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The Relevance of the Circular Economy for Climate Change: An Exploration through the Theory of Change Approach

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Abstract: The relevance of the circular economy for climate change is still a developing area of research that needs to be explored. This paper aims to provide an overview of the relevance of the circular economy for climate change through the theory of change approach framework. For this purpose, we analysed 96 articles from the Scopus and WoS databases in the "Arts and Humanities, Business, Management and Accounting, Economics, Econometrics and Finance and Social Sciences," with the keywords "Circular economy" and "Climate Change". Our analysis shows that 87% of the reviewed articles showed a strong relevance of the circular economy for climate change. However, most of the articles focused on the mitigation aspect of climate change. The circular economy is widely practised in countries such as the United Kingdom, Italy, Belgium, and China. Our main theoretical contribution is in developing a logical framework through the theory of change, which is a novel approach in social science research apart from monitoring and evaluation studies.

Keywords: circular economy; climate change; theory of change (ToC); eco-innovation

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1. Introduction

Climate change is one of the leading global concerns [1]. Governments worldwide are looking for universal agreement and collaboration to maintain global temperature levels below 2 °C after the industrial revolution and not to let it exceed more than 1.5 °C [2,3]. The target to determine this average global temperature and keep it below 2 °C is now established in policymakers' frameworks [4]. International organisations and conventions associated with climate change, such as the 2009 Conference of the Parties (COP) by the United Nations Framework Convention on Climate Change (UNFCCC) in Copenhagen, have been intensively working on this issue [5]. Achieving the goal of keeping average global temperature below 2 °C requires a shift to zero emissions by 2050, which targets the reduction of greenhouse gas (GHG) emissions [6]. Until now, efforts to tackle the global warming crisis have been focused on energy efficiency through a transition to renewable energy [7]. The shift towards renewable energy can only address 55% of emissions coming from the energy sector. However, the remaining 45% derives from food production, manufacturing cars, garment production and other day-to-day materials [8]. In 2015, the United Nations (UN) Paris Agreement was signed by 195 countries, and they committed themselves to take action to reduce global emissions. The countries that signed this agreement mentioned in their nationally determined contributions (NDCs) that if they do not take action to mitigate their emissions, they will emit 29–32 billion more tonnes of CO_2 compared to the business as usual (BAU) by 2030 [4]. To accomplish the objectives of the Paris Agreement, decisive transformative actions are required. The circular economy (CE) could control global warming by emission reductions and transform the way we design and use products [9].

According to the World Economic Forum, it is estimated that by 2050, the global population will reach about 10 billion [10]. Global economies will thus have to meet the feeding demands of a 10-billion world population by 2050 [6]. From this current trend of the growing population, the consumption trend of the middle class in the emerging economies will likely double its percentage to 67% [11].

The current "take-make-waste" approach of the linear economy produces greenhouse gases, is resource intensive and heavily extractive, and worsens the climate crisis [12,13]. The linear production and consumption approach is not sufficient to manage resources such as water, land, and natural resources for future generations [8]. The current climate crisis may require transformation of the current trends by regenerating the linear model of production and consumption into a circular one [6].

The impacts of climate crises place an immense burden on environmental boundaries, for example, through loss of biodiversity. Indeed, with the worsening of the climate crisis, more than a million species of plants and animals are on the verge of extinction [14]. More than 90% of water and land-related environmental impacts are the result of resource extraction and processing [4,15]. Human activities should not further damage natural ecosystems [16]. Ecological diversity should be preserved for the resilience of the natural system [17]. Global GDP depends on nature and the ecosystem services they offer to us [18]. Three main economic sectors are highly dependent on nature, building and construction, agriculture, and the food industry [8]. The relationship between nature and these sectors are prominent [14]. With the current emission trend, global emissions will reach 649 billion tonnes of CO_2 by 2100 [19]. The mismanagement and exploitation of natural resources driven by public interests result in damaging the natural ecosystem and biodiversity loss [17]. The current scenario of the linear economy indicates the complexity of the challenges ahead for the future generation [20]. Some actions are required on the increasing demand for raw materials that impact nature and the ecosystem [21].

The CE from the industrial ecology point of view has attracted significant attention globally in the search of new long-lasting sustainable models for future generations [22]. The CE has been adopted as an alternative approach to the linear economy model by transforming the way products are designed and consumed [23]. Companies are progressively applying CE approaches in their day-to-day business to achieve more sustainable and efficient use of natural resources [6,22]. The CE fulfils the needs of what is necessary to tackle the climate change crisis [24]. This framework of regenerative economy reduces GHG emissions across all economic sectors through actions that require emission reduction across value chains, maintain energy in products, and sequester soil's carbon and the products we use [25]. The CE presents a wide range of economic benefits including a multi-trillion-dollar economy, which not only helps in reducing GHG emissions but also provides sustainable access to goods, better access to mobility and connectivity, and better air quality [26]. It also addresses our current significant challenges of resource scarcity, biodiversity loss, increasing waste, and pollution [21].

While there is a widespread literature on the benefits of the CE [27], there is a lack of academic literature exploring CE's direct relevance for CC. Durán-Romero et al. [6] were the authors of the paper entitled "Bridging the gap between CE and CC mitigation policies through eco-innovations and Quintuple Helix Model" [6]. Schroeder et al. [28] argued in their paper for the "Relevance of Circular Economy Practices to the Sustainable Development Goals" and found that the most vital relationships exist between CE practices and the SDGs: SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), SDG 8 (Decent Work and Economic Growth), SDG 12 (Responsible Consumption and Production), and SDG 15 (Life on Land) [28]. Cantzler et al. [29] conducted a systematic review of the CE and its CC mitigation potential and found that, out of all the analyzed studies, only 10% contributed to CE relationship with CC mitigation [29]. Since the relevance of the CE for CC and this link was not sufficiently investigated, there is a further reason to perform another literature review. In this regard, this paper explores the relevance of the CE for CC with the help of the theory of change (ToC) approach.

