

Implementation of Plastic Waste Reduction Policy in Malang City: A Quantitative Analysis of Achievement and Regulatory Gaps, 2020-2024

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Abstract

This study analyzes how Malang City's waste reduction and handling policy performed between 2020 and 2024 against the targets set in Mayoral Regulation No. 34/2018, and asks how legally binding the city's plastic-waste-reduction instrument actually is. A descriptive quantitative, ex post facto design was used, drawing on official secondary data from Malang City Government releases, the Malang City Environmental Agency (DLH), and earlier academic journal articles, analyzed through time-series trend analysis, policy-target gap analysis, compound annual growth rate (CAGR) analysis of waste infrastructure, and content analysis of the legal strength of the plastic-reduction instrument. City-wide waste handling realization had already exceeded its 2025 target by 2021 (74.00%, 4.00 points above the 70% target) and reached 98.68% by 2024, while reduction realization continued to lag behind the 30% target, at 26.17% in 2023 (a gap of -3.83 points). The number of waste transfer stations (TPS) grew at a compound annual rate of 11.99%, from 59 units in 2020 to 74 in 2022, yet a sub-district-level case study found a reduction rate of only 20.13% in Tunjungsekar, well below the city aggregate, pointing to an aggregation bias in how achievement is reported. The main instrument specifically targeting plastic, Mayor's Circular Letter No. 8/2021, turned out to be an administrative appeal with no binding legal force, and DLH itself acknowledged that its impact has so far been limited. Aggregate success on the handling side, in other words, risks masking implementation gaps at smaller territorial scales, and the weak legal standing of the plastic-reduction instrument makes passing the pending single-use-plastic-bag bylaw an urgent priority.

Keywords: *Plastic Waste Policy, Policy Implementation, Waste Reduction, Malang City, Circular Letter.*

A. INTRODUCTION

As East Java's second-largest city, with a population of 843,810 according to the 2020 population census (InfoPublik, 2021), Malang City faces mounting waste-generation pressure driven by population growth and expanding urban economic activity. Plastic waste is recorded as making up roughly 16% of the city's total waste, the second-largest contributor after household waste generally, with an estimated 139,287 plastic bags discarded each day, equivalent to 50,839,865 bags a year (Malang Raya Blok-A, 2023; Radar Malang, 2025). Total waste-generation figures for the city vary somewhat between sources: 279,148.37 tonnes in 2022 according to Malang Raya Blok-A (2023), 247,388 tonnes in 2023 according to a presentation by the head of the city's Regional Development Planning Agency (Bappeda) (Malang City Government, 2023), and a rise to 731.29 tonnes per day by 2024 according to DLH Malang City

(Malang City Government, 2025). That variation is itself an early signal of a data-consistency challenge in how the city reports its waste figures, one worth examining in its own right.

Malang City's government has issued a series of policy instruments to address the waste problem. Mayoral Regulation No. 34/2018 on the Regional Policy and Strategy (Jakstrada) for Household Waste Management sets targets of 30% reduction and 70% handling by 2025 (Malang City Government, 2018); Regional Regulation No. 7/2021 on Waste Management provides a bylaw-level legal umbrella (Malang City Government, 2021); and Mayor's Circular Letter No. 8/2021 on Plastic Waste Reduction requires retail businesses, hotels, restaurants, and cafes to cut their use of single-use plastic (Malang City Government, 2021b). That circular letter builds on an earlier one issued in 2018, an Appeal to Reduce Plastic Use (Malang City Government, 2018b).

An assessment by Saraswati, Suyeno, and Putra (2023) of how Regional Regulation No. 7/2021 has been implemented found that execution still falls short in practice, hampered by inadequate transfer-station (TPS) facilities in densely populated areas, unsuitable collection vehicles, and low public awareness. DLH Malang City has itself acknowledged that the impact of Circular Letter No. 8/2021 remains limited and has not meaningfully reduced plastic use (Mongabay Indonesia, 2021; detikJatim, 2025), a gap that has prompted civil-society groups, together with the city council (DPRD), to push for a regional bylaw restricting single-use plastic bags, targeted to take effect in 2026 (Malang Raya Blok-A, 2023). At the aggregate level, meanwhile, DLH Malang City reports strong waste-handling performance, 98.14% in 2023 and 98.68% in 2024 (Khufat, Warnidasari, & Firdaus, 2024; Malang City Government, 2025), well above the 70% target. A sub-district-level case study by Kartikasari, Hariyani, and Firdausiyah (2024) at the Tunjungsekar transfer station tells a rather different story, however, recording a reduction realization of only 20.13%, below the 30% national target, and raising the question of just how consistent the city's aggregate figures are with what is actually happening on the ground in smaller administrative units.

