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# Is academia addressing relevant questions to support a circularity transition in Latin America and the Caribbean?

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## Abstract

Latin America and the Caribbean (LAC) is advancing toward a Circular Economy (CE), supported by expanding policy initiatives and a growing body of academic research. Over the past decade, CE academic studies in the region have examined developments at multiple sectors, scales and circular strategies, thus, contributing to CE research in the region. Yet, it remains uncertain whether academic research addresses the critical questions most relevant for non-academic stakeholders—including policymakers, practitioners, and businesses—to support the CE transition in LAC. To assess this alignment, we compared 51 priority questions identified by 19 CE experts in LAC countries with the research objectives of 335 scientific publications on CE in the region. The analysis reveals the extent to which stakeholder priorities are reflected in academic literature and highlights persistent gaps where further research is needed. Our findings stress the importance of fostering more collaborative, transdisciplinary, and stakeholder-oriented research to accelerate a just and effective CE transition in LAC.

**Keywords** Circular economy · Latin America and the Caribbean · Global South · Thematic analysis · Stakeholder engagement · Research gaps

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## 1 Introduction

Latin America and the Caribbean (LAC) is a region of global significance when it comes to resource availability, biodiversity, and sustainability challenges. The region supplies nearly one-fourth of global agricultural exports, and over 40% of the planet's biodiversity, making it one of the largest biodiversity hotspots worldwide (OECD-FAO, 2019). Furthermore, LAC is home to approximately 8% of the global population and contributes about 10% of global greenhouse gas emissions (Cárdenas & Orozco, 2023), showing the importance of the LAC region for sustainable resource management and climate mitigation. Any structural change in LAC's production, consumption, and resource-use systems would imply significant changes worldwide (Schröder et al., 2020). Within this context, the Circular Economy (CE)—an economic paradigm that aims to maintain materials in circulation and reduce waste by recovering, retaining, and generating added value from products and materials along supply chains (Kirchherr et al., 2023)—has gained traction in both research and policy in LAC (Samaniego et al., 2022). Beyond its environmental benefits, CE in LAC is increasingly framed as an economic and social development

strategy, offering potential to improve productivity, enhance competitiveness, and foster more equitable resource distribution and quality of life across the region (Latin America and Caribbean Circular Economy Coalition, 2022).

A growing body of academic literature has been developed to explore circularity across LAC countries, focusing on multiple sectors (e.g., agriculture, waste treatment, and construction), scales (micro-, meso-, and macro-scale), and CE strategies (e.g., closing, slowing, and narrowing). For instance, Betancourt Morales and Zartha Sossa (2020) reviewed 57 scientific publications to identify the main trends of the CE concept across Latin America countries. Furthermore, Ospina-Mateus et al. (2023) conducted a bibliometric analysis of CE-related literature in the region, retrieving 632 records published between 1997 and 2017, and identified waste management as the dominant research area. More recently, Gallego-Schmid et al. (2024) undertook a systematic literature review of 247 records and combined with a PESTLE (political, economic, social, technological, legal, and environmental) framework to evaluate drivers, opportunities, and challenges for the CE transition in LAC. These efforts show that CE research is steadily growing in the region, despite persistent barriers such as limited research funding, weak institutional capacity, and insufficient cross-sectoral collaboration (van Hoof et al., 2023).

In the policy domain, CE has become increasingly embedded in policy agendas across LAC countries. Several countries—including Brazil (MDIC, 2025), Colombia (MINAM-biente, 2019), Chile (MMA, 2020), Costa Rica (MINAE, 2023), Ecuador (MAATE, 2024), Peru (MINAM, 2023) and Uruguay (MIEM, 2024)—have developed national CE strategies or roadmaps, which are supported by international organizations and regional networks. Regional coalitions, such as the Circular Economy Coalition for Latin America and the Caribbean (2024), bring together governments, businesses, and strategic partners, including the United Nations Environment Programme (UNEP), the Economic Commission for Latin America and the Caribbean (ECLAC), and the Ellen MacArthur Foundation (2022). These initiatives aim to harmonize CE actions, facilitate knowledge exchange, and promote just and effective transitions across the region. The Coalition, in particular, emphasizes the importance of research-driven evidence to inform policy design and implementation (Latin America and Caribbean Circular Economy Coalition, 2022).

While these stakeholders' initiatives highlight CE research as a core tool for decision-making processes, questions remain about whether academic research is sufficiently aligned with the needs of policymakers, businesses, and practitioners on the ground (Aguilar-Hernandez et al., 2024). Thus, despite the advances in CE research in LAC, an important knowledge gap persists: the degree of alignment between CE research outputs and the practical needs

of non-academic stakeholders driving the transition. This might imply a potential misalignment that could reduce the effectiveness of CE research in shaping actionable policies, business strategies, and innovations.

In this paper, we assess the extent to which academic research is engaging with stakeholder priorities. Specifically, we determine (1) which stakeholder questions are being directly or indirectly addressed in current literature, (2) which areas remain underexplored or overlooked, and (3) how research agendas can be better aligned to support CE implementation. For this purpose, we analyzed expert interviews and literature review data through a thematic analysis under four overarching categories: technology and data; culture, education, and society; economy and market; and policy-related aspects. In this way, the paper provides the current state of CE research in LAC and offers guidance for enhancing its societal relevance.

The article is structured as follows: Sect. 2 presents the methodological approach, including a comprehensive description of the interview design, updated literature review, and thematic analysis. Section 3 brings an analysis of the expert-identified questions and academic research. Section 4 discusses the implications for future research agendas and stakeholder engagement. Finally, Sect. 5 concludes with final remarks.