This paper addresses the essentiality for a systematic approach towards the relevance of the CE for CC. It also points out the logical framework which underlines the role of multiple stakeholders, crucial assumptions, and intended outcomes from which the rationales and the relevance of CE to CC are derived.

The article is organized as follows. Section 2 proposes a literature review with the definition of the CE, the linear to the CE approach, the relevance of the CE for CC, and the role of eco-innovation. Section 3 reviews the conceptual framework and the theory of change. Section 4 focuses on the literature review methodology and its results. Finally, Section 5 mentions a way forward after the pandemic, as well as discussion, implications, and limitations.

2. Literature Review

2.1. What Is the Circular Economy?

In the last two decades, countries worldwide have been adapting new policies towards the management of waste and raw materials, placing greater emphasis on the life cycle of products and the supply chains of materials [30]. More recently, the CE has been attracting the attention of policymakers as a crucial contribution to sustainable development, a low-carbon economy, and resource efficiency [15]. The CE has also attracted significant attention from multinational companies as a practical approach for the current climate crisis [28]. However, despite its increasing popularity, the concept of the CE still has no standard definition [31]. The Ellen Macarthur Foundation [8] defines the CE as "the systems-level approach to economic development designed to benefit businesses, society, and the environment." Authors such as Pearce and Turner define CE according to the 3Rs framework (reduce, reuse, and recycle) [32]. Various studies have been carried out to find out the operational definition of the CE [13,30–36]. Kirchherr et al. [31] analysed 114 definitions of the CE in the academic literature and provided the conceptualisation of the CE according to the three pillars of sustainability: environmental, social, and economic [31].

A CE model helps to decouple economic growth from the rising GHG emissions produced by consumption and helps in building social, economic, and natural capital [37]. The concept of the CE acknowledges all the economic sectors in assisting the transition towards renewable energy and increasing sustainable materials [8]. The concept of eco-innovation aims at significant progress towards the efficient use of energy and raw materials, designing long-lasting products that promote recycling and reuse of products by reducing waste [38]. The concept of a CE aims at sustainable management of raw materials [39]. The concept goes beyond building a systemic approach and helps in maximising the environmental, economic, and social benefits [40]. Thus, CE principles rely on changes in design and business models and change producers' and consumers' behaviours [41].

The CE falls into two types of business models: (1) those that promote reuse of products and extend their life cycle through repair and remanufacture, etc., and (2) those that make new products through recycling materials [42]. A recent study of seven European countries found that a transition towards a CE would help in making new green jobs that would generate employment by about 4% and also reduce a nation's GHG emissions by 70% [43]. The successful transition would be the ultimate low-carbon economy [42]. There is also much ongoing interest in how CE principles may be relevant for climate change mitigation, such as emission reductions in manufacturing products, energy savings, etc. [44]. The Ellen MacArthur Foundation mentions three primary principles for the CE: (1) design out waste and pollution to reduce GHG emissions across the value chain, (2) keep products and materials in use to retain the embodied energy in products and materials, and (3) regenerate natural systems to sequester carbon in soil and products [8]. According to the first principle, the environmental impacts of products should be considered at the design stage to minimise the usage of raw materials and waste production. The second principle aims to extend the life cycle of products and materials. The longevity of products could be achieved by reusing, repairing, and remanufacturing. The third principle aims for valuable nutrients of ecosystems to return to the environment [8].

2.2. Linear to Circular Economy

Sariatli [45], in his paper based on the empirical data and economic modelling of the Ellen MacArthur Foundation [41] and the report of the Sustainable Europe Research Institute (SERI), claims that 21 billion tons of raw materials used in manufacturing are not consolidated in the final product [45]. This could have happened during the loss in the transition stage of materials into products, as well as inefficiencies of the supply chain and storage structures [45]. The CE principles offer a systemic and cost-effective approach to fight against CC [46].

According to the Ellen MacArthur Foundation [8], if CE principles were to be applied to four vital industries (aluminium, cement, plastic, and steel), emissions may be reduced by 40% by 2050 [8]. Moreover, if CE principles were applied to food waste, emission reductions could reach up to 49%. There are several circular strategies available that aim at reducing the consumption of natural resources and materials which also help in minimising the production of waste [43]. These strategies could be arranged by their levels of circularity (Figure 1). Product sharing is one of the main components of smarter product use, and in manufacturing it is generally considered a strategy with high circularity. The product is used by more than one person and by many consumers. The second component in this ladder is the lifetime extension of products followed by recycling [44]. Incineration of materials has been considered a low-circularity strategy and placed at the bottom of circular strategies, because materials are no longer in use to be applied in other products. In general terms, more environmental benefits could be achieved by a greater number of circularity strategies [43].

