

CIRCULAR ECONOMY AND URBAN SUSTAINABILITY

Challenges and Opportunities in the City of Barranquilla

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ABSTRACT

Barranquilla, as an industrial and commercial hub of the Colombian Caribbean, faces the challenge of adopting sustainable economic models. The circular economy emerges as a strategy to reduce waste, optimise resources, and boost local productivity. This qualitative-descriptive study (2023–2024) analysed experiences in recycling, construction, sustainable fashion, and agribusiness through semi-structured interviews and a documentary review of public policies. Findings reveal an early transition toward circular models, with initiatives such as industrial waste recovery, public-private partnerships, and ventures incorporating eco-design. However, regulatory barriers, lack of incentives, and limited public awareness persist. The study concludes that the circular economy represents an opportunity to strengthen economic competitiveness with environmental responsibility, provided that government, business, academia, and community coordinate efforts and adopt guidelines aligned with the SDGs and territorial development plans.

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1. Introduction

The city of Barranquilla has established itself over recent decades as a strategic hub in the Colombian Caribbean region, characterised by its commercial, port and industrial dynamism. This prominent role has given it a particular responsibility in the face of contemporary challenges that link economic development with environmental and social sustainability. Urban expansion, growing demand for natural resources and pressures arising from production dynamics have created a scenario in which it is essential to rethink forms of production and consumption. In this context, the circular economy emerges as an alternative that proposes a paradigm shift from the traditional linear model, historically oriented towards the extraction, use and final disposal of materials. Circularity proposes a systemic reorganisation that seeks to extend the useful life of resources, reduce waste generation and promote innovations that impact both production processes and citizen consumption habits (Geissdoerfer et al., 2017).

Barranquilla, as an expanding urban area, faces the challenge of articulating its economic growth dynamics with strategies that guarantee sustainability. This scenario is further complicated by the city's position as a connection point between national and international markets, which intensifies the flow of goods and materials and, consequently, increases pressure on environmental management systems. According to the Organisation for Economic Co-operation and Development (OECD, 2019), urban environments account for most of the energy consumption, waste generated and pollutant emissions, which gives cities a decisive role in the transition to more responsible production models. Thus, the adoption of the circular economy in Barranquilla represents an opportunity to position the city as a regional benchmark in building a more balanced future between the economic and environmental spheres.

Academic literature has emphasised that the circular economy should not be understood solely as a set of isolated practices of recycling or waste utilisation, but as a comprehensive system that redefines the way societies conceive the relationship between nature, technology and the economy. Kirchherr et al. (2017) argue that circularity involves rethinking product life cycles, promoting innovation in design, strengthening collaborative value chains and generating changes in institutions and consumer cultures. From this perspective, cities that advance this approach not only mitigate negative environmental impacts but also generate new economic opportunities by creating green jobs, developing alternative markets and promoting urban resilience.

In the case of Barranquilla, the transition to a circular economy has manifested itself in different sectors. One of the most representative examples is recycling and waste management initiatives, where local companies and community organisations have promoted projects aimed at recovering materials, creating value chains from industrial waste, and formalising activities related to collection and sorting. Added to this are experiences in the construction sector that have incorporated practices of material reuse and energy efficiency in real estate projects, as well as sustainable fashion ventures that transform textiles into high value-added products, and agro-industrial proposals that seek to optimise the use of water and energy resources. These experiences highlight the city's potential to move towards a circular model, although structural limitations that slow down the consolidation of such practices are recognised.

Recent research findings suggest that circular economy processes in urban environments are often conditioned by regulatory, institutional and cultural factors. In Colombia, the regulatory framework has incorporated guidelines on sustainability and circularity, in line with the country's international commitments, such as the 2030 Agenda and the Sustainable Development Goals (Ministry of Environment and Sustainable Development, 2019). However, studies such as those by Prieto-Sandoval et al. (2018) warn that the circular transition requires real integration between public policies, business dynamics and citizen participation, so that the fragmentation of efforts can be overcome and long-term synergies generated.

