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CARE ECONOMY AND CIRCULAR ECONOMY: THE ESSENTIAL IS INVISIBLE TO THE EYES OF SOCIETY

Economia do cuidado e economia circular: O essencial é invisível aos olhos da sociedade

Economía del cuidado y economía circular: lo esencial es invisible a los ojos de la sociedad

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ABSTRACT

This study aims to identify and highlight patterns of gender inequality within the recycling chain in Brazil, focusing on the role of female waste pickers and their interface with organizations. The research adopts a documentary approach based on data from the sixth edition of the 2024 Recycling Yearbook, published by the Instituto Caminhos Sustentáveis, complemented by quantitative data analyzed through descriptive statistics disaggregated by region and state. The results reveal significant regional and income disparities, particularly in the North and Northeast regions, as well as the predominance of women in situations of socioeconomic vulnerability, especially Black women and heads of household, whose contributions remain largely invisible. The study concludes that, although the circular economy represents a promising path to sustainability, its effectiveness depends on the recognition and appreciation of female waste pickers as essential agents of environmental, social, and gender justice.

Keywords: circular economy, care economy, waste pickers, recycling, inequalities.

RESUMO

O objetivo do estudo é identificar e evidenciar padrões de desigualdades de gênero na cadeia da reciclagem, com foco na atuação das catadoras e sua interface com as organizações. A pesquisa adota abordagem documental a partir dos dados da sexta edição do Anuário da Reciclagem 2024, publicado pelo Instituto Caminhos Sustentáveis, e os dados quantitativos foram tratados por estatística descritiva por região e unidade federativa. Os resultados transparecem expressivas disparidades regionais e de renda, como no Norte e Nordeste, bem como a predominância de mulheres em situação de vulnerabilidade, em especial negras e chefes de família, cuja contribuição permanece invisibilizada. Conclui-se que, embora a economia circular represente um caminho promissor para a sustentabilidade, sua efetividade depende do reconhecimento e valorização das catadoras como agentes essenciais da justiça ambiental, social e de gênero.

Palavras-chave: economia circular, economia do cuidado, catadoras, reciclagem, desigualdades.

RESUMEN

El objetivo de este estudio es identificar y destacar patrones de desigualdad de género en la cadena de reciclaje, centrándose en el rol de las mujeres recolectoras de reciclables y su interacción con las organizaciones. La investigación adopta un enfoque documental basado en datos de la sexta edición del Anuario de Reciclaje 2024, publicado por el Instituto Caminhos Sustentáveis, y los datos cuantitativos se procesaron mediante estadística descriptiva por región y unidad federativa. Los resultados revelan importantes disparidades regionales y de ingresos, como en las regiones norte y nordeste, así como el predominio de mujeres en situación de vulnerabilidad, especialmente mujeres negras y cabezas de familia, cuya contribución permanece invisibilizada. Se concluye que, si bien la economía circular representa un camino prometedor hacia la sostenibilidad, su efectividad depende del reconocimiento y la valoración de las mujeres recolectoras como agentes esenciales de la justicia ambiental, social y de género.

Palabras clave: economía circular, economía del cuidado, mujeres recolectoras, reciclaje, desigualdades.

INTRODUCTION

Population growth and changes in consumption patterns have increased production and consumption, generating new products and equipment. Without adequate solid waste management, progressive environmental degradation occurs, affecting living beings. This scenario calls for the integration of economic, social, and environmental dimensions, since the linear economy is not sustainable (Korhonen et al., 2018).

In response, social innovation involves creating original solutions to collective problems, especially those related to inequality and precarious living conditions (Taylor, 1970). It is associated with the circular economy, which seeks to recover value through resource reuse and plays a fundamental role in promoting sustainability (Cajuela & Pádua, 2024; Geissdoerfer et al., 2017).

In this context, recycling stands out as a practice that, in addition to reducing environmental impacts, plays a central role in the social sphere, especially as a means of subsistence for women in situations of vulnerability, many of whom are Black and heads of household (Ferreira, Silva et al., 2023; Ferreira, Carvalho et al., 2023).

Tronto (1993) demonstrates that Black women and those belonging to the working classes face a disproportionate demand for care activities, which contribute to maintaining the privileges of those who receive such care. In this regard, it is relevant to consider the care economy, a concept that, particularly in Western societies, refers to the sexual division of labor traditionally attributed to women, assigning them responsibilities related to domestic work and the care of children, family members, and other dependents. This social configuration, influenced by patriarchal cultural patterns, often results in the devaluation and lack of remuneration of these activities, thereby perpetuating gender inequalities (Tizziani et al., 2025).

Recent data from the Brazilian Institute of Geography and Statistics (IBGE, 2024) indicate that Brazilian women devote, on average, 21.3 hours per week to domestic and care work—almost twice the time reported for men (11.7 hours). Black women perform 1.6 additional hours of such work compared to white women. Among women overall, 32.3% live below the poverty line; among Black women, this

figure rises to 41.3%, compared to 21.3% among white women. These data reveal a greater domestic burden and heightened economic exclusion affecting Black women.

The centrality of these factors is recognized in both national and international frameworks. According to Braga (2010) and the Stiglitz–Sen–Fitoussi report (2009), Gross Domestic Product is a limited indicator of progress. The report recommends incorporating measures of well-being, environmental sustainability, and quality of life into public policy in order to make group-based inequalities more visible.

In Brazil, the National Care Plan (Decree No. 12,562, 2025) defines care as a shared responsibility among the state, families, and society, while Decree No. 12,561 (2025) establishes ethical principles for data use and circular governance. Together, these initiatives emphasize the need for new social and environmental indicators capable of integrating invisible labor and sustainability concerns.

There is an intersection between the care economy and the circular economy, marked by the predominance of vulnerable Black women engaged in solid waste collection and recycling. These workers face precarious labor conditions and invisibility, with social, economic, and environmental consequences. This article aims to identify and highlight patterns of gender inequality within the recycling chain, focusing on the role of female waste pickers and their interface with organizations. The methodological approach consists of a documentary analysis of data from the 2024 Recycling Yearbook database (Reis & Reis, 2002).