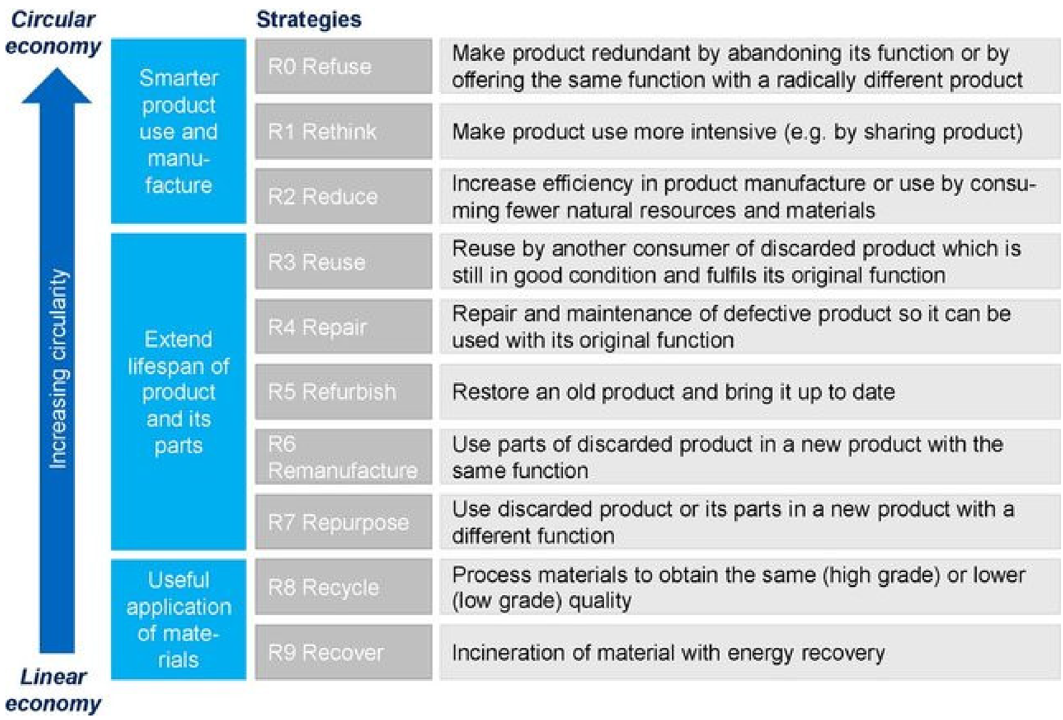

Figure 1. The 9R Framework of the CE. A linear to circular economy approach. Source: Adapted from Potting et al. [43].

2.3. Relationship between CE and CC

International cooperation is required to reduce GHG emissions to fight against the global issue of climate change [3]. In these circumstances, CE might be a crucial element for maintaining the global temperature, which entails a paradigm shift based on the three pillars of sustainability: environment, society, and economy [31]. A successful transition of the policies and measures towards renewable energy sources to limit the global average temperature to 1.5 °C might not be sufficient. For that reason, CE principles may provide additional reduction of emissions through innovative business models that enable more sustainable solutions [30].

A climate-neutral world by 2050 requires significant transformational changes of all value chains across the economy [6,47]. In this regard, it is crucial to recognise the role of different actors in this transformation. All actors have a crucial role to play in the transition towards climate neutrality [48]. The three most crucial actors defined by Henry Etzkowitz and Loet Leydesdorff in 1990 are academia (universities), corporations, and government through the tripe helix model [49]. The interactions between these three actors to foster social and economic development are vital in the concept of the knowledge society and knowledge economy [50]. The interlinkages between these three actors are crucial to foster systematic changes in society, and they are also essential for the successful transition toward a more circular world [6]. The role of civil society was further introduced by David F.J. Campbell and Elias G. Carayannis as a quadruple innovation model [51]. This incremental innovation in the triple helix model can help practitioners and policy designers better understand the roles of different actors and stakeholders in policy design and implementation [52]. Various researchers have investigated the concept of a quintuple helix extension to the quadruple helix model of innovation [53]. In addition, in exploring new solutions to the current environmental problem, another helix was added to the quintuple helix model that targets concerns of the environment [53]. This participation of different actors to work on common goals is known as institutional capacity [54]. To investigate the relevance of the CE for CC requires the acknowledgement and participation of all associated stakeholders through various interactions and knowledge transfer. This knowledge transfer may serve as a catalyst for developing new business models that help in the transition towards a sustainable society [50]. Therefore, we investigated and mapped different stakeholders that help explore CE's relevance for CC. We mapped academia (university), industry (corporations), government, civil society, and international organisations such as the UNFCCC, Ellen MacArthur Foundation, UNEP, and World Bank as the main stakeholders (Figure 2).

According to the European Commission, "Eco-innovation refers to all forms of innovation—technological and non-technological—that create business opportunities and benefit the environment by preventing or reducing their impact, or by optimising the use of resources. Eco-innovation is closely linked to how we use our natural resources, produce and consume, and the concepts of eco-efficiency and eco- industries. It encourages a shift among manufacturing firms from "end-of-pipe" solutions to "closed-loop" approaches that minimise material and energy flow by changing products and production methods—bringing a competitive advantage across many businesses and sectors." [55]. Rennings [56] defined eco-innovation as the tool of reducing environmental impacts that also helps in constructing new ideas, products, and processes [56]. Eco-innovations may also help change behaviour that is ecologically less impactful and are specified sustainability objectives [57]. The transition from a linear economy to a CE requires significant changes in the current business models and systematic approaches relevant to reducing emissions and climate change [6]. In this way, eco-innovations are crucial elements towards the implementation of CE principles for tackling climate change [17]. Eco-innovations influence the development of ecological technologies and require the cooperation of various actors at micro, meso, and macro levels [58]. It has been seen in the past few years that companies are adopting sustainability practices.in communication areas, e.g., publishing sustainability reports, ESG reporting, etc. [59]. The European Union (EU) aims at net-zero GHG emissions and at being climate-neutral by 2050 [60]. This objective is at the centre of the European Green Deal and is aligned with the EU's commitment to the 2015 agreement to combat global climate change [60]. In this regard, the EU is considering eco-innovation as the ultimate tool to maximise efficiency at all stages of production and help European businesses to become more environmentally sustainable [61,62].

