Socio-economy analysis of the community in Kediri City on the implementation of restriction policy of single-use plastic usage

Ella Arlaydes Tarnada Zanuar*, Arseto Yekti Bagastyo

Departmentof EnvironmentalEngineering, Faculty of Civil Planning and Geo Engineering,
Institut Teknologi Sepuluh Nopember,Surabaya Indonesia
*Corresponding author: bagastyo@enviro.its.ac.id

Abstract

The increasing use of single-use plastics in Kediri City prompted the issuance of Kediri Mayor Regulation No. 30 of 2023 on restricting single-use plastics. This study analyzes plastic waste composition, community and business participation, and the factors influencing policy implementation. Plastic waste composition was measured using the quarter sampling method in three districts, while participation data were analyzed using Structural Equation Modelling (SEM-PLS). The results show that plastic bags dominate single-use plastic waste, contributing up to 90%, particularly in residential areas due to small business activities. Support for the policy is relatively high, with 74.46% of the community and 64.64% of businesses agreeing, but concrete implementation remains low. SEM-PLS analysis reveals that environmental awareness, knowledge, and attitudes significantly influence the reduction of single-use plastics, while economic income factors are not significant. Continuous education, the provision of eco-friendly alternatives, and collaboration among stakeholders are essential to enhancing policy effectiveness.

Keywords: *single-use plastic, community participation, business actors, regulatory policies, waste composition, sem-pls*

Abstrak

Peningkatan penggunaan plastik sekali pakai di Kota Kediri mendorong diterbitkannya Peraturan Wali Kota Kediri No. 30 Tahun 2023 tentang pembatasan plastik sekali pakai. Penelitian ini menganalisis komposisi sampah, partisipasi masyarakat dan pelaku usaha, serta faktor-faktor yang memengaruhi implementasi kebijakan. Pengukuran komposisi sampah dilakukan dengan metode quarter sampling di tiga kecamatan, sementara data partisipasi dianalisis menggunakan Structural Equation Modelling (SEM-PLS). Hasil penelitian menunjukkan kantong plastik mendominasi sampah plastik sekali pakai hingga 90%, terutama di wilayah perumahan akibat aktivitas usaha kecil. Dukungan terhadap kebijakan cukup tinggi, dengan 74,46% masyarakat dan 64,64% pelaku usaha setuju, namun implementasi tindakan konkret masih rendah. Analisis SEM-PLS menunjukkan kesadaran lingkungan, pengetahuan, dan sikap berpengaruh signifikan terhadap pengurangan plastik sekali pakai, sementara faktor pendapatan ekonomi tidak signifikan. Diperlukan edukasi berkelanjutan, penyediaan alternatif ramah lingkungan, dan kolaborasi semua pihak untuk meningkatkan efektivitas kebijakan.

Kata Kunci: *plastik sekali pakai, partisipasi masyarakat, pelaku usaha, kebijakan regulasi, komposisi sampah, sem-pls*

1. Introduction

Single-use plastics pose one of the biggest challenges in waste management across various regions, including Indonesia. Plastics possess unique properties such as low density, variable mechanical strength, and chemical resistance, making them highly popular for various uses, particularly as packaging materials [1][2]. However, their resistance to degradation and extensive use have led to the accumulation of plastic waste, particularly single-use plastics, becoming a serious issue. According to the World Economic Forum (2016), the amount of plastic waste in global waters has exceeded 150 million tons, with an additional 8 million tons annually. Indonesia ranks as the second-largest contributor to marine plastic waste globally [3].

As an effort to address this issue, the Kediri City Government issued Mayor Regulation No. 30 of 2023 concerning the restriction of single-use plastics. This regulation aims to reduce the use of plastics such as plastic bags, Styrofoam, and straws by encouraging the community and business actors to transition to more environmentally friendly alternatives, such as paper bags, leaf-based containers, or bamboo straws. The policy is being implemented gradually through public and business outreach, as well as administrative

sanctions for violations. The policy targets include government institutions, educational institutions, businesses, and the general public. However, significant challenges remain in its implementation, particularly due to the lack of substantial behavioral changes among the community and business actors, as well as the continued ease of access to single-use plastics.

