

Socioeconomic Drivers of Municipal Solid Waste Generation: A PRISMA-Guided Systematic Review

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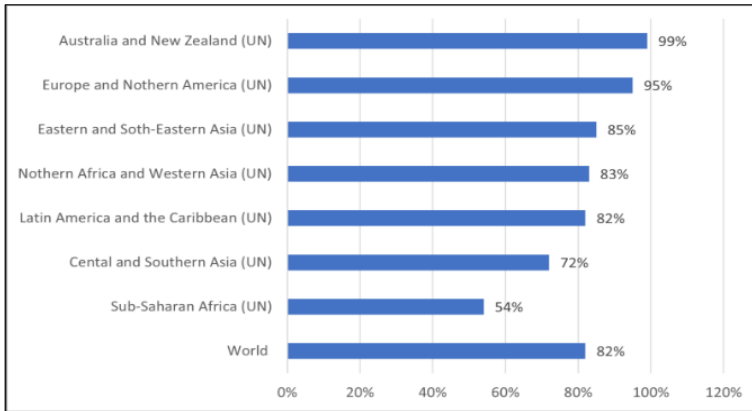
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Abstract - The increasing incomes, a fast urbanization process, and changes in consumption behavior have increased the rate of production of Municipal Solid Waste (MSW), which provides growing burdens to sustainable urban governance. The proposed study is a PRISMA-based systematic review of published empirical studies on MSW, to be conducted from 2003 to 2023, investigating the socioeconomic determinants of MSW, including GDP per capita, population size, population density, urbanization, and population age (65+). A total of 51 high-quality studies, characterized by high quality and reproducibility, were synthesized in the context of high, middle, and low-income conditions. The results indicate that economic and demographic growth are the prevailing factors of waste production worldwide, and both GDP per capita and population size have positive and significant effects. Large heterogeneity in regional effects, population density, and age structure is also found in the review, resulting in mixed outcomes, but urbanization is not linear, with waste accelerating in the early stages and dying out under mature governance and infrastructure. Support of the Environmental Kuznets Curve hypothesis is due to evidence of policy-induced decoupling in developed economies, which argues that sustainability and growth could co-exist where there is sound regulation. Although the evidence base is growing, the critical gaps in the research remain, such as a lack of longitudinal studies, the underrepresentation of developing economies, and the poor fit of policy and behavioural mediators. The research can be relevant to the Sustainable Development Goals (SDG 11 and SDG 12) and the EU Green Deal agenda as it presents an evidence map demonstrating the importance of regionally adaptive, data-driven, and circular economy-oriented waste management practices.

Keywords: Environmental Kuznets Curve (EKC), Municipal solid waste (MSW), PRISMA, Socioeconomic drivers, Sustainable Development Goals (SDGs)

I. INTRODUCTION

The processes of rapid urbanization, increasing income, and changing consumption habits are driving Municipal Solid Waste (MSW) upwards in various parts of the world, making waste management a fundamental issue of environmental and public-health concern in the sustainable development process. The European Union (EU) alone generates more than 200 million tonnes of municipal waste, and the rate in 2023 is 511 kg per capita, signifying the magnitude and the inability to overcome the issue ([eurostat, 2025](#)). The world forecasts high growth in all areas. By 2050, MSW volumes are projected to rise in East Asia & Pacific and South Asia (714 and 661 million tonnes, respectively), and the Sub-Saharan Africa region and Latin America & the Caribbean are also expected to rise according to the trends that follow population growth, urbanization, and economic development ([Kaza, 2018](#)). Because of this, waste is recognized by the EU as a part of the circular economy goals and the sustainability agenda ([EuropeanParliament, 2023](#)).

Figure 1. US firms planned changes in six expenditures.

Source: [OurWorldinData \(2024\)](#)

In addition to volumes, the difficulty is aggravated by unequal accessibility of basic collection services. The coverage of collections in Australia/New Zealand (99%), and Europe/North America (95%), and much lower in Sub-Saharan Africa (54%), with an average of 82% globally, representing strong differences in infrastructures, and policy needs to be socioeconomically sensitive to address them ([OurWorldinData, 2024](#)). In the future, the World Bank estimates that global MSW may be more than 3.5 billion tonnes in 2050 due to urbanization, economic growth, and consumption patterns, with serious consequences in land usage, pollution, greenhouse-gas emissions, and human health ([Zhang, 2025](#)).