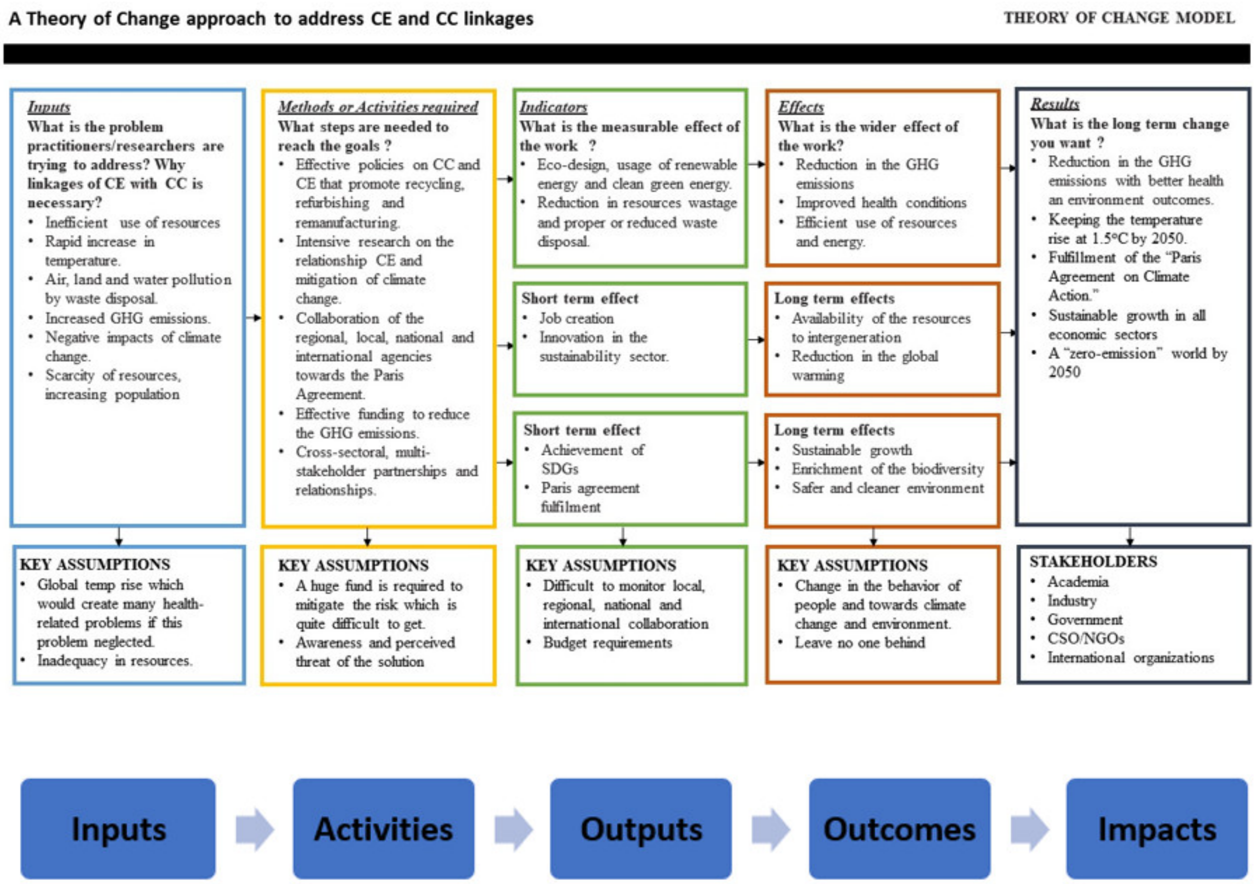

Figure 2. Exploring the relevance of the CE for CC. Source: Own exploration (data extracted from 96 papers and then clustered in the logical framework of the ToC).

Seeing the importance of eco-innovation, the EU set up an Eco-innovation Action Plan that focuses on funding opportunities and technology transfer into European companies. The EU has made other efforts to mobilise funding for eco-innovation, such as implementing the Horizon 2020 program, a framework programme for research and innovation in eco-innovation [55,60,63]. Eco-innovation principles contribute to the transition towards the circular economy, by improving efficiency in using natural resources, reducing environmental impacts, and promoting sustainable development, and they also help in achieving climate change neutrality [6,64,65]. We designated eco-innovation as the measurable effect in our framework (Figure 2). Understanding eco-innovation is important as it is relevant implementing CE principles to address CC.The transition towards climate neutrality may require active participation from all the actors that may promote the growth of eco-innovations. In this regard, the role of government's incentives and interactions between the different actors, such as corporations and academia with the involvement of civil society, may work as a catalyst in the development of technology associated with eco-innovation.

3. Conceptual Framework

We began with the current main problem of the climate crisis, the resource inefficiencies and rapidly increasing temperature and emissions, and the long-term goals of this research. Then we identified the activities or inputs that are required to achieve the intended impacts. Previous research shows [66,67] that effective policies on CC and CE, intensive research on the relationship between CE and CC, collaboration between regional, local, national, and international agencies towards the Paris agreement, adequate funding to reduce GHG emissions, and cross-sector and multi-stakeholder partnerships and relationships are needed to maintain global temperature below 2 °C. The eco-design and use of renewable energy and clean green energy, reduction in resource wastage, and proper or reduced waste disposal were considered the measurable effects of the transition toward a circular world. The reduction in GHG emissions, improved health conditions, and the efficient use of resources and energy would be considered immediate results or outcomes. These could be tangible results that could be demonstrated and set as preconditions required to achieve the objectives. The reduction in GHG emissions, fulfilling the Paris Agreement on Climate Action, sustainable growth in all economic sectors, and a transition towards a "zero-emission" world by 2050 were considered the intended impacts of this research. It is also critical to reflect on the key assumptions that might impact the intended impacts with the current activities or inputs. This may help to prevent potential risks between the inputs and the intended impacts.

