The Role of Higher Education Institutions in the Implementation of Circular Economy in Latin America

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Abstract: Circular economy (CE) describes a sustainable alternative approach to the current linear economy system. It is a growing topic among scholars, practitioners, and decisionmakers; it encompasses several concepts related to sustainability and requires the synergy of multiple actors for success, including higher education institutions (HEIs) as one of the most relevant ones. Current CE is based mostly on experiences in Global North developed countries, where the concept has gained great attention and has already influenced policies and strategies. However, CE in Latin American countries (LA countries) have not yet received such attention. Thus, some “unique problems” may remain unattended, and efforts to attain a CE are more likely to fail. Likewise, the study shows how the role of HEIs in CE in LA countries has not yet been fully explored, as the literature on this topic is scarce. This paper aims to address the main research question: what is the role of HEIs in the transition to a CE in Latin America? For this, a two-fold methodology was performed: (i) a systematic review which allows understanding of the trends of CE research in LA and the extent of the HEIs involvement; and (ii) a narrative review, which provides insights into the state of the art of CE research (gaps, drivers, and barriers) in LA countries and how this relates to HEIs. This approach drew implications for the role of HEIs in the implementation of CE in LA countries. HEIs are key actors in this transition, contributing in several ways to the CE by collaborating with industry, assisting policy makers, building human and intellectual capital, supporting community engagement projects, influencing campus culture, linking with international CE networks, and promoting an inclusive CE discourse. This research contributes to the CE body of knowledge from a Latin-American Global South perspective by discussing the factors that aim to define the role of HEIs in the CE transition in LA countries.

Keywords: circular economy; Latin America; higher education institutions; industrial ecology; developing countries; bibliometric analysis; systematic review

1. Introduction

The environmental burdens originated from the current linear economy system (take—make—dispose) have been widely analyzed under different sustainability perspectives [1–7], and several consequences for humankind have been forecasted at local, regional, and global levels [5,8–22]. Main anthropogenic activities have generated a wide range of unprecedented and troublesome environmental consequences [22,23], including natural resources and ecosystems depletion, climate change, environmental pollution, and many more [24–26]. Moreover, social issues arising from the current linear economic system contributing to a depleting society are now acknowledged [27–29].

The Circular economy (CE) arises as a concept that may support sustainable development at various levels (industrial/manufacturing, business, consumption, and so-
cial) [2,29–39] and is in line with other sustainability strategies, which contributed to its meaning [1,36,38–41], and has gained great momentum during the last years [30,31,34,42,43].

The following definition of CE by the Ellen MacArthur Foundation has been a reference for much of the current literature on the field: “The concept is characterized, more than defined, as an economy that is restorative and regenerative by design and aims to keep products, components, and materials at their highest utility and value at all times, distinguishing between technical and biological cycles. It is conceived as a continuous positive development cycle that preserves and enhances natural capital, optimizes resource yields, and minimizes system risks by managing finite stocks and renewable flows. It works effectively at every scale. This economic model seeks to ultimately decouple global economic development from finite resource consumption [44].”

Given that many sustainability-related fields have nurtured CE concept [31,35–37,39,45,46], CE is regarded as a “cluster concept” [47] or “umbrella concept,” which now has an independent role in academic research and is still evolving [34]. Thus CE activities are regarded as a “toolbox” for achieving various Sustainable Development Goal (SDG) targets [40].

The research in the concept is intense, and it is derived mostly from experiences in developed countries from the Global North. Due to their industrialization, these countries have passed take-back laws that aim to reduce the toxicity of materials, increase the availability of recyclable materials and prevent pollution [48]. As a result, the CE concept has been considered to promote efficient production and sustainable consumption [49]. In fact, CE has already influenced policies in large global economies, such as China, Japan, the United Kingdom, and the European Union [41,42]. However, while ambitious and committed efforts towards CE were reported in these regions, the path that emerging economies are taking has not yet been properly researched [50]. For countries that rely on different activities such as agriculture, fossil fuel, and mineral extraction, specifically Latin American countries (LA countries), CE requires a different roadmap. The COVID-19 pandemic in Latin America revealed significant shortcomings in the linear economy; the vulnerability of global value chains, the depletion of natural resources, and the exacerbation of social inequalities. The CE shows great potential if inclusive development is promoted in these regions [29,51]. The coordination and engagement of multiple stakeholders are relevant for a CE transition. However, CE is not only a “technological and business-oriented issue, social and institutional contexts matter” [52]. Achieving circular economic development in Latin American countries requires transparent, robust, and accountable institutions. It was proven that institutions have a strong bearing on the capacity of governments in Latin America to achieve economic development [53].

