

The Circular Transition Through the Network Governance

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Abstract of the thesis

United Nations has defined Sustainable Development Goals defined the most pressing challenges of our time. The aim of comprehensively deal with the social, economic, and environmental challenges that are affecting our society has attracted the interest of academics and practitioners worldwide. Several frameworks have been indeed developed to achieve sustainable development, each one with a different balance on specific goals. Among the variety of models proposed, the Circular Economy has gained a prominent place due to its promises of holistically deal with all the SDGs, with a delicate equilibrium between economic growth, environmental limits, and social inclusion and equity. The Circular Economy approach proposes a radical shift from the current linear economic model, in which production and consumption side of economic system are disconnected, to a circular one, in which material and energy loops are connected and designed together.

However, Circular Economy has to deal with several challenges to realise its full development and guarantee its broad diffusion as a framework for achieving sustainable development. Indeed, the extraordinary attention that Circular Economy got in the last 10 years has also generated a conceptual confusion about what this approach means, the general principles, and how should be implemented. Indeed, there is the danger for this umbrella concept to become a permanent issue or to collapse instead to become a coherent concept. In addition to that, the Circular Economy literature and practice have largely overlooked its governance dimension, with most of the attention primarily on the technological innovation on how shift the linear system to a circular one. This lack of focus on the governance dynamics risks to undermine the comprehensiveness of the approach, relegating Circular Economy to just a technical approach to implement within single organisations and limiting the holistic ambitions to transform the economic system.

Through this thesis, we try to give answers to these challenges and contribute to the future of Circular Economy as a helpful framework for sustainable development. In Chapter 2, we adopt an extensive bibliometric analysis approach to explore the umbrella nature of the Circular Economy and identify the future trajectory of the concept. The findings suggest a vibrant field that must pay attention to avoid the involution of the concept. In Chapter 3, we employ a Qualitative Comparative Analysis methodology to analyse the governance of 20 networks engaged in circular transition. We have been able to identify three different

configurations of network determinants that have successfully led to the network effectiveness, providing empirical evidence of the suitability of network governance for Circular Economy. In Chapter 4, we attempt a holistic answer to our main question, gathering all the findings and providing an overview of the actual state of the Circular Economy. In addition, we suggest various future research paths to be explored and to enrich the Circular Economy and governance literature. Moreover, we also give some advices to practitioners, that could use some of the findings as a blueprint for their engagement with Circular Economy.

Dedication and Acknowledgements

I would like to start by dedicating this thesis to my supervisor, Alessandro Sancino. In July of 2019, I was just a random guy trying to find his place in the world, with a lot of things read and what I considered at the time a visionary project rejected by graduate schools all over Europe. It was a message on ResearchGate from Alessandro that completely changed my life. As these four and a half years have confirmed, he demonstrated the ability to look beyond appearances and showed me what the word visionary really means. From that moment, Alessandro and I developed what I am proud to define as a special friendship. We have shared many challenging and happy moments, and it takes more than some words in a dedication section to describe our bond.

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Table of Contents

Abstract of the thesis.....	2
Dedication and Acknowledgements	4
1.1 Introduction	8
1.2 Sustainability and its Development	11
1.3 Current Approaches to Sustainable Development	14
1.3.1 Green growth	16
1.3.2 Doughnut economics.....	18
1.3.3 Degrowth.....	20
1.3.4 Circular economy	22
1.3.5 Overlaps and differences between approaches.....	26
1.4 Governance of the Circular Economy	29
1.5 Why Study Circular Economy Governance?	33
1.6 Research Questions	35
1.7 Relevance.....	42
1.8 Summary and Outlook	43
2.1 Introduction	45
2.2 Theoretical Framework.....	48
2.2.1 Knowledge perspectives	53
2.2.2 Geographical perspectives.....	58
2.2.3 Neglecting the social and governance dimensions	61
2.2.4 Research problem and introduction to the method	63
2.3 Methodology.....	65
2.3.1 Data collection.....	67
2.3.2 Data preparation	68
2.3.3 Data analysis	68
2.4 Results	72
2.4.1 Performance analysis.....	72
2.4.2 Science mapping.....	83
Co-authorship.....	83
Bibliographic coupling.....	91
2.5 Discussion and Conclusion	93

3.1 Introduction	98
3.2 Theoretical Framework.....	100
3.2.1 Network connectivity	104
3.2.2 Network trust.....	105
3.2.3 Network sustainability	106
3.2.4 Network management strategies.....	107
3.3 Methodology.....	109
3.4 Findings and Results.....	123
3.5 Discussion and Conclusion.....	128
4.1 Introduction.....	134
4.2 Addressing the research questions	135
4.2.1 What is the current state of the circular economy as an umbrella concept?	135
4.2.2 What kind of future scenarios can the Circular Economy expect to reach?	138
4.2.3 How can network governance contribute to the circular economy transition?	140
4.3 Future Research Agenda.....	141
4.3.1 Enhancing the conceptual clarity of the circular economy	141
4.3.2 Circular economy and wickedness.....	143
4.3.3 Exploring network governance.....	144
4.3.4 Different outcomes for network effectiveness.....	145
4.3.5 Place-based leadership for circular economy implementation	147
4.4 Implications for Circular Economy Practice	148
4.4.1 Moving towards a holistic circular economy.....	148
4.4.2 Defining and standardising the circular economy.....	149
4.4.3 Consumer engagement and education.....	150
4.4.4 Monitoring and evaluation by metrics beyond a technological and economic focus	151
4.4.5 Embracing a problem-oriented approach	152
4.5 Closing remarks	153
References	155

Chapter 1

Introducing the Circular Economy: sustainable development, wicked problems, and governance

1.1 Introduction

'I want Next Generation EU to make our Union a leader on circular economy. For too long, global growth has been based on predatory ideas. Humanity took away resources from the environment, and in exchange, produced waste and pollution. I am convinced this can change. With the European Green Deal, we aim at an economic and recovery model that gives back to our planet more than it takes away.'

Ursula von der Leyen – State of the Union 2020, 16th September 2020

With these programmatic words, Ursula von der Leyen, President of the EU Commission, underscored the urgent need for European institutions and national governments to embrace more sustainable economic practices. Her focus was on the pressing importance of protecting our planet and its natural resources, and the crucial role that humanity must play in achieving this objective. Our current production and consumption patterns are, and perhaps always have been, incompatible with the Earth's natural limits. National governments and policymakers at all levels must therefore engage with all societal stakeholders and prioritise this change. However, the great novelty of this discourse is the means outlined by von der Leyen. Indeed, she suggested a complete overhaul of our current linear economic model into a circular one, representing a major shift forward in the EU's efforts to create a more sustainable future.