This article contributes to debates on circular economy, recycling, and gender, in alignment with the 2030 Agenda (SDG 8 – Decent Work and Economic Growth; SDG 11 – Sustainable Cities and Communities) (Junges & Castro, 2022), by highlighting the invisibility of female waste pickers in Brazilian academic production. A search conducted in the Brazilian database Scientific Periodicals Electronic Library (SPELL) in July 2025 showed that, among 60 articles containing the term “*economia circular*” (circular economy) in the title, none addressed gender issues; among 217 articles with the term “*reciclagem*” (recycling) and 90 on “*catadoras*” (female waste pickers), only three mentioned “*catadoras*” (Alcântara et al., 2023; Iizuka, 2013; Silva, 2015).

This research reveals the multiple forms of oppression faced by female waste pickers by relating the interdependence of the circular economy, care, and gender. Recycling is not merely an environmental practice but also a struggle for recognition and gender justice. Female participation in waste picker organizations promotes sustainable work, women’s empowerment, voice, visibility, activism, and income generation.

THEORETICAL FRAMEWORK

Circular economy and recycling in Brazil

The circular economy, according to Ashby (2018), aims to recover the value of commodities through closed-loop systems and reuse and restoration techniques in order to improve the performance of production processes. Its main strategies include recycling, reuse, and the exchange of by-products, as observed in the construction sector (Meng et al., 2023).

In Brazil, the adoption of circularity practices was led by multinational rather than domestic companies (Loviseck, 2025), influencing sectors such as textiles and food production, with an emphasis on production processes and waste reduction through composting (Langa et al., 2024; Ouro-Salim et al., 2024). These initiatives indicate that Brazil complies with international commitments made at the Conference of the Parties (COP) and recognizes the circular economy as a foundation for ecological transformation and sustainable competitiveness.

Recent studies have addressed the value of glass packaging in light of regulatory and structural challenges (Buenos et al., 2024), the destination of waste and the impacts of open dumpsites (Streit, Guarnieri, Faria et al., 2024; Streit, Guarnieri, Morais et al., 2024), as well as bibliometric analyses of the field (Cajuela & Pádua, 2024; Morbach et al., 2024). Freitas et al. (2024) emphasize that the social sphere must consider the inclusion of recycling workers in the circular economy and the importance of public governance.

Despite these advances, significant challenges remain. The circular economy can be employed merely as rhetoric, legitimizing greenwashing practices and masking inequalities (Kirchherr et al., 2018; Korhonen et al., 2018). In Brazil, packaging containing misleading information undermines consumer trust, while logistical bottlenecks, double taxation on recycling activities, and the exclusion of waste pickers hinder the consolidation of this model (Streit, Guarnieri, Faria et al., 2024).

The National Solid Waste Policy (*Política Nacional de Resíduos Sólidos* – PNRS) (Law No. 12,305, 2010) establishes guidelines for integrated waste management in Brazil to reduce environmental and health impacts. However, its effectiveness is constrained by limited social accountability and low engagement among those most directly affected (Associação Brasileira de Resíduos e Meio Ambiente [Abrema, Anuário da Reciclagem], 2024; Santana et al., 2025). Even when organized in cooperatives, these groups face precarious working conditions, low income, and a lack of recognition (Figueiró & Bessi, 2020; Santana et al., 2025).

Case studies indicate that the PNRS has contributed to the reduction of open dumpsites and improvements in public health (Rodrigues & Rodrigues, 2020). Nevertheless, Silva et al. (2024) found that, in the state of Rio de Janeiro, the inclusion of waste pickers in sectoral agreements remains limited, and regulatory frameworks are insufficient to ensure sustainable investment. The expansion of recycling cooperatives and the recognition of waste pickers as social entrepreneurs (Morbach et al., 2024; Rey-Martí et al., 2016) depend on continuous public support, the development of urban sustainability indicators, and the valorization of decent work (Junges & Castro, 2022).

Junges and Castro (2022) observe that waste pickers seek cooperatives in pursuit of decent work, safety, learning opportunities, and higher income. However, public support through policies that strengthen these organizations and promote coordination with other sectors is essential (Korhonen et al., 2018).

Figueiró and Bessi (2020) point out that the work of waste pickers in cooperatives is important for sustainability yet remains undervalued because of prejudice. The lack of recognition and autonomy, combined with subordination to the managers of these organizations, weakens the agency of these marginalized actors and limits the potential of the circular economy as an inclusive strategy.

Female waste pickers remain invisible in the studies analyzed and face multiple forms of exclusion, including sexism, racism, classism, and ableism. This intersectionality (Crenshaw, 1991) confirms gender inequality in recycling and is deeply intertwined with race and class dynamics, which overlap and produce persistent forms of discrimination (Coelho et al., 2018). As a result, Black and peripheral women often resort to waste picking as a means of survival under precarious conditions, thereby perpetuating cycles of marginalization (Batista et al., 2023).

Thus, although promising, the circular economy can achieve sustainability only by incorporating social and gender dimensions. In this context, the care economy assumes a central role.

Gender and recycling: The care economy

The discussion of gender involves the analysis of structural inequalities present in family dynamics, political processes, and various social arenas, such as the labor market. This study focuses on the care economy, understood as a set of factors that intensify the inequalities faced by women in situations of vulnerability, including within the context of recycling and the circular economy.

Several studies have discussed these inequalities, whether in relation to wage disparities (RamírezUribe & Pérez, 2025), occupational segregation, barriers to labor market entry and career progression, the burden of double or triple work shifts, or responsibilities associated with care work (Tizziani et al., 2025).