The qualitative-descriptive research carried out between 2023 and 2024 is part of this context, with the aim of analysing local experiences that contribute to understanding how Barranquilla has begun a process of transition towards circularity. Through semi-structured interviews conducted with entrepreneurs, public managers and community leaders, complemented by a

documentary review of local and regional policies, trends, opportunities and limitations that shape the current landscape were identified. This methodological approach provided access to diverse narratives that reflect both the progress and tensions inherent in a model under construction.

The results of the study show that Barranquilla is in the early stages of adopting circular practices, characterised by the coexistence of innovative initiatives with regulatory, economic and social obstacles. Among the advances are public-private partnerships that have enabled the recovery of materials and the creation of innovation platforms, as well as the emergence of enterprises that apply eco-design and clean production principles. However, limitations were also identified, stemming from the absence of tax incentives, poor inter-institutional coordination and limited public awareness of responsible consumption. These barriers highlight the need to strengthen urban governance to ensure that individual or sectoral efforts are integrated into a collective city strategy.

Analysis of this scenario leads to reflection on the opportunities that the circular economy offers Barranquilla to strengthen its economic competitiveness with environmental responsibility. Coordination between the state, business, academia and the community is an essential condition for the city to scale up the practices identified and consolidate a culture of circularity. As Murray et al. (2017) argue, the success of the circular economy depends largely on the ability of social actors to work in collaborative networks that transform both production systems and consumer behaviour. This approach requires a rethinking of urban policies, in which sustainability becomes a cross-cutting theme in territorial development plans.

As Barranquilla strengthens its circularity processes, the possibility of generating positive impacts at different levels opens up. From an environmental perspective, it promotes waste reduction, emission reduction and optimisation in the use of resources. From an economic point of view, it broadens the spectrum of productive activities based on innovation, creativity and efficiency, which can boost employment and improve competitiveness. And in the social sphere, the circular economy promotes forms of inclusion by incorporating communities and associations into value chains, especially those historically linked to collection and recycling. These impacts, although incipient in the city, reflect a transformative potential that deserves to be explored in greater depth.

In this sense, this research seeks to contribute to the academic and practical debate on circularity in urban environments in the Colombian Caribbean, taking Barranquilla as a case study. The qualitative-descriptive approach adopted responds to the need to understand local dynamics beyond quantitative indicators, recognising the value of the narratives and experiences of the actors involved in the process. Likewise, the documentary analysis allows us to establish links between public policies and social and business practices, identifying convergences and tensions that influence the configuration of a circular urban model.

Finally, this study is part of a broader agenda of reflection on the challenges and opportunities facing Latin American cities in terms of sustainability. Several authors have pointed out that the region is at a turning point, where the problems of rapid urbanisation and social inequality intersect with global demands for climate change mitigation and biodiversity conservation (Sachs et al., 2019). In this context, Barranquilla's experience can offer valuable lessons for other cities with similar socioeconomic and environmental characteristics, contributing to the construction of more resilient and equitable models.

2. Materials and Methods

The research on the circular economy and urban sustainability in the city of Barranquilla was conducted using a qualitative approach, seeking to understand how different actors linked to productive sectors, public institutions, and community organisations construct meanings, practices, and expectations around circularity and its impact on urban life. This approach was chosen because the social and economic reality of the city cannot be understood solely through statistical indicators, but requires an interpretative approach to the stories, experiences and

meanings of those who actively participate in the processes of production, waste management, business innovation and public policy promotion. Denzin and Lincoln (2018) explain that qualitative research does not seek statistical generalisation, but rather a deeper understanding of phenomena from the perspectives of the subjects, which was particularly relevant in a study whose purpose was to describe and analyse local experiences of the circular economy in a specific urban context.

