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Sustainable Regional Development Strategy for Dealing with the Distribution of Landfill Points in West Lombok Regency

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ABSTRACT

To address the distribution of rubbish accumulation points, this study intends to perform a spatial analysis of the distribution of garbage accumulation points and to establish a sustainable regional development strategy. It is anticipated that the study's findings will be input and evaluation materials for regional planners in improving regional planning that is more responsive and adaptive. Waste is an environmental problem that must be addressed in urban areas, including in West Lombok Regency, which faces the distribution of garbage accumulation points. This study uses Geographic Information System and Strengths, Weaknesses, Opportunities, and Threats methods, with field survey techniques, secondary data analysis, and literature study. The sustainable regional development tactics that are possible to implement include: (1) Raising public awareness of the significance of environmental preservation; (2) Making policy support from local governments such as tax incentives or sanctions for businesses or individuals who still pollute the environment; (3) Developing infrastructure such as integrated landfills, recycling facilities, and waste treatment.

Keywords: waste, West Lombok, waste accumulation, Geographic Information System, regional development strategy.

INTRODUCTION

Waste management is an important issue in the development of a sustainable region (Aminah dan Muliawati, 2021). Urban areas, especially in West Lombok Regency, face an increasingly serious waste problem as the population grows and economic activity grows (Rohajawa et al., 2022). The increased amount of garbage production leads to the spread of illegal garbage dumps that pollute the environment (Naimatunisa, 2019). Despite the existence of a Final Landfill (landfill), there are still many landfills caused by the lack of public awareness of the importance of disposing of garbage in a suitable or less optimal garbage collection and transportation system (Khoiriyah, 2021; Ernawati et al., 2019).

To address this problem, a comprehensive and integrated approach involving various parties is needed (Munawir et al., 2021), both government, society, and business operators (Sofia, 2017; Munawir et al., 2022b; Brontowiyono et al., 2010; Widiyanto et al., 2019). One way this can be done is to use the Geographic Information System (GIS) as an aid in mapping and analyzing the distribution of landfill points (Hermawati et al., 2014; Maharani, 2017; Sari, 2014; Prasetyo et al., 2018). Mapping is the process of presenting factual (real-world) surface information, both the shape of the earth's surface and its natural elements, based on the scale of the map, the map projection system, and the symbols of the presented elements of the earth's surface (Jatmiko, 2011; Sutanta, 2017).

Development of the Waste Balance in West Nusa Tenggara in 2018, namely waste reduction of 46 Tons/Day and Handling of 472 Tons/Day later in 2023 Reduction of 358 Tons/Day and handling of 1,130 Tons/Day (Rakor DisLHK NTB, 2023; Hermawati et al., 2014; Sari, 2014). There is a Regulation restricting the use of single-use plastics in some districts such as East Lombok, Kota Mataram, West Lombok based on the regulations of the bupati/mayor area (Perda Lombok Timur No. 2 Tahun 2021; Perda Kota Mataram No. 4 Tahun 2019; Perda Lombok Barat No. 3 Tahun 2019).

Mapping can provide a description of a geographical phenomenon, spatial and non-spatial information, information about the types of features, points, lines, and polygons (Indarto, 2010; Sutanta, 2017; Munawir et al., 2019; Jatmiko, 2011). Using GIS, the distribution of landfill points can be spatially described and linked to other data such as region characteristics, population, land use, and so on (Hermawati et al., 2014; Maharani, 2017; Prasetyo et al., 2018; Munawir et al., 2022a). This can help in identifying the factors that affect the distribution of landfill points and formulate an appropriate sustainable area development strategy in dealing with waste problems (Sofia, 2017; Brontowiyono et al., 2010; Widiyanto et al., 2019).