It is against this background that the socioeconomic drivers of MSW should be understood to create effective reduction, diversion, and a circular economy policy. Previous research points to the roles of income and prosperity (usually proxied by GDP per capita), population size and density, age structure, and urbanization. However, results differ depending on the context and methodologies ([Blagoeva et al., 2023](#), [He et al., 2022](#), [Jorge, 2025](#), [Óskarsson et al., 2025](#)). Results from most of the analyses identify positive income waste relationships that align with the previous phases of Environmental Kuznets Curve (EKC) dynamics ([Akther et al., 2025](#), [Blagoeva et al., 2023](#), [Eguez, 2021](#), [He et al., 2022](#)). Others note policy-driven decoupling in advanced urban systems ([He et al., 2023](#)) or non-linearities and regional heterogeneity ([Ercolano et al., 2018](#), [Zhao et al., 2022](#)). Results of the population density and age composition are not same always, as sometimes with positive, negative, or sometimes nonlinear associations depending on infrastructure, behaviour, and institutional capacity ([He et al., 2022](#), [Jorge, 2025](#), [Mazzanti and Zoboli, 2008](#), [Paulauskaite-Taraseviciene et al., 2022](#), [Slučiaková, 2021](#)). Urbanization frequently raises MSW through lifestyle and consumption shifts ([Gui et al., 2019](#), [He et al., 2023](#), [Intharathirat et al., 2015](#), [Zhao et al., 2022](#)), yet mature urban systems can mitigate per-capita waste via governance and technology ([Wang et al., 2020](#)).

A. Problem Statement

The rising growth of MSW affects environmental quality, climate targets, and public health, particularly where collection and treatment systems lag demographic and economic change. Projections of >3.5 billion tonnes of waste by 2050 ([Zhang, 2025](#)) and widening service-coverage gaps ([OurWorldinData, 2024](#)) indicate that “business-as-usual” trajectories are unarguable. However, despite a sizeable literature, much of the evidence is single-country, cross-sectional, or limited to a subset of factors, leaving an incomplete and sometimes contradictory picture of how socioeconomic drivers interact to shape MSW across regions and over time ([Blagoeva et al., 2023](#), [He et al., 2022](#), [Jorge, 2025](#)). A rigorous, PRISMA-guided synthesis is needed to consolidate findings, explain heterogeneity, and ground a progressive empirical agenda.

B. Research Question

How do empirical literature reports on GDP per capita, population size, population density, urbanization, and population aging (65+) affect municipal waste generation across countries over 2003–2023?

Hence, the primary objective is to systematically review empirical evidence on the relationships between GDPs per capita, population size, population density, urbanization, and population age (65+) and MSW generation, following PRISMA standards.

C. Scope and Boundaries

This review focuses on socioeconomic determinants of municipal (not industrial or hazardous) waste at city, regional, or national scales. We synthesize peer-reviewed and credible grey literature focusing on the period of 2003 to 2023 across high, middle, and low-income contexts. This study focuses on five drivers as GDP per capita, population size, population density, urbanization, and population age (65+), and reports effect directions, magnitudes, and contexts. Cultural factors, policy design specifics, and technological advances are discussed as moderators, but not evaluated exhaustively unless linked to the core socioeconomic variables (policy-induced decoupling in Shanghai ([He et al., 2023](#))).

This PRISMA-based review makes three key contributions. First, it offers the most comprehensive evidence synthesis to date on the socioeconomic drivers of MSW, bringing together the research across high, middle, and low-income regions. Second, it reveals global heterogeneity in effect directions, such as the positive GDP waste relationship predicted by the Environmental Kuznets Curve ([Blagoeva et al., 2023](#), [Eguez, 2021](#), [He et al., 2022](#)) and mixed density and age effects reported in diverse contexts ([Mazzanti and Zoboli, 2008](#), [Paulauskaite-Taraseviciene et al., 2022](#), [Slučiaková, 2021](#)). Third, it identifies persistent research gaps, particularly limited longitudinal evidence and regional imbalances, and provides a policy-relevant evidence base supporting the Sustainable Development Goals (SDG 11 and SDG 12) and the EU Green Deal ([EuropeanParliament, 2023](#)).