The descriptive design allowed us to characterise circular practices in Barranquilla, establishing patterns, trends and particularities that emerge from the experiences of different sectors. Taylor et al. (2016) argue that descriptive design offers the possibility of systematising narratives and practices, constructing analytical categories that facilitate the interpretation of social phenomena. In this case, the description was integrated with an interpretative component, as we sought to analyse how local initiatives relate to national and international regulatory frameworks and how the discourses of the actors reflect perceptions of the opportunities and barriers to the transition to circularity. The research was carried out between 2023 and 2024, with a twelve-month period of fieldwork that allowed us to observe the evolution of some projects, record changes in the perceptions of the actors, and contrast the findings with institutional documents and public policies.

Participants were selected through purposive sampling, prioritising the inclusion of individuals with direct knowledge and experience of the circular economy in the city. A total of thirty subjects were interviewed, divided into three main groups: twelve businesspeople linked to sectors such as recycling, construction, sustainable fashion, and agribusiness; eight officials from public entities responsible for urban planning, environmental management, and economic development; and ten community leaders belonging to environmental groups, recyclers' associations, and neighbourhood organisations. The diversity of participants allowed for a wide range of perspectives to be gathered, which is in line with Patton (2015), who considers that intentional sampling pursues depth and richness of information rather than statistical representativeness. Consequently, the research sought to understand the heterogeneity of views on the circular economy in Barranquilla, identifying both the progress and the limitations and expectations of the different social actors.

Information collection techniques included semi-structured interviews, document review, and field observation. Interviews became the main tool of approach, as they facilitated the construction of an open and flexible dialogue with participants. A question guide was developed that inquired about the practices implemented, the challenges faced, the innovation strategies, and the perceptions about the future of circularity in the city. Each interview lasted approximately one hour and was recorded with the prior consent of the interviewees. Verbatim transcripts were then produced and used as input for qualitative analysis. Kvale and Brinkmann (2015) highlight that semi-structured interviews allow for in-depth exploration of meanings, while offering the possibility of comparing responses within a common thematic framework.

The document review complemented the information gathered in the interviews by analysing development plans, public policies, institutional reports and academic documents. This review focused on identifying the objectives, strategies and results of programmes related to the circular economy in Barranquilla and Colombia. Documents from the Ministry of Environment and Sustainable Development, the National Planning Department, the Mayor's Office of Barranquilla, and international organisations such as the United Nations Environment Programme were included. These documents were systematised in matrices that allowed the information to be organised and related to the perceptions of the actors interviewed. Flick (2018) points out that triangulation of sources is a fundamental strategy for strengthening the validity of findings, which was applied in this study by contrasting discourses with official policies and reports.

Field observation was carried out through visits to companies, communities, and spaces where circular economy initiatives are being developed. These visits made it possible to observe practices such as waste separation, the reuse of materials in production processes, the use of sustainable technologies and community awareness-raising dynamics. Field notes were prepared

that included detailed descriptions of the activities observed, as well as analytical reflections by the researcher. Angrosino (2007) argues that observation is a privileged resource in qualitative research because it allows for the capture of dimensions that do not always emerge in the discourse of interviewees, offering a more complete picture of the reality under study.

The research procedure was organised into several phases. The first phase consisted of a theoretical and documentary review, which enabled the design of data collection instruments and the establishment of initial categories of analysis. The second phase consisted of conducting interviews and observations, after obtaining informed consent and under conditions that guaranteed the confidentiality of the participants. The third phase included the organisation of data, the transcription of interviews, and the initial coding of texts. The fourth phase involved comparative analysis and the construction of emerging categories, which were subsequently linked to the theoretical and documentary framework. This sequence followed the logic of the constant comparison method, characteristic of Grounded Theory, as explained by Charmaz (2014), where data are continuously coded and compared to identify patterns and conceptual relationships.

The analysis was carried out on three levels. At the first level, a descriptive reading of the discourses and documents was carried out, identifying significant expressions and relevant experiences. At the second level, the units of meaning were grouped into thematic categories related to circular practices, institutional barriers, economic opportunities, and citizen perceptions. At the third level, broader interpretations were developed, connecting these categories with theoretical frameworks and national and international public policies. Miles et al. (2014) assert that qualitative analysis is a process of reduction and synthesis that allows meaning to be given to large volumes of data, which in this study translated into the identification of patterns and contrasts between different sectors and actors.