SWOT is an analytical method used to identify the strengths, weaknesses, opportunities, and threats of a business or project (Rangkuti, 2013; Robinson dan Pearce, 1997; Rachmat, 2014). SWOT can help in planning effective strategies and anticipating challenges that may be faced (Ferrel dan Harline, 2005; Mangundjaya, 2020; Astuti et al., 2020). SWOT was first introduced by Albert Humphrey, a project leader at Stanford University in the 1960s (Humphrey, 2005; Mary dan Coulter, 1999; Prinada, 2022). In conducting a SWOT analysis, there are several steps taken (Friesner, 2010; Putri, 2022; Yahya, 2022) namely :

1. Determine the objectives and objectives of the business or project to be analyzed
2. Collecting data and information relevant to that business or project, both from internal and external sources
3. Grouping such data and information into four categories, namely strengths, weaknesses, opportunities, and threats
4. Compiling a SWOT matrix that shows the relationship between strengths, weaknesses, opportunities and threats, and determining strategies that are appropriate to the conditions and situations of the business or project.

This study aims to analyze the spatial distribution of landfill points using GIS, and to draw up a sustainable area development strategy in dealing with the distribution of landfill points in West Lombok Regency. The contribution and benefits of this study can provide an overview and reference for the planning parties in the area to improve the planning of its main areas in the management of landfill distribution (Munawir, et al., 2022; Sari, 2014; Prasetyo et al., 2018; Hermawati et al., 2014). On the other hand, the information from this study provides additional information about the conditions of landfill sites and effective strategies in reducing the number of garbage dumps in West Lombok Regency (Sofia, 2017; Brontowiyono et al., 2010; Widiyanto et al., 2019).

This study has a distinguishing factor with similar studies that have been conducted by several other researchers, such as Yunita et al. (2023) mapping the distribution of legal and illegal polling stations in Sintang Subdistrict using GIS, or Rizqi (2023) which proposes a sustainable waste management strategy in Banjarmasin. This study not only analyzed the spatial distribution of landfill points using GIS, but also developed a sustainable area development strategy in dealing with the distribution of landfill points in West Lombok Regency. This study is expected to contribute to addressing the problem of litter, which is one of the indicators of sustainable cities.

RESEARCH METHODS

The study used two methods of analysis, namely: (1) Geographic Information System (GIS) and (2) SWOT. Method (1) GIS is used to create maps of landfill locations and physical and social environmental conditions of local communities. The (2) SWOT method is used to identify the strengths, weaknesses, opportunities, and threats of a project. To support both methods of analysis, the study also used three methods of data collection, namely: (a) field survey, (b) secondary data analysis, and literature study. Method (a) field survey was conducted to collect primary data on the location of the landfill and the physical and social environmental conditions of the local community. Method (b) secondary data analysis is performed using related documents such as statistical data, maps, and reports. The method of studying literature is carried out by reviewing scientific sources relevant to the research topic. The data obtained from all three data collection methods were then analyzed by (1) GIS method and (2) SWOT method. The results of the analysis are presented in the form of tabulation of data and maps created using GIS.

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The research location is the area of West Lombok Regency, especially in the southern part which is bounded by administrative areas including Sekotong Subdistrict, Lembar District, Gerung District, Kediri District, and Labuapi District. This region was chosen because it has a fairly high distribution of landfill points and has the potential to have a negative impact on the environment and society.