The EU Commission is not alone in making efforts to design and implement a more circular economy (CE), with this "new" economic system idea becoming increasingly mainstream. For instance, the Netherlands has been one of the world's first countries to set ambitious goals for a circular economy transition. Since 2016, the Dutch Government has developed several CE plans, among which the National Circular Economy Programme 2023-2030 stands out as highly ambitious. Indeed, this program outlines five transition agendas to engage society and revolutionise the entire economic system. The general goal is to dismantle the linear economy lock-ins and promote a shift towards circular economy transitions by creating advantages for the widest possible range of societal stakeholders (Netherlands Ministry of General Affairs, 2023). Beyond the Western world, numerous nations are actively developing comprehensive strategies to transition towards a more sustainable and circular economy. A world-leading CE stakeholder is the Chinese Government, which has actively engaged in a circular transition since the Law for the Promotion of the Circular Economy in 2008. Since then, the Chinese Government has integrated specific CE plans into its pivotal five-year plans, mainly focusing on reducing pollution through improved recycling and renewable resources, as well as more ambitious initiatives such as enhanced industrial design and remanufacturing (Bleischwitz et al., 2022). A final example of CE's popularity as a concept is its employment in some developing countries. A great instance is the Africa Circular Economy Alliance (ACEA), a coalition of 16 African nations committed to driving the continent's shift to a circular economy. This alliance follows a Triple Bottom Line (TBL) strategy, which seeks to balance economic, social, and environmental growth (Desmond & Asamba, 2019). As a collaborative platform, the alliance aims to leverage a circular economy to deal with complex environmental challenges by offering financial support and knowledge resources. It has already yielded positive results, including the Ecopost initiative that has repurposed 5000 tonnes of plastic waste into building materials, and has also initiated the Plastics Pact network, which endeavours to tackle the plastics issue from industrial design through to consumption (de Kock et al., 2020).

These are just a few examples of the interest that circular economy theory and practice has gathered in the past 15 years. The attention and resources that national governments are investing principally relate to the CE promises of decoupling growth from the environment with sustainable economic development following Earth's rhythm and limits.

However, the CE concept must confront some theoretical shadows and empirical inconsistencies if it is to radically alter the current linear economic system and change actual models of production and consumption. Indeed, as will be outlined in this chapter, CE implementation must deal with the conceptual fog which has gathered around its umbrella nature, and a consistent and coherent governance model is also needed for its effective design and implementation.

In this chapter, a historical framework of the concepts of sustainability and sustainable development is provided, underlining how the development of these two concepts has been necessary for the emergence of the circular economy. In addition, an overview of the different solutions developed for sustainable development is elaborated, with the intention of highlighting overlaps and differences between these alternative approaches and the advantages of adopting the CE approach. Furthermore, the argument is made that public actors must adopt a more horizontal and network governance approach to design and implement the CE, overcoming the limits of Traditional Public Administration and New Public Management in dealing with wicked problems. Indeed, the complexity and the extensiveness of the problems with which CE tries to deal necessitate governance models which are more oriented to a broader involvement of societal stakeholders.

The remainder of this chapter is structured as follows. Section 1.2 examines how sustainability unfolded from the Brundtland report, retracing the steps that culminated in the development of the SDGs in 2015. Section 1.3 addresses the variety of solutions developed to deal with the environmental goals posed by sustainable development. Following that, section 1.4 identifies why network governance is the most suitable approach for the CE transition. The review of sustainable development, the CE, and governance models leads to identifying the research issues this thesis addresses, which are outlined in section 1.5. These issues are reframed into research questions in section 1.6, which lead the thesis and guide its methodological approach. The contributions that this research will make are then presented, before the final section of the chapter provides an overview of the following chapters.

1.2 Sustainability and its Development

"The Earth has a deadline: 7:103:15:40:07". These are the years, the days, the hours, the minutes, and the seconds that appeared on the giant digital display in Union Square, in the centre of Manhattan, on 19th September 2020, in an artwork called the "Climate Clock". According to the Mercator Research Institute on Global Commons and Climate Change, these numbers represent the time left until the Earth's ecosystem will deplete its capacity to absorb the CO₂ emitted globally. If our production and consumption behaviours with the relative CO₂ production remain the same—and statistics are showing that they are actually on the rise (Geels, 2014; IPCC, 2018) —then the Earth's atmosphere will reach a point of no return of a 1.5°C rise, at which point unstoppable natural upheavals will irreversibly modify our planet.

This is just one among dozens of reasons—such as the dangerous increase of zoonotic diseases like COVID-19, also attributed to the effects of climate change (Naicker, 2011)—why we must concentrate our energies and research focus on a transdisciplinary effort (Mauser et al., 2013) to tackle what the literature has called the grand challenges of our times (George et al., 2016). Even if these challenges have been described in many different ways, the United Nations' Sustainable Development Goals (SDGs) (United Nations, 2015) are the benchmarks around which academic research and governments worldwide are currently aiming.

The history of the sustainable development concept dates back to 1972, when the word "sustainability" was first employed in the Blueprint for Survival and the 1972 Yearbook of the International Union for the Conservation of Nature (Kidd, 1992). However, the academic and political engagement in "sustainability" and all the concepts derived from it arise from two fundamental advances: the redaction of the Brundtland Report by the World Commission of Environment and Development (WCED), and the elaboration of the Triple Bottom Line concept by John Elkington in 1994.

The WCED, led by Norwegian Prime Minister Gro Harlem Brundtland, was the very first attempt by the United Nations to approach sustainable development with a transnational effort, uniting UN countries towards a comprehensive common goal. Among the merits of

this commission and its report, like the rise to the prominence of the sustainable development concept, the focus on a necessary "intergenerational equity" stands out. Indeed, defining sustainable development as a 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (Brundtland et al., 1987) meant committing the UN and all its members to a shared long-term vision of change and to an agreed guarantee that their respective environmental policy efforts are not just greenwashing (Parr, 2012).

Alongside the redaction of the Brundtland report, the TBL concept has provided a necessary multidimensional basis for sustainable development. Indeed, this concept, which originated in the business literature (Elkington, 1994), explicitly states the need to found sustainable development on the three pillars of social, environmental, and economic dimensions, summarisable in Elkington's definition of "people, planet, profit". Indeed, even if the Brundtland report had already affirmed the importance of going beyond the economic dimension, the TBL provided a strong direction in considering the combination of these three dimensions to achieve successful sustainable development.

Unlike the Brundtland report, which has generally gathered favourable judgements (Holden et al., 2014), the TBL had a polarising effect, generating a certain level of behavioural incoherence by some actors. On the one hand, it has been the foundation of several conferences, treaties and UN goals, such as the Agendas 21 established in June 1992 at the Earth Summit in Rio de Janeiro, as a comprehensive plan for a global sustainable development explicitly focused on the environmental dimension; the Millennium Development Goals (MDGs), which were the ancestors of SDGs, namely eight broad goals for 2015 established in the UN Millennium Summit in 2000; and from Rio+20, the United Nations Conference on Sustainable Development held in Rio precisely twenty years later, the Agenda 21, which focused on the implementation of sustainable development and substantially resulted in the launching platform for the SDGs.

On the other hand, the TBL has received many criticisms, especially for its strong business orientation (Williams, 2019) and the absence of a precise governmental dimension. Indeed, on the one hand, some scholars argue for the necessity of a global multi-scale governance effort to coordinate the comprehensive development of all three pillars of

sustainability (Homsy et al., 2019; Sachs, 2012). On the other hand, if the absence of a governance focus can be attributed to the popularity of neo-liberal positions at the time when the TBL was being theorised (Osborne, 1993), other scholars have suggested that the TBL concept should undergo some profound modifications due to its narrow focus on the economic domain and for seeing the environment as an externality to the social dimension (Henriques & Richardson, 2004).