Gender is a social construct shaped through the socialization of emotions, reinforcing the unequal distribution of roles between men and women across social spheres (Fávero, 2010). In the context of recycling, this construction contributes to the invisibility of female waste pickers who, in addition to experiencing an overload of care responsibilities, face multiple forms of exclusion. This demonstrates how gender inequalities intersect with the care economy, reinforcing the precarization of women's labor and limiting access to dignified working conditions within the circular economy chain.

According to feminist movements, the care economy encompasses both unpaid domestic labor performed within households, requiring time and physical and emotional effort, and paid care work carried out by caregivers, nannies, and domestic workers (Malaver-Fonseca et al., 2021; Tizziani et al., 2025). Even in contexts where incentives for formalization exist, Tizziani et al. (2025) found that precariousness persists among platform-based care workers in Argentina, highlighting the enduring devaluation of women's labor.

From feminist and ecofeminist perspectives, care is a central dimension of human life (Carrasco, 2001; Tronto, 1993). However, equality of opportunity within households is essential to ensure that women have time for themselves (Carrasco, 2001) and are less exposed to patriarchal violence.

For Tronto (1993), care should not be reduced to a female obligation; rather, it constitutes a political and social activity that has historically been devalued through hierarchies of gender, class, and race. Carrasco (2009) argues that the care economy should be dissociated from traditional economic analyses to reveal women's contribution to sustaining life and the social fabric. In this sense, care transcends the family sphere and becomes a political and collective issue central to human, social, and ecological sustainability.

According to [Shiva \(2005\)](#), women in the Global South lead practices of environmental preservation and resistance to forms of exploitation that threaten biodiversity and social justice. This critical perspective highlights that female waste pickers sustain the circular economy by repurposing waste, yet remaining invisible and subject to precarious working conditions, demonstrating the need to recognize this labor as fundamental to environmental justice.

Gender-based wage inequality also reflects this broader logic of devaluing women's work. Drawing on human capital theory, [RamírezUribe and Pérez \(2025\)](#) identify factors such as education, age, experience, socialization skills, marital status, productivity, and working hours as partial explanations for wage disparities in Mexico. Nevertheless, gender stereotypes and caregiving responsibilities, particularly in international labor contexts, exacerbate these inequalities.

For [Federici \(2018\)](#), the burden of care has historically fallen on women, whose domestic labor has been naturalized as a consequence of the sexual division of labor, legitimized by patriarchy and perpetuated over centuries. This process has produced profound and lasting impacts on social and economic relations.

[Igansi et al. \(2025\)](#) emphasize that unpaid care work remains extensive, particularly among women, reinforcing the need for public policies aimed at the economic valuation of these activities. In 2022, approximately 150 million people were engaged in care and domestic work worldwide, with women devoting 54% more weekly hours than men, largely outside the formal labor market. Despite accounting for approximately 10% of economic activity, these functions remain largely invisible in official statistics, perpetuating their devaluation.

The invisibility of care work ([Pasqualetto & Ghirardi, 2025](#)) has been addressed through recent policy initiatives in Brazil, such as the National Care Plan ([Decree No. 12,562, 2025](#)). This regulatory framework responds to the urgency of integrating the circular economy agenda with gender equity policies, particularly given that female waste pickers bear a double burden: recycling work and care responsibilities for children and other family members.

Waste pickers survive through collection activities carried out under precarious and unhealthy conditions, facing stigma, exclusion from the formal labor market, and extreme poverty ([Ferreira, Silva et al., 2023](#); [Ferreira, Carvalho et al., 2023](#)). While some are organized within cooperatives, many continue to work autonomously and without institutional support ([Silva, 2020](#)). These workers are essential to circularity; however, in 2018 Brazil generated approximately 79 million tons of waste, a significant share of which was not even collected ([Ferreira, Silva et al., 2023](#)).

According to the National Movement of Waste Pickers ([Movimento Nacional dos Catadores e das Catadoras de Materiais Recicláveis \[MNCR\], 2014](#)), of the approximately 800,000 individuals engaged in waste picking in Brazil, 70% are Black women. The majority are heads of household (56%), and in 51% of cases waste picking constitutes the family's sole source of income. Since the 1990s, these women have organized into groups, associations, and cooperatives seeking better living conditions and greater social recognition ([Ribeiro et al., 2012](#)).

[Silva \(2015\)](#) highlights that the political action of MNCR enabled the formal recognition of the profession and remuneration for services related to the source-separated collection of recyclable

materials. Cooperative organization strengthens partnerships, generates social gains, rebuilds social bonds and self-esteem, and promotes solidarity-based recycling as an alternative to incineration.

Coelho et al. (2018) show that female waste pickers' narratives about women's work are marked by sexism, the sexual division of labor, and the intersections of work and family responsibilities. The waste pickers themselves report diminished confidence in their capabilities, which they associate with life trajectories shaped by child labor, exclusion from the labor market, compounded constraints related to motherhood and marriage, and racial discrimination.

Ferreira, Silva et al. (2023) confirm that collective organization has enabled women to occupy management and leadership roles, experiencing the importance of collective action. In their struggle for equality and recognition, these women confront intersecting structural barriers of gender, race, and class. By asserting themselves as rights-bearing subjects, they transform waste picking into a practice of empowerment and resistance, corroborating the findings of Coelho et al. (2018).

Finally, Freitas et al. (2024) argue that the PNRS has been decisive in advancing legislation related to waste pickers, emphasizing the importance of training, social protection, and access to health services—particularly for those working in open dumpsites. These measures are essential for ensuring green jobs and recognizing waste pickers in the circular economy. These theoretical perspectives guide the research and support the analysis of gender, racial, and territorial inequalities within the circular economy and in the daily routines of female waste pickers.

METHODOLOGY

Given that women constitute the majority of the recycling sector, this study centers on female waste pickers. These women's trajectories are marked by the intersection of gender-, race-, and class-based oppressions that generate inequalities and discrimination (Batista et al., 2023; Ferreira, Silva et al., 2023; Silva, 2020), which in turn drive initiatives to empower these women (Coelho et al., 2018). The analytical focus reflects the study's epistemological commitment to an intersectional perspective (Crenshaw, 1991) and to recognizing of care as an analytical category, enabling an understanding of how social and productive relations shape the circular economy in Brazil.

