

CIRCULAR ECONOMY ANALYSIS IN 3 DISTRICTS OF LIMA, PERU

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Abstract. The proposed research is based on investigating the circularity of three districts in the city of Lima, the capital of Peru, located in different areas of the city: East Lima, South Lima, and North Lima. The variables to be analyzed within circular economy strategies are solid waste management, recycling, innovation, sustainability indicators, sustainable construction, and environmental education. The results obtained can be used in future studies as well as in management plans for these districts and other areas of the city.

Keywords: circular economy, sustainability, environmental.

1. Introduction

In recent years, the circular economy has been strongly promoted and supported by various policies in Latin America and the Caribbean. These policies are necessary to accelerate changes in innovation, supply chains, and the final disposal of waste (Schroder et al., 2020).

Circular economy is a key pillar of the Sustainable Development Goals (Atstaja et al., 2025). Furthermore, circularity is a pathway to sustainable urban development (Feleki et al., 2025).

A study conducted in Brazil, specifically in Curitiba, concludes that the circular economy is a new model for improving waste management and seeking new opportunities (da Silva, 2018).

Studies in Europe, for example in Sweden, have concluded that the circular economy is a multidimensional strategy and is not solely aligned with recycling (Heshmati & Rashidghalam, 2021).

In the case of Canada, the differences between applying circularity in the public and private sectors are widely explained, concluding that there is great importance in education and communication in the management of municipalities (Radu & Lux, 2025).

Finally, according to Herrera Jiménez et al. (2022), the path toward a circular economy requires a major change in the way people produce and consume, as well as in the way we do business by applying sustainable development.

This research compares 3 districts of the city of Lima in Peru and their strategies towards the circular economy, drawing a parallel on how different areas of the city can

align with sustainability. The reason for choosing these 3 areas of the city is that they are the areas of influence of the San Ignacio Loyola University in Lima (3 campuses) and this research has been carried out by a teacher and a group of Environmental Engineering students from the mentioned university.

The objective of this research is to understand the circular economy strategies of these 3 districts in the areas of influence of the university, and to serve as a basis study for other research as well as to indicate the strengths and weaknesses related to circularity and be an initial baseline for future work plans in the municipalities.

2. Materials and methods

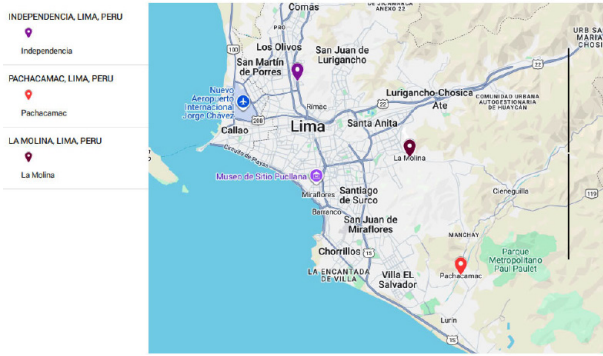
2.1. Study area

The districts of La Molina, Independencia, and Pachacamac are located in the city of Lima, the capital of Peru in South America (as can be observed in Figure 1).

2.2. Data collection

The following variables were analyzed: solid waste management, recycling, innovation, sustainability indicators, sustainable construction, and environmental education. Three districts of the city of Lima were analyzed: La Molina (East Lima), Pachacamac (South Lima), and Independencia (North Lima), for which plans developed by the municipalities, municipal decrees, as well as interviews with municipal officials were used.

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Note: The points represent the reference location of the analyzed districts.

Figure 1. Study Area: Districts of La Molina, Independencia and Pachacamac (source: prepared by the authors based on cartographic data from Google Maps, 2026)

A score from 1 to 5 was given to evaluate each district in their circular economy strategy.

3. Results

According to the results shown in Table 1, where a value is given to each variable analyzed for each district, related to the review of information and interviews, La Molina received the highest score for solid waste management, as well as for recycling, innovation, and environmental education.

Table 1. Evaluation of Circular Economy Strategy among the 3 districts (source: prepared by the authors, table and scores)

Variable	La Molina	Pachacamac	Independencia
Solid waste management	3	2	2
Recycling	3	2	2
Innovation	4	2	3
Sustainability indicators	2	3	3
Sustainable construction	1	1	2
Environmental education	4	2	2

However, the municipality of Pachacamac has the highest score for the use of indicators, but the lowest score for sustainable construction.

The district of Independencia has a good score for innovation, and while it is not the highest among the three districts evaluated, it is a leader in the northern area of Lima.

As can be seen in Figure 2, the district of La Molina leads the score, however the 3 districts show distinct characteristics, since this one has a population of higher socioeconomic level; Pachacamac has more rural areas and Independencia is an area with great potential for the development of the city.