3.1. Explanation of Theory of Change

In his book entitled *Theory of Change: A Practical Tool for Action, Results and Learning*, Annie [66] described the need for a road map of change in every community [68]. This roadmap would demonstrate the pathway of progress and the journey toward achieving improvement. The roadmap would also provide descriptions of assumptions, such as how to achieve the final goal, the map framework, and the activities required during the journey. This type of map he explained as a theory of change. The concept of ToC first appeared in the United States in the 1990s, in improvising evaluation theory and practises associated with the field of community actions. According to the evaluation perspective, ToC is part of programme theory and could be considered for broader programme analysis. On the other hand, ToC in the development field expanded beyond the notion of logical planning models, for instance in the logical framework approach [69,70].

Weiss [71] defines a ToC quite clearly as a theory of why and how an action works [71]. We define a ToC as a systematic and collective study approach on the relevance of the CE for CC and describe its linkages between inputs, activities, outputs, outcomes, and impacts on the future collective climate goals of all the countries.

According to the Center for Theory of Change, a ToC is "a rigorous yet participatory process whereby groups and project stakeholders identify the conditions they believe have to unfold for their long-term goals to be met." [72]. The conditions in the ToC are modelled as inputs, activities, outputs, outcomes, and impacts that are arranged in a causal framework [73]. The Center for Theory of Change recommends developing an outcome map, a visual diagram that depicts relationships between initial strategies and intended results [74]. These results should include both short- and longer-term outcomes and indicate changes at different levels, such as individuals, organisations, systems, and communities [74]. Thus, it would generate two products as the TOC work: an outcome map and a list of assumptions about change [73,74].

The ToC is practical and one of the fundamental parts of a successful paradigm shift. Thomas Kuhn first described paradigm shifts in his book entitled *The Structure of Scientific Revolutions*. He claims that studying the history of science shows that scientific evolution in any field occurs via multiple phases [75]. A group of researchers with a common intellectual mindset engages in solving problems caused by the discrepancies (anomalies) through which the paradigm is revealed by experiments or observations [76,77].

Setting up a ToC in a logical framework is like developing a roadmap that lays out the steps by which overall impact would be achieved. It helps in understanding whether the designed inputs are sufficient to reach the intended results. The ToC framework helps to connect short- and long-term goals, to identify potential risks associated with activities and assumptions in each step. This tool might also help align different stakeholders to the more significant intended impacts and help them understand their roles.

3.2. Literature Review Methodology

This study aims to comprehend the main trends and themes on the relevance of the circular economy and climate change. To attain an accurate picture of the circular economy and its relevance to climate change research, two sources were considered: Scopus and WoS. For this purpose, keywords such as "Climate Change" and "Circular Economy" were considered. Duplicates were removed and only unique papers from both sources were considered. After finalising the keywords, papers from academic literature referred to as scientific peer-review research published in academic journals of social science, business, and economics were considered (Table 1).

Table 1. Criteria for inclusion and exclusion of articles (Source: Own Elaboration).

Inclusion Criteria	Exclusion Criteria
• Article published between 2007 and 2020	• Theoretical and conceptual article (not empirical), systematic review, meta-analysis, and editorial
• Article published in peer-reviewed journal	• Books, memoirs, and unpublished theses as an article
• Article that mentioned CE and CC either in the title or in the abstract	• Title and field of the study not in the scope of the study
• Article based on a rigorous and clearly described methodology (qualitative, quantitative or mixed) and published in academic journals of social science, business, or economics.	• Article published in a language other than English

An excel document was then prepared. This resulted in 96 research papers from the Scopus and WoS (see Figure 3). Thus, further screening was performed by eliminating duplicates from both databases. This research's timeline was between 2007 to 2020, and only documents in English were considered for the analysis.