This study adopted a descriptive (Reis & Reis, 2002) and documentary research to characterize social phenomena based on empirical evidence. Descriptive research enables the understanding and systematization of the realities of male and female waste pickers within recycling organizations using secondary data, while also highlighting that the circular economy is not merely an environmental practice but a social phenomenon that reveals inequalities and possibilities for transformation.

The data source was the 6th edition of the *Anuário da Reciclagem 2024* (2024 Recycling Yearbook), published by the *Instituto Caminhos Sustentáveis*, which compiles updated information on the recycling sector in Brazil. Data collection was based on information extracted from the Federal Revenue Services database, totaling 3,028 formally registered organizations. In addition, 671 organizations with registration irregularities were identified and, for this reason, excluded from the statistical analysis. The

regularized organizations are distributed across 1,722 municipalities, located in 26 states and the Federal District, covering approximately 75% of Brazil’s population ([Anuário da Reciclagem, 2024](#)).

Quantitative data were processed using descriptive statistics and MSEXcel. Proportions (%), means, standard deviations, and minimum and maximum values were calculated according to the nature of the variables analyzed. The data were presented in tables and charts, and values were rounded to one decimal place.

The variables analyzed included the number of organizations and their distribution by region and state; the number of male and female waste pickers relative to the organizations; and the average monthly income of workers by region and state.

The use of secondary data and a quantitative approach provided a broad overview of the productive and social structure of recycling in Brazil. However, this strategy also entails interpretive limitations. While the method offers a national panorama, it does not capture the subjective and qualitative dimensions of female waste pickers’ experiences—an issue revisited in the final considerations. Nevertheless, the analysis is consistent with the theoretical framework presented and allows for the identification of how structural inequities manifest within the circular economy, reinforcing the need for intersectional public policies aimed at promoting decent work.

DISCUSSION, ANALYSES, AND RESULTS

Table 1 presents the distribution of the 3,028 organizations formally registered in the Brazilian Federal Revenue Services database, classified by region. A significant disparity among regions is observed, with the Southeast standing out by concentrating 37.8% of the organizations, followed by the South (28.1%) and the Northeast (19.4%). Although the Southeast comprises only four states, its large population and high degree of urbanization contribute to the greater concentration of cooperatives and associations. The position of the South is also noteworthy: despite consisting of only three states, it ranks second in the number of organizations, which may indicate more structured public policies, stronger community engagement, and more consolidated productive inclusion strategies.

Table 1 — Number and ratio of organizations by Brazilian regions

BRAZILIAN REGION	NUMBER OF ORGANIZATIONS	(%)
North	175	5.8
Northeast	587	19.4
Central-West	269	8.9
Southeast	1,146	37.8
South	851	28.1

Source: Recycling Yearbook ([Anuário de Reciclagem, 2024, p. 9](#))

The concentration of organizations in the most industrialized regions corroborates what [Kirchherr et al. \(2018\)](#) describe as the structural asymmetry of circularity, whereby the environmental and economic benefits of the circular economy tend to concentrate in territories with greater technical and political capacity for implementation. As a result, circularity—which should promote territorial equity and social sustainability—ends up reproducing historical regional development inequalities.

From the perspective of the care economy ([Carrasco, 2001](#); [Tronto, 1993](#)), the absence of structured policies in the North and Northeast reveals the invisibilization of environmental care performed by local communities and cooperatives, predominantly composed of women. These women operate under precarious conditions to compensate for the lack of state infrastructure, evidencing the displacement of care from the state to the female body—a dimension that is rarely quantified but central to social and ecological sustainability.

This regional inequality confirms one of the structural weaknesses of the circular economy in Brazil: the absence of standardization and national indicators to guide integrated policies ([Junges & Castro, 2022](#)). In the North and CentralWest, which together account for only 14.7% of the organizations, the low institutionalization of cooperatives reflects historic shortcomings in public investment and the fragility of systems of source-separated collection of recyclable materials ([Abrema, 2024](#)). In other words, the regions that are most socially and environmentally vulnerable are precisely those that benefit least from the potential of recycling. This scenario points to the need to strengthen governance mechanisms and data integration, similar to those proposed in [Decree No. 12,561 \(2025\)](#), whose principles of interoperability and transparency could inspire advances in the circular economy.

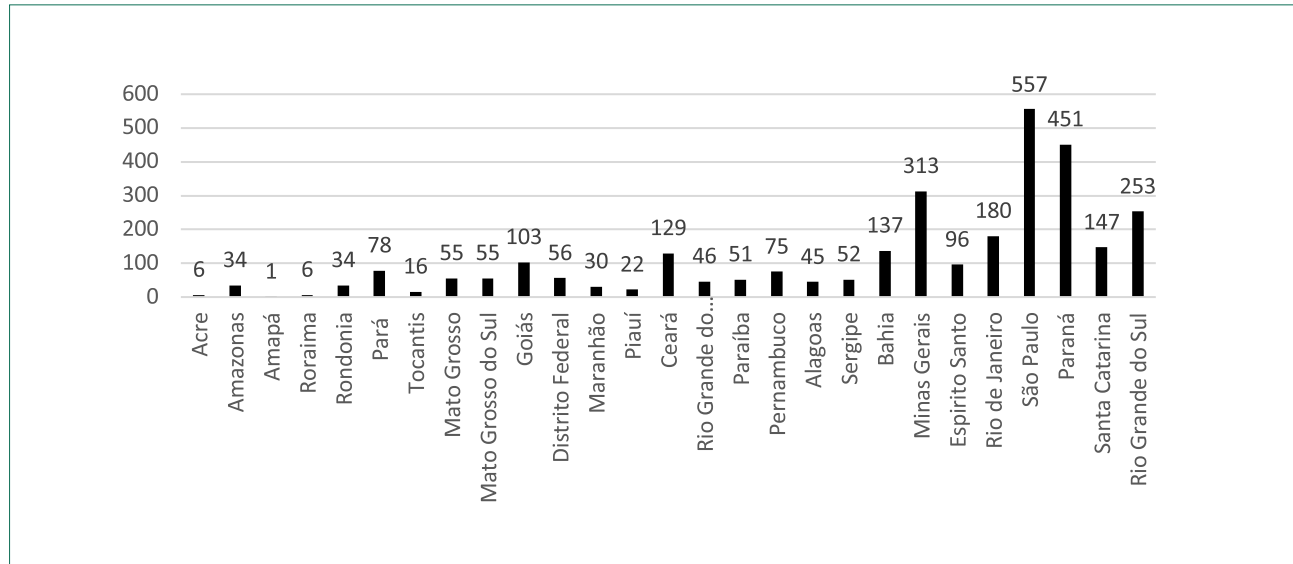
This overview reinforces the argument advanced by [Korhonen et al. \(2018\)](#) and [Santana et al. \(2025\)](#) that the circular economy is a contested concept, whose implementation depends on unequal institutional and political arrangements, since territories differ substantially in their capacities. The lack of standardization and national indicators produces fragmentation that prevents the consolidation of a redistributive public policy framework.