However, based on these two concepts, sustainable development has witnessed vast adoption by all international organisations, national governments, businesses, and NGOs, which have progressively relied on this concept when building their environmental policies. The zenith of TBL's history was the formulation of the Sustainable Development Goals mentioned above by the UN, established in a historic agreement in 2015 with the unanimous commitment of all 193 of its members. This agenda for the future established 17 interdependent goals (Figure 1) that must be achieved by 2030, adjourned and detailed two years later via 169 targets and 247 indicators. Even at first glance, it is clear how revolutionary these goals are, but several reasons relevant to this dissertation must be stressed.

Firstly, the SDGs have successfully learned from some of the failures of past sustainable development efforts. Indeed, differently from the MDGs, Agenda 2030 does not make the erroneous distinction between developing and developed countries, instead affirming that no country can be defined as 'developed' when analysed through the lens of sustainable development (Biermann et al., 2017), and that the SDGs are based on a strong 'leave-no-one-behind' principle, recognising the necessity of widening the stakeholders involved in this unprecedented process of transformation as much as possible (Sachs et al., 2019). In addition, Agenda 2030, in which the SDGs were established, witnessed the participation of the world's most important political leaders, unlike the Rio+20 conference, whose important goals were undermined by the lack of participation of several key global leaders.

Secondly, even if the SDGs continued in the same vein as MDGs by taking a 'governance through goals' approach (Biermann et al., 2017; Sachs, 2012), Agenda 2030 has two distinct merits compared to its predecessor. On the one hand, hundreds of intermediate and final

targets and indicators have been specified through the heavy involvement of civil society and a vast array of governments, providing the necessary comprehensive global perspective lacking in the MDGs; on the other hand, Agenda 2030 has left total freedom in choosing the right approach to deal with the SDGs to national governments, employing a non-binding approach for the achievement of the targets and the goals (Biermann et al., 2017) and recognising the inherent contextual nature of sustainable development application along with the necessity of adopting exploratory governance mechanisms guided by a learning-by-doing approach (Sachs et al., 2019).

In the context of this wide discretion of means offered by the SDGs, several sustainability and sustainable development approaches have thrived in recent years. The following section examines the predominant approaches adopted to attain sustainable development. Specifically, it first outlines the fundamental tenets of each approach, followed by an analysis of their relationship with the SDGs, an overview of their empirical adoption, and an assessment of their advantages and drawbacks. This overview is fundamental to understanding CE's position within the broad spectrum of sustainable development strategies. Indeed, CE's overlaps with other existing approaches, its unique position, and the heightened interest in it and adoption of it compared to other approaches will all be discussed.

1.3 Current Approaches to Sustainable Development

As highlighted in section 1.2, the United Nations has empowered governments and various societal stakeholders with the autonomy to select their own approaches to tackle the multifaceted environmental, economic, and social challenges posed by the SDGs. This empowerment has catalysed the emergence and diversification of several sustainability paradigms, including but not limited to green growth, the doughnut economy, degrowth, sustainability transition, and the circular economy. While all these models have distinct foundational principles and proposed strategies, they also display areas of convergences and have various intersections.

The following sections will articulate the core principles inherent to each approach, elucidating their relationship with the SDGs and critically examining their limitations and the

criticisms they have received. Furthermore, the overlapping and differences between these frameworks will be delineated, before finally establishing why the CE has become the predominant strategy by which to achieve a sustainable economy (see Table 1). This analysis is instrumental in offering a clear, comparative understanding of the various approaches and in establishing CE's distinctive position in the contemporary discourse on sustainable development.

Table 1 - Overview of sustainability development approaches

	General principles	View on current economic system	Relationship with SDGs	Diffusion	Pros	Cons
Green Growth	Decoupling economic system from environment	Compatibility	Focus on economic and environmental SDGs	Broad diffusion from both public and lay actors	Focus on environmental challenges; Economic growth;	High transition costs; possible inequalities;
Doughnut Economy	Economy moving within environmental and social boundaries	Incompatibility	Focus on environmental and social SDGs	Little diffusion	Promotion of equality; Environmental protection; Science-based	Complexity of transition; Resistance from existing stakeholders
Degrowth	Prosperity without economic growth	Adversarial	Focus on environmental and social SDGs	Almost no diffusion	New measures of performance; Focus on environment and well-being	Economic instability; Transition unclear; Societal resistance
Circular Economy	Closing, narrowing, slowing material and energy loops	Compatibility	Comprehensive approach to economic, environmental, and social SDGs	Broad diffusion from both public and lay actors	Comprehensiveness; Scalability; Economic resilience	Umbrella concept; Lack of Governance dimension

1.3.1 Green growth

The foundational basis of green growth as an approach to sustainable development lies in its effort to decouple economic development from environmental sustainability (Jacobs, 2012). Indeed, this approach advocates promoting economic growth while ensuring that the Earth and its natural assets are not harmed and can continuously provide the resources needed for human well-being (Antal & Van Den Bergh, 2016). According to the literature, economic decoupling can mainly be achieved through two instruments (Jacobs, 2012). The first is prioritising resource efficiency, with an identified need to reduce the amount of resources introduced in our economic system and improve the design of products to make their production more environmentally compatible (Reilly, 2012). The second means is the advancement of innovation and technology, where heavy investments in green technologies, renewable energy, and sustainable infrastructures are at the base of any shift towards more sustainable and green economic development (Jacobs, 2012; Mensah et al., 2019).

Green growth proponents emphasise the need to integrate environmental and economic policies with a strong and deep engagement of private stakeholders in this transition. Indeed, this approach advocates for the implementation of market-based mechanisms, employing financial instruments such as carbon pricing, green taxation, and general sustainable finance tools to steer societal stakeholders towards eco-friendly practices and discourage anti-environmental or free-riding behaviours (Mihálovits & Tapasztai, 2018; Romano et al., 2018). By aligning economic incentives with environmental limits, green growth aims to create a new economic paradigm whereby societal stakeholders can thrive in a sustainable and resilient society (Hallegatte et al., 2012). An example of this market-driven approach is the European Green Deal promoted by the EU in 2020. This comprehensive strategy developed a range of financial instruments to transform the EU economy into a climate-neutral model by 2050. Embracing a green growth approach, the European Green Deal is founded on incentives for societal stakeholders to shift towards a more efficient use of resources and energy, renewable resources, and a general employment of technological innovation to achieve sustainable development.

The green growth approach is unambiguously connected with the SDGs and the concept of sustainable development, as identified by the UN in 2015 (Acosta et al., 2020). Its inherent

focus on sustainable infrastructures, technological innovation, and economic development directly contributes to the achievement of SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 7 (Affordable and Clean Energy). In addition, this approach has indirect spillover effects that support a range of other SDGs. For example, reducing environmental degradation and pollution contributes to both SDG 3 (Good Health and Well-being) and SDG 6 (Clean Water and Sanitation). The focus on sustainable infrastructure and innovation underpins SDG 11 (Sustainable Cities and Communities), enhancing urban environments (Fay, 2012; Gu et al., 2018; Merino-Saum et al., 2018).

However, the transition to green growth faces several obstacles, primarily high transition costs and the necessity of overall economic restructuring. Shifting from a resource-intensive economy requires enormous investment in technologies, infrastructure, and workforce training (De Haas & Popov, 2023; Noh, 2019). This upfront economic effort is challenging to sustain, both for developed countries, which can count on the support of supranational organisations such as the EU, and above all, for developing countries, who may find the financial burden unbearable (Tawiah et al., 2021). This also indirectly affects the potential for inequality that green growth strategies carry with them. Indeed, dependence on such financial instruments could unevenly distribute the benefits of this transition and exacerbate the existing economic, social, and environmental gaps between nations (Kousar et al., 2023).