This study aims to analyze community and business actor participation in supporting the single-use plastic restriction policy in Kediri City by identifying consumption patterns, levels of engagement, and primary sources of plastic waste in each district. Utilizing Structural Equation Modelling (SEM), this research seeks to provide a comprehensive understanding of the effectiveness of various stakeholders' participation in implementing the policy, as well as the efforts needed to enhance compliance and awareness in reducing single-use plastic usage.

2. Material and Methods
Geography of Kediri City

This study was conducted in Kediri City, which comprises three districts: Kota District, Mojoroto District, and Pesantren District. Questionnaire surveys were carried out in all three districts, and to gather data on waste generation and reduction, assessments were conducted at designated Waste Banks and TPS 3R facilities. This was followed by observations at TPS facilities to examine the composition of unmanaged plastic waste that was not processed by Waste Banks. The selection of Waste Bank and TPS locations was determined using purposive sampling.
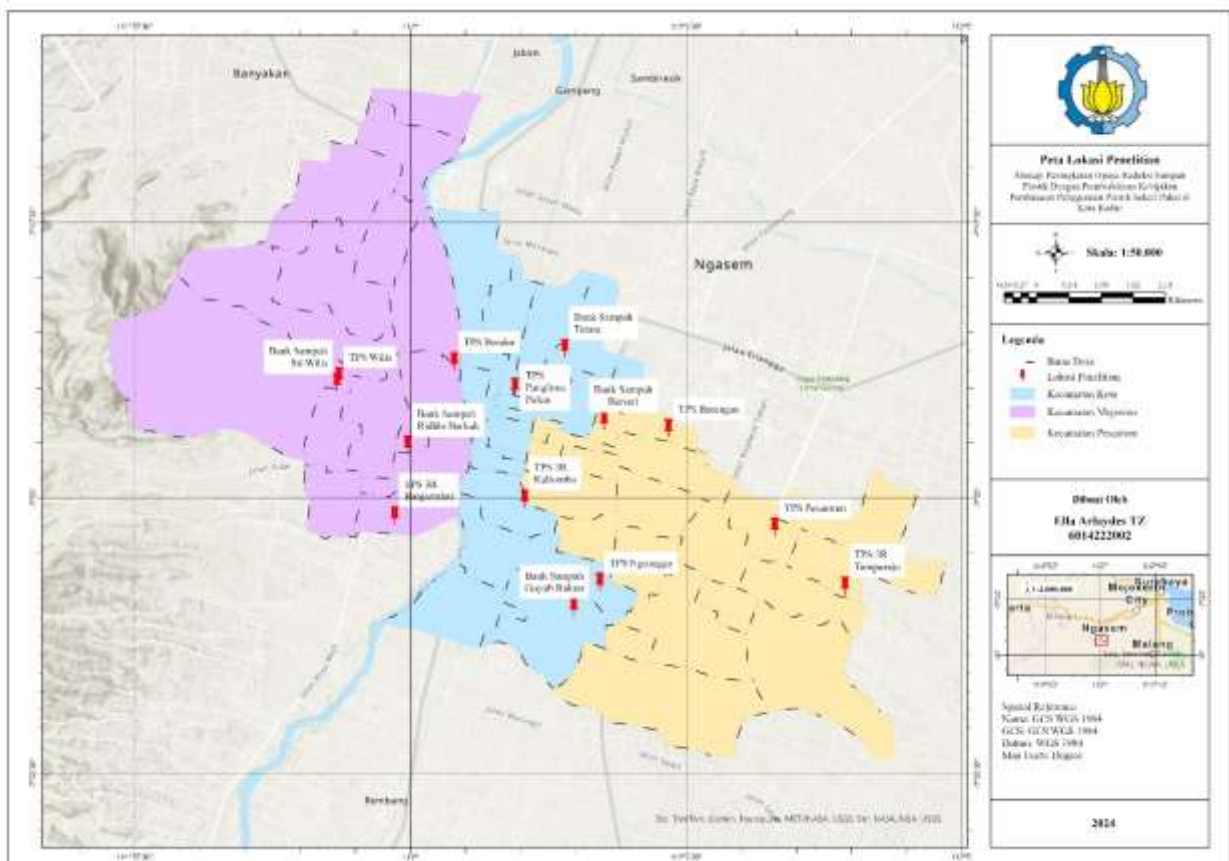
Figure 1. Research Area Map in Kediri City
Source: Geographical Map of Kediri City