Using this systematic method, the review will help understand how much economic development, demographic trends, and urbanization patterns determine the waste trends throughout the world and provide insights into sustainable consumption, production, and waste management.

II. METHODOLOGY

The paper is based on the Preferred Reporting Items of Systematic Reviews and Meta-Analyses (PRISMA) to demonstrate transparency, reproducibility, and rigor in the methodology and approach to locating and synthesizing the previous studies on socioeconomic drivers of Municipal Solid Waste (MSW) generation. The PRISMA methodology is a systematic and stepwise process that keeps selection bias at a minimum and increases the reproducibility of systematic reviews.

A. Eligibility Criteria

Inclusion and exclusion criteria were developed to narrow down high-quality and relevant studies. Eligible studies met the following conditions:

- Published between 2003 and 2023 in English.
- Focused on municipal solid waste generation (not industrial or hazardous waste).
- Examined at least one socioeconomic driver such as GDP per capita, population, population density, urbanization, or population age.
- Employed quantitative or mixed methods designs with measurable waste indicators (kg or tonnes per capita).
- Journal articles or conference proceedings, publications of reputable institutions (World Bank, OECD).

Studies that focused solely on policy, technology, or awareness programs without linking to socioeconomic factors were not included in the study.

B. Information Sources and Search Strategy

A comprehensive search was conducted across ScienceDirect, Google Scholar, and ResearchGate between January and March 2025. Grey literature from organizations such as the World Bank, European Environment Agency, and OECD was also reviewed. The search strings were developed iteratively using Boolean operators and truncations, for example,

“municipal waste generation” OR “solid waste” OR “MSW”) AND
 (“GDP” OR “income” OR “economic growth”) AND (“population” OR
 “population density” OR “urbanization” OR “demographic structure” OR
 “aging population”) AND (“socioeconomic factors” OR “drivers”).

Only studies published in English and in also recent timeframe were retained.

C. Study Selection

The search yielded 219 records. Following the elimination of redundancy and filtering titles and abstracts due to irrelevance, 56 full-text articles were evaluated. After the full text assessment, 51 papers included in the synthesis met all the eligibility requirements. The PRISMA flow diagram will be a summary of this process, with stages of identification, screening, eligibility, and inclusion.