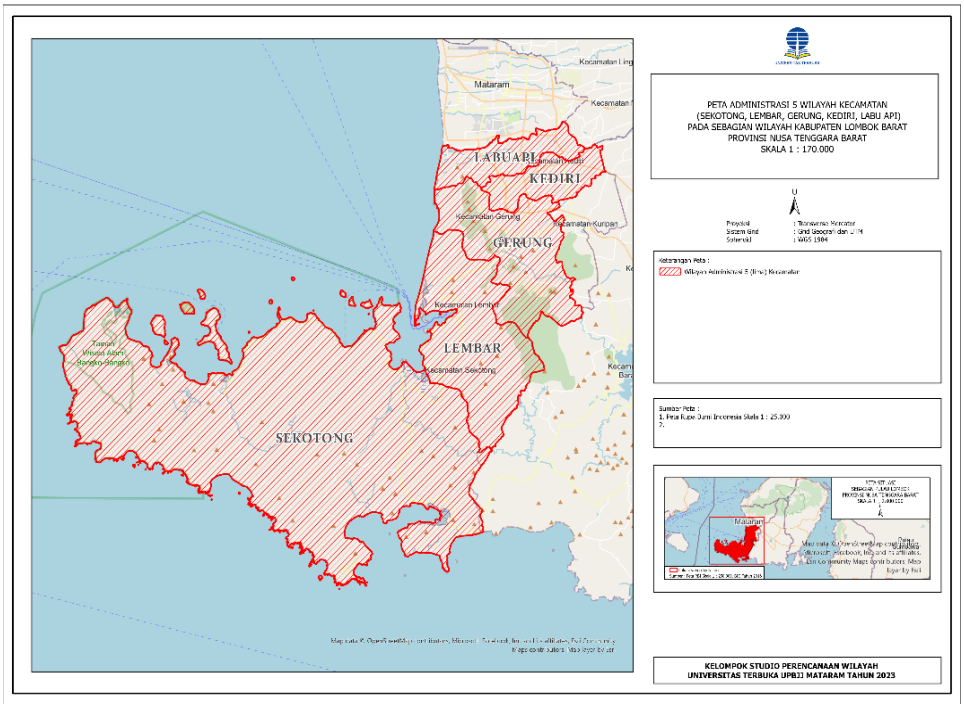

Figure 1. District Administrative Map of South West Lombok Regency. Source: UT Area Planning Studio Group Map

RESULTS AND ANALYSIS

Geographic Information System and SWOT

One of the analysis methods used is Geography Information System with data collection used in this study is field survey. Field surveys were conducted to collect primary data on the physical and social environmental conditions of local communities and the location of landfills. The field survey was conducted using an Android-based GPS that uses the Locus GIS application. The application can record the coordinate points of the location of the garbage heap in a shapefile format that can be opened with GIS. From the results of the field survey, 22 landfill points were obtained that were scattered in several villages in West Lombok Regency, among others:

1. Desa Buwun Mas : 2 points
2. Desa Cendi Manik : 1 point
3. Desa Desan Geres : 1 point
4. Desa Dasan Tapen : 3 points
5. Desa Jembatan Kembar Timur : 1 point
6. Desa Terong Tawah : 1 point
7. Desa Sekotong Tengah : 1 point
8. Desa Lembar Selatan : 5 points
9. Desa Pelangan : 5 points
10. Desa Rumak : 1 point
11. Desa Labuan Tereng : 1 point