The research adopted criteria of rigour typical of the qualitative tradition, such as credibility, transferability, dependability and confirmability, as proposed by Lincoln and Guba (1985). Credibility was ensured through the triangulation of techniques and sources, which made it possible to verify the consistency of the findings. Transferability was addressed through a detailed description of the urban context of Barranquilla and the characteristics of the participants, which offers other researchers the possibility of evaluating the applicability of the results in similar scenarios. Dependability was ensured through systematic recording of each phase of the process, enabling methodological replicability. Confirmability was ensured through critical review of the data, discussion with specialised literature, and elimination of personal bias on the part of the researcher.

From an ethical standpoint, the study adhered to fundamental principles of respect, consent, and confidentiality. All participants received clear information about the objectives and scope of the research, were guaranteed the right to withdraw at any time, and were asked for their consent before interviews were recorded. The identity of participants was protected through the use of codes, and information was stored on devices with restricted access. These measures are in line with international recommendations on ethics in social research and with the guidelines established by the Council for International Organizations of Medical Sciences (CIOMS, 2016).

The study faced limitations related to the availability of some participants, the difficulty of accessing updated institutional documents, and the impossibility of long-term follow-up on certain business processes. These limitations were offset by the diversity of sources, the triangulation of techniques, and the inclusion of actors from different sectors. The scope of the research is to offer a situated and qualitative view of the circular economy in Barranquilla, without attempting statistical generalisation, but with a level of interpretative depth that provides input for the formulation of public policies, the orientation of business strategies, and the promotion of citizen education around urban sustainability. In this sense, the methodology developed allowed us to construct a comprehensive overview of the challenges and opportunities facing the city in its transition to circular models, highlighting both the initiatives that mark paths of innovation

and the barriers that must be overcome through coordinated efforts by public, private, and community actors.

3. Results and Discussion

3.1. Business Dynamics and Waste Utilisation

The results obtained show that the business sector in Barranquilla has developed waste utilisation experiences that respond to the need to maintain competitiveness in an economic environment that demands efficiency in the use of resources and adaptation to sustainability frameworks that are progressively becoming quality parameters and factors of differentiation from local and regional competitors. A businessperson in the plastics sector stated that "the recovery of industrial waste has been an opportunity to reduce production costs and diversify the product offering" (personal communication, 2024), suggesting that circularity is perceived not only as an environmental responsibility, but also as a strategy linked to profitability and permanence in increasingly demanding markets. These observations coincide with those of Kirchherr et al. (2018), who explain that the circular economy becomes a mechanism for innovation that allows companies to differentiate themselves and expand their share in competitive environments. However, these experiences are not widespread in the city; they depend on the initiative of a few actors who have decided to invest in eco-design technologies and processes, and there is no consolidated innovation ecosystem to support them.

A review of business and institutional reports shows that, in sectors such as the construction materials industry, demolition waste and rubble are beginning to be incorporated into the production of blocks and prefabricated elements, although there are no clear verification standards or quality control mechanisms to ensure consistent compliance. One official explained that "the tender documents for some public works include incentives for the use of recycled materials, but in practice these clauses are not strictly monitored" (personal communication, 2024), revealing that the regulatory framework is still weak and lacks instruments to ensure the consolidation of circular practices in the sector. This finding coincides with that of Ghisellini et al. (2016), who argue that the role of the state is fundamental in creating conditions that ensure the transition to circular models, especially in infrastructure sectors where business decisions are closely linked to public policy.