Higher education institutions (HEIs) represent the type of institution in LA countries which has an essential role not only for research but also for the unity of different actors such as government, industry, and civil society [54]. The intellectual capital is the value of intangible assets of HEIs, such as scholars’ knowledge and expertise, and it is relevant for any effort towards CE [55,56]. HEIs are considered main actors which aid all relevant efforts towards sustainable development [35,57–59]. Additionally, they are expected to play an essential role in the global sustainability agenda of these decades [4,60]. The engagement of HEIs in developing countries poses unique challenges [61,62], as HEIs are able to address regional and cultural differences when importing sustainability solutions from developed regions [63] and have a unique opportunity to harness the benefits of local circular practices, which are commonly performed in Latin American countries by people out of necessity [48]. While defining the role of HEIs regarding CE, there should be caution with “one-size-fits-all” approaches, and there may already be some degree of embeddedness of HEIs in local social issues, which should be understood as well [64].

The role of other stakeholders was already addressed by reviewing the literature. There are CE reviews about policies [43,65], business models [66], industry [67], and supply chain [68]. However, there is a lack of research on the role of HEIs in the pursuit for a CE in Latin American countries, even though these are main stakeholders for CE. Thus, a route for HEIs’ involvement in CE does not exist in the region. The present study addresses this
gap by providing an analysis of literature under a bibliometric systematic and narrative approach. This research aims to define the role of HEIs for the transition to CE in Latin American countries and poses an opportunity to contribute to the CE body of knowledge from a Latin American, Global South perspective by answering the following main research question: what is the role of HEIs in the transition to a CE in Latin American countries?

2. Aims of the Study

The systematic literature review aims to: (i) identify the circular activities related to CE keywords (See Table 1) which are more relevant in current research in Latin American countries where HEIs are involved; (ii) describe how the trend of CE research in LA evolves and to what extent HEIs have been involved; (iii) identify the main countries, HEIs, and authors contributing to this literature.

Table 1. CE keywords based on the CE diagram from [44].

| Circular Renewable Flow Management | Finite Materials Stock Management |
|-----------------------------------|----------------------------------|
| Biosphere                         | Virtualize                       |
| Regeneration                      | Restore                          |
| Biogas                            | Stock                            |
| Biochemical extraction            | Technosphere                     |
| Cascade                           | Recycling                        |
| Farming                           | Refurbish                        |
| Renewable                         | Reuse                            |
| Regenerate                        | Maintenance                      |
| Substitute material               | Prolong                          |
| Finite material                   | Sharing                          |
|                                  | Collection                       |

The narrative literature review aims to: (i) assess the state-of-the-art CE research; (ii) analyze the main drivers and barriers of CE theory; (iii) discuss what characterizes CE in LA; (iv) discuss how CE and HEIs relate; (v) draw implications for the role of HEIs for CE transition in LA countries.

3. Methods

The systematic review consists of two query searches. Search 1 and Search 2 provide different information. Search 1 reflects many activities, which now may be included in a CE approach, and were either reported before the CE became popular in the region, or were analyzed without considering the current CE concept. On the other hand, Search 2 refers to the CE concept as defined by EMF [44].

Search 1 allows the acknowledgement of activities related to CE keywords (based on the CE diagram by EMF [44] (see Table 1)), which have already been reported in HEIs in Latin American countries. Results in Search 1 are not expected to directly address the CE concept; instead, the authors aim to draw insights about activities, which are now considered circular (or that contribute to CE transition), that have been studied and HEIs involved. Search 2 allows for understanding of how the CE concept itself was addressed in Latin American countries and how HEIs are engaged in current research. After searching in the selected database, citation information was downloaded. After reading the title, abstract, and keywords, articles were eliminated according to the following criteria: (1) all the articles that had results based on Search 1 but do not belong to Latin American countries; (2) repeated articles not related to the topic, even though they had keywords based on the EMF diagram (Table 1) and were neither related with CE, nor with HEIs. Articles selected were fully read, and the required information was obtained.

A narrative review is the traditional type of review, which has no systematic search and select literature and responds to broad questions [69]. After downloading, reading, and cross-referencing the most relevant literature of CE, which is discussed in the following sections, the main insights aiding the goals of this study were discussed. The factors
which aid in defining the role of HEIs for implementing CE in Latin American countries were analyzed.

Figure 1 shows the whole research methodology followed in this study. Table 2 shows the detailed literature search information, including all the queries performed. The selected database is Scopus, and all journal articles published from 2010 to 2020, written in English, were explored.

Figure 1. Literature review methodology.
Table 2. Literature search information.

| Literature Search Information |
|--------------------------------|
| Database                      | Scopus |
| Time span                     | 2010–2020 |
| Type of documents             | Journal Articles |
| Language                      | English |
| Elimination criteria          | Repeated articles, not related with the topic, not related with CE, and not related with HEIs Articles that are pertaining to the topic are selected after reading the abstract. Some keywords in Search 1 deliver results that do not relate to the topic. |

Search 1: activities related to circular economy keywords from Table 1 in Latin American countries involving higher education institutions