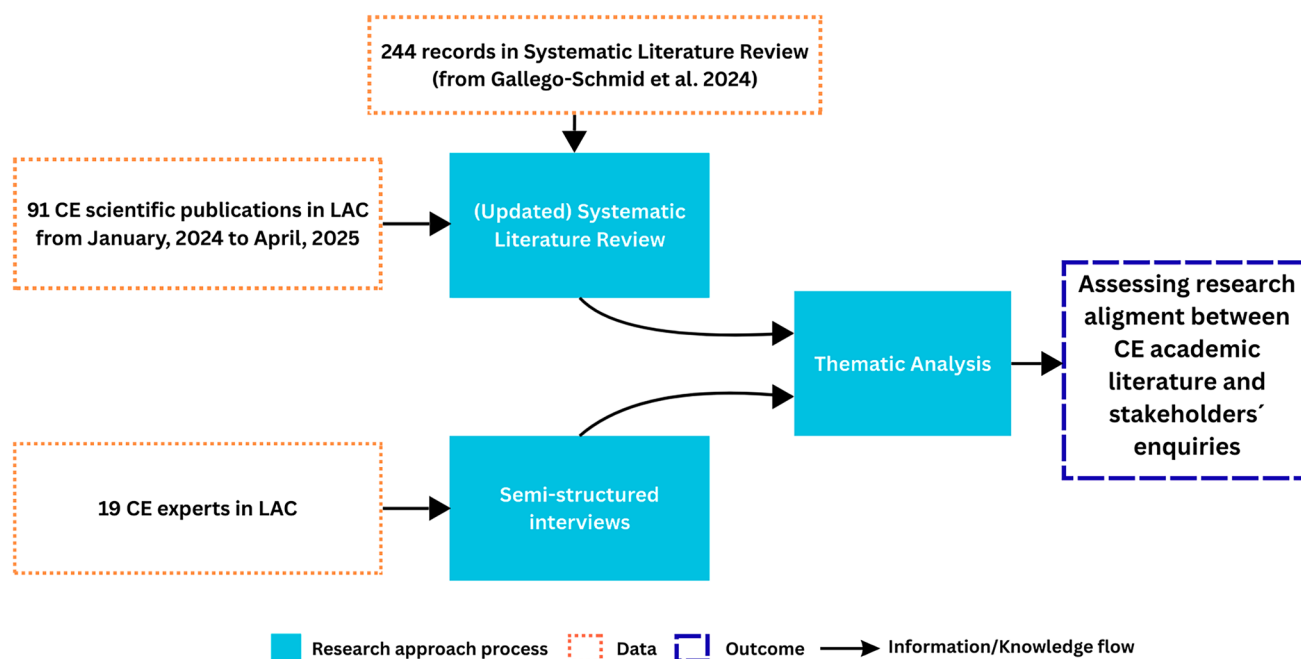
## 2 Methods

We applied a convergent mixed-methods design (Guest, 2013) that integrates three complementary qualitative approaches: semi-structured interviews (to collect stakeholder priorities), an updated systematic literature review (to gather academic research objectives), and thematic analysis (to analyze each dataset and facilitate comparison). Interviews and the systematic literature were treated as parallel data sources and analyzed via the same thematic framework to ensure comparability. Figure 1 provides an overview of the research flow, and the following sub-sections provide details on each stage.

### 2.1 Semi-structured interview design

For the expert interviews, we used the semi-structured interview protocol proposed by Adeoye-Olatunde and Olenik (2021), beginning with an assessment of method appropriateness (to ensure the ability to capture societal and practice-oriented questions), followed by sampling, instrument design, recruitment, data collection, documentation, and reporting.

First, we conducted a stakeholder mapping, compiling a list of 56 potential participants based on their documented contributions to CE development in LAC (e.g., participation



**Fig. 1** Research flow diagram of the applied convergent mixed-methods approach. Adapted from Guest (2013)

in national plans, consultancy reports, and publication records). The potential participants were identified using publicly available information from reports, documents through Google search engine, and professional networking platforms (e.g., LinkedIn). Each candidate was contacted via email and received a formal invitation letter to participate in the study.

In this paper, participants were considered CE experts if they had a major contribution to CE in their sectors in LAC countries and had worked at least 3 years in the CE field. From this list, 16 experts initially accepted interviews; additional invitations and snowball sampling resulted in a final sample of 19 CE experts in LAC, including 11 countries and 3 regional experts. The final sample comprised 9 government representatives, 6 business and consultancy professionals, and 4 academics (see details in S1.1).

Considering that this study covers the entire LAC region, the sample size might be considered relatively small. Nevertheless, the interviewees are high-level representatives who played key roles in the development of their sectors. For example, some of the interviewees have contributed to the development of national and roadmaps Colombia (MINAM-biente, 2019), Uruguay (MIEM, 2024), Chile (MMA, 2020), and Ecuador (MAATE, 2024). Furthermore, our aim was to reach thematic saturation (i.e., the point on which further interviews do not present new overarching themes), which can be achieved with as few as 10 interviews depending on the topic (Vasileiou et al., 2018). Compared to other regional studies engaging CE experts—e.g., in research developed at

European level that typically include around 50 interviews (see, for example, Kirchherr et al., 2018; Leipold et al., 2023)—a lower interview response rate would be expected in regions where CE initiatives are less developed. The sample size may have potential impacts on the results, which are discussed in limitations and further research (Sect. 4.4). Overall, the sample size is justified by the expertise and representativeness of the interviewees, as well as the thematic saturation.

Second, we created a semi-structured interview guide, which covered questions about sector-specific CE opportunities and challenges, perceived knowledge gaps and data needs, enabling or constraining policies, markets and technologies, and priority research questions that academic work should address to support CE implementation in LAC. Prior to interviews, participants received information sheets and provided consent for audio recording, anonymization, and research use (see S2). Oral consent from the participants was obtained at the start of recording.

Third, we conducted the expert interviews online between March and November 2024, lasting 35–75 min (see S1.1). Interviews were conducted either in Spanish or English as preferred, audio recorded, and, where necessary, translated from Spanish to English.

Fourth, interviews were initially transcribed with Microsoft 365 Copilot (Microsoft, 2025) as an AI tool, revised and edited by the researchers, anonymized, and prepared for coding in the thematic analysis (see Sect. 2.3). From the transcripts, we extracted 51 stakeholder

questions (see S1.2 and S1.3). The summaries of transcripts and the extracted questions were then mapped to the analytic framework for coding (see Sect. 2.3). To preserve confidentiality, we do not release raw interview audio or any potentially identifying metadata.

## 2.2 Systematic literature review update

To compare stakeholder priorities with academic research, we updated the systematic literature review of Gallego-Schmid et al. (2024) by extending the publication window from January 2024 to April 2025. The original study considers multiple dimensions based on the PESTLE framework, offering a suitable basis for comparison when applying the thematic analysis proposed in this paper.