Table 1. Location**,** type and source of landfill

No	Village	Subdistricts	CoordinateX	CoordinateY	Type of Garbage	Garbage Source
1	Buwun Mas	Sekotong	394906.125	9020539.103	Plastic, paper, cloth, wood	Household, stall, market
2	Buwun Mas	Sekotong	395614.670	9021609.075	Plastic, paper, cloth, bottle	Household, stall
3	Pelangan	Sekotong	383298.540	9024687.374	Plastic, paper, cloth, bottle, can	Household, stall, ship
4	Pelangan	Sekotong	383542.968	9025809.168	Plastic, paper, cloth, wood	Household, stall, market
5	Pelangan	Sekotong	382569.438	9028513.31	Plastic, paper, cloth, bottle	Household, stall
6	Pelangan	Sekotong	382318.384	9029044.879	Plastic, paper, cloth, bottle, can	Household, stall, ship
7	Sekotong Tengah	Sekotong	395243.692	9029521.689	Plastic, paper, cloth, wood	Household, stall, market
8	Cendi Manik	Sekotong	396213.605	9029588.802	Plastic, paper, cloth, wood	Household, stall, market
9	Pelangan	Sekotong	382888.527	9030146.173	Plastic, paper, cloth, wood	Household, stall, market
10	Labuan Tereng	Lembar	399411.200	9035086.045	Plastic, paper, cloth, wood	Household, stall, market
11	Lembar Selatan	Lembar	399361.305	9035287.392	Plastic, paper, cloth, wood	Household, stall, market
12	Lembar Selatan	Lembar	399346.940	9035477.186	Plastic, paper, cloth, wood	Household, stall, market
13	Lembar Selatan	Lembar	399265.994	9035486.856	Plastic, paper, cloth, wood	Household, stall, market
14	Lembar Selatan	Lembar	398455.626	9037009.099	Plastic, paper, cloth, wood	Household, stall, market
15	Lembar Selatan	Lembar	399034.533	9037366.736	Plastic, paper, cloth, wood	Household, stall, market
16	Jembatan Kembar Timur	Lembar	399636.597	9037714.08	Plastic, paper, cloth, bottle	Household, stall, market
17	Dasan Geres	Gerung	404786.872	9041377.255	Plastic, paper, cloth, bottle	Household, stall, market
18	Dasan Tapen	Gerung	404812.502	9041974.208	Plastic, paper, cloth, bottle	Household, stall
19	Dasan Tapen	Gerung	405116.733	9042023.276	Plastic, paper, cloth, bottle	Household, stall
20	Dasan Tapen	Gerung	405439.216	9042151.848	Plastic, paper, cloth, bottle	Household, stall
21	Rumak	Kediri	403956.856	9044710.66	Plastic, paper, cloth, wood	Household, stall
22	Terong Tawah	Labuapi	400779.798	9046120.126	Plastic, paper, cloth, bottle	Household, stall, market

Field review results, 2023

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The types of garbage found in those villages are plastic, paper, cloth, wood, bottles, and cans. The most common sources of garbage are from households, stalls, markets, and ships.

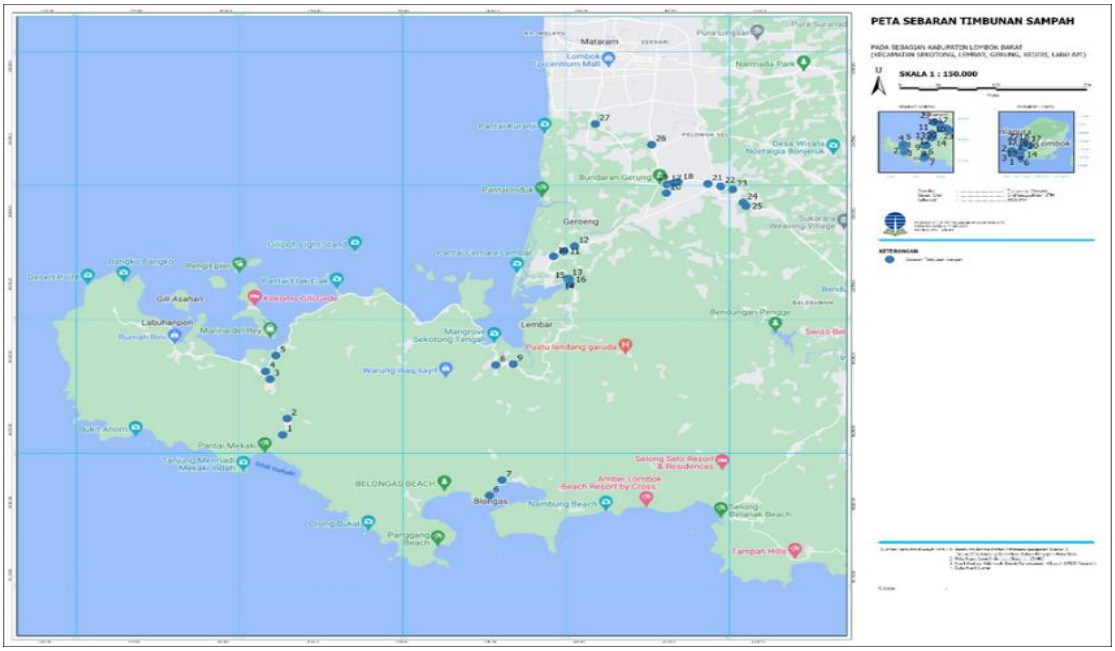

Figure 2. Landfill Point Distribution Map. Source: Survey Data Processing Results Map, Year 2023