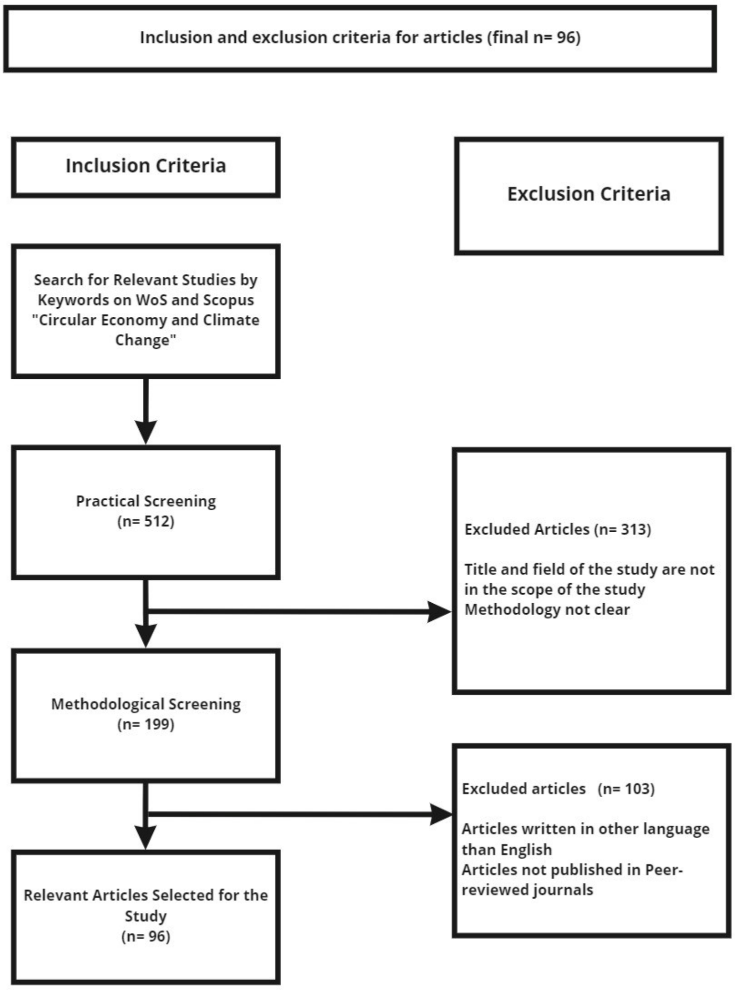

Figure 3. Workflow for selecting studies for the analysis. Source: Own elaboration.

4. Results

The following subsections are the results of the academic database analysis review. The annual trends of the circular economy and climate change in different categories are shown in Table 2. As we can see, there is no article from 2007–2013, which might be due to the criteria we used for selection of the articles. The trend shows how the movement significantly increased in the last four years. The database consisted of 96 articles published between 2007 and 2020.

Table 2. Sample distribution and data collection (n = 96).

Focused Area of the Study (% of Published Articles)	
• Bioeconomy 16% • Waste Management 15% • Energy efficiency 10% • Urban Studies 13% • Construction industry 8.3% • Circular Business Models 6.25% • Packaging 6.25% • Industrial ecology 5.2% • Sustainability 4.2% • Eco-design 4.2% • Food Industry 3.2% • Green economy 3.2% • Fashion industry 2% Geographical distribution (% of published articles) • Europe 15% • China 8% • United Kingdom 6.25% • Italy 5.25% • Belgium 5.2% • Czech Republic 3% • Finland 3% • Norway 3% • Russia 3%	• Spain 2.8% • Australia, Austria, Chile, Hongkong, India, Jordan, Mexico, Nigeria, Singapore, South Korea, Sweden, Switzerland, United States 1.5% • Not Mentioned 37% Year of Publication (% of published articles) • 2020 28% • 2019 29% • 2018 19.5% • 2017 10% • 2016 8.3% • 2015, 2014, 2013, 2007 1.5% Focused area of the study (% of published articles) • Mitigation 54% • Adaptation 26% • Cross-cutting Issues 10% • Not Mentioned 10% Research designs and method (% of published articles) • Case study 51% • Qualitative 28% • Quantitative 12.5 • Experiment 8.5 • Spain 2.8% • Australia, Austria, Chile, Hongkong, India, Jordan, Mexico, Nigeria, Singapore, South Korea, Sweden, Switzerland, United States 1.5% • Not Mentioned 37% Year of Publication (% of published articles) • 2020 28% • 2019 29% • 2018 19.5%
Presence of the word "Climate change" in the title or in the abstract or methodology (n = 96) • Abstract or methodology 87% • Title 7.2%	

The geographical trends show the focused country of the articles. Some considerations can be drawn from the geographic distribution of the articles and the countries involved in the research papers. Although climate change and circular economy research are widely recognised worldwide by the academic literature, with many countries having published one article, publications are not spread evenly throughout the world. Moreover, the countries most involved in the academic literature are nations in European Union followed by China.

This database was further classified according to the type of studies. For this purpose, the kind of approach used in the paper was considered, such as experiment, case study, literature review, etc. The results show that 51% of the papers were categorised as case studies. A case study refers to a research approach that generates an in-depth understanding of an issue in its real-life context [78]. A total of 28% were categorised as qualitative analyses, while quantitative analyses represented only 12.5%.

The database was further classified according to the applied theme of the study, i.e., mitigation or adaptation. The criteria for this selection were chosen from the Green Climate Fund's taxonomy, which defines as its mandate "to promote the paradigm shift towards low-emission and climate-resilient pathways has prioritised 8 strategic result areas, 4 each for mitigation and adaptation". This document can be found in the Supplementary Materials (S1). According to our database, 54% of the articles were based on the mitigation theme; 26% were based on adaptation, only 10% were cross-cutting, and the remaining 10% did not mention any theme.

The papers were also classified based on the presence of the word "Climate change" in the title, the abstract, or the methodology. The results show that 86% of the articles mentioned climate change in either the abstract or the methodology, while only 7% mentioned it in the title.

After the Pandemic—A Way Forward

The whole world is currently facing the COVID-19 emergency. The pandemic has restricted people's movements, impacted their livelihoods, and disrupted supply chains and economic activities [79]. The pandemic and the different measures of lockdowns imposed by the countries have revealed vulnerabilities, exposed the current system to various risks, and caused economic recession [80]. The disruption in the present scenario has also triggered an inability to adapt to and control the systemic exposure caused by the pandemic. Essentially, this current scenario has highlighted the drawbacks of the linear system [48]. The CE could open the way for a resilient recovery after this pandemic by decoupling economic growth from natural resource extraction and their environmental impact [80]. The CE approach addresses the drawbacks of the linear economy. It could provide a systemic transition that generates business and economic opportunities, builds long-lasting resilience, and offers societal and environmental benefits [81]. This pandemic would require governments to take vital actions that focus on boosting economies during emergencies and widening the systematic transition towards the circular world, which could be more resilient against future global crises [82]. Achieving the shift towards the CE might require a concerted effort from all actors [48]. International organisations could promote important emission-reduction programs such as reforestation and energy efficiency programs and include the CE in their climate agenda. National and local governments and municipalities could apply CE principles to their climate change action plans and mainstream the policies. Businesses could respond to climate change emergencies by scaling up opportunities that create value in new ways and provide societal and environmental benefits [24,48].