Selection of Research Locations

To support the implementation of the single-use plastic reduction policy, research locations were strategically selected to gain in-depth insights into the challenges and opportunities in implementing this policy. The selection criteria included high waste volume, service areas aligned with policy targets, the presence of active waste banks, and the potential for community involvement in plastic waste reduction programs.

For this study, two TPS (Temporary Waste Disposal Sites) were chosen from each sub-district: a total of 14 TPS in Pesantren Sub-district, 12 TPS in Kota Sub-district, and 14 TPS in Mojoroto Sub-district. Regarding waste banks, two were selected from both Mojoroto and Kota sub-districts, while in Pesantren

Sub-district, the selection was based on the activity level of the waste banks. In total, 30 waste banks were recorded in Mojoroto Sub-district, 25 in Kota Sub-district, and 5 in Pesantren Sub-district. This selection process aimed to represent the conditions in each sub-district comprehensively, with the selected research locations detailed as follows:

Table 1. Research Locations

Mojoroto District	Kota District	Pesantren District
TPS Bandar	TPS Ngronggo	TPS Burengan
TPS Wilis	TPS Panglima Polim	TPS Pesantren
TPS 3R Banjarmlati	TPS 3R Kaliombo	TPS 3R Tempurejo
Bank Sampah Sri Wilis	Bank Sampah Teratai	Bank Sampah Berseri
Bank Sampah Ridhlo Berkah	Bank Sampah Guyub Rukun	

Source: DLHKP Kediri City

Measuring the Composition of Single-Use Plastic Waste

The measurement of single-use plastic waste composition was conducted using the quartering method, following the SNI-19-3964-1994 standard. This process involved mixing the waste, dividing it into four parts, and randomly selecting one part until a total weight of 100 kg was reached. The waste was then sorted by type of single-use plastic, including plastic bags, polystyrene (styrofoam), and plastic straws, in accordance with Kediri City Regulation No. 30 of 2023. Each type of waste was weighed and recorded, and the composition was calculated using the following formula:

$$\% \text{ waste composition} = \frac{Waste\ weight\ per\ type\ (kg)}{Total\ weight\ of\ waste\ collected\ (kg)}\ x\ 100\ \%$$

These measurements were carried out over an eight-day period at designated waste disposal sites (TPS), to ensure accurate and representative results regarding the generation of single-use plastic waste.

Determination of Research Respondents

The analysis of community participation aspects in this study was conducted through the distribution of questionnaires to the community and business actors. The sampling method used was purposive sampling, a technique of selecting samples based on specific considerations aligned with the relevant population characteristics [6]. The determination of sample size was based on the population in the three sub-districts of Kediri City, with a margin of error set at 10%, following the approach proposed by Isaac and Michael [7]. To ensure the accuracy of the data obtained, the sample size was calculated using Slovin's formula, as follows:

$$n = \frac{N}{1 + Ne^2}$$

information:
n = Number of samples (people)
N = number of population (people)
e = Error rate (%)

The population in each sub-district determines how many samples are taken. Table 2 below shows the population of Kediri City by sub-district.