First, to update the systematic review, we established the keywords and eligibility criteria following principles from the PRISMA guidelines (Moher et al., 2015). We included peer-reviewed scientific articles in English, published between January 2024 and April 2025, that explicitly addressed CE in LAC and reported research objectives or explicit research questions at the regional level or in any LAC country. The search strategy used the keywords ‘circular economy’ AND ‘country/region name’ as listed in S1.4. We used ScienceDirect as the search engine. Screening occurred in two stages (title/abstract and full-text), and was performed by four reviewers, with disagreements resolved by consensus. This process generated 133 records for screening. After full-text assessment, 91 new records were included (see S1.5). Exclusion criteria were: non-peer-reviewed materials (e.g., editorials, letters, theses), studies without LAC relevance, non-related to CE research, purely conceptual texts lacking explicit research objectives, and duplicates (details in S1.5).

Second, we retrieved all 247 records from the supplementary materials of Gallego-Schmid et al. (2024). After double-checking and discussion among the four reviewers, 3 records were excluded because they primarily focused on other topics, such as energy transition. Thus, 244 records from Gallego-Schmid et al. (2024) were retained.

Finally, we merged both datasets (i.e., the updated review and the records from Gallego-Schmid et al. (2024)). For each included article, we extracted bibliographic metadata, geographic and sectoral focus, analytical scale (micro/meso/macro), CE strategies (closing/narrowing/slowing/regenerating), and the stated research objectives or explicit research questions (see S1.6). The updated literature review yielded 335 relevant records and 405 extracted research objectives. These 405 objectives were analyzed following the thematic analysis procedure described in Sect. 2.3.

## 2.3 Thematic analysis

To compare both interviews and literature review results, we developed a thematic analysis, implemented following the six phases described by Braun and Clarke (2006). First, after the data collection (in Sects. 2.1 and 2.2), we compiled and repeatedly read both datasets to gain familiarity. Second, initial codes were generated inductively to capture key ideas from interview transcripts and from extracted research objectives. Third, codes were iteratively organized into broader categories and candidate sub-themes, and contradictory or minority perspectives were preserved and coded separately. Fourth, themes and sub-themes were refined to ensure internal coherence and distinctiveness (see S1.7), providing the basis for the results presented in Sect. 3. We grouped sub-themes under four overarching categories informed by CE literature (e.g., Kirchherr et al., 2018):

1. *Technology and data* covers technological innovations, lab or empirical research, and studies mainly focused on engineering and natural sciences. This category also includes data collection and methodological advancements, as well as tools supporting CE analysis.
2. *Culture, education and society* encompasses socio-cultural dimensions, including public awareness, education, and societal understanding of CE concepts and implementation.
3. *Economy and market* focuses on economic drivers and business-level aspects of CE, such as adoption strategies, market potential, and economic feasibility.
4. *Policy* addresses governance structures and regulatory frameworks at local, national, or regional levels, including policy development and CE implementation.

## 2.4 Research alignment analysis

To analyze the alignment between research priorities and stakeholder perspectives, we first counted the number of appearances of each overarching theme across both datasets (interviews and literature review). Within each overarching theme, we identified 27 sub-themes and computed the relative frequency of each sub-theme as:

$$f_{s,d} = \frac{n_{s,d}}{n_{T,d}} \quad (1)$$

where  $f_{s,d}$  is frequency of sub-theme  $s$  in dataset  $d$  (i.e., interviews *int* or literature *lit*),  $n_{s,d}$  is the number of appearances of sub-theme  $s$  in dataset  $d$ , and  $n_{T,d}$  is the number of appearances of overarching themes  $T$ . Then, we estimated a Research Alignment Ratio (RAR) for each sub-theme as:

$$RAR_s = \frac{f_{s,int}}{f_{s,lit} + \varepsilon} \quad (2)$$

where  $\varepsilon = 1 \times 10^{-6}$  to avoid division by zero when  $f_{s,lit} = 0$  as a lack of literature coverage on a certain sub-theme. Based on the RAR estimation, we classified alignment levels values, assuming a relative difference of  $\pm 25\%$ , and  $\pm 75\%$  between  $f_{s,int}$  and  $f_{s,lit}$ , as follows:

- High =  $0.75 < RAR_s < 1.25$
- Medium =  $0.25 \leq RAR_s \leq 0.75$  or  $1.25 \leq RAR_s \leq 1.75$
- Low =  $RAR_s < 0.25$  or  $1.75 < RAR_s$

It is important to note that misalignment can occur in two directions ( $RAR_s < 1$  or  $RAR_s > 1$ ) because the  $RAR_s$  is a ratio centered on 1. For this reason, the ‘Medium’ category includes two ranges, representing moderate deviation either below or above perfect alignment (i.e.,  $RAR_s = 1$ ), and only small deviations are considered ‘High’, while larger deviations fall into ‘Low’.

Finally, the alignment level assigned to each overarching theme is based on a count of the sub-theme classifications (see S1.8 and S1.9). For example, if an overarching theme contains two sub-themes classified as ‘Low’ and one sub-theme as ‘high’, the overarching theme is classified as ‘low’, as this is the most frequent category. We intentionally avoid averaging RAR values because such averages can be misleading. For instance, combining sub-themes with RAR values of 0 and 2—meaning ‘low’ levels of alignment—would result in an average of 1, which would incorrectly fall within the ‘High’ alignment range, despite the underlying misalignment. Thus, the aggregated sub-theme categories should be interpreted as descriptive indicators that help illustrate general patterns of alignment across overarching themes.

### 3 Results

#### 3.1 Circular Economy research landscape in Latin America and the Caribbean

The updated literature review showed that CE research in LAC addresses a wide range of sectors, although unevenly distributed. Waste management remains the dominant attention, representing 29% of the reviewed publications (Fig. 2a), which reflects both the urgency of waste-related challenges in the region and the availability of data and case studies in this area. Manufacturing accounts for 17%, often linked to eco-design, and product innovation. Agriculture, forestry, and livestock together represent 16%, mostly related to the importance of biomass and bioeconomy research in a region with vast natural resources (Circle Economy, 2023). The energy sector research contributes 8%, covering studies

on renewable integration and resource efficiency, while construction (with 7%) addresses topics such as recycling of demolition waste and the use of secondary materials.

In terms of CE strategies (Fig. 2b), most studies focused on closing loops (48%), mainly related to recycling and recovery activities. A substantial portion (30%) combines strategies (e.g., closing and slowing), reflecting attempts to integrate multiple CE strategies. Narrowing (9%) and slowing (9%) resource flows remain underrepresented, while regenerative strategies (4%) are still emerging, often tied to bio-based solutions.