Query: (TITLE-ABS-KEY (“campus” OR “higher education”) AND (“biosphere” OR “regeneration” OR “biogas” OR “biochemical extraction” OR “cascade” OR “farming” OR “renewable” OR “regenerate” OR “substitute material” OR “finite material” OR “virtualize OR “restore” OR “stock” OR “technosphere” OR “recycling” OR “refurbish” OR “reuse” OR “maintenance” OR “prolong” OR “sharing” OR “collection”) AND TITLE-ABS-KEY (“latin america” OR “south america” OR “belize” OR “costa rica” OR “salvador” OR “guatemala” OR “honduras” OR “mexico” OR “nicaragua” OR “panama” OR “argentina” OR “bolivia” OR “brazil” OR “chile” OR “colombia” OR “ecuador” OR “guiana” OR “paraguay” OR “peru” OR “Suriname” OR “uruguay” OR “venezuela” OR “cuba” OR “dominican republic” OR “haiti”))

| Results                      | 1025 |
| Results after elimination    | 53   |

Search 2: circular economy research in Latin American countries and the extent of higher education institutions involvement

Query: (TITLE-ABS-KEY (“circular economy”) AND TITLE-ABS-KEY (“latin america” OR “south america” OR “belize” OR “costa rica” OR “salvador” OR “guatemala” OR “honduras” OR “mexico” OR “nicaragua” OR “panama” OR “argentina” OR “bolivia” OR “brazil” OR “chile” OR “colombia” OR “ecuador” OR “guiana” OR “paraguay” OR “peru” OR “Suriname” OR “uruguay” OR “venezuela” OR “cuba” OR “dominican republic” OR “haiti”))

| Results                      | 203 |
| Results after elimination    | 90  |
| Articles related to HEIs     | 4   |

4. Results and Discussion

4.1. Activities Related to Circular Economy Keywords Involving HEIs in Latin American Countries

Figure 2 provides insights from the results of Search 1 [70–121]. Figure 2 presents the number of articles by CE keyword, year, country, journal, and affiliation. This information allows scholars to understand how activities, considered “circular” to some degree, were addressed without considering the current CE concept. Figure 2a shows the CE keywords and the number of articles with topics related to each keyword. Those with more results are associated mainly with waste management (recycling, collection, and reuse) and energy (renewable and biogas). The number of articles on related CE activities has increased in the last years; 77% were published after 2015, and 30% only in 2020, as shown in Figure 2b. This shows the increasing trend in topics related to CE in LA countries where HEIs are involved. It is important to note that most of these studies do not address the CE concept as understood in this article but address topics related to CE keywords.

Brazil is the main contributor to Search 1 results (58%), followed by Mexico (17%) and Colombia (6%). These three countries sum up 87% of the articles (Figure 2c).

Sustainability (Switzerland) and Journal of Cleaner Production are the journals with most articles, each with 11% of the articles (Figure 2d), and Brazilian universities are the main contributors, as expected given the fact that Brazil is the country which contributed with.
more than half of the articles. A Chilean and a Mexican university count more than one publication each (Figure 2e).

Figure 3 shows the author keywords co-occurrences (minimum three occurrences) for selected articles of Search 1 (53 articles). The most occurring author keywords are: “sustainable development”, “sustainability”, “Brazil”, “recycling”, and “waste management.” Other keywords with high occurrence are related to water and energy: “wastewater”, and “renewable energy.” This figure identifies that the most researched topics in these articles are related to waste management and energy efficiency and that the HEIs involved are mainly from Brazil.

The following articles were selected from Search 2: [50,51,68,122–208]. Figure 4 presents insights into this set of results, including articles by year, country, journal, affiliations, and authors, and also presents which of these articles were related to HEIs. These articles refer to the current CE concept. Figure 4a shows the distribution per year. No articles were found before 2016. Publications in the last two years (2019 and 2020) count for almost 80% of the results, while articles from 2020 represent half of them. This shows how novel the CE research is in the region is, and how publications show a growing trend. However, from 90 articles, only four (4%) involved case studies related to HEI campuses, food waste-to-energy [129], waste management strategies [180], collection of recyclable waste [154], and community engagement [169].

Figure 2. Results for Search 1.
4.2. Circular Economy Research in Latin American Countries and the Extent of Higher Education Institutions’ Involvement

Half of the results (52%) in Search 2 are from Brazil, as Figure 4b shows, which is remarkable compared with the second country on the list, Mexico, with approximately 10% of the publications. These are followed by Bolivia (8%), where the authors with more publications (See Figure 4e) have been working with topics related to waste management [155,156,159,175]. Brazil, Mexico, Bolivia, Chile, and Colombia sum up 80% of the results.

The journals with more publications are Sustainability (Switzerland) (12%), Journal of Cleaner Production (7%), Waste Management and Research (7%), and Waste Management (6%). The rest counted for 4% or less of the results (Figure 4c).

Figure 4d shows the affiliations with more than three articles, and Figure 4e shows the authors with more than three articles. Most occurring affiliations include Italian HEIs, which correspond to the top two most occurring authors. The most occurring authors hold co-authorship in some articles [153,155–157,159,194]. Most top affiliations are Brazilian HEIs, but there is also a Bolivian and a Mexican HEI.