From an intersectional perspective ([Crenshaw, 1991](#)), the precariousness observed in less structured regions intensely affects Black women heads of household, for whom waste picking often represents one of the few available means of subsistence. Territorial inequality is therefore not only economic, but also gendered and racialized, reflecting the same exclusionary patterns that permeate the care economy and unpaid reproductive labor.

The North records the lowest proportion of organizations (5.8%), highlighting imbalances in access to productive inclusion policies and solid waste management. This scenario exposes persistent historical inequalities among Brazilian regions and signals the need for more equitable, territorybased actions. The underrepresentation of the North—a vast region marked by pronounced social vulnerabilities—poses a challenge to the effective implementation of the PNRS, which, according to [Rodrigues and Rodrigues \(2020\)](#), can generate positive impacts on health, quality of life, and social inclusion when implemented comprehensively.

Figure 1 shows the distribution of recycling organizations by state.

Figure 1 - Number of organizations by state



Source: Recycling Yearbook (Anuário de Reciclagem, 2024, p. 10)

The lack of equitable policy support for cooperatives in northern Brazil exemplifies what [Shiva \(2005\)](#) defines as ecological colonialism: the displacement of the environmental and social costs of sustainability onto poorer and more racialized populations. Territorial inequality, in this sense, is also an inequality of power and visibility.

From the care economy perspective, institutional gaps cause environmental care to fall disproportionately on vulnerable women, who perform tasks essential to the regeneration of urban ecosystems without formal recognition or social protection. This reinforces the need for territorially sensitive and intersectional public policies, as proposed by [Piedras et al. \(2025\)](#), that simultaneously consider gender, race, and region as interconnected dimensions of exclusion.

The average number of organizations per state was 112.1, with a standard deviation of 133.3, revealing high heterogeneity in regional distribution. This variation reflects both population differences and degrees of industrialization and urbanization across states. Although the circular economy is present throughout the country, its implementation is uneven. The territorial reach of these organizations highlights their strategic role in urban solid waste management, particularly in regions with limited coverage of source-separated collection of recyclable materials ([Alcântara et al., 2023](#); [Ferreira, Silva et al., 2023](#)). However, territorial presence alone does not ensure social inclusion or decent working conditions for waste pickers.

As [Carrasco \(2009\)](#) emphasizes, recognition of care-related activities—and, in this case, environmental care—depends not merely on institutional existence, but on the symbolic and material

valuation of those who perform such work. The mere existence of cooperatives does not guarantee social justice; decent working conditions, autonomy, and political voice must also be ensured.

Female waste pickers thus emerge as politically invisible subjects whose labor sustains the circular economy without due recognition. The discrepancy between territorial presence and effective inclusion suggests that the rhetoric of circularity may conceal the persistence of exploitative relations and inequalities, as criticized by Kirchherr et al. (2018) and [Korhonen et al. \(2018\)](#).

These structural inequalities are also reflected in workforce composition, marked by the feminization of activities and the overlap of gender, race, and territory. Of the 3,028 regular organizations, 770,608 waste pickers were registered. As shown in Table 2, however, the relationship between the number of waste pickers and organizations is uneven across regions.

Table 2 - Number and proportion of waste pickers relative to organizations, by region

BRAZILIAN REGION	NUMBER OF WASTE PICKERS	(%)
North	3,692	5.2
Northeast	18,513	26.2
CentralWest	7,527	10.7
Southeast	21,694	27.2
South	19,182	30.7

Source: Recycling Yearbook ([Anuário de Reciclagem, 2024, p. 13](#))

While some cooperatives concentrate large numbers of workers, others operate with very small teams, possibly reflecting the persistence of informality in the sector. Moreover, the exclusion of 671 organizations with registration irregularities exposes structural shortcomings that contradict the principles of the PNRS ([Law No. 12,305, 2010](#)), which establishes formal organization as a prerequisite for productive inclusion and access to public policies. Associativism is essential for ensuring social protection for waste pickers ([Junges & Castro, 2022](#)) and for securing income generation ([Figueiró & Bessi, 2020](#)).

The unequal distribution of waste pickers reinforces [Korhonen et al's \(2018\)](#) argument that the circular economy, despite its discourse of inclusion and sustainability, still operates through an instrumental and unequal logic that privileges regions and actors with greater institutional capacity. This asymmetry reflects exclusionary formalization policies that, under the guise of efficiency, marginalize informal groups—particularly female waste pickers—thereby widening the gap between the ideals of circularity and social reality.