Representatives from governments, health systems, civil society, and businesses have been demanding an effective and inclusive response to the severe impacts of the COVID-19 pandemic [80,83]. A "new European economic model: more protective, more sovereign, more resilient, and more inclusive" is what a network of 180 European environmental activists, business leaders, members of the European Parliament (MEPs), and politicians have been suggesting as necessary for further substantial investments [44].

After the beginning of pandemic, the local government of the city of Amsterdam launched a program called "City Doughnut"—an approach representing how the city would incorporate CE principles with Doughnut economics [84–86]. CE principles such as regeneration and redistribution of resources by design could be seen in the vision of Doughnut economics [87]. The concept of Doughnut economics was first derived by the British economist Kate Raworth in 2012 [87]. According to Raworth, the purpose of Doughnut economics is to meet the needs of all people within the boundaries of the planet. It works according to two primary principles [87]: (1) the social pillar, to ensure that no one is left behind in accessing essential commodities; and (2) the ecological pillar, to ensure that all essential commodities are met within the planetary boundaries (Figure 4). At its core, the CE principles align with those of Doughnut economics by promoting business models and incentives that encourage the flow of resources and enhance circularity by enhancing resource efficiency [87]. The core principles of Doughnut economics are well-being of humans and the balance of socio-economic and ecological health [84]. A CE complements Doughnut economics by managing the better use of resources and decoupling emissions growth from resource use [85].

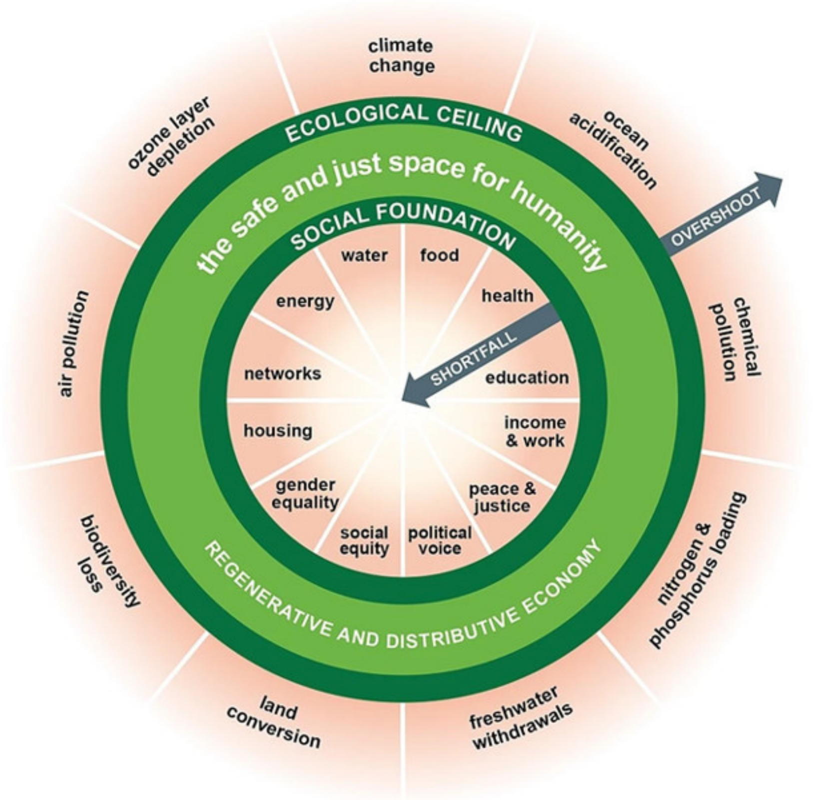

Figure 4. Doughnut economic model. Source: Raworth [87].

5. Discussion

The objective of this research was to investigate the relevance of the CE for climate change. We reviewed 96 peer-to-peer reviewed articles for this research. For this purpose, a ToC (Figure 2) was used as a theoretical framework in which essential assumptions were mentioned along with the role of multiple relevant stakeholders. These stakeholders are the main drivers of innovation and knowledge transfer for systematic change. A transition towards the paradigm shift of a thriving, carbon-neutral world and achieving the goals of the Paris Agreement require mapping all the relevant stakeholders and identifying associated challenges. We also identified the role of eco-innovations as a mediator in both CE and climate change. The current economic model has given little to no attention to social and environmental well-being. Until the introduction of the report by the Brundtland commission in 1987, most economic policies were focused on achieving short-term goals [88]. CE principles such as reuse, reduce, and recycle have been introduced in the past few decades to achieve sustainability [21]. Still, the relevance of the CE for climate change needs to be explored. Some new concepts such as "cradle-to-cradle", "multi-value creation", "people-planet-profit", and "responsible entrepreneurship" were introduced and discussed by the researchers and practitioners in the debate on sustainability in recent years [40,46]. These concepts attracted significant attention by the findings drawn from climate change impacts, increasing temperature, and limited resources [89]. CE principles received substantial attention as these principles could create value for the new sustainable economic model and contribute to the two pillars of sustainability: social and environmental [59].

The paradigm shift from a linear to a circular economy would only gain momentum when the majority of stakeholders work together with the same vision. Indeed, CE principles contribute not only to reducing environmental impacts by GHG emission reductions but also to job creation. The European Commission evaluated through the European Green Deal that the CE could create 580,000 jobs in the EU. Waste management alone would create 170,000 direct jobs by 2035 [44–55]. Many local jobs would be created by the new business model related to repairing, reusing, and recycling.