Figure 5 shows the author keyword co-occurrence (keywords occurring at least four times) from Search 2 results. “circular economy” is the most occurring keyword, as these articles directly address the current CE concept. Besides that, the most occurring keywords are: “sustainable development”, “waste management”, “recycling”, “Brazil”, “sustainability”, “human”, and “municipal solid waste”. This evidences that approaches related to waste management are at the core of CE research in LA countries and that Brazil is the main contributor.

4.3. State-of-the-Art of Circular Economy Research

Scientific publications on CE have increased dramatically during the last years (CE has attracted attention from practitioners and scholars). Most of the CE literature until 2018 was published after 2003 [38]. Now it has become a trending topic [2,28–30,32,38,39,45,47,209,210]. However, the CE concept is not free of flaws. Cultural traits were identified as the main barriers to CE [42]. The lack of understanding of societal issues and other constraints (geographical, cultural, institutional, biophysical, financial) may hinder CE dissemination.
and generate unintended effects [29, 35, 36, 42, 46]. It is unclear whether CE can promote economic growth while reducing the burden on natural resources and ecosystems and improving social equity simultaneously [38, 211]. For instance, the current CE narrative needs to address further the inclusion of non-traditional units of production and consumption, such as worker cooperatives, grassroots organizations, and peasant organizations. Becerra et al. [51] suggested that academics commonly overlook these actors.

![Figure 4. Results for Search 2.](image-url)
There is a lack of consensus and evidence on how all stakeholders can be equally incorporated and benefited within the CE [35]. Possible rebound effects of CE are not fully understood by scholars [35, 46, 47], and ecological and thermodynamics constraints, which are usually disregarded, may limit the concept as well [212, 213].

Given the aforementioned, CE must gain legitimacy and consensus among stakeholders, as it is still seen as a contested concept [214]. This divergence requires further discussion, which may slow down the implementation of CE solutions [209, 215], but allows stakeholders to influence the meaning of CE according to their aims [2]. Given this, the concepts’ popularity coupled with the lack of consensus may hinder its potential [216].

Some authors shared skeptical views on the effectiveness of CE for attaining sustainable development, as significant challenges exist regarding recycling and recovery activities associated with thermodynamics and ecological constraints (entropy generation in material loops and waste energy occurring at every process), [214, 215]. Skene [213] argues that precursors and current CE research are overly optimistic towards the effectiveness of CE theory. Waste energy (energy leakages, or dissipative use of materials and energy) in all processes in any material and energy loop may disable any CE potential for sustainable development [27]. Furthermore, Cullen [212] compares CE with a “perpetual motion machine,” which is impossible to achieve given the physical constraints of an entropic universe. Therefore, scholars should avoid claiming that CE is fully attainable [212]. By realizing its flaws and limitations, CE may be accepted as a “theoretical ideal,” and thus used as a benchmark to measure circularity on a scale ranging from linear at one end to an upper circularity limit at the other.

4.4. Drivers and Barriers

Different barriers and drivers for CE have been addressed from different perspectives. Govindan and Hasanagic [217] identified “hard” drivers and barriers, corresponding to technical and economic factors, and “soft” ones, corresponding to institutional and social factors. Having the required technology available is a prerequisite for CE that Latin American countries may fail to accomplish. However, technical barriers are not at the core of
more pressing barriers reported by CE practitioners in the European Union, who identified
hesitant culture (at company level), lacking consumer awareness and interest, low virgin
material prices, and high upfront investment costs as main barriers to CE. Likewise, the
greatest challenge reported in [124] when assessing a bottom-up governance approach for
implementing a “regional sustainable circular value ecosystem” in a rural context in Mexico
was convincing stakeholders of the value of this proposal. Critical discussion of these
barriers must be adequately addressed by policymakers and practitioners, thus raising the
odds for a successful CE transition. Deeply rooted cultural traits cannot be changed by
policies or technology innovation requiring other types of approaches. Different barriers
interact in a kind of chain reaction mechanism, e.g., “low virgin materials prices” favor
linear products, and that results in “lacking consumer interest and awareness”, which leads
to a “hesitant company culture” to transition to CE practices [42].

The lack of understanding of social dimensions in current CE theory is well-recognized
as the central gap in recent literature reviews on the topic [2,27–29,37,46], but other gaps
have also been identified. Institutional aspects have also been disregarded [34]. Ignoring
these aspects may impede a successful CE transition. Padilla-Rivera et al. [28] highlighted
the relevance of integrating social aspects in CE policy-making. Conflicting relations among
CE stakeholders (e.g., between large multinational practitioners and smaller local suppli-
iers located in developing countries) and conflicts regarding virgin resources extraction
(e.g., several industries and an important part of the population benefit from extractive
activities) can affect the viability of a CE proposal in developing countries [29].