From an intersectional lens ([Coelho et al., 2018](#); [Crenshaw, 1991](#); [Ferreira, Silva et al., 2023](#)), race, gender, and class intersect to shape these regional disparities, producing a triple exclusion: Black women with low educational attainment and precarious labor insertion sustain the productive base of circularity

without recognition of their contributions. This dynamic exemplifies what Carrasco (2009) calls the paradox of care, whereby work that is essential to sustaining life—here, environmental care—remains invisible and undervalued.

The regional distribution of waste pickers further confirms significant disparities in territorial integration. While the Southeast and South together account for more than 57.9% of workers, the North represents only 5.2%, revealing structural and infrastructural inequalities that directly affect the organization of the activity and weak adherence to the PNRS (Law No. 12,305, 2010), thereby limiting income opportunities (Junges & Castro, 2022).

This imbalance supports Tronto’s (1993) thesis that care, when displaced onto marginalized groups, tends to be naturalized as a moral obligation rather than recognized as socially relevant labor. For female waste pickers, care for the environment and the community becomes a form of reproductive, invisible work that remains unrecognized by the formal economic system.

The institutional fragility of the North and Northeast also reflects what Shiva (2005) describes as “ecological injustice,” in which women in peripheral territories disproportionately bear the social and environmental costs of sustainability. This reality exposes the limits of the circular economy when implemented without redistributive policies, as it fails to confront structural inequalities and ends up reproducing and concentrating social exclusion in historically marginalized regions.

From a gender perspective, women predominate: they account for 54.2% of the workforce (38,280), while men represent 45.8% (32,328). Table 3 shows the distribution by gender and region, highlighting the strong presence of women in the Central-West, Southeast, and South. In these regions, the average number of women (7,656) exceeds that of men (6,466), reinforcing women’s central role in collection and sorting activities.

Table 3 — Gender representation by Brazilian region

BRAZILIAN REGION	FEMALE (N)	FEMALE (%)	MALE (N)	MALE (%)
North	1,879	4.9	1,814	5.6
Northeast	8,753	22.8	9,760	30.2
CentralWest	4,351	11.4	3,175	9.8
Southeast	11,894	31.1	9,800	30.3
South	11,402	29.8	7,779	24.1

Source: Recycling Yearbook (Anuário de Reciclagem, 2024, p. 16)

This configuration reveals not only the feminization of the activity, but also the strategic importance of women in the socioeconomic dynamics of cooperatives and associations. As noted by [Ferreira, Silva et al. \(2023\)](#) and [Silva \(2020\)](#), women frequently assume leadership roles in waste picker organizations, even while bearing the burden of domestic labor and family responsibilities. Female empowerment in recycling emerges as both a form of resistance and a means of constructing livelihood alternatives and collective organization, challenging historically exclusionary gender norms.

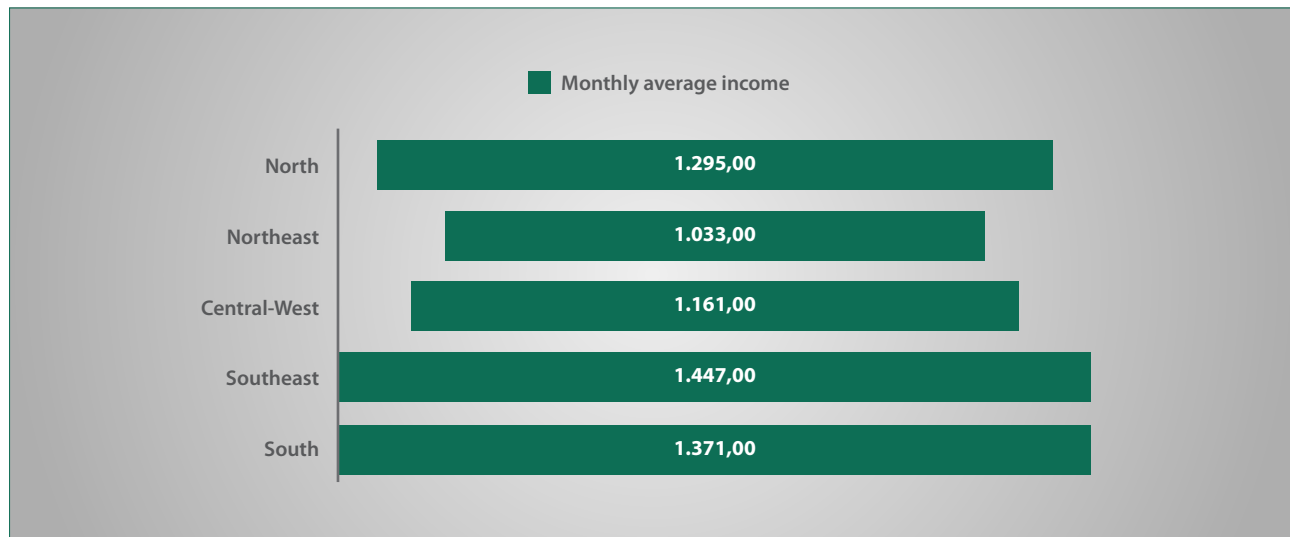
The predominance of women in recycling exemplifies what [Federici \(2018\)](#) and [Coelho et al. \(2018\)](#) describe as the dual exploitation of women's labor, which is simultaneously productive and reproductive. Female waste pickers ensure environmental sustainability through sorting and reuse while sustaining their families amid the absence of public care policies. This overload reflects the persistence of what [Carrasco \(2001\)](#) terms the patriarchy of labor, wherein activities related to sustaining life—such as cleaning, care, and recycling—are socially assigned to women but economically devalued.

This feminization of recycling can also be understood, following [Crenshaw \(1991\)](#), as an intersectional phenomenon combining sexism, racism, and classism, given that most female waste pickers are Black, peripheral, and heads of household. More than mere statistical data, this configuration reveals a deeply entrenched social hierarchy within Brazil's circular economy.

The collective organization of female waste pickers ([Ferreira, Silva et al., 2023](#)) can be interpreted, following [Tronto \(1993\)](#), as a form of political care, in which solidarity and community action function as resistance to erasure and precarization. This ethical and political dimension of care should be recognized as an emancipatory practice.