Regardless of the economic investments required, Green Growth policies hinge on aligning economic incentives with environmental objectives, predominantly utilising market mechanisms as a principal means of implementation. This approach necessitates robust and meticulously planned policy frameworks to effectively guide and incentivise sustainable practices. However, this pathway is riddled with potential pitfalls, including market failures and resistance from powerful stakeholders who benefit from the status quo, posing significant risks of policy failures. Often, such policy missteps arise from an inadequate understanding of the intricate interplay between environmental and economic systems, coupled with a lack of comprehensive stakeholder engagement in both the design and execution of policies (Capasso et al.,

1.3.2 Doughnut economics

Initially created by economist Kate Raworth in an article published in 2012 and later developed in her well-known book in 2017, the doughnut economy is a more radical economic perspective on how to shift our economic system to make it compatible with planetary boundaries and social foundations (Raworth, 2012; 2017a). The doughnut metaphor is employed as a visual device to explain the external and internal limits within which inclusive and sustainable economic activities could be developed. Following a TBL approach, Raworth acknowledges the primacy of the environmental and social pillars, and argues that the economic one must follow their direction and limits (Raworth, 2017a). Departing from other approaches, the doughnut model, with its explicit external and internal limitations placed on economic development, goes beyond a generic set of guidelines to instead make a prescriptive call to action to create a redistributive economic model that is sustainable in the long run.

The external environmental boundaries of this new kind of economy are represented by nine ecological ceilings, characterised by the nine planetary boundaries outlined by Steffen et al. (2015). Specific limits of ocean acidification, amounts of global freshwater use, or land system change are some examples of the environmental limits within which economic activities must happen, and must not overstep, not only to "respect the environment" but to guarantee human survival on Earth. That said, the social pillars or social foundations developed by Raworth are largely influenced by the social aims outlined in the SDGs. The main characteristic is the intersectionality of these social boundaries, upon which a new economic paradigm should be designed and developed (Fanning et al., 2022). Indeed, the survival and thriving of the current economic system is based on the violation of several limits of human deprivation, such as food, water, health, or income, but also gender equality, education, and political voice. A new economy, based on the metaphor of the doughnut, can establish an inner ring of social boundaries that must not be overstepped but within which societal stakeholders can freely move (Raworth, 2017b).

Despite being recently developed and quite radical in its approach to contemporary economic systems, the doughnut economy model has already gained followers. Adoption of the doughnut metaphor as leverage to redesign more sustainable economic models has mainly been concentrated in urban contexts, such as Brussels, Copenhagen, and Portland (Turner et al., 2022). However, the leading centre of the doughnut diffusion is the City of Amsterdam, which, in the aftermath of COVID-19, has built a City Doughnut portrait together with Kate Raworth, not only to change the economic image of the city but also to radically redesign the image of a socially inclusive and environmentally sustainable city (Gemeente Amsterdam, 2020). An example is the true-price initiative, where the city employs a dual strategy. Firstly, it reveals the hidden environmental and social costs of the economic system, such as carbon footprints and ensuring fair worker compensation. Secondly, it promotes locally produced products exempt from these additional costs. This approach not only highlights the unseen expenses associated with conventional consumer goods, but also encourages the consumption of local, more sustainable options (Nugent, 2021).

However, the adoption path of the doughnut economics model is paved with obstacles, especially concerning the complexity of the challenges and the political and economic resistance to its implementation (Biermann et al., 2022). The inherent complexity of the model lies in its attempt to embody a broad range of economic, social, and environmental dimensions and challenges within a single comprehensive framework. This integration, while instructive regarding a radical turnaround of our society beyond the focus on the economic mode, poses a severe translation challenge to policymakers who wish to outline actionable strategies for doughnut economy implementation (Schokkaert, 2017). The multidimensional nature of the model demands both a comprehensive knowledge of complex challenges and a high level of coordination between several public actor levels and all the societal stakeholders.

In addition to implementation challenges, the doughnut economy also suffers from political and economic resistance to the radical changes required for its adoption (Raworth, 2017a). Indeed, the transformative shift from the traditional growth economic model to a framework that prioritises environmental ceilings and social foundations represents a serious threat to established interests and power structures. Resource-intensive industries, such as fossil fuels or chemical manufacturing, have sufficient economic and political

power to stop or at least resist changes that threaten their profitability. A notable instance is the recent COP28, the 28th United Nations Climate Change Conference, presided over by Sultan Al Jaber in the UAE. He is widely known as supporting the expansion of oil and gas production and for his strenuous defence of the fossil fuel industry against the onslaught of sustainability policy pressures. In addition, the creation of policies and strategies not based on traditional measures such as GDP or economic growth may be met by politically risk-averse and path-dependent behaviours from policymakers (Endres & Ohi, 2003). This resistance is also powered by fear of the temporary but unavoidable economic instability that would occur after such a radical overhaul of the economic system, which is why national governments are tentative in fully committing to the doughnut economy (Basheer et al., 2022; Affairs & Perry, 2021)

1.3.3 Degrowth

The degrowth approach advocates radical transformation from the traditional growth-centric economic paradigm to a deliberate downscaling of production and consumption to achieve sustainability and social equity (Kallis et al., 2018). At the core of the degrowth approach is a strong critique of the concept of perpetual economic growth at the expense of environmental sustainability, and the inevitable environmental degradation, natural resource exhaustion, and social inequality which follow. The approach proposed by the degrowth paradigm is a complete redefinition of what growth and societal progress mean, replacing GDP growth as the main measure of human well-being with community resilience, or natural ecosystem functioning as indicators of the health of our societies (Kallis, 2011). The reduction of resources introduced into the economic system, the minimisation of waste, and more equal redistribution of wealth are just a few examples of how the degrowth paradigm envisions the new production model. In addition, the degrowth approach promotes new kinds of human lifestyles, more aligned with the planet's natural limits, and focuses on relational goods rather than just material consumption (Meissner, 2019).

This new economic system is founded on the promotion of a "prosperity without growth" approach, suggesting a society in which economic activities and policymakers' strategies

focus on preserving the environment and ensuring thriving societal well-being (Jackson, 2016). This could be achieved by reimagining economies for more local production, sustainable agriculture, renewable energy, and, in general, grassroots and cooperative business models oriented at redistributing profits rather than accumulation in the hands of a few people (Muraca, 2012; Schmelzer et al., 2022). In addition, this radical transition must be participatory and inclusive, involving all societal stakeholders regardless of how they are organised. Indeed, degrowth proponents stress the necessity of including marginalised communities and developing countries to ensure a just and equitable transition (Chiengkul, 2017; Hausknost, 2017).

The relationship with SDGs and the idea of sustainable development as designed by the UN is complex and multifaceted. Indeed, on the one hand, the degrowth approach is an effective framework for delivering several SDGs, focusing primarily on environmental ones such as SDG 13 (Climate Action), SDG 14 (Life Below Water), and SDG 15 (Life on Land), by promoting an economy with fewer resources introduced into the economic system and more sustainable consumption practices. Moreover, similarly to the doughnut economy, the degrowth approach is attuned to the social inclusion goals of sustainable development, like SDG 12 (Responsible Consumption and Production), SDG 10 (Reduced Inequality), and SDG 3 (Good Health and Well-being), fostering economic and business activities not oriented towards profits but rather to different performance measures, such as happiness (Sekulova, 2014). On the other hand, degrowth has a problematic relationship with SDGs on what sustainable development should mean. Indeed, while the UN equates development with economic growth, the degrowth approach prefers to emphasise the need to improve quality of life regardless of consumer goods or economic wealth over mere economic expansion (Belmonte-Ureña et al., 2021; Robra & Heikkurinen, 2020). Degrowth prefers to focus more on the environmental and social pillars of the TBL, framing the economic pillar as a means to support the other two.