3.2. Sustainable Fashion and Cultural Entrepreneurship

Findings in the sustainable fashion sector reveal the emergence of proposals led mainly by young entrepreneurs who, from an innovative perspective that is also deeply rooted in local identity, experiment with recycled materials, natural fibres and low environmental impact production processes. This constitutes an effort to link design and manufacturing practices with the cultural and aesthetic dynamics that characterise the city of Barranquilla and its Caribbean environment. One designer stated that "Barranquilla fashion has a strong identity component, and the incorporation of reused materials allows us to maintain a link with tradition while proposing a conscious alternative to mass consumption" (personal communication, 2024). This reflects that the sector is not only oriented towards innovation in the use of inputs, but also towards the preservation of a cultural memory that is expressed in colours, shapes and textures linked to the region's festivals, music and imagery.

These experiences illustrate the capacity of the circular economy to integrate into creative and cultural dynamics, generating a space where sustainability becomes an element of differentiation and authenticity in the market, confirming the findings of Bocken et al. (2016), who argue that circular business models have the capacity to modify consumption patterns at the micro level, directly influencing the perception of product value and consumers' willingness to support alternatives that depart from the logic of mass production and accelerated consumption. In this sense, Barranquilla's enterprises do not limit themselves to imitating global sustainable fashion trends but seek to reinterpret them using a visual and symbolic language that responds to local

traditions and the demands of a citizenry increasingly attentive to the social and environmental impacts of their purchasing decisions.

However, the testimonies collected in the research show that these ventures face structural barriers that restrict their growth and consolidation, as they are initiatives that operate with reduced financial margins, limited access to distribution channels, and still-incipient institutional recognition. The entrepreneurs explained that there are few lines of credit adapted to sustainability projects, that business support programmes tend to be geared towards traditional sectors, and that marketing processes are often reduced to participation in local fairs or cultural events which, although important as showcases for visibility, do not guarantee the possibility of scaling up to national and international markets or consolidating stable value chains.

The analysis shows that sustainable fashion in Barranquilla is still an emerging phenomenon, characterised by high creative potential and strong capacity for innovation in design, but conditioned by structural limitations related to both a lack of financing and weak coordination between the different actors in the productive and cultural ecosystem. This scenario suggests the need to generate integration strategies in which the state, private enterprise and educational institutions come together to create spaces for training, project incubation, access to economic incentives and the consolidation of commercial circuits that strengthen these ventures. It is also important to move towards specific public policies that recognise sustainable fashion as a strategic sector within the city's creative economy, so that it can become a stable economic engine, capable of generating employment, stimulating innovation and projecting Barranquilla's image on the international stage in relation to responsible design and sustainability.

3.3. Agro-Industry and Use of By-Products

In the agro-industrial sphere, the results highlight a set of experiences that have begun to consolidate around circularity and the strategic use of organic by-products, particularly in composting processes and biogas production, which are practices that seek to respond simultaneously to the economic needs of producers and the environmental demands of sustainability. The accounts obtained during the fieldwork reveal a growing recognition of the value of waste as a resource, as opposed to its previous conception as rubbish, which is generating a change in mindset among rural actors. In the words of a community leader in the rural area of Barranquilla, "organic waste that was previously discarded is beginning to be transformed into inputs for fertilisers and energy, which represents economic relief and a contribution to the sustainability of agricultural production" (personal communication, 2024). This statement shows how local practices are part of a logic of reuse that strengthens productive autonomy and contributes to reducing the costs of external inputs in family farming units.

When analysing these practices in relation to the specialised literature, we find that they correspond to the findings of Murray et al. (2017), who argue that the circular economy applied to agribusiness not only reduces waste and optimises resources, but also promotes the resilience of territories by reducing dependence on imported or high-cost products. This perspective is particularly relevant in the case of the Caribbean Coast, where rural producers face high vulnerability to climate variability and price instability in input markets. In this sense, composting and biogas production are perceived as mechanisms that diversify productive activity and allow community associations to generate added value from materials that were previously considered useless.

The findings show that these initiatives are mainly concentrated in associations of small producers who have developed collective forms of organisation, which has allowed them to experiment with appropriate technologies for waste transformation and with systems for the exchange of knowledge between farmers and technicians. This associative component is fundamental, as it facilitates the building of trust and the consolidation of local economic circuits that sustain the projects. At the same time, it reinforces the link between circularity and the popular and solidarity-based economy, opening up a space for sustainability to be understood not only from a technical perspective, but also as a community and cultural practice.