The observed gender disparities reinforce the argument that sustainability cannot be understood solely in environmental or economic terms, but must be critically examined through the lenses of care and social justice.

Figure 2 presents the average monthly income of recycling workers by region in Brazil in 2023. The highest average income observed in the Southeast (BRL 1,447.00) and South (BRL 1,371.00), regions characterized by higher levels of urbanization, more developed logistics infrastructure, and stronger public policies supporting the circular economy and compliance with the PNRS ([Law No. 12,305, 2010](#)). These conditions contribute to more structured work environments and relatively higher income levels.

Figure 2 - Average monthly income of waste pickers, by region of Brazil (R\$, 2023)

Source: Recycling Yearbook (*Anuário de Reciclagem*, 2024, p. 16).

Income data confirm Carrasco's (2009) thesis on the structural devaluation of care: although the circular economy promises economic recognition for environmental labor, female waste pickers' remuneration remains below the social value they generate. The concentration of higher incomes in more industrialized regions aligns with Kirchherr et al.'s (2018) critique of the corporate capture of circularity, wherein sustainability is measured in terms of efficiency gains rather than distributive justice. Circularity thus risks becoming a technocratic discourse that masks the essential grassroots labor—predominantly performed by women—that sustains the system.

From the care economy perspective (Shiva, 2005; Tronto, 1993), the low income of female waste pickers reflects the transfer of sustainability costs to racialized female bodies, who perform environmental care without social protection. In this context, care ceases to be a collective ethic and instead becomes a mechanism of economic exclusion.

The lowest average income was recorded in the Northeast (BRL 1,033.00), reflecting historical structural barriers such as limited access to adequate equipment, fragile formalization processes, and insufficient institutional support for cooperatives and associations. Interestingly, although the North has the smallest absolute number of organizations and waste pickers (Tables 1 and 2), it exhibits an average income higher than that of the Northeast. This finding may suggest lower local competition or differentiated valuation of recyclable materials, requiring further investigation into regional recycling markets.

This inversion illustrates the non-linear nature of socioeconomic exclusion. As Igansi et al. (2025) argue, gender and income inequalities are not solely determined by macroeconomic indicators, but are closely linked to labor informality and the absence of public care networks. The slightly higher income

observed in the North does not indicate structural valorization, but rather precarious compensation associated with lower living costs and heightened informality.

The contrast between the Northeast and the North highlights the intersectional vulnerability of Black women in the Northeast, who accumulate layers of exclusion and face greater barriers to accessing support policies. This dynamic confirms [Crenshaw's \(1991\)](#) argument that inequality is experienced simultaneously across race, gender, and territory—an axis that circularity has yet to critically address.

Regional wage disparities demonstrate the urgency of territorially sensitive public policies that account for the economic, social, and environmental specificities of each region. Given that 54.2% of the recycling workforce is female—many of whom are Black and heads of household—these wage inequalities become even more acute, exposing the intersections of class, gender, and race ([Batista et al., 2023](#); [Ferreira, Silva et al., 2023](#); [Tizziani et al., 2025](#)).

In this context, valuing the labor of female waste pickers, especially in regions with lower average incomes, is essential for promoting social justice and economic sustainability within the circular economy. As [Freitas et al. \(2024\)](#) argue, the creation of green jobs and poverty reduction are directly linked to institutional recognition and the expansion of social protection for recycling workers.

Valuing female waste pickers' labor must therefore be understood as a precondition for sustainability, not merely its outcome. As [Tronto \(1993\)](#) emphasizes, care should be understood as a political practice rather than a moral or charitable action. Recognizing female waste pickers' labor is tantamount to recognizing the material and ethical foundations of the circular economy itself.

The persistence of low female remuneration in less developed regions corroborates the arguments of [Carrasco \(2001\)](#) and [Coelho et al. \(2018\)](#) regarding the sexual division of labor, whereby women remain confined to activities associated with cleaning, maintenance, and recycling—tasks that are vital to the system yet systematically undervalued.

The feminization of circular poverty suggests that the circular economy continues to operate under a linear logic of exploitation, now disguised by environmentally progressive rhetoric. As [Kirchherr et al. \(2018\)](#) warn, circularity risks becoming a corporate narrative unless it incorporates recognition of human labor and care as central dimensions of sustainability.

Table 4 highlights significant disparities in waste pickers' earnings across Brazilian states. In the North, Acre records the highest average income (BRL 1,550.00), while Roraima shows the lowest national value (BRL 383.33). In the Central-West, Mato Grosso leads with BRL 1,724.98, whereas the Federal District has the lowest average in the region (BRL 1,050.00). In the South, Paraná presents the highest value (BRL 1,563.87), while in the Southeast, Rio de Janeiro stands out (BRL 1,503.89) compared to Minas Gerais (BRL 1,168.60). In the Northeast, Alagoas records the highest income (BRL 1,424.29), while Rio Grande do Norte has the lowest (BRL 600.00).

Table 4 - Average monthly income of waste pickers by state and region (R\$)

STATE	MONTHLY AVERAGE INCOME (BRL)	MINIMUM AMOUNT (BRL)	MAXIMUM AMOUNT (BRL)
Acre	1,550.00	383.33	1,550.00
Amazonas	1,438.69		
Amapá	1,147.00		
Rondônia	1,241.67		
Pará	1,064.86		
Roraima	383.33		
Tocantins	1,055.77		
Mato Grosso	1,724.98	1,050.00	1,724.98
Mato Grosso do Sul	1,306.97		
Goiás	1,385.87		
Distrito Federal	1,050.00		
Paraná	1,563.87	1,191.62	1,563.87
Santa Catarina	1,494.82		
Rio Grande do Sul	1,191.62		
Espírito Santo	1,232.20	1,168.60	1,503.89
Minas Gerais	1,168.60		
Rio de Janeiro	1,503.89		
São Paulo	1,436.36		
Bahia	1,012.63	600.00	1,424.29
Sergipe	1,019.15		
Alagoas	1,424.29		
Pernambuco	1,108.33		
Paraíba	1,138.67		
Rio Grande do Norte	600.00		
Ceará	926.24		
Piauí	976.47		
Maranhão	1,148.48		

Source: Recycling Yearbook ([Anuário de Reciclagem, 2024, p. 17](#)).