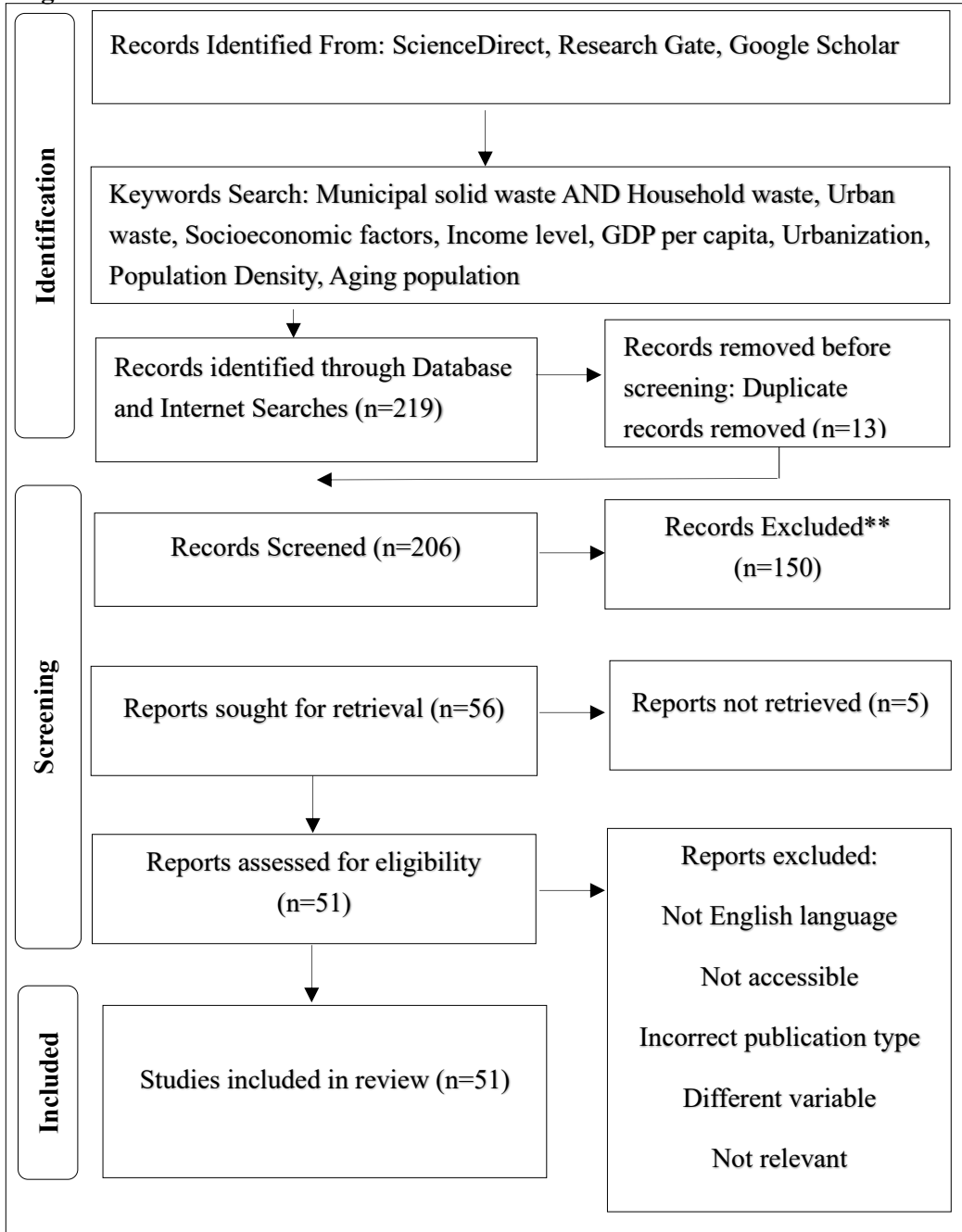
D. Data Extraction and Synthesis

A standardized extraction matrix was developed in Excel to capture the following as authors, year, geographic scope, variables examined, methodological approach, direction and significance of effects, and key findings. A narrative synthesis was performed, supported by vote counting by direction of effect, to identify consistent and divergent patterns across the five socioeconomic variables.

E. Reporting Transparency

All stages of the review adhere to the PRISMA reporting standards. The final dataset, inclusion log, and quality-assessment matrix are available upon request. The next section presents the synthesized findings categorized by the study’s focus.

Figure 1: PRISMA Model of inclusion and exclusion of articles



Source: Author developed based on the literature search

III. DISCUSSION

A. *Comprehensive Synthesis of Socioeconomic Drivers*

Summarization of 51 PRISMA-screened studies indicates that the major drivers of municipal solid waste (MSW) generation in the world are economic and demographic growth. In different regional and time-based settings, GDP per capita always stands out as the strongest and the most statistically significant predictor of waste growth. Analysis of multiple countries in the European EU has indicated that with 1 percent growth in the GDP per capita, the MSW production increases by 0.144 to 0.4% ([Akther et al., 2025](#), [Eguez, 2021](#)), where other widespread research proves the same positive relationship ([Blagoeva et al., 2023](#), [He et al., 2022](#), [Korica et al., 2020](#), [Slučiaková, 2021](#)). This is the consumption material-use nexus of the former stage of the Environmental Kuznets Curve (EKC) as economic growth has an initial heavy burden on the environment, followed by a stabilization in the more advanced policy and technology.