This gap between aggregate and micro-level achievement, combined with the comparatively weak legal standing of a circular letter next to a regional or mayoral regulation, has not been examined quantitatively in much depth in the existing literature on plastic waste policy in Malang City. Earlier studies have tended either toward a single-location case study (Kartikasari, Hariyani, & Firdausiyah, 2024) or a descriptive-qualitative evaluation of bylaw implementation (Saraswati, Suyeno, & Putra, 2023), without explicitly testing the size of the reporting gap across administrative levels or systematically assessing the legal strength of the regulatory instrument. Against that background, this study sets out to: (1) analyze the trend in Malang City's waste reduction and handling achievement from 2020 to 2024 against the targets in Mayoral Regulation No. 34/2018; (2) analyze the growth rate of transfer-station (TPS) infrastructure as the backbone of handling capacity; and (3) assess the

legal strength of the city's plastic-waste-reduction instrument and what that implies for how effectively it can be implemented.

The study is framed by George C. Edwards III's (1980) model of policy implementation, which identifies four variables that determine implementation success: communication, resources, disposition, and bureaucratic structure. The communication variable is used here to analyze the choice of policy instrument, a circular letter rather than a regional regulation, as a form of communicating obligations to policy targets, while the resources variable is used to interpret the growth of TPS infrastructure as a determinant of the city's waste-handling capacity.

Two further theoretical lenses sharpen the interpretation of this study's two central puzzles. The choice of a non-binding circular letter over a binding regulation to address plastic waste is read here also through Edelman's (1964) theory of symbolic politics, which distinguishes policies that produce tangible material outcomes from those that function mainly to reassure the public that government is responsive to a problem, regardless of whether the instrument actually changes behavior on the ground; a circular letter, by construction, is closer to the latter than the former. Separately, the gap between the city's aggregate handling achievement and the much lower reduction rate recorded in the Tunjungsekar case study is interpreted through the modifiable areal unit problem, or MAUP (Openshaw, 1984), a well-established methodological finding in spatial statistics that the scale and boundaries chosen for aggregating data can themselves distort the apparent pattern in that data, so that a percentage calculated over an entire city can look considerably more favorable than the same measure calculated over any one of the smaller units that make it up.

B. METHODS

This study takes a quantitative, *ex post facto* approach, analyzing official data on Malang City's waste-management policy achievement without manipulating any variable directly. The population consists of all official data on the city's waste reduction and handling achievement published between 2020 and 2025, treated as a census of available secondary data, so no random sampling was performed.

The secondary data draw on three sources: (1) official releases from the Malang City Government and its Environmental Agency (DLH), published on the city's official website, malangkota.go.id; (2) earlier academic journal articles containing quantitative data on the city's waste-policy achievement, specifically Khufat, Warnidasari, and Firdaus (2024) and Kartikasari, Hariyani, and Firdausiyah (2024); and (3) the regulatory record itself, Mayoral Regulation No. 34/2018, Regional Regulation No. 7/2021, and Mayor's Circular Letter No. 8/2021. Population and administrative-area data come from Statistics Indonesia's (BPS) official 2020 population census release. All of this material was gathered through documentary study.

The analysis proceeded in four stages. First, a time-series trend analysis traced how reduction and handling realization changed from year to year. Second, a gap analysis, calculated as $\text{Gap} = \text{Realization} - \text{Target}$, measured achievement against the

endpoint targets in Mayoral Regulation No. 34/2018 (30% reduction and 70% handling by 2025); because that regulation does not lay out a tiered set of annual targets, the 2025 endpoint was used as the benchmark for every year of observation. Third, compound annual growth rate (CAGR), calculated as $CAGR = [(final\ value / initial\ value)^{(1 / number\ of\ years)} - 1] \times 100\%$, measured how quickly the number of transfer stations (TPS) grew between 2020 and 2022. Fourth, a descriptive comparison was made between the city-wide aggregate achievement and the sub-district-level case-study achievement (Tunjungsekar) to test the consistency of reporting across administrative levels, alongside a content analysis of the type and legal strength of the policy instrument governing plastic-waste reduction. All quantitative calculations were carried out in Python.