The Paris Climate Agreement requires a more substantial commitment by all the signatories to reduce their GHG emissions. In this regard, the CE would play a crucial role in curbing global emissions. The transition towards a CE would require strong policies from all governments worldwide. The policy design should be based on a long-term vision, and governments should foster and provide incentives to circular business models that contribute to emission reductions and resource efficiency. Businesses need to consider new business models that promote eco-innovations to achieve resource efficiency, reduce environmental impacts, and adopt more renewable energy sources. Businesses also need to create awareness about their sustainability initiatives that promote changing consumer behaviour by adopting more CE principles. Academia could contribute to the transformation by introducing new courses on circularity and climate change. They could also expand their research on optimising the efficient use of raw materials, promoting research on recycling, reusing, and reducing. The role of civil society organizations in bringing transformational changes cannot be sidelined. They play an essential role in strengthening citizen engagement with public policies and improving governance. They hold governments accountable by monitoring their policies and advocating for effective public–private partnerships. They also engage effectively with several partners and create awareness for the common good. CSOs could contribute by creating awareness related to CE and educating citizens to adopt CE principles in their lives. They can also work with governments to develop new policies on implementing CE principles and promote circularity. In addition, CSOs with local groups and communities can ensure that CE policies are also helping marginalized sections of the society. Therefore, we also considered CSOs as relevant stakeholders for this research that could help in bringing transformational changes from the linear to the circular economy.

5.1. Implications

5.1.1. Theoretical Implications

This research provided new knowledge about the literature on the relevance of the CE for CC. According to the authors' knowledge, there is a lack of publications exploring the CE's relevance for CC. First, we explored the links between CE and climate change by designing a ToC logical framework. This was the first time where ToC was used as a theoretical framework in social science research apart from monitoring and evaluation studies. This framework provides freedom to researchers and practitioners to design the logical framework which underlines the role of multiple stakeholders, crucial assumptions, and intended outcomes. We also explored the necessary stakeholders that are influential in enabling the paradigm shift towards a more circular and sustainable world. By analysing the role of the CE in achieving the Paris Agreement and climate neutrality by 2050, we identified the need for a strict policy from governments and strong incentives for companies to adopt new business models that generate fewer GHG emissions and are more resource efficient.

Second, we identified the role of eco-innovation as a moderator between CE and CC. The need for adopting CE principles and new regenerative business models that promote sustainability is due to the current climate crisis, increasing global population, and resource inefficiency. To achieve global climate goals, the current economic model needs to be more efficient, to focus on changing consumption patterns, to redesign business models, and to build resilience infrastructure for climate change that improves the well-being of the planet as well as of human beings. Based on the findings of this research and the significant relevance of the CE in achieving climate neutrality, this research proposes a logical framework for action to society, businesses, and governments.

Third, we identified that the CE could be applied in Doughnut economics, which is an emerging new economic model for the well-being of the planet that focuses on the efficient use of natural resources within planetary boundaries. The Netherlands government is taking this model quite seriously and trying to include the CE principles in it. These collective actions from all the Netherlands stakeholders would help them achieve their climate goals and to provide benchmarking framework to governments worldwide. There is a need to investigate further and research in-depth the exact utilisation of the CE principles for CC if integrated with the principles of Doughnut Economics.

5.1.2. Policy Implications

This research provides theoretical knowledge to policy designers. Governments will play a crucial role in reducing emissions and achieving the goals of the Paris Agreement. In this regard, the implementation of the CE principles with CC policies is the highest priority. This includes the execution of planned frameworks and policies that stimulate the transition towards resource efficiency and proper management of natural resources and help to achieve climate targets. The theoretical support in the CE principles is provided by the policy design, but the shift from theory to practice requires transformational changes through eco-innovations. Public policy could aid in bringing social, organisational, and technological transformations and may provide incentives to industries' value chain. Eco-innovations are one of the crucial tools for the transition from a linear to a circular economy and tackling climate change. Through this research, we explored the relevance of the CE for CC through the role of eco-innovations. We highlighted that the development of eco-innovations should be promoted in public policy. This research provides insights on how eco-innovations may stimulate the achievement of the Paris Agreement goals. This research provides implications to policymakers to consider the role of the CE in mitigating climate change. Public policies could also mobilise the public sector and relevant investors in CC. Our research that, with the help of quintuple helix model, the private sector could be incentivised by public policies. This would contribute to the paradigm shift to achieve carbon neutrality. The role of public policy would strengthen the CE's enablers and scale up regulatory frameworks, improve renewable technology, etc.

5.2. Limitations

This research has multiple limitations. First, the theoretical framework developed with the help of the ToC is a pioneering study that explores the relevance of the CE for CC and the role of multiple stakeholders. We developed several assumptions while building this framework. We may have missed some other assumptions. Second, we analysed 96 papers only in English. If we could have broadened the scope of this research, we would have added other relevant publications in another language, such as Chinese. When we started the literature review for this research, we found many papers written in Chinese. This study may be the pathway toward conducting research in the future to find linkages between the CE and CC. Nevertheless, this study may need to be further developed by other theoretical approaches, such as a systematic literature review. Third, we only considered relevant publications that fit the domain of the researchers. For example, we did not include engineering studies. We suggest that for future research, other disciplines may be added to obtain different results. We recommend that further empirical research use ToC in social science research apart from the M&E studies. There are also some limitations associated with the CE studies. For example, few studies show how much CE has reduced GHG emissions and helped in attaining climate change goals. Therefore, we suggest including examples of successful case studies conducted on the CE and CC. We hope this research provides an analytical framework to researchers and practitioners to use ToC beyond M&E studies.

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