These disparities reveal territorial inequalities related to waste management practices, the types and values of recyclable materials, and levels of cooperative organization. They also reflect gendered and racialized inequalities, as most waste pickers are Black women with lower educational attainment and heightened social vulnerability (Ferreira, Silva et al., 2023; Tizziani et al., 2025). These findings underscore the need for regionalized and intersectional public policies aimed at promoting economic justice, labor valorization, and the mitigation of structural inequalities (Piedras et al., 2025). As Freitas et al. (2024) emphasize, valuing recycling labor is central to a more inclusive and sustainable circular economy. Women in recycling clearly demonstrate the essential nature of their role, even as they contend with the unpaid and unrecognized burdens of the care economy—burdens that remain invisible to legal, social, and economic institutions, yet are fundamental to environmental sustainability.

The wage disparities documented in Table 4 consolidate the argument that the Brazilian circular economy reproduces structural inequalities of gender and territory. As Carrasco (2009) and Pasqualetto and Ghirardi (2025) argue, inadequate remuneration for care work—here embodied in the labor of female waste pickers—reveals a profound inconsistency between sustainability discourse and prevailing economic practices.

The economic invisibility of female waste pickers does not stem from a lack of productivity, but from the absence of political and symbolic recognition (Fraser, 2001). When care is performed under precarious conditions, it remains excluded from development metrics and well-being indicators. Public policies that fail to incorporate a gender perspective ultimately neutralize women's role in environmental sustainability, perpetuating a logic of exploitation that is simultaneously ecological, social, and patriarchal.

Consolidating the circular economy in Brazil therefore requires recognizing care as a foundational dimension of sustainability rather than a peripheral concern. As Tronto (2013) argues, care entails responsibility and interdependence—values that should guide both waste management and labor relations.

By articulating care, circularity, and intersectionality, this study demonstrates that transitions to sustainable models cannot occur without the symbolic and material redistribution of labor. Recognizing female waste pickers as protagonists of the circular economy is thus an indispensable condition for achieving socially just sustainability.

FINAL CONSIDERATIONS

The analysis of data from the sixth edition of the 2024 Recycling Yearbook, published by the Instituto Caminhos Sustentáveis, made it possible to identify how the circular economy—particularly in the recycling sector—is configured in Brazil from a gender perspective. The study revealed multiple layers of oppression affecting women—predominantly Black, heads of household, and with low levels of formal education—who sustain this sector under conditions marked by informality, invisibility, lack of rights, and limited institutional support.

Although the circular economy is often presented as a more sustainable alternative to the linear economy, its implementation in Brazil remains permeated by gender, racial, and territorial inequalities. Recycling generates income for vulnerable groups, yet it does not ensure social inclusion or recognition.

Without confronting these inequalities, there is a risk that circularity will remain largely rhetorical, rendering the labor of female waste pickers invisible and perpetuating precarious working conditions.

The investigation identified pronounced inequalities in the distribution of recycling organizations, average income levels, and infrastructure. The Southeast concentrates a larger number of organizations and exhibits higher income indicators, whereas the Northeast faces more severe structural constraints. These disparities reveal shortcomings in public policies and underscore the need for territorially differentiated strategies. Variations were also observed in the number of waste pickers per organization, indicating operational imbalances, with many entities operating under precarious conditions and exhibiting limited integration into support networks. Such constraints restrict the potential of the circular economy to promote social inclusion and sustainable development.

The circular economy can contribute to sustainability in Brazil; however, it continues to be shaped by inequalities related to gender, race, class, and territory—particularly in the case of Black female waste pickers, who remain in subordinate positions. Waste picker organizations are foundational to an ethical economy, and their recognition and valorization are decisive for promoting empowerment and equity, as well as for confronting social, economic, and environmental forms of violence. The effective implementation of the National Solid Waste Policy (PNRS – Law No. 12,305/2010), with an explicit focus on gender equity, is essential to ensure recognition and improved working conditions. Integrated and intersectional public policies are therefore urgent to guarantee dignity, income, and citizenship for female waste pickers.

Social implications. The study indicates that 54.2% of the recycling workforce is composed of women, who face low economic valuation and an accumulation of domestic and care responsibilities. These dynamics obscure women's labor and reproduces structural forms of oppression. The intersection of racism, sexism, and classism constrains access to improved living and working conditions, particularly given low educational attainment, thereby perpetuating cycles of familial exclusion. Nevertheless, women's participation in leadership roles and collective organization within cooperatives has been increasing, enabling the occupation of new spaces and fostering processes of empowerment.

Practical implications. The circular economy generates income for waste pickers, reduces environmental impacts, and promotes sustainability. To ensure that it is socially and gender just, it is necessary to expand social protection, guarantee decent work, and strengthen public policies that recognize the central role of waste pickers in recycling systems.

The main limitation of this study lies in its reliance on secondary data from the 2024 Recycling Yearbook, which precludes more detailed analyses of local experiences and prevents the disaggregation of average income data by race and gender. This limitation restricts a more nuanced understanding of the diversity and complexity of female waste pickers' experiences. Future research should therefore adopt qualitative approaches—such as interviews and case studies with waste pickers and cooperative or association managers—to enable regional comparisons and intersectional analyses that articulate race, class, and territory, thereby deepening debates on environmental justice, women's empowerment, and productive inclusion within the circular economy.

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NOTE

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

DATA AVAILABILITY

The entire dataset supporting the results of this study can be accessed at:

<https://www.abrema.org.br/2024/07/18/brasil-destinou-333-milhoes-de-toneladas-de-lixo-de-forma-inadequada-em-2022/>

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