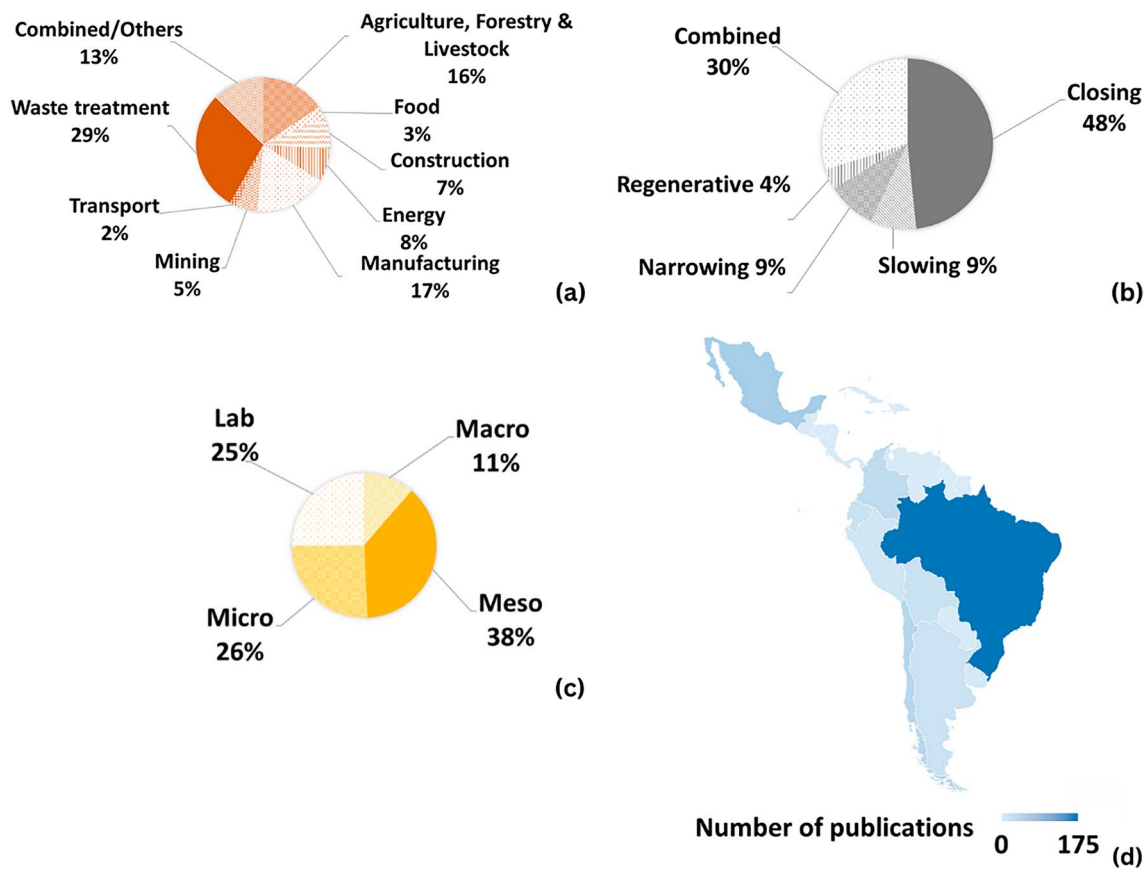
Regarding scale dimensions (Fig. 2c), CE research in LAC is predominantly conducted at the lab-, and micro-level (51%), focusing on firms, products, or technologies, with fewer at the meso-level (38%), such as regional supply chains, and limited macro-level analysis (11%). Geographically (Fig. 2d), publications are concentrated in a few countries, led by Brazil (49%), followed by Mexico (12%), Chile (8%), and Colombia (6%). These findings are consistent with previous reviews (Ospina-Mateus et al., 2023), confirming persistent sectoral and geographic imbalances in CE research across LAC.

#### 3.2 Research alignment with stakeholders' perspectives

##### 3.2.1 Technology and data

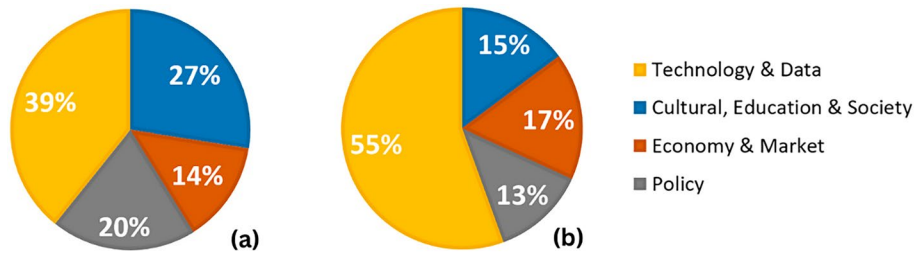
Technology and data questions emerged as the most prominent category, representing 39% of questions from CE experts and 55% of the academic literature (see Fig. 3). Stakeholders' concerns centered on understanding the socio-economic and environmental impacts of CE implementation, through developing methods and tools for monitoring circularity, identifying relevant indicators, assessing technical feasibility, and documenting best practices (see S1.2). For instance, interviewees expressed a strong interest in developing metrics to guide the CE transition in the LAC context (Int13 and Int17). This recurring concern reflects a broader demand for empirical evidence, tools, and practical guidance to support implementation, which is partly driven by the limited data availability and institutional infrastructure in the region (Aguilar-Hernandez et al., 2024).

Academic research has responded with work spanning empirical and experimental studies in lab and business to test CE practices, method development, impact assessments using tools such as life cycle assessment, and value chain analyses exploring systemic aspects of CE transitions (e.g., Lara-Topete et al., 2022; Monsiváis-Alonso et al., 2020; Vélez-Henao & Pauliuk, 2025). The literature is thus aligned with stakeholder priorities in terms of methodological development, technical feasibility, and indicators. However, this alignment is undermined by limited science communication



**Fig. 2** Circular economy research landscape in Latin America and the Caribbean, including share of **a** publications per sector (total of 405 research objectives from 335 reviewed scientific publications), **b** publications per circular economy strategy, **c** publications per scale

category, and **d** number of publications per country (Brazil leading with 175 publications). The data for Figure 2 can be found in Supplementary Information SI1



