies for waste management in Serang City is in quadrant 1 or the Growth strategy, despite the low intersection point value. However, quadrant 1 indicates a highly advantageous condition by leveraging existing opportunities. In such a situation, the approach that should be adopted is to aggressively support growth policies. Thus, the growth approach is a viable method for waste management and serves as a benchmark for researchers in designing their strategies.

C.   Matriks *IE (Internal dan Eksternal)*

With the determination of SWOT analysis for the IFAS and EFAS matrices through the Cartesian diagram, the results are shown in the SWOT matrix through the calculation of the EFAS and IFAS matrices:

Tabel 6 Strategy Formulation Using the EFAS and IFAS Matrices

	Kekuatan (*Srengths*)	Kelemahan (*Weakness*)
Faktor – Faktor Eksternal	1. Government support for community-based waste reduction 2. Community-based waste management through the Waste Bank and TPS3R can reduce waste at the Cilowong Final Disposal Site (TPA) 3. The availability of regulations governing waste management 4. The presence of TPS3R waste management infrastructure based on community waste handling 5. Supporting facilities for waste management to reduce community-based waste through the Waste Bank 6. Availability of waste processing equipment at the Cilowong Landfill 7. Collaboration between the Tangerang Selatan City Environmental Agency and the Cilowong Landfill for additional revenue generation	1. Lack of waste transportation infrastructure and distribution of Temporary Waste Disposal Sites (TPSS) in Serang City 2. Limited human resources or trained personnel for waste management 3. Insufficient improvement in leachate treatment at the landfill 4. Decreasing capacity of the Cilowong Landfill 5. Insufficient socialization and education regarding waste management and reduction in Serang City

Peluang (*Opportunity*)

1) Potential to increase innovation in waste utilization through community-based waste management programs
2) Potential for community-based waste management to create a cleaner environment
3) Potential to increase the economic value of waste through waste management processes
4) Application of new technologies in waste processing to improve waste management
5) The government has received support from environmental activists to address waste management
6) Potential for increased collaboration with external parties for the development of waste management

Strategi S-O

1) Maximize government support and strengthen the involvement of environmental activists and the community in reducing and utilizing waste reduction results. (S1,S2,O1,O2,O5)
2) Utilize support by establishing strong cooperation with external parties and utilizing technology for waste processing. (S7, O4, O6)
3) Optimizing and strengthening waste reduction support facilities in the community to enhance innovation in household waste reduction outcomes. (S4, S5, O1, O6)
4) Expanding public awareness through community-based waste management, such as Waste Banks and TPS3R, regarding the utilization of waste through outreach and education using information technology. (S2, S3, O1, O2, O3, O4)

Strategi W-O

1) Conduct training and development of experts or officers of the Environmental Agency in waste management through collaboration with external institutions that have expertise in the environmental field. (W2, O6)
2) Add and improve waste transportation and Temporary Waste Disposal Sites (TPSS) for adequate waste management in collaboration with external parties or across sectors. (W1, W3, O6)
3) Address the potential overload of the Cilowong Final Disposal Site (TPA) by adopting technological innovations in waste processing. (W4, O4)

Ancaman(*Threats*)

1. The community's inconsistent response to waste management programs
2. The community's perception that waste management is difficult
3. The private sector's role in waste management is still limited
4. Illegal actions that damage the environment, such as littering due to a lack of public awareness, leading to the emergence of illegal dumpsites.
5. Existing regulations are not yet fully supportive

Strategi S-T

1. Increase government support for encouraging community cooperation through TPS3R and Waste Banks in order to maintain consistent coordination and community response. (S1,S2,T1,T2)
2. Prevent illegal dumping sites caused by illegal waste disposal by expanding waste management infrastructure through TPS3R. (S3, S4, T4)
3. Preventing public perceptions of the difficulty of managing waste by improving and promoting waste management systems through TPS3 in waste collection, sorting, and processing. (S4, T2)

Startegi W-T

Maximize strict supervision and awareness education about the negative environmental impact caused by littering through strict fines or the posting of information. (W2,W5, T4)

Sources : research field data proccess 2024

Based on the table above, it is evident that the researcher has formulated a strategy by the strategic position itself, which is in the aggressive/growth strategy. Based on the recommendations from the SWOT analysis presented earlier, the following are the researcher's recommendations for the Strategic Plan, particularly regarding Waste Management in the City of Serang:

1) *Aggressive Strategy (growth-oriented strategy) (Strengths – Opportunities)*

A growth strategy is a strategy that can optimize the strengths of an organization and leverage or seize opportunities outside the organization. Its objective is to provide broader and higher-quality services. Programs recommended by the researcher based on this strategy in the strategic planning of waste management include coordination and synchronization of waste management infrastructure and facilities by implementing an Android-based application related to the sale and purchase of products made from recycled waste through environmental activists from existing programs such as the Waste Bank and the Reduce, Reuse, Recycle Waste Processing Facility (TPS3R). It was previously identified through a SWOT analysis that these programs generate recycled products, so these products should be sold more widely to enable environmental activists to produce more recycled waste. On the other hand, the application needs to include features showing the locations of existing Waste Banks and TPS3R sites, as other members of the community also need to be aware of and involved in community-based waste management activities, as well as the products produced and the prices at which they are sold.