The radical approach taken by the degrowth approach brings several drawbacks that prevent its diffusion. The primary concern regards the economic instability and spike in unemployment which are likely to follow the implementation of degrowth practices (Sekulova et al., 2013). Indeed, reduced production and consumption could create unemployment and trigger a general economic deceleration, but it could also diminish the

amount of resources available to invest in green infrastructures, such as renewable energy or sustainable housing (Klitgaard & Krall, 2012). In addition, while the degrowth approach is clear in its critiques of contemporary economic systems, it lacks clear transition pathways and practical steps for implementation (Büchs & Koch, 2019). The academic community is increasingly advocating for the gathering of empirical data to validate degrowth strategies' efficacy and long-term sustainability. However, due to a very limited number of real-world examples, progress in this area is advancing at a slow pace (Fitzpatrick et al., 2022).

The radical nature of degrowth, its potential impacts, and the lack of a concrete plan are creating political and societal pushback. Similar to what is happening with doughnut economics, the political viability of degrowth is being challenged by risk-aversion, institutional resistance, and entrenched growth-centric interests (Kish & Quilley, 2017). Additionally, societal resistance is significant. Overall, its proposed shift from a capitalistic society based on material success to valuing lower consumption and intangible and relational goods requires a profound transformation of the current economic system and society as a whole (Sekulova et al., 2013).

1.3.4 Circular economy

The circular economy (CE) has generated incredible hype in academic research (Geissdoerfer et al., 2017) and the international agenda. Examples come from all over the world, such as China being the most active country in the world in CE implementation, approaching circularity as a mid-industrialised country (Ghisellini et al., 2016) trying to combine its economic growth while attempting to eliminate or at least diminish environmental problems. The key role of China is also evident in the academic literature, with Chinese scholars' works dominating the list of the most-cited papers in the CE literature (Homrich et al., 2018). In addition to China, the European Union has also directed policy attention towards implementing revolutionary changes in resource loops management, focusing particularly on waste. The CE is one of the explicit goals of the Urban Agenda for

the EU, but it also published a dedicated action plan in March 2020 as a fundamental part of the EU Green deal, suggesting the existence of a potential market of 600 billion euros of gains each year.

Due to its widespread adoption, the debate around what the CE actually means and how to define it is quite heated. Indeed, as the Bibliometric chapter will discuss, the CE is an umbrella concept in which different and often contrasting definitions and models coexist and clash. A comprehensive and exhaustive definition has been provided by Geissdoerfer et al., who define the CE as a "*regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling.*" (2017, p. 759). This definition provides an overview of the two main and most-shared principles governing the CE model.

The first foundational principle of the CE concerns its transformative relationship with the current economic system. As the circular metaphor suggests, CE's principal intention is to change the direction of the economic system from a linear one to a circular one (Stahel, 2016). The linear economic system is characterised by a "take-make-dispose" approach in which the production and consumption sides are disjointed and operate independently without regard for their reciprocal impacts (Sariatli, 2017). The consequences of the misalignment between the two sides of the economic system are resource depletion, environmental pollution, waste accumulation, and an overarching sense of economic inefficiency (Velenturf, 2021). This has led to acknowledgement of the unsustainability of the current economic system in the face of the global challenges outlined by the UN with the SDGs. In this regard, the CE aims to redesign the economy by linking the two disconnected sides of the economic system and designing out waste and pollution through the use of the 'circular' metaphor.

The principal aim of the CE is to completely redesign the economic system through the use of three complementary strategies. The first is to close material and energy loops, transforming waste into a resource and creating a regenerative cycle that mimics the natural system. This approach is not merely about recycling but rather, it represents a complete shift in industrial production and consumer behaviours. Indeed, products are designed from

the outset with their end-of-life in mind, made to be easily manufactured, assembled, and repaired (den Hollander et al., 2017). The novelty of this approach lies in acknowledging that single businesses are embedded in a broader system in which each stakeholder must take responsibility for the environmental consequences that the economic system produces on the planet. Indeed, closing the loop also requires a shift in consumer behaviour, with more sustainable consumption patterns beyond recycling being established, along with understanding and application of practices like sharing and repairing rather than disposing and replacing (Shevchenko et al., 2023).

After the closure of the loop, the CE approach advocates for narrowing the material and energy loops by reducing the quantity of resources introduced into the economic system. This strategy is both functional, in reducing the ecological footprint of the economic system, but also forces the design and manufacturing of products and the adoption of consumer behaviours that maintain or even enhance their functionality and value (Bocken et al., 2016). This means the design of inherently less resource-intensive goods, using new and more sustainable materials as well as redesigning products to use fewer components (Tukker, 2015). In addition, consumers are encouraged to orient their choices towards products that are not only more efficient but also more durable and repairable, extending their lifespan and minimising the overall amount of resources introduced into the economic loop (Bradley & Persson, 2022).

The last pillar upon which the CE approach is based is the slowing of the material and energy loops (Cooper, 2020). Strictly linked to the narrowing strategy, this principle aims to keep products in use for as long as possible, changing production and consumption models by maximising the longevity and repairability of products. The focus of the slowing strategies is on the design of goods, with businesses responsible for guaranteeing a certain level of durability of their products. Slowing means extending product lifespan and promoting advanced R principles beyond recycling, such as the right to repair, reuse, and/or refurbish (Lüdeke-Freund et al., 2019).

The greatest strength of the CE concept lies in its capacity to comprehensively deal with all the SDGs and the economic, environmental, and social challenges that they pose (Schroeder et al., 2019). Indeed, in contrast to the doughnut economy and the degrowth

approach, the circular economy, or at least its mainstream part, is not against economic growth *per se*, but instead proposes a new notion of sustainable economic growth which is more aligned with environmental stewardship and societal well-being. Indeed, unsustainable economic activities strongly linked to the current linear economic system will be replaced by new businesses which are congruent with the three circular loops strategy, of remanufacturing, refurbishing, or repairing. This will promote economic Sustainable Development Goals such as SDG 8 (Decent Work and Economic Growth), SDG 12 (Responsible Consumption and Production), social Sustainable Development goals, like SDG 1 (No Poverty) and SDG2 (Good Health and Well-Being), and environmental goals, such as SDG 13 (Climate Action) and SDG 15 (Life on Land) (Rodriguez-Anton et al., 2019; Khajuria et al., 2022).

The circular economy, heralded for its potential to transform the economic system while preserving the environment, is not without its drawbacks (Corvellec et al., 2022). Among these, two critical issues are fundamental to shaping the CE into a coherent and actionable concept. The first issue pertains to its definition. As discussed above, the CE discourse is characterised by rapid evolution, marked by an exponential increase in the volume and complexity of scholarly discussion. While this burgeoning theoretical landscape is indicative of CE's growing prominence and intellectual richness, it also presents a challenge (Blomsma & Brennan, 2017) as the proliferation of definitions, frameworks, and interpretations can dilute the clarity of the concept and make it difficult to create a shared and holistic understanding of what the CE entails and how it should be operationalised. This definitional ambiguity risks hindering the effective implementation of CE principles and, in the worst-case scenario, even relegating the CE to the realm of buzzwords (Hobson, 2021).