Any approach which aims for sustainable development, such as CE, should be holistic
and interdisciplinary [57]. Schröder et al. [29] advocated that merging the human devel-
opment index (HDI) concept within CE discourses can make CE an inclusive economy,
which cares for human well-being and not just economic and technical factors. Com-
bining CE with other proposals (which agree to sustainable development principles at
different extents) may help overcome gaps on social and cultural issues. Social and Sol-
arity Economy (SSE) may complement current CE to focus on equity regarding labor
and governance. SSE promotes bottom-up practices focused on alternative ways of living,
community grassroots organization, fair trade, and others [166], which enriches current CE
theory. Calisto Friant et al. [2] proposed the term “circular society” to distinguish among
CE discourses, which may or may not consider social dynamics, such as wealth, power,
technology, and knowledge. Gutberlet et al. [166] coupled the insights from the SSE and
the “ecological economy” to suggest an “amended circular economy,” which works under
a more complete framework than the “mainstream circular economy,” and is suitable for
Global South regions. Likewise, a sharing economy CE transition was analyzed in [137].

4.5. Circular Economy in Latin America

CE has a great potential for contributing to local and inclusive development efforts,
but its needs to be integrated with collaborative, bottom-up, and innovative dynamics [51].
Besides economic, policy, institutional, and technological barriers, addressing social barriers
is critical for implementing CE in the context of developing countries. Overcoming these
barriers may not be an easy task, but failing to recognize them may threaten any effort
towards CE [136].

A social aspect that may influence how CE is practiced in Latin American countries is
different worldviews. How different worldviews conceive “development” or “quality of
life” depends on subjective and cultural aspects, thus considering this is essential when
discussing sustainability-related topics, such as CE [218,219].

Circular behaviors out of necessity already exist in lower-income countries. A higher
share of economic activities are related to repairing, reusing, or sorting waste, and thus,
advantages for the transition to a CE may exist [48]. For example, informal waste picking
activities contribute directly to material recovery and mitigating environmental burdens.
They are an essential part of the waste management chain for recycling products in devel-
oping countries, being the main actors that improve recycling rates. However, their level
of environmental contribution contrasts with their low economic revenue [130,157,189]. Although this type of informal activity is common, in some countries it is considered illegal [220,221]. Solutions for Latin American countries should nurture existing local knowledge when it is adequate to the given context. The diversity of adaptation initiatives from different sectors and groups through bottom-up processes (e.g., local indigenous organizations, workers and peasant organizations, and waste pickers) should be recognized [222]. An initial technology design can be approached from this inclusion, as different organizations will deliver different ways of innovation, learning, and organization for circular production modes [51]. In fact, according to some authors, the success of CE implementation in developing countries depends on the inclusion of informal sectors into a formal CE strategy [176,206]. Grassroots organizations, such as waste pickers organizations, may contribute with a proper pedagogy to disseminate waste management and recycling knowledge, making complete sense for ordinary people. However, waste pickers are mostly excluded as the protagonists in the transition to CE [166].

In the case of Ecuador, their average income is below the basic salary, making it necessary for them to count on additional sources of revenue [130]. They usually belong to a socioeconomic profile that shows basic needs limitations. Moreover, there is a lack of training that restricts the generation of added value [130]. Thus, inclusive frameworks should exist. In this case, the expertise of scavengers regarding waste disposal and recycling should be fully recognized and may be accredited as specialized service providers in the waste management chain [166]. Including this informal sector requires low economic investments and yields environmental and economic benefits [221]. Reike et al. [39] suggested that this sector can be integrated along with education efforts from CE scholars and practitioners. This is very important, given that the lack of articulation among stakeholders related to CE transitions is worse in Global South countries than in developed ones [122]. Frugal innovation solutions (i.e., solutions to fulfill local needs) allow circular products and pursue environmental sustainability in Latin American developing countries. Busch et al. [131] showed how a frugal approach to solar technology contributes to a socially inclusive form of energy use for domestic use (water heating) in Brazil. Nevertheless, delivering policy implications from these small-scale solutions remains very complex.

In developing countries, such as those in Latin America, natural resource extraction is a leading economic activity, and decoupling economic growth from natural resources extraction, and related waste generation and contamination is a relevant issue when transitioning to a CE [48]; thus, acting upon these activities may have significant economic, social and political effects. However, a bio-economic potential results from the synergies between the agriculture and bio energy sectors for promoting CE [204]. Success depends on enabling proper structural conditions, industrial ecology synergies, proper governability, public policies, and institutional quality. Well-designed public policies can accelerate a CE transition, but many shortcomings related to the current linear economy system must be overcome in LA countries [136,143]. Main policy areas identified for the European context are related to reuse, repair and remanufacturing, green public procurement and innovation, and promotion of waste markets [65]. These policies should be adapted to the context of CE countries, and HEIs can be the main contributors to this task. The CE approaches, which focus solely on increasing resource efficiency and productivity, may not be enough to decoupling in Latin America developing countries. Thus a holistic approach is required [223].