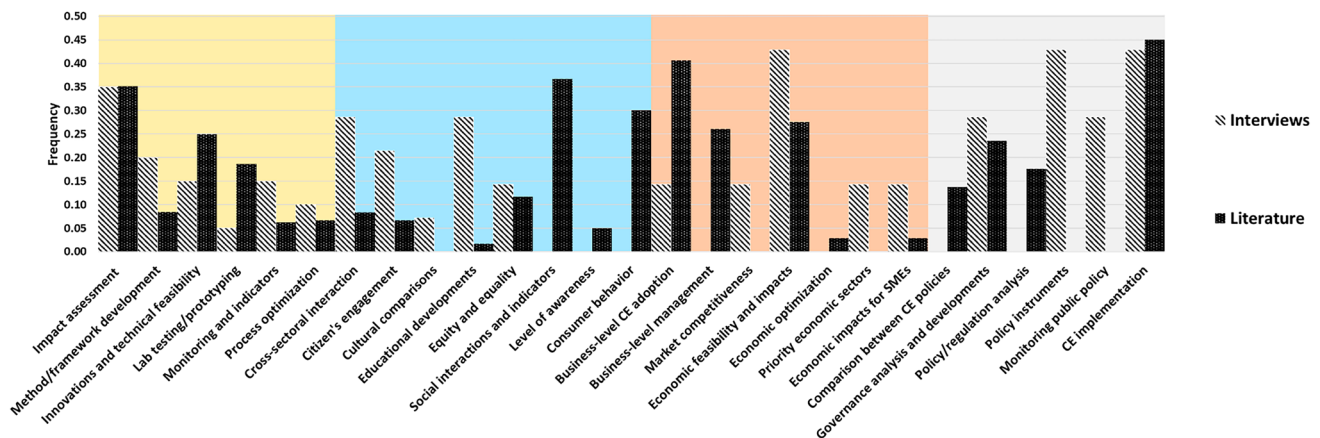
**Fig. 3** Share of **a** question from circular economy experts per thematic category (total of 51 questions from 19 interviews), and **b** share of research objectives from academic literature per thematic category

(total of 405 research objectives from 335 reviewed scientific publications). The data for Figure 3 can be found in Supplementary Information SI1

and dissemination beyond scientific publications, and a lack of engagement with non-academic actors (Int1 and Int7). In the LAC region, CE research remains fragmented, often clustered in academic “islands” with scarce stakeholder interaction, impeding the transfer of knowledge.

Figure 4 brings the frequencies of the identified 27 sub-themes across interviews and academic literature. In technology and data, interview and literature frequencies were relatively balanced. Impact assessment was equally represented

in both datasets ( $f_{int} = 0.35$ ,  $f_{lit} = 0.35$ ), suggesting strong agreement on its importance. Interviews placed more emphasis on monitoring and CE indicators ( $f_{int} = 0.15$  vs.  $f_{lit} = 0.06$ ) and methods/framework development ( $f_{int} = 0.20$  vs.  $f_{lit} = 0.08$ ), while the literature focused more heavily on lab testing/prototyping ( $f_{lit} = 0.19$  vs.  $f_{int} = 0.05$ ). This pattern indicates that research efforts are still concentrated on experimental and pilot-scale studies, whereas stakeholders



**Fig. 4** Relative frequency of 27 identified sub-themes in the 51 key questions from interviews and 405 research objectives from the literature review datasets. The yellow area represents technology and

data; blue area with culture, education and society; orange area with economy and market; and grey area with policy sub-themes. The data for Figure 4 can be found in Supplementary Information S11

are calling for more applied tools to monitor and operationalize CE strategies.

### 3.2.2 Culture, education, and society

Culture, education, and society questions rank second in CE experts' enquiries (27%) and third in academic coverage (15%). While levels of attention are comparable, the topics addressed differ significantly. Stakeholders are concerned with fostering collaboration across sectors, raising CE awareness in both public and private spheres, and integrating CE into education and public engagement. For instance, some interviewees highlighted the importance of fostering effective collaborations and institutional arrangements among stakeholders to enhance innovation in the implementation of CE strategies (Int4 and Int9).

In education, interviewees emphasized the role of early-stage education in shaping a culture of circularity and developing the skills and capabilities necessary to support the CE transition (Int10 and Int12). Otherwise, academic work has mainly focused on business-level CE adoption, supply chain, and consumer behavior, often emphasizing decision-making and operational aspects (e.g., Carvalho Machado & Kindl Da Cunha, 2022; Ferrari et al., 2023; Rodríguez-Espíndola et al., 2022). This differs from stakeholders' broader concerns, which include the need for systemic collaboration across sectors and more inclusive public engagement strategies (Int6 and Int9).

Culture, education and society presented low overall alignment, with several sub-themes missing in either dataset (see Fig. 4). Interviewees strongly emphasized cross-sectoral interaction ( $f_{int} = 0.29$  vs.  $f_{lit} = 0.08$ ) and citizen's engagement ( $f_{int} = 0.21$  vs.  $f_{lit} = 0.07$ ). In contrast, the CE literature focused on social interactions and indicators ( $f_{lit}$

$= 0.38$  vs.  $f_{int} = 0.00$ ) and consumer behavior ( $f_{lit} = 0.30$  vs.  $f_{int} = 0.00$ ), pointing to a focus on individual-level dynamics rather than systemic interventions.

Although CE research is contributing to awareness-raising, especially at the business level (Betancourt Morales & Zarthia Sossa, 2020), it remains limited in addressing the more complex questions raised by stakeholders, such as how to foster cross-sectoral collaboration between government, industry, and civil society, or how to effectively engage citizens in CE initiatives. These concerns point out the inherently social dimension of a CE transition, which requires addressing behavioral change, capacity building, and institutional changes (Samaniego et al., 2022). Thus, such gaps call for transdisciplinary approaches (see, for example, Petit-Boix et al., 2022) that integrate social sciences with engineering and environmental sciences to co-create effective, evidence-based tools for supporting the social transformation required by a circularity transition in LAC.

### 3.2.3 Economy and market

Economy and market concerns accounted for 14% of CE experts' questions and 17% of academic literature. Stakeholders raised concerns about the economic cost of implementing CE strategies and their implications for businesses, particularly small and medium-sized enterprises (SMEs). For example, interviewees raised concerns about the financial risks faced by SMEs when transitioning from linear to circular models (Int5, Int7, and Int17). Other relevant enquiries include prioritizing key supply chains (Int2 and Int8) for circularity within specific countries and identifying strategies to maximize product value (Int8 and Int18). These concerns reflect both the challenges and opportunities

in making the CE transition financially feasible, while contributing to broader sustainability goals.