C. RESULTS AND DISCUSSION

1. Waste Generation and Composition in Malang City

Malang City's waste-generation figures vary somewhat across official sources. A presentation by the city's Bappeda at a technical coordination meeting put generation at 247,388 tonnes in 2023, equivalent to about 687 tonnes per day (Malang City Government, 2023), while another source cites 279,148.37 tonnes for 2022 (Malang Raya Blok-A, 2023). A more recent DLH release puts generation at 731.29 tonnes per day by 2024 (Malang City Government, 2025). The variation across these closely spaced figures points to a broader challenge in keeping the methodology for calculating waste generation consistent from one reporting period to the next, a finding with direct relevance for improving local data governance going forward.

By composition, organic waste dominates Malang City's waste stream, accounting for 61% of the total in 2024, with plastic waste the second-largest contributor at 16% (Malang City Government, 2025; Radar Malang, 2025). Bappeda's 2023 data break this down further, showing household organic waste making up 47% of total generation, of which 54.39% is food waste (Malang City Government, 2023). Plastic bags alone are estimated at 139,287 discarded per day, or 50,839,865 a year (Malang Raya Blok-A, 2023), a volume that underlies the urgency behind Malang City's push for a single-use-plastic-bag restriction policy.

2. Reduction and Handling Achievement Against Policy Targets

Mayoral Regulation No. 34/2018 sets targets of 30% waste reduction and 70% waste handling by 2025 (Malang City Government, 2018). Reduction realization rose from 22.71% in the second semester of 2020 to 24.12% in the first semester of 2021 and 26.17% in 2023, though at every one of these observation points it remained below the 30% target, with the gap narrowing from -7.29 to -3.83 points (Table 1). Handling realization tells the opposite story: it had already exceeded the 70% target at the earliest available observation, reaching 74.00% in the first semester of 2021 (a gap of +4.00 points), and kept climbing to 98.14% in 2023 and 98.68% in 2024, well ahead of target by +28.14 and +28.68 points, respectively.

Table 1. Malang City's Waste Reduction and Handling Realization Against the 2025 Target

Period	Reduction Realization (%)	Gap vs 30% Target (points)	Handling Realization (%)	Gap vs 70% Target (points)
2nd sem. 2020	22.71	-7.29	-	-
1st sem. 2021	24.12	-5.88	74.00	+4.00
2023	26.17	-3.83	98.14	+28.14
2024	-	-	98.68	+28.68

Source: compiled from Malang City Government (2022, 2025) and Khufat, Warnidasari, & Firdaus (2024).

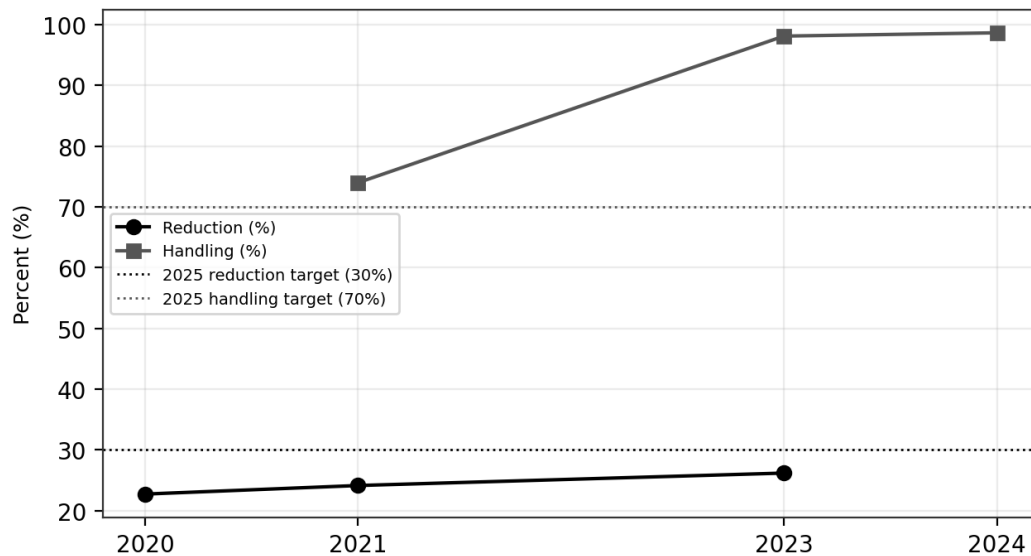


Figure 1. Trend in Malang City's Waste Reduction and Handling Realization Against the 2025 Target

Source: Compiled by the Author from the Data in Table 1.