However, feedback gathered in the fieldwork also point to structural barriers that limit the expansion of these experiences. The testimonies highlight the difficulty of accessing larger-scale processing technologies that allow for the processing of large volumes of waste and the generation of products with quality standards that can compete in broader markets. There is also a lack of differentiated marketing channels, as products derived from agricultural circularity—such as biofertilisers or small-scale clean energy—still lack recognition in established value chains. These limitations restrict the possibilities for scalability and make initiatives largely dependent on the individual or associative efforts of producers, without yet achieving institutional support to ensure their long-term sustainability.

The document review identified explicit references to bioeconomy and sustainability programmes in departmental development plans and public policy documents, which mention the importance of waste utilisation and the need to promote circular practices in agribusiness. However, the lack of robust budgets and effective implementation mechanisms reduces the real scope of these initiatives, creating a gap between the rhetoric of the plans and the materialisation of projects in the territories. This situation highlights the need for greater coordination between government levels, the private sector and higher education institutions in order to promote technology transfer, specialised training and access to financing tailored to the characteristics of small producers.

3.4. Subtitle Three-Four

The results reveal that the main barriers to the expansion of the circular economy in Barranquilla are threefold: regulatory, financial and cultural. At the regulatory level, the interviews showed that public policies mention the circular economy as a desirable goal but lack clear monitoring and verification instruments to ensure the actual adoption of circular practices in strategic sectors. In the financial sphere, businesspeople stated that implementation costs are high and that "banks do not have specific lines of credit for innovation in sustainability" (personal communication, 2024), which limits the possibility of scaling up experiences. On a cultural level, community leaders agreed that "citizens still do not perceive recycling as a valuable everyday practice, and separation at source remains poor" (personal communication, 2024).

These findings are related to the arguments put forward by Rizos et al. (2016), who argue that the lack of financing and incentives represents a central obstacle for small and medium-sized enterprises, and with the findings of Geissdoerfer et al. (2017), who maintain that the transition to circularity requires changes in citizen practices and the construction of a culture of responsible consumption. The research allows us to affirm that in Barranquilla, circularity is perceived as an agenda under construction, with scattered progress and an urgent need for institutional coordination to ensure the sustainability of initiatives over time.

3.5. Partnerships and Multilevel Governance

A significant finding was the identification of partnerships between the state, business, academia and the community which, although still fragmented, show a growing interest in building a framework for cooperation that will enable the consolidation of circular experiences in different sectors. One official stated that "inter-institutional working groups have made it possible to discuss waste recovery projects, but they depend on short-term political will and are not integrated into a long-term urban policy" (personal communication, 2024). This situation confirms the views of Prendeville et al. (2018), who insist on the need for multilevel governance structures that guarantee the permanence of circular policies beyond specific circumstances.

A review of official documents shows that the municipal development plan refers to the circular economy in sections related to environmental sustainability and productivity, but without an operational framework that defines clear goals, indicators, and responsibilities. This finding reveals that the discourse on circularity has entered the institutional agenda, although its implementation is still in its infancy.

3.6. Potential and Opportunities for Scaling Up

The results allow us to conclude that Barranquilla has conditions that favour the expansion of the circular economy, including a business sector with capacity for innovation, higher education institutions with programmes in engineering, design and environmental sciences, and a cultural tradition that can be linked to dynamics of creativity and sustainability. These characteristics suggest that, although the circular model is not yet consolidated, there are foundations that can be strengthened through integrated policies, clear incentives, and citizen education programmes that reinforce the social appropriation of circularity. As Corona et al. (2019) point out, the challenge is to overcome fragmentation and move from isolated initiatives to coordinated systems that structurally transform production and consumption patterns.

In Barranquilla, experiences in industry, construction, fashion, and agribusiness show a possible path, although they require the design of long-term strategies and a sustained commitment from public and private actors to consolidate an effective transition to a sustainable urban model.