Academic research focuses on evaluating the economic feasibility of CE practices within specific sectors (Fig. 2b)—such as waste treatment, agriculture, and construction (e.g., Cohen et al., 2022; Silva et al., 2023; Weber et al., 2020)—which have been recognized as priority sectors for the CE transition in the LAC region (Circle Economy, 2023).

Overall, economy and market category also showed low alignment (see Fig. 4), as research tended to emphasize business-level studies, such as CE adoption ( $f_{lit} = 0.41$  vs.  $f_{int} = 0.14$ ) and business management ( $f_{lit} = 0.26$  vs.  $f_{int} = 0.00$ ), whereas interviewees highlighted sectoral priorities ( $f_{int} = 0.14$  vs.  $f_{lit} = 0.00$ ) and the economic challenges faced by SMEs ( $f_{int} = 0.14$  vs.  $f_{lit} = 0.03$ ). Although stakeholder concerns were related to addressing sectoral feasibility, the interviewees call for more granular insights—particularly at the country level—regarding the identification of priority supply chains and the economic implications of CE strategies for SMEs (Int5, Int10, Int14). This highlights the need for continued research on the economic impacts of the CE transition within specific national contexts across the region.

### 3.2.4 Policy

Policy-related questions account for 20% of CE expert enquiries. These questions center on identifying effective policy instruments to execute CE strategies, improving cross-sectoral collaboration, especially between the public–private sectors and academia (Capano & Woo, 2017). A recurring theme among interviewees was the need to identify enabling mechanisms for CE implementations in the specific LAC context (Int4, Int5, and Int16). In contrast, academic research addresses policy-related topics in 13% of reviewed studies. These include comparative analyses of CE policies and governance structures across LAC countries, evaluations of municipal solid waste governance, and the role of the informal economy (e.g., waste pickers) in the CE transition (for example, Botelho Junior et al., 2024; Fuss et al., 2021; Labra Cataldo et al., 2025).

It is important to note that informal systems in many Global South regions encompass a broader range of CE practices beyond waste management—such as repair and maintenance, and the reuse of products and components—often driven by economic necessity (Korsunova et al., 2022). However, there are only a few studies examining the informal sector beyond waste management in LAC, for example in electronics (Kahhat et al., 2022; Lepawsky et al., 2023), and more recently in the informal built environment (Linares-Capurro et al., 2025). The limited number of studies and the predominant focus on waste management-related informal activities may reflect a bias toward Global North framings of circularity—especially from the EU perspective

(Hartley et al., 2020)—in which CE conceptual foundations are ‘imported’ by LAC countries, and then adapted to regional contexts. This potential bias may contribute to the underrepresentation of these wider informal circular practices in academic research. Given its importance for workers’ rights, sustainable enterprises and well-being (ILO, 2025), the informal sector remains a crucial research area to explore for the CE research in LAC.

Overall, policy category presented a low level of alignment (see Fig. 4). Both interviews and literature stressed governance analysis and development ( $f_{int} = 0.29$  vs.  $f_{int} = 0.24$ ) and CE implementation at local and national level ( $f_{int} = 0.43$  vs.  $f_{lit} = 0.45$ ). However, several topics raised by interviewees—such as policy instruments ( $f_{int} = 0.43$  vs.  $f_{lit} = 0.00$ ) and monitoring public policy ( $f_{int} = 0.29$  vs.  $f_{lit} = 0.00$ )—remain largely absent from the literature. While some stakeholder questions have been addressed—notably those concerning governance and collaboration in waste management—there is a persistent disconnect between academic insights and stakeholder awareness, which might come from limited science communication or weak connections between researchers and non-academic stakeholders, as suggested by the lack of stakeholder awareness of relevant academic work observed in some of analyzed interviews.

### 3.2.5 Overview research alignment

Table 1 summarizes the thematic alignment levels derived from the research alignment ratio (details in S1.9). Overall, these results indicate that CE research in LAC is only partially aligned with stakeholder priorities. While there is reasonable convergence in the technology and data theme—where interview and literature frequencies are relatively balanced—significant gaps remain in culture, economy, and policy sub-themes, where stakeholder emphasis is not adequately reflected in the academic literature. Considering the overarching themes, there is low-to medium-level of research alignment, highlighting the need for more systemic, cross-sectoral, and policy-oriented research efforts to better support CE implementation in the region.

## 4 Discussion

Considering the initial question—‘*Is academia addressing relevant questions to support the CE transition in LAC?*’—we could say that ‘*Partially, yes*’ as there is a medium-, low-level of research alignment. The overarching categories addressed in academic research are broadly similar to the questions proposed by experts (see Fig. 3). Despite these thematic overlaps, there are considerable misalignments at the level of specific sub-themes—particularly in socio-cultural, economic, and policy-related dimensions (see Fig. 4).

**Table 1** Summary of degree of alignment per thematic category, including research alignment ratio (RAR) ranges and key sub-themes

| Thematic category              | Degree of alignment            | Examples of sub-themes (RAR)                                                                                                                                                                                                          |
|--------------------------------|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Technology and data            | Medium (3 out of 6 sub-themes) | Innovations and technical feasibility (0.6)<br>Lab testing/prototyping (0.3)<br>Process optimization (1.5)                                                                                                                            |
| Culture, education and society | Low (7 out of 8 sub-themes)    | Cross-sectoral interaction (3.4)<br>Citizen's engagement (3.2)<br>Cultural comparisons (> 17.1)<br>Educational developments (17.1)<br>Social interactions and indicators (0.0)<br>Level of awareness (0.0)<br>Consumer behavior (0.0) |
| Economy and market             | Low (5 out of 7 sub-themes)    | Business-level management (0.0)<br>Market competitiveness (> 17.1)<br>Economic optimization (0.0)<br>Priority economic sectors (0.0)<br>Economic impacts for SMEs (4.9)                                                               |
| Policy                         | Low (4 out 6 sub-themes)       | Comparison between CE policies (0.0)<br>Policy/regulation analysis (0.0)<br>Policy instruments (> 17.1)<br>Monitoring public policy (> 17.1)                                                                                          |

In contrast, technology and data themes presented a medium degree of alignment with CE academic research addressing most of the stakeholders' concerns, which also raises an important question: Why do stakeholders continue to ask for knowledge on technology and data, despite the large body of scientific literature already available in this theme? Drawing on these findings, we identify three key factors driving the misalignment between academic research and non-academic stakeholder needs: (1) science communication, (2) the process of setting research priorities and defining expected roles, and (3) the level of transdisciplinarity within CE research in LAC.