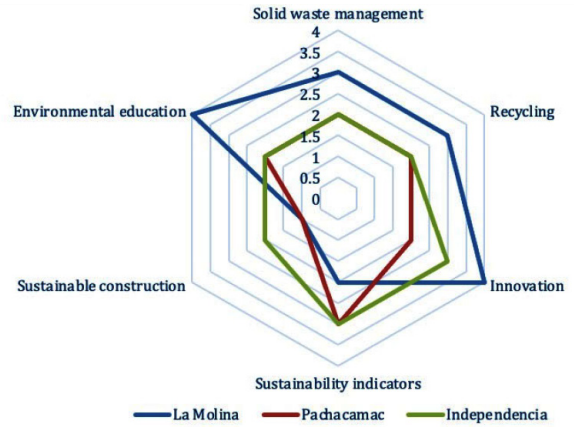


Figure 2. Comparison and evaluation of the circular economy strategy among the 3 districts (source: prepared by the authors)

4. Discussion

The Independencia District has a Circular Economy Strategy for 2030, which considers waste management, water management, urban sustainability, environmental education, policies, and governance. It is also aligned with the Sustainable Development Goals. Its main strengths lie in volunteer work, youth engagement, and the promotion of community gardens. Among its main challenges are lack of resources and delays in tax payment. Educational institutions in the area are key partners (Municipalidad de Independencia, 2022).

In the La Molina district, there is a waste recovery program for both organic and inorganic waste. The purpose of the organic waste is composting, for the maintenance of green areas and local flower shops, and incentives are also provided to the community. With inorganic waste, work is done with recyclers, raising awareness, mapping routes, and working with the community and environmental education, especially with children. In terms of environmental education, the municipality has partnered with an international program to work on waste circularity and adapt the experiences to the local community.

The municipality of Pachacamac bases its circularity strategy on environmental education, which has a project called EDDUCA (Municipalidad Distrital de Pachacamac, 2023), which works with young promoters in environmental education throughout the district. Additionally, one of the municipality of Pachacamac's objectives for 2030 is 100% collection of solid waste and proper management of liquid effluents (Municipalidad Distrital de Pachacamac, 2025). Finally, the municipality of Pachacamac promotes the project "Saberes que crean futuro" (Knowledge that Creates the Future) by UNESCO, which is focused on the circular economy, especially in the textile sector (UNESCO, 2024).

Recycling is still a challenge, and a similar situation occurs in Latin America; a study conducted in Brazil indicates that the challenges for implementing a circular

economy are focused on recycling, waste collection, and the informal waste collectors (Pincelli et al., 2021).

Based on the results obtained, it can be said that La Molina is the municipality that comes closest to an adequate circular economy strategy; however, it is necessary to highlight that the districts have differentiating factors in their management, location, and resources.

It is important to highlight that the municipality of Independencia, despite not having the highest score, does have a management in progress in the northern area of the city of Lima, and according to the interview carried out and the information reviewed, considerable efforts are being made to achieve a circular economy management.

In the case of the analysis of results from the municipality of Pachacamac, it still has low scores in some constructs; however, it is crucial to consider that it is a district with a different reality, since it has more extensive rural areas and is located in an area further away from the metropolitan area. It is possible to draw a parallel with a study on circular economy carried out in Italy, where they indicate that larger and even more industrialized municipalities tend to adopt the circular economy more quickly (Ghinoi et al., 2024).

5. Conclusions

Among the three districts evaluated, the one with the most initiatives related to innovation is La Molina, as it promotes actions beyond the initiatives at the national level. According to the information reviewed from the interview conducted, the municipality of La Molina considers the guidelines of the Ministry of Environment of Peru related to the circular economy.

It is important to note that, in general, informality and low tax collection in Peru are a problem in different areas, limiting the development of many projects and areas with needs.

The districts of North Lima and South Lima have the disadvantage of delayed tax payments, which leads to a shortage of resources and efficient management to achieve sustainability in the goal of circularity.

In Pachacamac, we found challenges due to have fewer urban areas; therefore, there are issues in waste management and water resources, which also pose difficulties in planning.

It is relevant to take into account, for more in-depth studies, the issue of water resources, energy and climate change in the circular economy strategy, not only at the municipal and government level but also at the private level.

Sustainable construction is an aspect that has not been worked deeply in the evaluated municipalities, unlike in other parts of the city of Lima. The Pachacamac district has the lowest score in this area, however, La Molina and Independencia also do not stand out. In other parts of the city, sustainable construction, with

certifications such as LEED or EDGE, is much more developed and continues to grow, becoming a trend in the city. This is a very interesting topic to explore in further research, especially due to its influence on circularity and climate change.

A major difficulty is the lack of sustainability indicators to be able to measure continuous improvements in sustainability in each municipality. A growing trend in Peru is the number of companies formally reporting their sustainability strategies; however, it would be a true innovation to see reports in the public sector, especially using international indicators such as GRI. It is worth noting that in the interviews, the experts do mention aligning municipal strategies with the Sustainable Development Goals, because it would provide standardization.

In general, recycling represents a challenge in all the municipalities evaluated. It is worth noting that recycling is just one of many circularity strategies, with innovation and design being key to addressing this challenge and truly reducing the environmental impact both in these municipalities and throughout Lima city.