3. Growth of Waste Transfer Station (TPS) Infrastructure

The number of waste transfer stations (TPS) in Malang City grew from 59 units in 2020 to 74 in 2022 (Khufat, Warnidasari, & Firdaus, 2024), a cumulative increase of 25.42% over two years, equivalent to a compound annual growth rate (CAGR) of 11.99%. This infrastructure expansion coincided with Malang City receiving the Adipura Award for 2022-2023 (Khufat, Warnidasari, & Firdaus, 2024), suggesting external recognition of the city's broader progress on waste management during that period.

4. The Gap Between City-Wide Aggregates and Sub-District Realities

One of the more consequential findings of this study is the sizeable gap between the city's aggregate handling achievement (98.14-98.68%) and the reduction achievement recorded in a sub-district-level case study. Kartikasari, Hariyani, and Firdausiyah (2024) found that reduction realization at the Tunjungsekar transfer station reached only 20.13% in 2023, well below both the 30% national target and the city's own average reduction realization of 26.17% for the same year. That gap

suggests an aggregation bias in how policy achievement is reported: strong performance in some parts of the city can mask weaker performance elsewhere once the data are presented only as a city-wide aggregate.

5. Legal Strength of the Plastic-Waste-Reduction Instrument

A content analysis of Malang City's plastic-waste-reduction instruments shows that the main one explicitly addressing plastic, Mayor's Circular Letter No. 8/2021 on Plastic Waste Reduction, takes the form of an administrative appeal directed at retail businesses, hotels, restaurants, and cafes, not a regional or mayoral regulation with binding legal force and sanction mechanisms (Malang City Government, 2021b). That stands in contrast to the city's general waste-management legal framework, which already takes the form of a binding bylaw, Regional Regulation No. 7/2021 (Malang City Government, 2021). DLH Malang City has itself acknowledged that the circular letter's impact remains limited (Mongabay Indonesia, 2021; detikJatim, 2025), consistent with the push by civil-society groups and the city council (DPRD) to draft a regional bylaw restricting single-use plastic bags, targeted to take effect in 2026 (Malang Raya Blok-A, 2023).

Read through Edwards's (1980) implementation framework, this study's findings point to mixed performance across the model's four variables. On the resources variable, TPS growth at a compound annual rate of 11.99% has underpinned the city's high, and above-target, handling achievement since as early as 2021. That success has not, however, carried over to source-level reduction, which remained below target through the last observation year, 2023. The same pattern appears in Batu City, suggesting more generally that strengthening end-of-pipe handling capacity is easier to achieve than changing the source-level behavior that reduction requires, since the latter depends on intervening at the level of households and businesses.

On the communication variable, choosing a circular letter over a regional or mayoral regulation to govern plastic-waste reduction represents a comparatively weak form of policy communication in legal terms. A circular letter is, by its nature, an appeal without a clear sanction mechanism attached, quite different from the approach taken by other cities such as Denpasar, which regulates plastic-bag restrictions through a Mayoral Regulation (Denpasar Mayoral Regulation No. 36/2018) that carries greater binding force. DLH Malang City's own acknowledgment that the circular letter's impact remains "limited" (Mongabay Indonesia, 2021) can reasonably be read as a direct confirmation of weakness on both the communication and bureaucratic-structure variables in Edwards's framework, since a legally weak policy instrument struggles to produce consistent compliance from its targets without adequate monitoring and enforcement behind it.

Read through Edelman's (1964) theory of symbolic politics, the choice of a circular letter takes on a further layer of meaning beyond simple legal weakness. A circular letter allows local government to be seen publicly addressing a visible problem, plastic waste from retail, hospitality, and food service, without incurring the political and administrative cost of imposing binding restrictions on business activity,

a cost regulations with sanctions inevitably carry. DLH's own admission that impact has been limited (Mongabay Indonesia, 2021; detikJatim, 2025) is, on this reading, less a policy failure in the ordinary sense than a fairly predictable outcome of choosing a symbolic instrument for what is, in substance, a distributive and regulatory problem: reducing plastic use requires reallocating real costs onto retailers and consumers, something an appeal cannot compel. The city council and civil-society coalition pushing for a binding bylaw (Malang Raya Blok-A, 2023) can accordingly be understood as pressing precisely for the shift from symbolic to substantive policy that Edelman's framework would identify as necessary for the instrument to produce material rather than merely reassuring effects.