#### 4.1 Science communication

In general, science communication in sustainability (including CE-related topics) remains fragmented, both in terms of the channels used and the methods applied to engage non-academic stakeholders (Corner et al., 2018). Research findings are often disseminated through academic publications, which are not always accessible to policymakers, businesses, or civil society actors. For instance, in areas such as technology and data, relevant research exists that can support the decision-making process related to CE implementation in LAC countries (e.g., Kahhat et al., 2022; Vélez-Henao & Pauliuk, 2025), but it often does not reach stakeholders in actionable formats. This one-way mode of communication tends to limit the societal impact of research, which is especially important in the LAC context, where accessibility

to scientific publications is usually constrained due to economic factors.

By contrast, dialogue-based communication—where scientific insights are co-produced, tested, and discussed with stakeholders—tend to generate more actionable outcomes (Suldovsky et al., 2017). For example, the Circular-ity Gap Report (Circle Economy, 2023), and the National CE Strategy of Uruguay (MIEM, 2024) and Chile (MMA, 2020) preparations involved engagement with diverse actors, including academia, governments, industries, and international organizations. Although these initiatives do not stem directly from academic research, their outcomes are data-driven and capture the needs of multiple stakeholders.

#### 4.2 Setting research priorities and roles

The mismatch between sub-themes suggests a potential misalignment between stakeholder priorities. This becomes particularly evident given that CE research in LAC is still largely focused on micro-level studies, often related to lab applications, whereas the majority of non-academic stakeholders tend to operate at meso- and/or macro-level, emphasizing system integration and cross-sectoral linkages. This brings up a question of whether research is consolidating CE 'fundamentals', particularly waste management, before adopting a systemic perspective. For instance, macro-level studies highlight weak recycling systems and informal practices (Ferronato et al., 2022), policy needs (Xavier et al., 2021), the potential of CE to address e-waste (Mohammadi

et al., 2021), and the need to scale up pilot projects and build international partnerships to manage plastic waste (Ferro-nato et al., 2024). Likewise, other studies emphasize the necessity of interdisciplinary collaboration and international support to enhance recycling systems in the LAC context, where political instability, a lack of technical expertise, and insufficient long-term planning are major obstacles (Ferro-nato et al., 2024). Overall, these studies highlight structural, regulatory, and collaboration challenges, aligning with stakeholder-identified priorities.

Aligning stakeholders' priorities goes beyond science communication and requires participatory processes to systematically capture stakeholder needs. When research is generated in such participatory foundations, they are more likely to reflect the realities, priorities, and constraints of those leading CE initiatives (Kujala et al., 2023). At the same time, the active involvement of academia as a stakeholder ensures scientific rigor and credibility, while co-creation approaches help translate evidence into accessible messages that resonate with both academic and non-academic communities. In the LAC context, where diverse socio-economic realities coexist and policy capacities vary significantly across countries (Schröder et al., 2020), strengthening such participatory processes are particularly relevant. It allows scientific research to move beyond technical analysis and become a tool for shared understanding, policy alignment, and collective action toward a CE transition.

It is important to consider the roles by each academic and non-academic stakeholder taken in the participatory process. Traditionally, the responsibility for science communication typically lies with individual scientists or specialist organizations and networks (Corner et al., 2018). However, in the LAC context, there is both a lack of institutional capacity within research centers and a shortage of “boundary organizations” (Corner et al., 2018) that limits an effective mediation between research and practice. This gap often results in fragmented efforts and limited uptake of scientific insights by policymakers, businesses, and communities. In such settings, building collaborative research processes, where stakeholders are actively involved, can be more suitable for aligning CE research with stakeholders' priorities.

Considering the characteristics of LAC countries as a cultural group, building trust and commitment come from strengthening professional/personal relations between stakeholders (Ogliastri et al., 2023). Within this context, a pragmatic stakeholder engagement offers a promising approach as it involves strengthening relationships through collaboration, dialogue, and knowledge co-creation, as well as pursuing societal change through joint problem-solving (Kujala et al., 2023). Such engagement not only supports effective policy and practice but also provides a more suitable setting for aligning research agendas with societal priorities. Moreover, embedding pragmatic stakeholder engagement in

CE research can enhance the legitimacy of research, improve the allocation of funding, and foster co-created solutions for CE transitions in the region (IDB, 2023).

Nevertheless, the lack of institutional capacity and limited investment in sustainability and CE research in LAC (Mazzuca & Munck, 2021) remains a barrier to building strong relationships between academic and non-academic stakeholders, building platforms for collaborative and transdisciplinary research. Public investment in research and innovation is particularly limited, for instance, in 2021, R&D represented only 0.6% of the region's GDP, compared to more than 2.0% in OECD countries (ECLAC, 2024). This funding gap constrains the ability of governments and research institutions to foster sustained CE initiatives.

Collaborative efforts supported by international cooperation offer promising pathways. For example, programs led by the German Cooperation in Peru (GIZ, 2024), and IDB in regional projects (IDB, 2021) have supported CE-related research and capacity-building in multiple countries. Likewise, partnerships between ECLAC and academic institutions have developed methodologies for measuring circularity tailored to regional realities (van Hoof et al., 2022). These initiatives demonstrate that collaborative funding and cross-institutional engagement can strengthen the foundations for CE research, aligning scientific outputs with stakeholder needs and contributing to more sustainable pathways. However, as research priorities and pilot innovative initiatives are often externally funded, publicly financed CE developments remain limited and uneven across countries. This emphasizes the need for stronger national-level financial instruments as enabling mechanisms (Aguilar-Hernandez et al., 2024; Ospina-Mateus et al., 2023) that can support the systemic rollout of CE research and implementation. Strengthening domestic financing capacities and aligning them with research agendas could reduce existing gaps between stakeholder needs and academic outputs.

### 4.3 Transdisciplinary CE research in LAC

While 16% of CE literature in LAC addresses multiple thematic areas (see S1.6), only a few studies adopt truly transdisciplinary approaches. This is notable given that circular challenges are inherently complex and systemic, demanding integration across disciplines to capture environmental, economic, policy, and social dimensions (Kirchherr et al., 2023). Many of the key questions identified by the interviewees—such as how to design inclusive policies, develop viable business models, or assess potential trade-offs—cannot be adequately addressed within the boundaries of a single discipline. Instead, they require transdisciplinary research processes that bridge academic fields while actively involving practitioners and policymakers. Encouragingly, examples of transdisciplinary research are emerging in the region.