Table 2. Population in Kediri City Based on District

District	Number of Population (People)	Total Population (People)
Mojoroto	115.346	
Kota	84.634	289.418
Pesantren	89.626	

Source: BPS Kediri City 2023

So the calculation of the number of samples that can be taken in this study is as follows:

$$n = \frac{289.418}{1 + (289.418\ x\ (0,1)^2)}$$
$$n = 99,89 = 100 \text{ people}$$

Data Requirements

This study uses primary data and secondary data, where primary data is done by conducting field surveys, interviews and filling out questionnaires to the community. The details of the primary data and secondary data used can be seen in **Table 2**.

Table 2. Data Types and Retrieval

No	Data Type	Data Collection Method
1	Data on the composition of single-use plastic waste in Kediri City	Primary Data
2	Questionnaire and interview data	Primary Data
3	Number of residents in Kediri City	Secondary Data
4	Mayor Regulation Number 30 of 2023	Secondary Data
5	Data on the composition of single-use plastic in waste banks	Secondary Data

Analysis of Community and Business Actors' Behavior

The data analysis method in this study employed Structural Equation Modeling (SEM) with the Partial Least Squares (PLS) technique. Additionally, descriptive analysis was applied to understand the characteristics and behavior of the community in decision-making related to reducing single-use plastic usage. The SEM analysis process was conducted using Microsoft Excel 2013 and SmartPLS software, enabling more efficient and accurate data processing. The framework of this study is as follows:
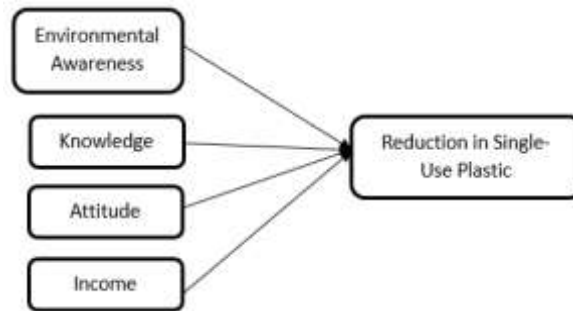
Figure 2. Research Thinking Framework
Source: Research results, (2024)

The assessment of each questionnaire utilized a Likert scale, where respondents were asked to evaluate a series of statements using five response options [10]:
1. Strongly disagree
2. Disagree
3. Somewhat disagree
4. Agree
5. Strongly agree

3. Results and Discussion
Composition of Single-Use Plastic Waste

The plastic waste analyzed includes plastic bags, styrofoam, and plastic straws, as categorized under Kediri City Mayor Regulation No. 30 of 2023. The data obtained through waste sorting at each location is presented in diagram form to facilitate the interpretation of single-use plastic waste composition in each district. The results of the single-use plastic waste composition analysis across the three districts are as follows:
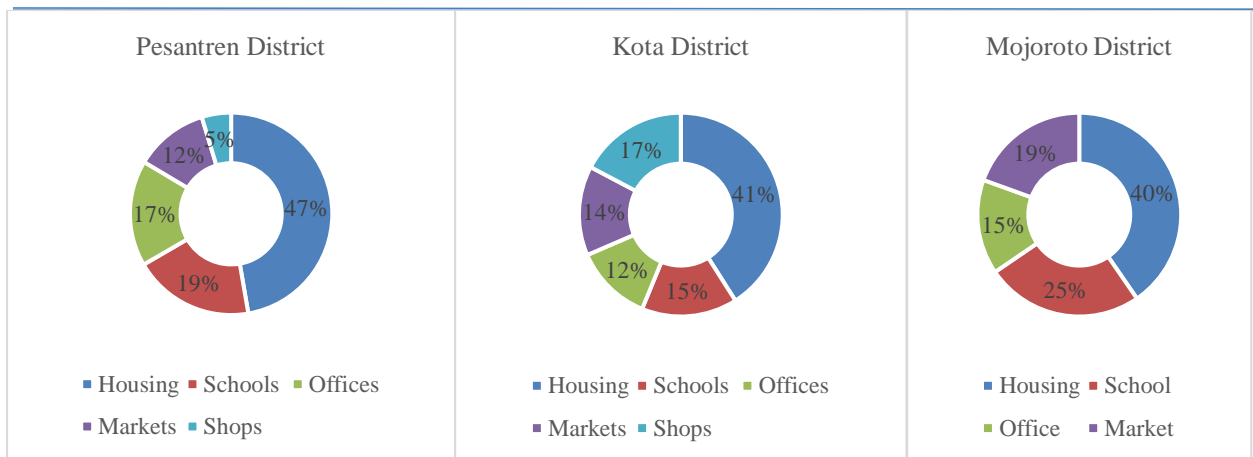
Figure 3. Composition of Single-Use Plastic in Kediri City