Figure 2 shows the distribution of garbage in the districts of Sekotong, Lembar, Labuapi, Kediri, and Gerung in West Lombok Regency, West Nusa Tenggara. The map was created based on data collected from 22 sample points in several villages, indicated by a 1:150,000 scale in the upper right corner of the map. The type of garbage found at each sample point is indicated by the color blue, as described by the legend in the center-right corner of the map. Meanwhile, the sources of garbage that exist at each point are generated from homes, stalls, markets, and ships. This map was drawn and presented using the geographic information system based application ArcGIS Pro from Esri based on field survey data.

Figure 3. Conditions at the location of the landfill Source: Survey Documentation, Year 2023

Figure 3 shows the conditions of garbage dumps strewn and accumulated on the roadside in West Lombok Regency. Such garbage comes from many types, such as plastic, paper, cloth, wood, bottles, and cans. Some of the waste is deliberately disposed of at the site by people who do not care about environmental cleanliness. Some of the waste is carried away by sewer flows that cross the road. This picture was taken during the day, when the sun was shining hot and caused an unpleasant smell

from the garbage. This image shows how poor waste management is, which poses various problems such as air, soil, and water pollution, the spread of diseases, and aesthetic damage. This image also shows the need for public awareness and participation in reducing, sorting, and recycling garbage, as well as the need for governments to provide facilities and regulations that support good waste management.

One of the efforts made by the government in waste management is to provide a Reduce, Reuse, and Recycle Waste Management Place (TPS3R). TPS3R is a facility that serves to manage waste by reducing, reusing, and recycling waste generated by the community. TPS3R can help reduce the volume of waste dumped into landfills, increase the economic value of waste, and raise public awareness of the importance of environmentally friendly waste management.

Based on data from the Directorate General of Cipta Karya of the Ministry of Public Works and Public Housing (PUPR), there are 12 TPS3Rs officially managed by the government in West Nusa Tenggara Province (NTB) in 2020. Of the 12 TPS3Rs, 4 of them are in West Lombok Regency, i.e:

1. TPS3R Village Sekotong Barat, Subdistricts Sekotong
2. TPS3R Village Lembar, Subdistricts Lembar
3. TPS3R Village Gerung, Subdistricts Gerung
4. TPS3R Village Kediri, Subdistricts Kediri

Table 2. Recapitulation of TPS3R Distribution in Kota Regency

No	District/City	TPS3R		Total
		Active	Non-active	
1	Dompu	1	3	4
2	Lombok Barat	2	10	12
3	Lombok Timur	6	9	15
4	Lombok Tengah	5	3	8
5	Kota Mataram	3	0	3
6	KLU	2	13	15
7	KSB	1	3	4
8	Sumbawa	7	0	7
9	Bima	1	0	1
10	Kota Bima	1	0	1
Total		29	41	70

Source: DisLHK NTB data, 2023

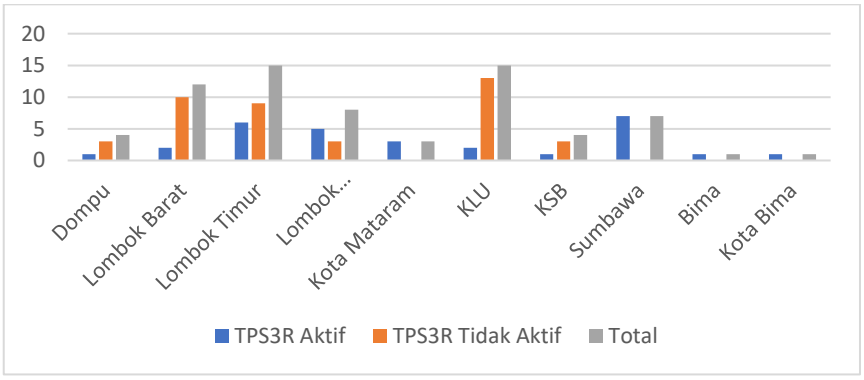

Figure 4. Distribution Diagram of TPS3R in Kota Regency. Source: DisLHK NTB data, 2023