In addition to the definitional quagmire, a lack of focus on the governance and social dimension aspects of the CE is observable, as most analyses prefer to focus on technical and business model innovations. Indeed, as Chapter 2 explores, the CE literature has skyrocketed in the last ten years. However, this has not corresponded with an academic interest in the role of the public actor and what kind of governance model and policy tools should be adopted to help an effective circular transition. This absence of research in the CE literature is a significant oversight due to the pivotal position that governance structures and processes have in enabling the systemic change as required by the CE approach.

Indeed, this gap limits understanding of how policies, regulations, and institutional arrangements may hinder or support CE implementation (Kirchherr et al., 2017). In addition, it overlooks how the complex socio-political dynamics, composed of power structures and vested interests, can influence the pace and direction of change (Corvellec et al., 2022). There is a risk that CE initiatives could be implemented in a fragmented and ad-hoc manner without adequately considering the broader systemic barriers. Moreover, the CE ambition of simultaneously dealing with all the SDGs and all the wicked problems that result from them requires a holistic governance approach. Public actors must be capable of first identifying all the societal stakeholders necessary for such a transition, and then engaging them from the beginning in the identification of what the CE is and how to implement it in order to convince them to pool the necessary financial, informational, organisational, and social resources to overcome all barriers.

1.3.5 Overlaps and differences between approaches

An examination of the various approaches to sustainable development and the SDGs confirms, as the UN stated in 2015, that no singular mandatory path must be followed. The flexibility in pursuing the 17 goals allows every societal stakeholder to tailor their approach, in order to align with their values and norms. The subsequent overview will dissect the overlaps and distinctions among these four approaches, pinpointing the commonalities and unique traits they possess (see Table 1 for a synthetic overview). Lastly, the section will outline why the CE was chosen over other approaches as the main focus of this thesis.

Regarding the overarching principles and prevailing perceptions of the economic system, two distinct patterns can be observed among the four sustainability approaches outlined above. On the one hand are the decoupling paradigms represented by green growth and CE, which espouse a vision of a system where economic growth persists without detriment to the environment. These two approaches operate within the existing economic framework but seek alternative ways to enhance its sustainability. Nevertheless, a

significant distinction arises in terms of the clarity and specificity of their plans on how to foster sustainable economic growth. Indeed, the green growth approach has a general drive towards sustainable development, while often lacking a precise blueprint for this transition. In contrast, the CE approach explicitly articulates its transition principles, employing the circular metaphor and various mechanisms such as the R principles to outline a clear path to the sustainable overhaul of economic activities (Kirchherr et al., 2017).

On the other side of the spectrum, the doughnut economics and degrowth approaches present critical counter-narratives to the notion of continuous economic growth as compatible with environmental limits. Doughnut economics proposes a less radical, albeit still transformative, vision, as it allows for economic growth but only within a redesigned framework that respects both environmental ceilings and specific social foundations. Instead, the degrowth approach posits that the existing economic system is irredeemably flawed, thus challenging the traditional metrics of economic success and societal well-being. It advocates for new indicators of prosperity that prioritise specific factors such as happiness and community over mere economic expansion. Degrowth proponents advocate for deliberately downscaling production and consumption as the only way for a sustainable and equitable society. However, similar to the green growth approach, supporters of degrowth struggle with articulating a detailed roadmap for achieving this alternative model of prosperity. The real-life translation into concrete and actionable strategies of a clear vision of the current economic system remains a challenge. Indeed, critiques of the degrowth approach underline the lack of a clear, defined pathway to translate its visionary goals into a practical reality (Schwartzman, 2012).

The alignment of these four sustainability approaches with the SDGs mirrors their respective stances on the economic system to a considerable extent. The green growth approach, embodying the decoupling ideology, predominantly focuses on the economic SDGs, with a moderate emphasis on environmental objectives and a notable neglect of the societal challenges highlighted by the SDGs. In this regard, a significant critique of this approach is its potential to exacerbate existing inequalities both between nations and between developed and developing countries, undermining the holistic spirit of SDGs (D'Alessandro et al., 2020). Conversely, the narratives of degrowth and doughnut economics, which fundamentally challenge the current economic paradigm, tend to

gravitate more towards environmental and social SDGs. Indeed, they strongly critique contemporary economies for perpetuating the environmental and social crisis that our societies are facing (Kallis et al., 2012). Beyond the barricades built against the Triple Bottom Line by the other three approaches, the CE commits to a more balanced and expansive engagement with the SDGs. As outlined above, the CE is lauded for its potential to address environmental, economic, and social SDG challenges simultaneously (Calisto Friant et al., 2020). This holistic approach makes it particularly promising as a way of advancing a comprehensive sustainable development agenda.

A final interesting confrontation between the four approaches is in their degrees of diffusion and adoption. As seen in Table 1, the disparity between them can be attributed mainly to their respective positions on the existing economic paradigm. Green growth and the CE have achieved widespread acceptance mostly because they propose modifications to the current framework of capitalist economic growth. This perceived compatibility with the existing system provides a sense of security to societal stakeholders, by ensuring that their positions of influence and power will not be jeopardised. This alignment with the prevailing economic order acts as a catalyst for their broader adoption and implementation.

Conversely, the more radical propositions offered by degrowth and doughnut economics, which advocate for a profound transformation or even a complete overhaul of the current economic system, have encountered substantial resistance from a broad spectrum of societal stakeholders. Not only do private businesses and industries resist these approaches due to the potential threat they believe would be posed to their interests and survival, but public actors demonstrate reluctance too. Indeed, government entities are typically risk-averse and prefer to adhere to path-dependence and isomorphic behaviours, opting for evolutionary and incremental rather than revolutionary changes. Furthermore, the radical shift proposed by these approaches also directly impacts individual consumers and citizens, who may find the prospect of a dramatic economic and societal transformation daunting. Consequently, while all four paradigms aim to address the pressing needs of sustainability, the extent of their diffusion and influence in each case is intricately tied to their perceived degree of disruptiveness and compatibility with the existing economic and social structures.

This comprehensive overview offers an in-depth comparative analysis of the four distinct sustainability approaches, aiming to delineate their commonalities and divergences while highlighting the rationale behind selecting the Circular Economy as the focal point of our research. As previously discussed, the CE emerges as a particularly compelling model for sustainable development due to its unique characteristics. Indeed, it presents a balanced and integrative framework that combines the comprehensiveness of its approach with a detailed set of guiding principles for enacting this transformative shift. Moreover, the widespread diffusion and acceptance of the CE underscore its practicality and resonance with current economic and societal structures, making it an exemplary case study for our investigation.

1.4 Governance of the Circular Economy

The multifaceted ambition of the CE to achieve environmental, economic, and social SDGs places the approach at the forefront of the challenge of dealing with several wicked problems simultaneously. The reduction of waste and pollution, lessening the depletion of natural resources, slowing or halting biodiversity loss, addressing economic inequalities, and offering a radical shift of societal and cultural norms are just a few examples of the level of wickedness that the design and implementation of the CE must deal with to be effective. A consequence of wickedness is the difficulty for governments at all levels to design and implement an effective circular transition (Head & Alford, 2015). Indeed, without the right governance model, circular economy and circular transitions are inevitably doomed to failure or, at least, to produce sub-optimal outcomes (Corvellec et al., 2022).