Finally, circularity has many aspects and in the case of municipalities it represents a challenge due to issues of management, budget, stakeholder engagement, resources, among others, so it is considered that there is room to carry out many research that could be useful both academically and in the application of the strategies.

References

- Atstaja, D., Liepa, I., Vembris, A., Rivza, B., Osipova, S., & Cudecka-Purina, N. (2025). Circular economy index: A new methodology for evaluating circularity in municipalities. *Sustainability*, 17(11), Article 4867. <https://doi.org/10.3390/su17114867>
- da Silva, C. L. (2018). Proposal of a dynamic model to evaluate public policies for the circular economy: Scenarios applied to the municipality of Curitiba. *Waste Management*, 78, 456–466. <https://doi.org/10.1016/j.wasman.2018.06.007>
- Feleki, E., Tschapke, V., Borngesser, W., & Kiesel, L. (2025). Transforming urban landscapes: Circular economy practices in European cities. *Circular Economy and Sustainability*, 5, 4945–4956. <https://doi.org/10.1007/s43615-025-00674-5>
- Ghinoi, S., Silvestri, F., Spigarelli, F., & Tassinari, M. (2024). A methodological proposal for developing a Municipality Indicator of Circular Economy (MICE). *Resources, Conservation and Recycling*, 211, Article 107871. <https://doi.org/10.1016/j.resconrec.2024.107871>
- Google Maps. (2006). *Study area: Districts of La Molina, Independencia and Pachacamac*. <https://www.google.com/maps/d/pdf?mid=15gPmbiVL8eLHwpBB600V4pKMBVYwu1U&pagew=792&pageh=612&llsw=-12.530138%2C-77.100763&llne=-11.678837%2C-76.824731>
- Herrera Jiménez, J., Rondón Toro, E., Samaniego, J., & Santori, S. (2022). *Panorama de las hojas de ruta de economía circular en América Latina y el Caribe* [Overview of the circular economy roadmaps in Latin America and the Caribbean]. Documento de Proyectos, CEPAL.

- Heshmati, A., & Rashidghalam, M. (2021). Assessment of the urban circular economy in Sweden. *Journal of Cleaner Production*, 310, Article 127475. <https://doi.org/10.1016/j.jclepro.2021.127475>
- Municipalidad de Independencia. (2022). *Estrategia de economía circular de la Municipalidad de Independencia* [Circular economy strategy of the Municipality of Independencia]. <https://economiacircularperu.pe/estrategias-de-economia-circular-de-independencia-al-2030/>
- Municipalidad Distrital de Pachacamac. (2023). *Programa Municipal de Educación, Cultura y Ciudadanía Ambiental de la Municipalidad Distrital de Pachacamac. Sistema Nacional de Información Ambiental (SINIA) – Ministerio del Ambiente* [Municipal Program of Education, Culture and Environmental Citizenship of the District Municipality of Pachacamac. National Environmental Information System (SINIA) – Ministry of the Environment]. <https://sinia.minam.gob.pe/normas/programa-municipal-educacion-cultura-ciudadania-ambiental-1669>
- Municipalidad Distrital de Pachacamac. (2025). *Reporte de seguimiento anual 2024 del Plan Estratégico Institucional 2019–2026* [2024 annual follow-up report of the 2019–2026 Institutional Strategic Plan] [Informe anual]. Oficina General de Planeamiento, Presupuesto y Modernización. <https://munipachacamac.gob.pe/portaltransparencia/planeamiento/PLANES-POLITICAS/REPORTE-DE-SEGUIMIENTO-PEI-2024-ANUAL.pdf>
- Pincelli, I. P., de Castilhos Júnior, A. B., Matias, M. S., & Rutkowski, E. W. (2021). Post-consumer plastic packaging waste flow analysis for Brazil: The challenges moving towards a circular economy. *Waste Management*, 126, 781–790. <https://doi.org/10.1016/j.wasman.2021.04.005>
- Radu, C., & Lux, G. (2025). Circular economy promotion and disclosure among Canadian municipalities. *Sustainability Accounting, Management and Policy Journal*, 16(4), 1016–1044. <https://doi.org/10.1108/SAMPJ-06-2023-0445>
- Schröder, P., Albaladejo, M., Ribas, P. A., MacEwen, M., Tilkanen, J., & Ambiente, M. (2020). *La economía circular en América Latina y el Caribe* [The circular economy in Latin America and the Caribbean]. In *Oportunidades para fomentar la resiliencia*. Chatham House.
- UNESCO. (2024). *Saberes que crean futuro: Mujeres artesanas crean nuevos productos a partir de material de segundo uso* [Knowledge that creates the future: Women artisans create new products from second-hand materials]. <https://www.unesco.org/es/articles/saberes-que-crean-futuro-mujeres-artesanas-crean-nuevos-productos-partir-de-material-de-segundo-uso>