In Table 2 and Figure 4 show where Waste Management Reduce, Reuse, Recycle (TPS3R) is one community-based waste management effort utilizing waste shredder and compost sifter technology. The TPS3R aims to reduce the volume of waste dumped into Final Landfills (landfills), increase the economic value of waste through recycling, and empower communities in waste management. TPS3R can also produce products such as organic fertilizers, handicrafts, and alternative fuels from

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waste. West Nusa Tenggara Province (NTB) is one of the provinces in Indonesia that has implemented the TPS3R concept in waste management. Based on data from the National Waste Management Information System (SIPSN).

The next analysis method used is SWOT Analysis or Strengths, Weaknesses, Opportunities, and Threats which is used to determine sustainable regional development strategies in dealing with the spread of landfill points in West Lombok Regency. Here is the analysis.

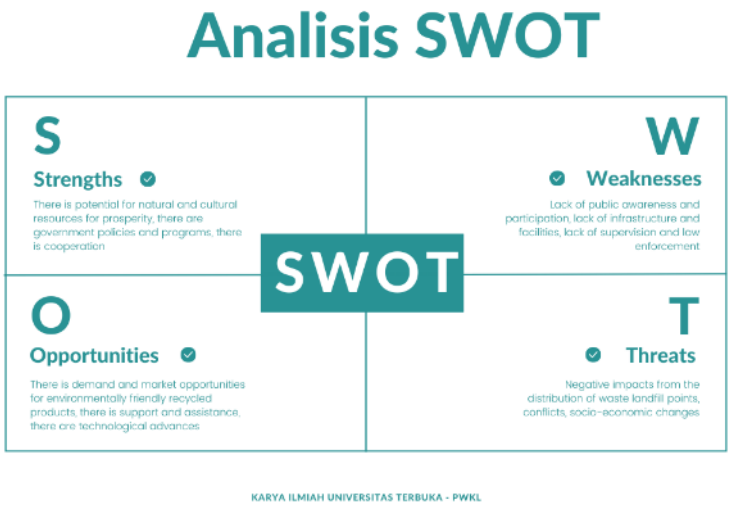

Figure 5. SWOT analysis Sources of SWOT Analysis Results, 2023

Strengths

The existence of potential natural and cultural resources that can be exploited to improve the well-being of society and the quality of the environment.

The existence of local government policies and programs that support the development of sustainable areas, such as TPS3R and TPA programs.

There is cooperation and partnership between the government, the public, and business actors in waste management.

Weaknesses

Lack of public awareness and participation in waste management.

Lack of adequate and even infrastructure and waste management facilities.

Lack of oversight and enforcement related to waste management.

Opportunities

There is a great demand and market opportunity for recycled and environmentally friendly products.

Support and assistance from external parties, such as central government, donor agencies, NGOs, academics, and the media.

There are technological advances and innovations that can simplify and improve the waste management process.

Threats

There are negative impacts of the spread of landfill points on the environment and public health, such as pollution of soil, water, air, and the spread of diseases.

The existence of competition and conflict of interest between parties involved in waste management, such as governments, communities, and business operators.

Changes in social, economic, political, and environmental conditions that may affect waste management, such as natural disasters, economic crises, changes in government, and changes in consumption behavior.