Before delving into what kind of governance approach is most suitable for the needs of the CE approach in dealing with multiple wicked problems, we should explore what the concepts of wickedness and wicked problems mean and how they originated. Rittel and Webber developed the concept in the seminal article published in 1973, "Dilemmas in a General Theory of Planning", and it was initially used to describe a specific class of planning problems that were tricky to define and resistant to a definitive solution, differently from easier and solvable tame problems. Since this original conceptualisation, wicked problems

have become increasingly salient, drawing the attention of several scholars in different disciplines. The notion of wickedness provides a powerful device with which to summarise the increasing complexity of society and the crisis of the single societal stakeholders, especially public actors, in effectively dealing on their own with this kind of complexity (Weber & Khademian, 2008).

Wicked problems are a heuristic epistemological category used to describe various societal challenges characterised by intricate characteristics that distinguish them from tamer issues (Alford & Head, 2017). First, they are inherently complex, consisting of many interdependent elements that interact in unpredictable ways, making the definition of problems and potential solutions highly uncertain and ambiguous (Head, 2019). Prominent examples are pressing environmental challenges such as climate change or biodiversity loss, and complex social problems such as poverty or social mobility (Noordergraaf et al., 2017). Second, they affect all societal sectors, thus involving a vast spectrum of stakeholders with a wide range of values and beliefs. The necessity of involving all stakeholders comes from acknowledging that no single actor has all the necessary resources to successfully deal with such levels of complexity, with the mandatory pooling of quadruple helix societal stakeholders (Dentoni, 2018). However, the involvement of such a range of different stakeholders often leads to conflicting views on the nature of the problem, what kind of goals should be set and achieved, and the desirability of potential solutions (Innes & Booher, 2018).

Furthermore, wicked problems resist a definitive formulation. This is not only a consequence of the different perspectives brought by the variety of stakeholders involved, but rather an acknowledgement that understanding the problem is part of the problem-solving process (Hajer & Wagenaar, 2003; Klijn & Koppenjan, 2015). Any explanation of wicked problems can be disputed, and scientific knowledge is insufficient to clear the definitional fog around them (Funtowicz & Ravetz, 1993; Giampietro & Funtowicz, 2020). Coupled with the resistance to a definitive formulation, wicked problems are characterised by not having a clear stopping rule. Any potential solution upon which stakeholders agree is just a temporary response, namely a "better" or "worse" response subject to ongoing debate and adaptation (Termeer et al., 2019).

Public administration and governance scholars agree that these characteristics make wicked problems a unique and challenging domain that requires collaborative and multifaceted approaches to be adopted which go beyond the traditional governance models (Termeer et al., 2015). Weberian or Traditional Public Administration is inadequately equipped to deal with the inherent complexity of wicked problems. Indeed, rigid hierarchies, impersonal rules, and top-down linear processes are based on assumptions of predictability and certainty that are fundamentally mismatched with the nature of wicked problems (Raab et al., 2015). Bureaucratic organisation is often accompanied by difficulties involving external societal stakeholders, which is fundamental to sufficiently pooling the necessary resources to deal with wickedness. In addition, the inherent compartmentalisation of Weberian Public Administration does not allow for holistic and integrated approaches, with narrow solutions lost in the maze of organisational siloes (Roberts, 2000). Taking climate change as a prominent example of wicked problems, it is possible to observe how the different and separate approaches taken by various public sectors, such as energy, transportation, agriculture, or waste management, will inevitably result in conflicts between uncoordinated policies, or at least in duplication of effort.

For different reasons, New Public Management (NPM) has demonstrated considerable inadequacies when it comes to addressing wicked problems. Predominantly influenced by the tenets of efficiency, the privatisation of public services, and market-based solutions, NPM fails to adequately engage with the multifaceted nature of complex societal challenges (Head & Alford, 2015). NPM primarily emphasises quantifiable outcomes, often reflected through financial performance indicators, which are misaligned with the intrinsic characteristics of wicked problems. Such problems defy simple quantification and measurement, as they often encompass a myriad of interdependent variables that cannot be reduced down to singular metrics (Head, 2022). Moreover, the inflexible commitment to market-oriented solutions and privatisation promoted by the NPM approach overlooks the need for a comprehensive and multidimensional approach. For instance, issues like climate change or public health crises necessitate extensive coordination and involvement across sectors and stakeholders, which transcend the simplistic boundaries of market incentives. This is further compounded by NPM's tendency towards centralised decision-making, prioritising efficiency metrics over broader stakeholder engagement. Such a narrow focus is especially problematic given the extensive scope of wicked problems, which often extend

beyond economic considerations to include profound environmental and social implications. Therefore, NPM's reliance on financial tools and market mechanisms proves to be too limited and restrictive to address the complex, interwoven challenges presented by wicked problems (Peters, 2017).

The analysis of the Weberian Public Administration and New Public Management models reveals a critical gap in their capacity to navigate the intricate and unpredictable nature of the various wicked problems prevalent in contemporary society. As public administration and governance scholars have noted, an observable shift has occurred towards more horizontal, flexible, and cooperative governance frameworks (Torfing et al., 2012). This shift has been underpinned by a growing consensus that the traditional governance paradigms are incompatible with the contemporary multifaceted and evolving societal challenges. Among various emergent governance approaches, network governance stands out as particularly influential (Isett et al., 2011). It presents itself as a viable, horizontal alternative to the Weberian model's vertical hierarchies and New Public Management's market-centric strategies. Network governance is distinguished by its emphasis on fostering collaboration across organisational boundaries, societal sectors, and different levels of government (Koliba et al., 2018). This model addresses the inadequacies of its predecessors and recognises the need for a more integrated, participatory, and resilient approach to dealing with the systemic issues that characterise the modern world (Klijn, 2020).

The network governance model starts from the assumption that no single organisation possesses the requisite knowledge, financial means, or authority to independently resolve wicked problems (Hood & Margetts, 2007). This realisation necessitates the promotion of collaborative efforts and sharing knowledge among a variety of societal actors, thereby fostering a more comprehensive grasp of complex issues and pooling the resources necessary to manage such intricacy. In this regard, network governance advocates the establishment of non-hierarchical, collaborative, and mutually beneficial relationships among stakeholders, while also suggesting that the development of innovative and multifaceted solutions will not only be more likely but also sustainable over time, which are crucial considerations given the persistent and evolving nature of wicked problems (Krogh, 2022). Furthermore, the inherent adaptability of network structures and their participants is

an invaluable asset in addressing wicked problems, as this flexibility allows policies and solutions to evolve in response to new insights and shifting contexts (Provan & Lemaire, 2012), a critical feature for navigating the uncertain and dynamic nature of wicked problems. Another pivotal aspect of network governance is the integration of diverse perspectives from various societal stakeholders (Klijn & Koppenjan, 2015). This inclusivity both enriches the understanding of the problem and its potential complexities, and bolsters the legitimacy and acceptance of the solutions devised. Engaging with a wide range of viewpoints ensures a broader, more profound comprehension of the issue at hand and cultivates informed and widely supported solutions.