4.6. Circular Economy and Higher Education Institutions

International commitments, such as the 2030 Agenda and the Sustainable Development Goals, exert pressure to improve the engagement level of HEIs in some areas of sustainability action (energy efficiency and renewable energy), which may be related to CE [224]. The importance of HEIs for sustainability challenges has been highlighted by national and international frameworks [225].
Over the last two decades, the interest in higher education for sustainable development has increased among scholars [4]. HEIs are main actors in the economic development and innovative potential of regions, but now and an increasing number of additional roles are expected [226–228]. HEIs, as institutional actors, are enablers of social, economic, and cultural development [62,63,227,229–233], and sustainability [225,234–236]. HEIs can foster collaboration between actors and catalyze public awareness and engagement in CE practices [237]. A main contribution of HEIs is the generation of human capital, which understands the need to pursue sustainable development and is very important to drive the implementation of CE [37,137,238]. It was shown that the intellectual capital of HEIs influences directly and positively in such initiatives [56,57]. The role of HEIs in developing countries should be addressed adequately given the specific context where it operates [229]. It is clear that all HEIs are now expected to engage actively in national and regional development, both in developed and developing countries; however, the way that HEIs should engage should be agreed [62].

The role of HEIs has evolved. Now sustainable development and outreach (“third mission” contributing to socio-economic development) compromises are expected by society (stakeholders, civil society, governments, and industry) [61,64,239]. HEIs may promote action towards sustainability by internal operative and cultural changes and by their triple function: teaching, researching, and community engagement [36,58]. Regional HEIs can engage closely with local communities, providing the region with a self-developing capacity, thus obtaining mutually beneficial outcomes [39]. HEIs outreach can be addressed by building collaboration channels with local actors (communities, planners, government bodies, NGOs) and fostering student participation in engagement and professional projects [60]. Thus, HEIs can tackle circular behaviors already established in the local communities (which may be disregarded by current CE theory), gather them as a local knowledge body, and merge them with outside knowledge on CE business models. HEIs have a unique opportunity to harness the benefits of the local circular practices commonly performed in developing countries by people out of necessity, not by choice [48].

There are various ways in which HEIs relate to regional development, which depend on the characteristics of the region [233]. If the role of HEIs regarding CE in Latin American countries is to be defined, simultaneously occurring challenges should be acknowledged, such as massification, globalization, marketization, digitalization [58], and now even adaptation to the COVID Pandemic, [240]. To cope with these increasingly complex demands, HEIs should be integrative and networked (University 4.0) [58].

4.7. Addressing the Role of Higher Education Institutions for the Transition to a Circular Economy in Latin American Countries

Table 3 sums the factors that aid in defining the role of HEIs for the transition to a CE in Latin American countries. The way HEIs engage in developed regions may not be suitable to less developed regions, given poorer infrastructure and technology conditions [241], different cultural traits, and institutional constraints, which may hinder the catalytic role of HEIs in developing countries [62]. There are different types of HEIs (research, entrepreneurial, and engaged), and thus different roles and engagement modes for each type [227]. In the least developed regions, research-oriented HEIs may be the only link to the global scientific knowledge network, playing a central role in fostering development in such areas [229]. These institutions allow knowledge and technology transfer from the Global North, where CE is gaining great momentum [242].

Developing countries face some unique challenges and require some unique elements regarding HEIs, especially research-oriented ones (when compared with developed countries): creation and retention of a scientific community, research relevance to society and industry, cultural and social development and critique, formation of a new generation of scholars and technicians, research in national languages [229].

Furthermore, practical efforts of HEIs do not occur in isolation but require the engagement of other actors and stakeholders and benefit from participating in formal and
informal networks [59,232,242]. There must exist an absorptive capacity in the region to incorporate novel knowledge into society [62].

CE implementation requires both top-down and bottom-up approaches [41]. However, initiatives on campus may go beyond. Brinkhurst et al. [243] suggested considering “faculty and staff” as the “institutional middle”, whose leadership roles are critically important to change behaviors towards sustainability.

Table 3. Factors that aid to define the role of higher education institutions for circular economy in Latin American countries.

| Factors Which Aid to Define the Role of HEIs for the Implementation of CE in Latin American Countries | Implications for the Role of HEIs |
|-------------------------------------------------------------------------------------------------|----------------------------------|
| **Factors relating to the rest of CE stakeholders in developing countries:**                  |                                  |
| - The distrust of governments [244], which are drivers for CE in the Global North and in China [43,245]; | - Are expected to become cultural change agents for sustainable development, and their role may be greater than the rest of stakeholders in this endeavor [57]; |
| - The characteristic barriers in developing countries for innovation activities perceived by firms [246]; | - Are main promoters of innovation in developing regions [252]; |
| - The lack, or low reports, of non-governmental organizations promoting CE in Latin American [128]; | - Can aid decisionmakers and governments in defining the CE policy and agenda; |
| - The lack of inclusion of informal practitioners of circular activities already existent in Latin American countries in CE discourse [50,175,247]; | - Should contribute to the environmental literacy of members (staff, students, faculty, citizens); |
| - Less environmental literacy on the consumer side (citizens) [28,248,249];                      | - Can reach informal practitioners of circular activities and small producers through community engagement and outreach activities; |
| - Actors demonstrate a lack of awareness of the benefits of CE solutions [124];                   | - May mediate between actors with differing attitudes towards CE. This role should be studied. |
| - The inclusion of small producers in CE discourse and practice should be promoted [250];        | - Given the eroded perception of government and institutions, and the characteristic barriers that firms face for innovating for CE in Latin American countries, HEIs may become the main drivers for the transition to CE in these regions, among other stakeholders. However, this role has been just marginally explored in recent literature on CE. |
| - The lack of suitability between CE solutions and the context [251];                              |                                  |
| - Actors with differing stances on CE [38];                                                     |                                  |
| - The lack of articulation among actors [122].                                                  |                                  |
Table 3. Cont.