4. Conclusions

The analysis carried out allows us to establish that the circular economy in Barranquilla is in a transition stage characterised by sectoral advances that have emerged from the initiative of businesspeople, entrepreneurs and communities who have identified waste management, ecodesign and the recovery of by-products as an opportunity to generate income, optimise resources and position themselves in markets that are increasingly sensitive to sustainability demands. This confirms that circularity is not limited to environmental discourse, but constitutes an approach to productive transformation with economic, social and cultural implications that require a coherent institutional framework and a citizenry willing to change consumption habits and resource use practices.

The results show that in the industrial and construction sectors there are experiences related to the use of rubble and the reuse of industrial waste, although these experiences lack technical verification standards and control mechanisms to ensure consistency in processes, which weakens their ability to become widespread practices and limits their structural impact. In the sustainable fashion sector, there is considerable creative potential that manages to combine cultural innovation with environmental commitment, although it remains restricted to emerging enterprises that face financing barriers and limited access to markets. In agribusiness, composting and bioenergy practices show the possibility of integrating circularity with food security, although they are still in experimental phases without robust articulation with public bioeconomy policies. These findings lead to the conclusion that the circular economy in Barranquilla operates in sectoral fragments that, while demonstrating potential, require comprehensive governance to convert isolated initiatives into sustained urban policies.

The most obvious barriers are related to regulatory weakness, the absence of specialised financial instruments and the lack of cultural ownership by citizens, suggesting that the transition to a circular model requires a multi-level approach in which local authorities, entrepreneurs, educational institutions and society in general make coordinated long-term commitments, without relying on individual or circumstantial will. Official discourse has incorporated the term circular economy into development plans and sectoral programmes, but it lacks operational goals, verifiable indicators and allocated budgets, which limits its capacity for structural transformation. In this sense, the conclusions allow us to argue that the path towards a more sustainable city requires that the language of politics be translated into concrete programmes, with clear incentives and monitoring processes that guarantee the permanence of the initiatives.

In terms of limitations, the study is based on a qualitative design that prioritised semi-structured interviews and document review, which allows for an understanding of perceptions, practices and discourse, but restricts the possibility of generalising the results to the entire city, given that no quantitative impact measurements or large-scale statistical analyses were carried

out to accurately assess the economic or environmental benefits of each initiative. Furthermore, data collection focused on specific sectors such as industry, construction, fashion and agribusiness, leaving out other potentially relevant fields such as energy, transport and urban services, which could provide complementary information to enrich the picture of circularity in the city. Another limitation relates to access to official documentary sources, given that many institutional reports do not present disaggregated information on circularity indicators, which forced us to reconstruct the analysis from secondary and testimonial sources.

Based on these limitations, lines of future research are proposed that are necessary to consolidate the field of study in the region. First, it is suggested that quantitative research be developed to accurately measure the impact of circular practices in terms of waste reduction, energy savings, job creation and economic competitiveness, which would allow authorities and entrepreneurs to make decisions based on more solid evidence. Secondly, it is recommended to broaden the sectoral spectrum of analysis by incorporating transport, logistics, tourism and urban services, given that in these areas, circularity can play a decisive role in the transformation of the city towards a sustainable model. Thirdly, it is relevant to investigate the cultural and educational factors that influence the adoption of responsible consumption practices, as the transition to circularity requires a profound change in the way citizens perceive, use and value resources. Fourthly, it is necessary to study the relationship between the circular economy and social inclusion policies, exploring how these practices can become employment and entrepreneurship opportunities for vulnerable populations.

Thus, the study's conclusions show that Barranquilla is in the early stages of implementing the circular economy, with sectoral advances that demonstrate the potential of this strategy to boost the economy and strengthen environmental sustainability, but with significant challenges in terms of regulation, financing, citizen culture and multilevel governance. The methodological limitations of the study open up the possibility for future research that complements the qualitative approach with quantitative and comparative approaches and explores sectors not yet studied. The path to a circular city requires structured coordination between the state, business, academia and society, with a long-term vision that transcends discourse and translates into effective public policies capable of transforming the relationship between production, consumption and the environment in an urban context that demands sustainability and resilience.