For instance, studies on circularity in cocoa production in Colombia demonstrate how industrial ecology, management theory, and social sciences can be combined to analyze production systems (van Hoof et al., 2024). Such approaches illustrate the potential of transdisciplinary research to generate actionable insights that are both scientifically rigorous and socially relevant in the LAC context.

#### 4.4 Limitations and further research

As mentioned in Sect. 2.1, a key limitation of this thematic analysis is the sample size of interviews. While interviews are a crucial qualitative tool for capturing stakeholder perceptions, determining an appropriate sample size is challenging. This issue has been widely discussed in psychology and clinical research, where interviews are more commonly applied. Vasileiou et al. (2018), for example, conducted a systematic literature review showing that interview studies range from 6 to 200 participants, with adequacy often assessed by thematic saturation (i.e., the point at which no new themes emerge). In this study, a 35% response rate (see S1.1) could limit a full thematic saturation. This likely reflects the comparatively small number of CE experts in the LAC region relative to other regions such as Europe (e.g., Leipold et al., 2023). However, interviewees highlighted both opportunities and challenges, for example, limited CE awareness, weak policy and financial instruments, the role of informal economies, emerging CE policies, and the region's biomass potential (see S1.3). These factors are consistent with findings in the CE literature in the region (e.g., Gallego-Schmid et al., 2024; Ospina-Mateus et al., 2023), suggesting that the overall CE narrative in LAC is well captured within our sample.

Another limitation concerns the mismatch between the interviewees' country expertise and the main country represented in the literature. Only 21% of the interviewees—including three experts with regional experience—were specialized in Brazil (see S1.1), while almost half of the reviewed studies focus on Brazil. Although our analysis is conducted at the regional level, we acknowledge that this mismatch may introduce some bias. A more detailed analysis that incorporates additional perspectives from CE experts in Brazil could help refine the understanding of research alignment in that context. This consideration also applies to other countries with a substantial share of CE literature, such as Mexico, Chile, and Colombia. Thus, further country-level research could help clarifying the degree of research alignment across LAC.

Beyond these limitations, two additional points merit attention for further research. First, there is limited understanding of the degree of connection and collaboration among academic researchers across the region. While we identified a mismatch in priorities between academic and

non-academic stakeholders (in Sect. 4.2), we did not find clear evidence regarding the extent of coordination—or lack thereof—among researchers themselves. Such fragmentation could also contribute to research misalignment. Based on the authors' experience in the region, this disconnection may come from socio-cultural dynamics within academia, limited research networks, or constrained funding opportunities. This hypothesis promises further research. Second, around 70% of the interviewees in this study were women, which is noteworthy from a gender inclusion and equity perspective. Although this outcome emerged unintentionally from the sampling process, it raises interesting questions about diversity, inclusion, and equity within the LAC circularity transition. Anecdotally, and based on engagement with non-academic stakeholders, it appears that CE initiatives in the region are often driven by women. Exploring whether this observation holds more broadly—and understanding why, and how such leadership may shape differently the CE transition in LAC—offers a promising direction for future research.

#### 5 Final remarks

Although academics have engaged with key technical questions, CE research in the LAC region appears less responsive to societal and policy-related challenges. Based on the thematic analysis, we consider two key aspects that call for deeper exploration going forward: (1) using lessons from participatory approaches and applying them to the development of research agendas in LAC, and (2) exploring how pragmatic stakeholder engagement approaches can be applied to the LAC context, considering cultural aspects and the current institutional capacity constraints. Efforts to enhance these aspects will be essential for supporting the CE transition in LAC that is not only scientifically sound but also societally grounded and regionally relevant.

This paper contributes to both CE scholarly and non-academic stakeholders. For academic researchers, the study identifies areas where CE research in LAC is advancing, as well as domains where further inquiry is urgently needed. For policymakers, businesses, and practitioners, it clarifies whether existing research provides the knowledge base required to design and implement effective CE strategies. Thus, the findings contribute to the broader debate about the role of academia in supporting CE transitions and highlight how academic inquiry can be more effectively oriented toward societal needs. By positioning CE research within the context of regional priorities and challenges, this study brings advances in the CE debate by emphasizing the need for stakeholder-driven approaches to knowledge production.

A main assumption of this paper is that there is a growing expectation for CE research to directly contribute to societal development, often explicitly stated in the conclusions of many of the reviewed scientific publications. This reflects an aspiration for CE research to move beyond theory and produce tangible benefits for policy, practice, and communities. However, it is important to acknowledge that academia's role extends beyond addressing immediate practical implications. CE research plays a crucial role in driving innovation, challenging the status quo, and envisioning alternative futures through rigorous scientific inquiry (Kirchherr & Hartley, 2025). Thus, a complete alignment between research agendas and stakeholder demands would not be desirable, as such alignment could risk reducing the diversity of methodologies, theoretical developments, and critical reflections that are essential for maintaining a “healthy” and forward-looking CE research ecosystem. Circularity is highly contextual, which makes it essential to ask whether scientific outputs are genuinely contributing to societal challenges while still preserving the academic mission of critical independence. In this sense, this paper contributes to opening a reflection on the role of CE academic researchers and their relation with non-academic stakeholders by bridging their needs and priorities with the current trajectory of CE research in LAC, providing a lens through which alignment, gaps, and opportunities can be critically assessed.

Building on this reflection, we consider that CE research in LAC has established a valuable foundation, but the next step requires a shift toward more collaborative, impact-oriented, and transdisciplinary approaches. The urgency and complexity of the CE transition demand stronger integration of diverse perspectives and expertise, as well as active engagement with the societal actors most affected by the CE transition. By positioning the LAC region as a case study within the Global South, this research invites the global CE research community to reflect critically on whether the current research agenda adequately addresses the pressing needs of policymakers, practitioners, and businesses. Advancing the CE transition in LAC requires a dual commitment: one that values the independence and creativity of academic inquiry, while simultaneously fostering knowledge co-creation with non-academic stakeholders. In this way, future CE research can meaningfully contribute to sustainable pathways in the region.

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**Data availability** The data that supports the findings of this study are available in the Supplementary Information S11 of this article.

## Declarations

**Conflict of interest** The authors declare no competing interests.

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