| Factors Which Aid to Define the Role of HEIs for the Implementation of CE in Latin American Countries | Implications for the Role of HEIs |
|------------------------------------------------------------------------------------------------|----------------------------------|
| **Factors related to characteristics of Latin American countries:**                           |                                  |
| - Lack of enabling social, institutional, and political conditions [62,251];                   | - May not address political problems and corruption rates, as it does not fit the expected HEIs mission. |
| - High corruption rates [251,253];                                                           | - Can harness the already existing knowledge, and know-how of informal organizations performing circular activities and merge it with state-of-the-art outcomes from developed regions [48], thus delivering an inclusive CE agenda; |
| - Informal circular activities already occurring out of necessity, and contributing importantly to sustainability. Actors related to these activities are usually part of vulnerable populations [48,51,130,157,166]; | - Can promote innovation regarding the dependence on resource extraction; |
| - High dependence on resource extraction [48];                                               | - Can engage (for CE) in different ways, depending on the context, thus reflecting different worldviews accordingly. |
| - Different worldviews [218];                                                               |                                  |
| - Different ways of HEIs engagement [229];                                                   |                                  |
| - Consumer behavior with low environmental literacy [251];                                  |                                  |
| - Lack of technological infrastructure [251].                                                 |                                  |

| HEIs:                                                                                           |
|------------------------------------------------------------------------------------------------|----------------------------------|
| **Factors related to the barriers to innovation in developing countries:**                      |                                  |
| - Knowledge barriers [254];                                                                    | - Can address these barriers directly by its teaching, research and outreach functions [37,45,226,255]; |
| - Lack of training opportunities [130];                                                        | - Generate human capital [33,241] which allows society to address CE transition according to the context; |
| - Lack of circularity in HEIs curricula [37].                                                  | - Generate external impacts from the individual’s education, technology and productivity spillovers [256]. |

| HEIs:                                                                                           |
|------------------------------------------------------------------------------------------------|----------------------------------|
| **Factors related to circularity drivers in developing countries:**                            |                                  |
| - Know-how on circular activities already exist in developing countries (e.g., informal waste sorting) [48,247]; | - Can help to integrate informal sectors in CE; education efforts can be expected from CE scholars and practitioners [39]. |
| - Frugal innovation solutions allow for achieving circular products and inclusive energy use [131]; |                                  |
| - Human capital is very important to handle CE transitions [137].                              |                                  |
Table 3. Cont.

| Factors Which Aid to Define the Role of HEIs for the Implementation of CE in Latin American Countries | Implications for the Role of HEIs |
|---|---|
| **HEIs expected roles** [64]: | **HEIs:** |
| - Community engagement [236]; | - Are enablers of regional development in all aspects [63,231]; |
| - Stakeholders synergies for innovation (HEIs, industry and government) [257]; | - Outreach requires collaboration channels with the rest of actors and promotes student participation in engagement and professional projects [60]; |
| - Local knowledge on circularity which can be harnessed by scholars and included in a CE framework [166]; | - Should be integrative and networked (University 4.0) [58]. |
| - Collaboration with stakeholders and benefactors [258]. | |

**CE theoretical gaps and limitations**
- Despite the relevance of decoupling economic growth from environmental degradation for developing countries, it is not clear if it can occur with the implementation of current CE discourses [223]. A lack of rigor on the understanding of thermodynamics principles which govern any phenomena occurring in the universe, including any form of economy, entail the risk to indulge in overoptimistic stance towards CE [35,47,212–214];
- Rebound effects of CE have not been thoroughly addressed by scholars [35,46,47];
- Lack of consensus among stakeholders about CE [210,214];
- CE discourse can include, or not, a human development component [27–29];
- The paths towards CE that emerging economies may be pursuing are poorly researched [50].

**Research (fostered by HEIs):**
- Can influence CE meaning [2], thus acknowledging these gaps and avoiding overoptimistic discourses;
- An “optimal circularity”, or upper circularity, can be defined [212] from the assessing of local contextual factors;
- Rebound effect of CE initiatives should be understood;
- The relevance of the social side of CE should be considered;
- Theoretical tools may aid in the practice of CE in Latin American countries: HDI [29], SSE [27], inclusive economy framework [166], circular society framework [2].