The case of Italy, China, and Taiwan demonstrates that such a non-linear dynamic process can be defined as an inverted-U process with a turning point at intermediate levels of income (an example of such a dynamic is the Italian municipalities, which exhibit an inverted-U shape) ([Ercolano et al., 2018](#)), Shanghai has managed to record falling per-capita waste even as it increases its GDP through strict reduction policies ([He et al., 2023](#)), and Taiwan's long-term income growth corresponded with declining plastic and glass waste because of increased recycling and awareness of consumers ([Nguyen et al., 2020](#)). The GDP also affects the waste composition, the efficacy of recycling, as well as investment in infrastructure ([Carvalho and Marques, 2014](#), [Kolekar et al., 2016](#), [Ma and Hipel, 2016](#), [Paulauskaite-Taraseviciene et al., 2022](#)). Policy-oriented research confirms GDP's centrality in shaping waste outcomes, with economic growth linked to increased resource use and landfill pressure ([Malek et al., 2023](#), [Năstase, 2023](#), [Ogieriakhi and Wang, 2024](#)). Recent analyses further highlight the GDP or the economic development as one of the main dominances of generating high amount of waste ([Smailbegovic et al., 2025](#), [Soderberg et al., 2025](#), [Sohel Rana et al., 2025](#), [Taweesan et al., 2025](#)). The relevance of GDP in influencing the results of waste production is supported by policy research, which revealed that the rise in economic activity is associated with higher consumption of resources and landfill strains ([Malek et al., 2023](#), [Năstase, 2023](#), [Ogieriakhi and Wang, 2024](#)). Overall, economic prosperity amplifies consumption and packaging intensity, though mature economies increasingly demonstrate the potential for decoupling through targeted policy and behavioural change.

B. *Global Heterogeneity in Effects*

Although the predictors based on income and economic scale are steady, it is observed that cross-national heterogeneity can be found in terms of population, density, age, and urbanization variables. The research indicates that population increase creates an evident upward movement in aggregate MSW, which can be seen in consumption, domestic wastage as well as demands of service provision. ([Blagoeva et al., 2023](#), [Eguez, 2021](#), [Mazzanti and Zoboli, 2008](#)). Near-linear relationships between population and waste output in Sri Lanka, Mexico, Ghana, China, India, Nepal and Taiwan are proved by empirical evidence ([Addae et al., 2023](#), [Basnayake and Visvanathan, 2014](#), [Chen, 2018](#), [Dangi et al., 2011](#), [Gomez et al., 2009](#), [Ma and Hipel, 2016](#), [Miezah et al., 2015](#), [Nguyen et al., 2020](#), [Khan et al., 2016](#)). However, in high-capacity or well-managed systems, population scale can coincide with efficiency gains and improved collection coverage, as shown in Iceland, where larger municipalities demonstrated greater management efficiency ([Óskarsson et al., 2025](#)). Similar findings appear in Arctic cities, where

population effects remain strong but are moderated by institutional quality and density ([Filimonova and Birchall, 2024](#)).

Population density produces more complex and context-specific outcomes. Denser cities generally generate more waste due to concentrated consumption and limited sorting space, ([Addae et al., 2023](#), [Mazzanti and Zoboli, 2008](#), [Miezah et al., 2015](#), [Nguyen et al., 2020](#), [Slučiaková, 2021](#)) but several studies find either weak or negative associations once economic structure is controlled ([Korica et al., 2020](#), [Soukiazis and Proenca, 2020](#)). Economies of scale in waste collection and infrastructure often lead very high-density regions to achieve lower per-capita waste generation ([Ercolano et al., 2018](#), [He et al., 2022](#), [Jorge, 2025](#), [Paulauskaite-Taraseviciene et al., 2022](#)). Chinese and Lithuanian evidence demonstrates that well-governed, densely populated municipalities can reduce waste through recycling participation and resource optimization ([Paulauskaite-Taraseviciene et al., 2022](#), [Wang et al., 2020](#)).

Demographic composition adds another layer of variability. Older populations typically produce less household waste due to lower consumption and stronger sorting behaviors ([He et al., 2022](#), [Slučiaková, 2021](#)), while younger, economically active cohorts generate more packaging and disposable waste ([He et al., 2023](#)). Some studies, however, identify positive correlations between aging and waste due to healthcare-related consumption ([Ercolano et al., 2018](#), [Jorge, 2025](#)). This diversity underscores the non-uniformity of socioeconomic influences of urbanization, density, and age interact with governance quality and social norms to produce highly localized waste outcomes.