The gap between the city's aggregate achievement (98.14-98.68% handling) and the sub-district-level achievement (20.13% reduction in Tunjungsekar) is an important methodological contribution of this study, and one best explained through the modifiable areal unit problem (Openshaw, 1984) rather than as a simple data error. Because the city-wide figure aggregates high- and low-performing sub-districts into a single number, strong results in better-resourced or more compact parts of the city can mathematically offset, and thereby conceal, weak results in areas like Tunjungsekar; the aggregate percentage is not wrong in a technical sense, but the zonal scale at which it is calculated systematically flatters overall performance relative to what most residents in any single sub-district actually experience. This pattern is also relevant to the disposition variable in Edwards's framework, since implementers at the sub-district level, working under tighter resource constraints, tend to produce weaker outcomes than the aggregate picture reported at the city level would suggest. Saraswati, Suyeno, and Putra's (2023) finding of inadequate TPS facilities in densely populated areas and unsuitable collection vehicles further reinforces the interpretation that success in implementing Malang City's waste policy has not yet been achieved evenly across the city.

In practical terms, Malang City does not need to look far for a template of what a binding instrument looks like: Jakarta's Gubernatorial Regulation No. 142/2019 requires shopping centers, supermarkets, and traditional markets to stop providing conventional plastic bags altogether, backed by administrative sanctions for non-compliance (Jakarta Provincial Government, 2019), while neighboring Bogor City's Mayoral Regulation No. 61/2018 imposes an outright ban on plastic-bag provision by modern retailers, again as a regulation rather than a circular letter (Bogor City Government, 2018). Both instruments demonstrate that a legally binding, sanction-backed rule is administratively achievable at the city level in Indonesia and is not merely an aspirational standard. Malang City's planned 2026 bylaw should draw directly on this precedent, and its rollout would be strengthened further by linking it to the national Extended Producer Responsibility roadmap under Ministry of Environment and Forestry Regulation No. P.75/2019, which already obligates large retail and food-service producers to report and reduce the packaging waste they introduce (Ministry of Environment and Forestry, 2019), giving the city a national

regulatory hook to anchor local enforcement against the very commercial establishments Circular Letter No. 8/2021 currently only appeals to.

Taken together, these findings point toward a clear strategic recommendation: Malang City needs to upgrade its plastic-waste-reduction instrument from a circular letter to a regional or mayoral regulation with clear binding force and sanction mechanisms, a step already under way through the pending single-use-plastic-bag bylaw targeted for 2026 (Malang Raya Blok-A, 2023), alongside a more granular reporting system that tracks achievement down to the sub-district level so that implementation gaps in lower-capacity areas are not obscured by the city's aggregate figures.

D. CONCLUSION

This study finds that Malang City's waste-management policy implementation between 2020 and 2024 produced uneven results, both across dimensions and across territorial levels. At the city-wide aggregate level, handling realization had already exceeded the target in Mayoral Regulation No. 34/2018 by 2021 (74.00%, a gap of +4.00 points) and reached 98.68% by 2024, underpinned by TPS infrastructure growing at 11.99% per year. Reduction realization, however, remained below the 30% target through the last observation (26.17% in 2023, a gap of -3.83 points), and a sub-district-level case study in Tunjungsekar found a far lower reduction realization, 20.13%, pointing to an aggregation bias in how the city's achievement is reported.

The study also finds that Malang City's plastic-waste-reduction instrument, Mayor's Circular Letter No. 8/2021, is an administrative appeal without binding legal force, a weakness the city's own Environmental Agency has acknowledged as a reason for its limited impact so far. This underscores the importance of strengthening the instrument into a more legally binding regulation if significant plastic-waste reduction is to be achieved.

On the strength of these findings, Malang City's government is encouraged to accelerate passage of the pending regional bylaw restricting single-use plastic bags, so that plastic-waste-reduction policy no longer rests on a circular letter that carries only an appeal, not binding force. DLH Malang City would also do well to build out an achievement-reporting system that extends down to the sub-district level, so that implementation gaps in lower-capacity areas can be identified and addressed rather than obscured by city-wide aggregate data.

Drawing directly on comparative practice, the pending bylaw should be modeled on binding, sanction-backed instruments such as Jakarta's Gubernatorial Regulation No. 142/2019 and Bogor's Mayoral Regulation No. 61/2018, both of which prohibit rather than merely discourage plastic-bag provision by retailers, and should be explicitly linked to the national Extended Producer Responsibility roadmap (Ministry of Environment and Forestry Regulation No. P.75/2019) so that large retail and food-service producers operating in Malang City face reduction obligations under national as well as local law.

Future research could usefully extend the sub-district-level case-study approach to more parts of Malang City, to build a more comprehensive map of spatial variation in plastic-waste-policy implementation, and could survey compliance among retail businesses, hotels, restaurants, and cafes with Circular Letter No. 8/2021, to measure directly how effective that appeal-based instrument has been, both before and after the new plastic-bag restriction bylaw takes effect.

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