Single-use plastic waste continues to dominate waste accumulation in residential areas of Kediri City. This is attributed to community activities that not only generate household waste but also stem from small businesses such as vegetable vendors, food sellers, and convenience stores, which frequently use single-use plastic containers. Based on the analysis, the largest contribution comes from plastic bags, accounting for approximately 90% of total single-use plastic waste. This finding aligns with [11], which revealed that plastic bag usage remains prevalent among street vendors and small businesses. This condition underscores the importance of evaluating community and business participation in the implementation of single-use plastic restriction policies to understand the extent to which these policies are comprehended and executed. The results of the questionnaire regarding the attitudes of the community and businesses towards this policy are presented in the following diagram.
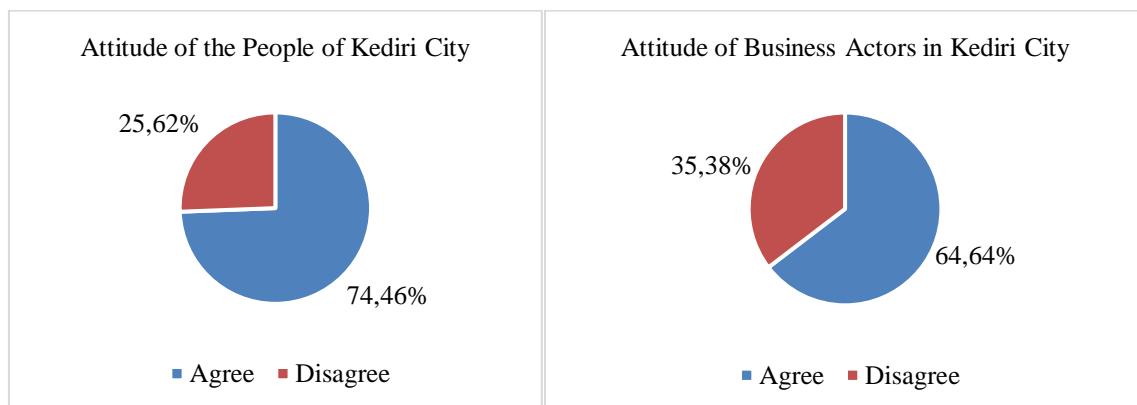

Figure 4. Results of the Community and Business Actors' Attitude Questionnaire in Kediri City

Based on the questionnaire results, 25.62% of the community and 35.38% of business operators in Kediri City are still reluctant to switch from single-use plastics to more environmentally friendly materials. This contributes to the high composition of single-use plastic waste in the study area. Interviews also revealed that not all community members and business operators are aware of the single-use plastic restriction policy. Meanwhile, those who are aware of the policy tend not to implement it because single-use plastics remain easily accessible and are often provided free of charge by vendors. These findings align with research [12] in South Africa, which states that inadequate monitoring and ineffective policies, such as low plastic levies, hinder the optimal reduction of plastic usage.

Community and Business Participation

The analysis of the implementation of the single-use plastic reduction policy in Kediri City in this study was conducted using the Structural Equation Modeling (SEM) method, described as follows:
1. Validity and Reliability Testing
    Validity testing aims to ensure that the data used accurately represent the phenomena being studied. Validity in this research was assessed through convergent validity and discriminant validity to confirm that each indicator aligns appropriately with the construct being measured.