Urbanization exemplifies this duality. Rapidly urbanizing economies such as China, Thailand, and India exhibit strong positive correlations between urban growth and MSW ([He et al., 2023](#), [Intharathirat et al., 2015](#), [Khan et al., 2016](#), [Miezah et al., 2015](#), [Zhao et al., 2022](#)) while longitudinal evidence reveals that advanced urban systems can decouple through infrastructural and institutional improvements ([Wang et al., 2020](#)). This non-linear “two-phase” pattern, initial acceleration followed by stabilization, reflects the same developmental trajectory predicted by EKC theory.

C. Research and Policy Gaps

Though the evidence base is very large and diverse, there are still significant gaps. The world literature is yet. was filled with single-country and European-centric analysis ([Akther et al., 2025](#), [Eguez, 2021](#), [Mesjasz-Lech, 2024](#)), restricting its application to fast urbanizing areas in Asia, Africa, and Latin America. Most studies factor out individual drivers, particularly GDP and population, without taking into consideration the interactions and feedback processes of variables. ([Akther et al., 2025](#), [Blagoeva et al., 2023](#)). Most of the datasets are cross-sectional or short-term and therefore do not allow the possibility of finding dynamic and long-run relationships. Moreover, there is still limited evidence of low- and middle-income economies (although these are the most affected by the sharp rise in urban waste and the least equipped with waste management institutions).

The effects of age remain unclear, and the outcomes of the studies vary throughout the regions and demographic characteristics. In addition, the lack of adequate interconnectedness of governance, education, and technological adoption variables that mediate socioeconomic waste relationships exists. ([Filimonova and Birchall, 2024](#), [Ogieriakhi and Wang, 2024](#)). Future studies must use panel models and spatial econometrics in revealing causal relationships and regional dependence, and include policy variables which explain the variation in waste trends Thee policy implications of the findings are that they will facilitate policies that are consistent with SDG 11

(Sustainable Cities and Communities) and SDG 12 (Responsible Consumption and Production), as well as the EU Green Deal. (EuropeanParliament, 2023). The strategizing should be centered on the ability to decouple waste and the GDP growth, the interventions to be applied should be adjusted to the demographics and urbanization levels, and the models of a circular economy should be introduced that will incorporate the economic, social, and environmental aspects. The region-specific policies and long-term monitoring that are evidence-based will play a critical role in turning the waste growth into sustainable management of resources.

IV. CONCLUSION

It is a PRISMA systematic review that summarizes international studies on socioeconomic factors of municipal solid waste (MSW) production. The results support that economic growth, population increase, and urbanization are the strongest drivers of MSW, yet their effects differ in regions and development phases. There is a steady and statistically significant positive correlation between GDPs per capita and waste, which holds the earlier stages dynamics of the Environmental Kuznets Curve. On the same note, the increase in population and urbanization can increase the rate of waste generation by increasing consumption levels, industrialization, and services. Nevertheless, the evidence also shows that already developed economies and highly populated cities may also attain decoupling with adequate governance and infrastructural investment, and overall behaviour change, leading to the reduction of per-capita waste even though economic growth persists.

The international disparities in the direction of effects-especially the variables of population density and age structure, point to the fact that the socioeconomic forces behind waste are context-dependent and determined by cultural, institutional, and policy contexts. In the developed setting, older populations produce less household waste because of the decrease in consumption and increased sorting behaviour. Still, in younger and urbanizing settings, packaging and plastic waste are more likely to increase. Such results support the necessity of flexible, area-specific solutions, which are in line with demographic, economic, and infrastructural facts.

The chronic lack of evidence, including the fact that few longitudinal or multi-variable studies exist, developing countries are understudied, and the interaction between socioeconomic, institutional, and behavioural variables remains poorly studied, are the reasons that more integrated research designs are needed. The panel data and spatial econometric methods should be used in future studies to capture the dynamic and regional differences in waste production.

Policymaking-wise, the review advocates the international shift to sustainable consumption and production as expressed in SDG 12, and sustainable urban development as expressed in SDG 11, and is in line with the EU Green Deal model. The dual approach of economic policies to achieve effective waste reduction is the promotion of resource decoupling with GDP growth, and social policies to increase participation, education, and public awareness in the process of minimal waste. The absence of evidence can be filled by closing the gap between the socioeconomic drivers and acknowledging their heterogeneity through data-driven, equitable, and circular waste management systems that balance economic prosperity with environmental sustainability can be designed by governments and planners.

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