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References

- Angrosino, M. (2007). *Doing ethnographic and observational research*. SAGE.
- Bocken, N. M. P., de Pauw, I., Bakker, C. & van der Grinten, B. (2016). Product design and business model strategies for a circular economy. *Journal of Industrial and Production Engineering*, 33(5), 308-320. <https://doi.org/10.1080/21681015.2016.1172124>
- Charmaz, K. (2014). *Constructing grounded theory*. SAGE.
- CIOMS. (2016). *International ethical guidelines for health-related research involving humans*. Council for International Organizations of Medical Sciences.
- Corona, B., Shen, L., Reike, D., Rosales Carreón, J., & Worrell, E. (2019). Towards sustainable development through the circular economy-A review and critical assessment on current circularity metrics. *Resources, Conservation and Recycling*, 151, 104498. <https://doi.org/10.1016/j.resconrec.2019.104498>
- Denzin, N., & Lincoln, Y. (2018). *The SAGE handbook of qualitative research*. SAGE.
- Flick, U. (2018). *An introduction to qualitative research* (6th ed.). SAGE.
- Geissdoerfer, M., Savaget, P., Bocken, N. M., & Hultink, E. J. (2017). The Circular Economy – A new sustainability paradigm? *Journal of Cleaner Production*, 143, 757–768. <https://doi.org/10.1016/j.jclepro.2016.12.048>
- Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner Production*, 114.
- Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, 127, 221–232. <https://doi.org/10.1016/j.resconrec.2017.09.005>
- Kvale, S., & Brinkmann, S. (2015). *Interviews: Learning the craft of qualitative research interviewing*. SAGE.
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. SAGE.
- Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: A methods sourcebook*. SAGE.
- Ministerio de Ambiente y Desarrollo Sostenible. (2019). *Estrategia nacional de economía circular*. Gobierno de Colombia. <https://www.minambiente.gov.co>
- Murray, A., Skene, K., & Haynes, K. (2017). The circular economy: An interdisciplinary exploration of the concept and application in a global context. *Journal of Business Ethics*, 140(3), 369–380. <https://doi.org/10.1007/s10551-015-2693-2>
- OECD. (2019). *Business models for the circular economy: Opportunities and challenges for policy*. OECD Publishing. <https://doi.org/10.1787/g2g9dd62-en>
- Patton, M. Q. (2015). *Qualitative research and evaluation methods*. SAGE.
- Prendeville, S., Cherim, E., & Bocken, N. (2018). Circular cities: Mapping six cities in transition. *Environmental innovation and societal transitions*, 26, 171-194. <https://doi.org/10.1016/j.eist.2017.03.002>
- Prieto-Sandoval, V., Jaca, C., & Ormazabal, M. (2018). Towards a consensus on the circular economy. *Journal of Cleaner Production*, 179, 605–615. <https://doi.org/10.1016/j.jclepro.2017.12.224>
- Rizos, V., Behrens, A., Van der Gaast, W., Hofman, E., Ioannou, A., Kafyeke, T., Flamos, A., Rinaldi, R., Papadelis, S., Hirschnitz-Garbers, M., & Topi, C. (2016). Implementation of Circular Economy Business Models by Small and Medium-Sized Enterprises (SMEs): Barriers and Enablers. *Sustainability*, 8(11), 1212. <https://doi.org/10.3390/su8111212>
- Sachs, J. D., Schmidt-Traub, G., Kroll, C., Lafortune, G., Fuller, G., & Woelm, F. (2019). *Sustainable Development Report 2019: Transformations to achieve the Sustainable Development Goals*. Bertelsmann Stiftung and Sustainable Development Solutions Network (SDSN).

Taylor, S. J., Bogdan, R., & DeVault, M. (2016). *Introduction to qualitative research methods: A guidebook and resource*. Wiley.