Table 3. Average Variance Extracted (AVE) Value of Community Participation

Variable	Average Variance Extracted (AVE)	Composite Reliability	Cronbach's Alpha
Environmental Awareness_(X1)	0,598	0,816	0,702
Knowledge_(X2)	0,509	0,804	0,880
Attitude_(X3)	0,626	0,893	0,850
Income_(X4)	0,649	0,847	0,730
Reduction in Single-Use Plastic_(Y)	0,673	0,890	0,832

Table 4. Average Variance Extracted (AVE) Value of Business Actor Participation

Variable	Average Variance Extracted (AVE)	Composite Reliability	Cronbach's Alpha
Environmental Awareness _(X1)	0,785	0,916	0,866
Knowledge _(X2)	0,680	0,893	0,850
Attitude_(X3)	0,666	0,908	0,878
Income _(X4)	0,823	0,933	0,893
Reduction in Single-Use Plastic_(Y)	0,814	0,946	0,924

Based on the two tables above, it can be observed that all research variables have an AVE value greater than 0.50, and both composite reliability and Cronbach's Alpha exceed the threshold of 0.60. This indicates that the measurements for each variable have met the required reliability criteria. Therefore, it can be concluded that the measurements for all research variables are reliable, and the data collected from these measurements can be used for further testing or analysis. These results strengthen the validity of the research in measuring the constructs under study.

2. Hypothesis Testing

Hypothesis testing was conducted to identify the relationships between dependent, independent, and mediating variables using the analysis of Original Sample (O) and P-Value through bootstrapping. A hypothesis is considered significant if the t-statistic exceeds 1.96 at a 5% error level ($\alpha=0.05$). The results of this testing are presented in a table to facilitate the interpretation of relationships between the research variables.

Table 5. Community Participation Hypothesis Testing

Hypothesis	Influence	Coefficient	T *Statistics*	P *Values*	Description
X1	Environmental Awareness _(X1) → Reduction in Single-Use Plastic _(Y)	0,409	3,648	0,000	Significant
X2	Knowledge _(X2) → Reduction in Single-Use Plastic _(Y)	0,362	4,443	0,000	Significant
X3	Attitude _(X3) → Reduction in Single-Use Plastic _(Y)	0,259	5,068	0,007	Significant
X4	Income _(X4) → Reduction in Single-Use Plastic _(Y)	0,349	4,403	0,250	Not Significant

The results of the hypothesis testing on community participation indicate that the variables Environmental Awareness (X1), Knowledge (X2), and Attitude (X3) have a positive and significant influence on the Reduction of Single-Use Plastic Usage (Y) in Kediri City, with coefficient values of 0.409, 0.362, and 0.259, respectively. Meanwhile, the Income variable (X4) shows a positive but insignificant influence, with a P-value of 0.250 > 0.05. In conclusion, Environmental Awareness, Knowledge, and Attitude are key factors supporting the policy of reducing single-use plastics, while Income requires further approaches to enhance its contribution.

Table 6. Hypothesis Testing of Business Actor Participation

Hypothesis	Influence	Coefficient	T *Statistics*	P *Values*	Description
X1	Environmental Awareness _(X1) → Reduction in Single-Use Plastic _(Y)	0,309	3,648	**0,000**	**Significant**
X2	Knowledge _(X2) → Reduction in Single-Use Plastic _(Y)	0,472	5,653	**0,000**	**Significant**
X3	Attitude _(X3) → Reduction in Single-Use Plastic _(Y)	0,166	2,019	**0,005**	**Significant**
X4	Income _(X4) → Reduction in Single-Use Plastic _(Y)	0,865	28,277	**0,096**	**Not Significant**

The hypothesis testing results indicate that Environmental Awareness (X1), Knowledge (X2), and Attitude (X3) have a positive and significant influence on reducing single-use plastic usage by business actors in Kediri City, with coefficients of 0.309, 0.472, and 0.166, respectively. However, the Economic variable (X4), while having a positive influence, is not significant, as indicated by a P-value > 0.05. These findings align with community participation results, which highlight awareness and knowledge as key factors in supporting the single-use plastic restriction policy. Nevertheless, among both the community and business actors, the implementation of concrete actions to reduce single-use plastics requires a more comprehensive approach, such as additional education and economic incentives to enhance commitment and participation in this policy.