Table 3. SWOT Matrix

	Opportunities	**Threats**
Strengths	**(ST)** Develop recycled and environmentally friendly products that can increase people's income and well-being.	**(WT)** Improving the quality and quantity of infrastructure and waste management facilities that can reduce negative impacts on the environment and public health.
Weaknesses	**(SO)** Socialize and educate people about the importance of good and correct waste management.	**(WO)** Coordinate and collaborate with relevant parties in waste management, such as governments, communities, businesses, NGOs, academics, and the media.

SWOT Matrix Analysis Results Source, 2023

Table 3. The SWOT matrix is a table that divides strategies into four categories, namely: (1) SO Strategies, which leverage strengths and opportunities; (2) WO Strategies, which minimize weaknesses and exploit opportunities; (3) ST Strategies, which leverage strengths and avoid threats; and (4) WT Strategies, which minimize weaknesses and threats.

RESULTS AND DISCUSSIONS

The results of the research were conducted using Geographical Information System (GIS) and Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis methods. The authors will also compare the results of this study with the results of other studies that have similarities or similarities with the topic of this study. The author will also provide implications and recommendations of the results of this research for the development of knowledge, especially in the area of planning and management, as well as for improving environmental quality and public welfare in West Lombok Regency.

The results of the SIG analysis showed that the distribution of landfill points in West Lombok Regency is uneven and tends to be concentrated in some villages that have certain characteristics. Based on the data obtained from the field survey, there are 22 landfill points scattered in five subdistricts, namely Sekotong District, Lembar District, Gerung District, Kediri District, and Labuapi District. A map of the distribution of points of landfills can be seen in Figure 2.

From the map of the distribution of landfill points, it can be seen that the points of landfill tend to be near highways, settlements, markets, or places of high economic and social activity. This suggests that the distribution of landfill points is influenced by factors such as population growth, consumption rates, and lack of public awareness and participation in waste management. In addition, the distribution of landfill points is also influenced by factors such as lack of infrastructure and waste management facilities, lack of supervision and enforcement, as well as the presence of potential natural and cultural resources that can be exploited for the development of sustainable areas.

The results of SWOT analysis show that the development of sustainable areas in addressing the distribution of landfill points in West Lombok Regency has strengths, weaknesses, opportunities, and threats that are interconnected and affect each other. Based on the results of SWOT analysis, the author can formulate a sustainable regional development strategy that suits the conditions and needs in West Lombok Regency. Results of SWOT Analysis and sustainable region development strategy can be seen in Figure 5.

This study is in line with the research conducted by Suwerda (2012) on waste management in Denpasar City in terms of objectives, methods, and outcomes. The study also aims to analyze the

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spatial distribution of landfill points using GIS and devise a sustainable area development strategy using SWOT.

The research conducted by Hutapea (2018) on waste management in Medan City has similarities with this study in terms of background, methods, and results. The study also raised the problem of garbage as one of the environmental problems that must be addressed in urban areas, including in the city of Medan, which faces the spread of landfill points.

CONCLUSIONS

This study successfully analyzed the spatial distribution of landfill points using Geographic Information Systems (GIS) and identified the strengths, weaknesses, opportunities, and threats of sustainable area development in addressing landfill point spread using SWOT. The study found that the distribution of landfill points in West Lombok Regency is influenced by factors such as lack of public awareness and participation, lack of infrastructure and waste management facilities, lack of supervision and enforcement, as well as the presence of potential natural and cultural resources, local government policies and programs, cooperation and partnership between relevant parties, market demand and opportunity, support and assistance from external parties, and technological and innovation advances. The study recommends several sustainable area development strategies that can be done, including: (1) Increasing public awareness of the importance of preserving the environment; (2) Policy making support from local governments such as tax incentives or sanctions for businesses and individuals who still pollute the environment; (3) Development of infrastructure such as integrated landfills, recycling facilities, and waste treatment. This research contributes to the development of knowledge, especially in the area of planning and management of areas, as well as to the improvement of environmental quality and public welfare in West Lombok Regency.

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