4.8. Final Remarks: The Critical Endeavor to Define the Role of Higher Education Institutions

It is clear that the main stakeholders for implementing CE include policymakers (government), companies, business consultants, HEIs, and other organizations, and that require synergies among these are lacking [58,123]. In developed countries in Europe, governments and non-governmental organizations, such as the Ellen McArthur Foundation or the Dutch Circle Economy, have driven CE transition initiatives [245]. However, a systematic review on CE in Latin America performed by Betancourt Morales and Zartha Sossa [128] did not report similar organizations in the region fostering CE. It is worth realizing the eroded perception of governments and public administration institutions in general in LA due to perceived corruption and inequity [244]. CE scholars perceived a sort of indifference or inability of governments in developing countries to provide CE solutions [223]. Metrics such as the corruption footprint allow understanding that corruption, and its effects, are much more relevant in Latin American countries than in their Global North counterparts [253].

Moreover, innovation is a crucial aspect for implementing CE business models [259]. Despite that synergy among stakeholders should exist [257], HEIs are critical actors for implementing any innovation system in emerging economies [252]. Guerrero et al. [246] identified characteristic barriers for innovation in developing countries: lack of proper poli-
cies, weak legislation, inefficient state administration, lack of credit and funding assistance, lack of training opportunities, corruption, and lack of entrepreneurship education in HEIs. Ecuadorian firms involved in innovation activities perceived that knowledge barriers are as relevant, or even more so than the market and economic ones [254]. HEIs can directly address these knowledge barriers. Furthermore, the role of HEIs as a cultural change agent for transitioning to sustainable development was considered by scholars to be greater than the rest of the stakeholders due to their mission and potential outreach to diverse society sectors [57].

4.9. Limitations of the Study and Research Agenda

It is worth noting that the current review is based on peer-reviewed journal articles, thus excludes CE initiatives occurring in LA involving HEIs, which may be reported in other types of indexed publications and grey literature. This latter type of literature may provide insights on many circular activities, which may be missing in current peer-review literature, but poses challenges related to methodological considerations that should be addressed [260] in a further literature review. Only developing countries in Latin America were analyzed; however, there are other developing regions for which different insights may exist.

In order to implement a research agenda for defining the role of HEIs for the implementation of CE in LA countries, it is recommended to update the present study in the following years and further analyze the role of HEIs for CE in other developing regions in the world. Scholars should use different approaches that directly gather information and data from HEIs, such as surveys, or even workshops, which can define the role of HEIs for CE in LA countries in a participative manner. Moreover, most of the studies that were analyzed are related to waste management or renewable energy research; it is essential to also focus on approaches that are located higher in the circularity hierarchy. This may contribute greatly to the CE transition in the region, such as eco-design and alternative business models [261].

It is recommended to update the present study in the following years to track publications related to the topic and perform an additional review on the role of HEIs in a CE transition in other developing regions in the world.

5. Conclusions

HEIs are vital stakeholders for implementing CE in developing countries and are increasingly expected by society to play an active leading role in all the aspects of any sustainability transition. HEIs are critical actors for implementing innovation systems in developing countries, where knowledge gaps can be relevant and are addressed by teaching, research, and outreach. HEIs are relevant to any regional development, and thus can aid to the implementation of CE in Latin American countries by providing knowledge to companies aiming to transition to CE, engaging communities and different grassroots organizations in a transition pathway, defining a proper framework for each country or region, linking directly with international CE networks, and providing expert advice for policy making. HEIs in Latin American countries hold a unique position to identify and harness circular practices performed out of necessity and promote an inclusive CE agenda, discarding CE discourses that may not deliver the desired results in a given context. Thus, integrating the differing worldviews of local informal know-how with the global CE state-of-the-art practices to provide a proper CE framework. HEIs should aid policymakers and decisionmakers when implementing top-down approaches for CE and may also promote bottom-up initiatives from different grassroots organizations, allowing for an “institutional-middle” approach, which addresses behavior changes towards sustainability.

Brazil is the main contributor to CE research in the reviewed literature, followed by Mexico, and most of the reviewed articles (approximately 80%) have been published since 2016. Results show a growing trend in CE-related research in the region.
In Europe and China, governments, organizations and companies, have played a central role in promoting CE; in Latin American countries, governments and public institutions hold an eroded image from the society given perceived corruption and inequity, and companies find difficulties for the required innovation given economic barriers related to market instability and high investment costs. Thus, HEIs are central actors for implementing CE in Latin American countries and need to work in synergy with the stakeholders. Nevertheless, their role has not been fully explored by current CE researchers. Only 4% of the articles which address CE in LA countries are related to HEIs. To further understand the role of HEIs for CE in Latin American countries, a research agenda must include various points. It is recommended to update the present study in the following years and further analyze the role of HEIs for CE in other developing regions in the world. Finding a method to review the grey literature systematically is relevant. A participative approach may render good results and include surveys and workshops with other HEIs in the regions. Moreover, activities higher in the resource use hierarchy are underexplored in the reviewed literature but have great potential to foster a sustainable CE in the region and must be addressed by scholars.

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