4. Conclusion

This study reveals that single-use plastics, particularly plastic bags, still dominate the composition of waste in Kediri City, especially in residential areas. This is influenced by activities not only from household waste but also from small businesses such as vegetable vendors, food sellers, and grocery stores that rely heavily on single-use plastics. The analysis shows that plastic bags contribute the most waste, accounting for 90% of total single-use plastic waste. Questionnaire results on the attitudes of the community and business actors indicate varying levels of acceptance toward the single-use plastic restriction policy. While 74.46% of the community and 64.64% of business actors support this policy, a significant proportion of the community (25.62%) and business actors (35.38%) are still reluctant to switch from single-use plastics to more environmentally friendly alternatives. Key factors include entrenched habits, the ease of access to single-use plastics, and the provision of free plastics by sellers.

Based on the analysis using Structural Equation Modelling (SEM-PLS), the variables of environmental awareness, knowledge, and attitude have a positive and significant influence on reducing single-use plastic usage. However, the economic variable shows a positive but insignificant effect. These findings highlight that increasing environmental awareness, understanding, and attitudes among the community and business actors are critical to supporting this policy. Overall, the implementation of the single-use plastic restriction policy in Kediri City faces challenges, particularly in ensuring active participation from the community and business actors. Thus, further efforts are needed, including more extensive policy socialization, enhanced environmental education, and the provision of accessible environmentally friendly alternatives for the community and business actors.

5. Acknowledgment

6. Abbreviations

%	Percentage
TPS	Temporary Shelter
3R	Reduce, reuse and recycle

BPS	Central Bureau of Statistics
DLKP	Department of Environment, Cleanliness and Parks

7. References

[1]   Yuliyawati Y, Kamaluddin M. Persepsi Konsumen terhadap Kebijakan Kantong Plastik Berbayar. 2021;XV:48–54.

[2]   Purwaningrum, P. (2016). Upaya Mengurangi Timbulan Sampah Plastik di Lingkungan. Indonesian Journal of Urban and Environmental Technology, 8(2): 141-147

[3]   Jenna, R. Jambeck. 2015. Plastic waste inputs from land into the ocean. University of Georgia.

[4]   Peraturan Walikota No 30 Tahun 2023 Mengenai Pembatasan Penggunaan Plastik Sekali Pakai

[5]   Standar Nasional Indonesia (SNI) 19-3964-1994 tentang Metode Pengambilan dan Pengukuran Contoh Timbulan dan Komposisi Sampah Perkotaan

[6]   Sugiyono. (2016). Metode Penelitian Kuantitatif, Kualitatif, dan Kombinasi (Mixed Methods). Bandung: Alfabeta.

[7]   Yuliana, L., & Khusnullaili, F. (2020). Analisis Kualitas Layanan Perpustakaan Alternatif Wilayah Selatan Kota Yogyakarta dengan Model Servqual. Jurnal Kajian Ilmu dan Perpustakaan, Vol. 5, No. 2, 119-127.

[8]   Badan Pusat Statistik Kota Kediri Jawa Timur. kedirikota.bps.go.id, 2023.

[9]   SIPSN. (2021). Capaian Kinerja Pengelolaan Sampah. Kementerian Lingkungan Hidup dan Kehutanan.

[10]   Djaali and Muljono. 2007. Likert Scale. Jakarta: Pustaka Utama.

[11]   Block, B. (2013)." China Reports 66-Percent Drop in Plastic Bag Use", WorldWatch Institute. [Online] Available: http://www.worldwatch.org/node/6167, (July 1, 2016)

[12]   Dikgang, J., Leiman, A., Visser, M., 2012. Analysis of the plastic-bag levy in South Africa. Resour. Conserv. Recycl. 66, 59–65.