2) *Diversification Strategy (Strengths-Threats).*

The Diversification Strategy is a strategy that leverages an organization's strengths to mitigate external threats that could hinder its objectives, thereby avoiding negative impacts or significant changes. Programs recommended by researchers based on this strategy for strategic waste management planning include waste handling through sorting and processing at central composting facilities, with activities such as Composting Houses, This compost fertilizer serves as an alternative to synthetic fertilizers, containing organic elements essential for maintaining soil structure, making it easier to cultivate and rich in oxygen (Saves in Siahaan, 2023). Composting aims to reduce the volume of organic waste and produce residual waste from the organic waste composting process. The presence of composting houses is expected to prevent the perception that waste management is complex for the community. This composting facility can serve as a waste reduction facility while also utilizing waste through recycling by enhancing public understanding, awareness, and active participation regarding organic waste or household waste, with the resulting compost able to be sold to the agricultural sector that requires organic fertilizer. This program can also be introduced to schools or at the village level.

3) *Turnaround Strategy (Weaknesses – Opportunities)*

A turnaround strategy is a strategy that addresses or overcomes weaknesses within an organization and leverages opportunities outside the organization. Programs recommended by researchers based on this strategy for strategic waste management planning include waste handling through transportation, as well as coordination and synchronization of waste management infrastructure and facilities using Android-based technology or related waste transportation applications. Given the limitations in waste transportation infrastructure outlined in the 2018-2023 Strategic Plan of the Serang City Environmental Agency, which result in limited waste management capabilities, the Serang City Environmental Agency needs to improve and develop waste transportation services that are currently beyond its reach and address the accumulation of waste due to a lack of transportation. This Android-based waste transportation application is expected to allow waste transportation personnel to be scheduled according to community preferences. The application can be utilized via Google Maps/GPS to locate areas where waste needs to be collected, with a pre-set waste schedule feature for waste disposal (Kai et al., 2018).

4) *Defensive Strategy (Weaknesses – Threats)*

A defensive strategy is a strategy to minimize internal weaknesses within an organization and avoid or reduce the impact of greater threats from outside the organization. Programs that can be

recommended by researchers based on this strategy in strategic waste management planning are the operation and maintenance of waste management facilities and the implementation of monitoring, guidance, verification, and supervision of the implementation of plans, policies, and technical aspects of urban waste management through activities such as the availability of a call center operator at the Serang City Environmental Agency to identify needs or issues related to reports of illegal waste accumulation (Illegal Waste Collection Points). Based on the 2018-2023 Strategic Plan of the Serang City Environmental Agency, the waste issues are waste accumulation and approximately 150 illegal waste collection points located in Serang City. Therefore, communication technology to identify the location of illicit waste based on community reports is needed. This will enable call center operators to forward the results of complaints to the waste collection department, allowing for direct monitoring and supervision of waste management by community needs. This can also be done through the website or illegal waste reporting application, enabling the public to submit complaints about waste accumulation based on location (Fadhli & Amelia Putri, 2022).

Conclusion

Based on the analysis of the IFAS and EFAS matrix calculations, the coordinates from the Cartesian diagram indicate that the alternative strategy is in the aggressive (growth) quadrant, with a total internal factor score of 0.45 and a total external factor score of 0.43. Although it is at a low intersection point, this quadrant describes a favorable situation, so the alternative strategy is the SO Strategy (Strengths – Opportunities), which involves maximizing government support and strengthening the involvement of environmental activists and the community in reducing and utilizing waste reduction results and utilizing support by establishing strong partnerships with external parties and leveraging technology for waste processing, optimizing and strengthening waste reduction support facilities in the community to enhance innovations in household waste reduction outcomes, and expanding public awareness through community-based waste management systems such as Waste Banks and TPS3R regarding the utilization of waste through outreach and education using information technology.

Ethical considerations
This research properly followed ethical policies for research involving human subjects, in addition to confirming the consent of all informants involved.

Conflict of Interest
"The authors declare no conflicts of interest".

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