1.5 Why Study Circular Economy Governance?

As shown in the previous sections, the circular economy has become a prominent concept in the sustainability development debate and is now a widespread approach to dealing with several wicked problems. Indeed, the promise of simultaneously dealing with all the environmental, economic, and social challenges posed by the 17 Sustainable Development Goals represents a tasty opportunity for governments, private businesses, non-profit organisations, universities, and any other societal stakeholders seeking to foster the more sustainable development of the current economic system.

However, the circular economy does not lack drawbacks and theoretical and empirical issues that must be resolved. As outlined in section 1.3.4, two specific features of the current CE approaches act as hindrances to its full development. The first concerns the conceptual clarity of the CE and its future as a usable and employable concept. The catchy circular metaphor, the capacity to group together several literature strands, and the comprehensiveness of its scope have prompted skyrocketing interest in the CE concept in the last ten years (Goyal et al., 2021). As Chapter 2 will explore, this increased production has undoubtedly benefitted the concept, which has diversified and expanded its theoretical basis beyond its initial industrial and waste management roots. The CE has indeed acted as

a catalyst for several existing group of scholars and practitioners to find a conceptual umbrella under which develop a comprehensive and interdisciplinary approach to sustainable development. However, this abundance of literature has also cast a shadow over the conceptual clarity of the CE and its consequent employability. Indeed, there has been an overabundance of different approaches to definitions, with some scholars counting more than 100 (Kirchherr et al., 2017).

The pervasive ambiguity surrounding the CE concept risks relegating it to the same fate as the notions of sustainability and sustainability development, which have become diluted buzzwords applied too broadly, thus losing their strength. Alternatively, this lack of definitional clarity might lead to the concept's collapse, rendering it ineffective due to indistinct theoretical underpinnings and uncertain implementation trajectories (Blomsma & Brennan, 2017). Extensive research on the CE has scrutinised the definitional quagmire, with several scholars emphasising the imperative to systematically deal with this ambiguity (Calisto Friant et al., 2020; Ghisellini et al., 2016; Kirchherr et al., 2017). Despite these efforts, a holistic overview of the CE domain is still lacking. Such a comprehensive synthesis is essential not only to grasp the current status of the concept but also as a foundation to anticipate its future trajectory and identify potential strategies to mitigate any adverse outcomes. Indeed, developing a more consolidated and nuanced understanding of the CE concept is crucial to ensuring its viability as a transformative paradigm which can be deployed to deal with the environmental, economic, and social challenges posed by the SDGs.

The second significant obstacle this study has identified for the CE is the scant attention it has received from practitioners and academics regarding the governance aspects which are essential for a circular transition. Indeed, while interest in, and literature on, the CE have surged exponentially over the past decade, as has been discussed above, this expanding curiosity has yet to be paralleled by an equivalent focus on the governance mechanisms vital for steering and sustaining the circular transition in the long run. The role of public actors and the intricacies of governance structures in fostering or hindering CE practices remain critically underdeveloped. Public administration and governance scholars have largely neglected the CE, an oversight which leaves a substantial research gap in the CE knowledge, as the success of the CE lies not only in technological and business innovations

but also in robust and supportive governance systems. A deeper dive into the governance dimension is therefore imperative to build understanding of how policies, regulations, and institutional arrangements can either accelerate or impede the adoption of circular practices. There is a fundamental need to recognise and understand the interplay between governance structures and circular initiatives to formulate effective strategies and create an enabling environment for the CE transition.

In addressing these issues, this research has three aims. It seeks to:

1. Map the perspectives and communities of knowledge that make up the CE field mosaic.
2. Examine the future employability and comprehensiveness of the CE.
3. Explore the CE's governance dimension and understand if the network governance model is the most suitable framework to help to ensure its comprehensiveness and holistic promises.

In the following section, these research aims are formulated into research questions, which are then used as a guide for the entire thesis.

1.6 Research Questions and a Pragmatist philosophy

Moving from the aims outlined in the previous sections, the main research question leading this thesis is:

Can the circular economy effectively contribute to sustainable development, and if so, how?

As outlined above, the CE path to contribute to sustainable development is challenged by two specific issues, namely the definitional debate and the lack of theoretical and empirical research about its governance. Therefore, in order to answer the main research question, it is further divided into two specific sub-questions:

1. What is the current state of the circular economy as an umbrella concept?
2. What kind of future conceptual scenarios can the circular economy expect to reach?
3. How can network governance contribute to the circular economy transition?

In order to provide a holistic answer to the main research question and coherently answer the three subquestions, I employ the philosophy of Pragmatism to guide the theoretical and empirical journey of the next chapters. As a philosophical tradition, Pragmatism emphasises the centrality of action and practical outcomes as the basis for determining the truth and meaning of concepts (Ansell, 2011). This focus on practical utility over abstract theorising makes it particularly suitable for addressing complex, real-world problems, which in our case is to improve the general employability of ambitious concepts such as the Circular Economy. Originating in the late 19th century with seminal thinkers such as Charles Sanders Peirce, William James, and John Dewey, Pragmatism emerged as a response to the more abstract and often disconnected nature of the prevalent at time idealist and realist philosophies. The main idea of the founding Pragmatists was to create a bridge between theory and practice by insisting that ideas and theories should be evaluated based on their practical effects and usefulness in solving real-world problems and not solely on their axiological value.

In this regard, Pragmatism emphasises that knowledge is not a static accumulation of facts but an evolving process that develops through continuous inquiry, reflection, and experimentation (Dorf & Sabel, 1998). This iterative approach promotes adaptability and innovation, aiming for individuals and communities to continuously refine their knowledge in response to changes in contextual circumstances or the emergence of new challenges. In this view, learning and understanding are dynamic processes profoundly shaped by experience and the practical implications of our actions. Knowledge is constantly tested and updated through practical engagement with real-life situations in a world defined by Pragmatists as a complex and interconnected system (Dunn, 2019). This emphasis on the connection with the practice of ideas encourages a flexible and responsive attitude toward problem-solving and learning, promoting a culture of continuous improvement and adaptation.

Central to Pragmatism is the rejection of rigid dichotomies and dualisms that separate thought and action, theory and practice, or fact and value (Lorino, 2018). Instead, Pragmatists argue for a more integrated view where these elements are interrelated and influence one another in a dynamic interplay, even if it were conflictual. This perspective leads to a holistic understanding of phenomena, recognising the fluidity and interconnectedness of different aspects of reality. By viewing these elements as part of a large and interconnected system, Pragmatism encourages a more nuanced and comprehensive approach to understanding and addressing problems (Farjoun et al., 2015). Indeed, in real-life situations, individuals and groups go back and forth between theory and practice, recurring facts and values interchangeably. This integrative stance helps bridge gaps between different domains of knowledge and practice, fostering a more cohesive and effective way of thinking and acting (Sætre & Van De Ven, 2024).

Pragmatism also places a strong emphasis on collaborative problem-solving and governance (Ansell, 2011). In this context, it promotes the idea of stakeholders working together through deliberation and negotiation to address complex public issues. This collaborative approach is grounded in the belief that diverse perspectives and experiences can lead to more effective and innovative solutions (Ansell & Gash, 2008). By fostering dialogue and joint inquiry, Pragmatism aims to create a more inclusive and participatory form of decision-making responsive to contemporary society's needs and challenges. This approach enhances the quality of decisions and builds stronger, more resilient communities by involving a broad range of voices in the problem-solving process. Therefore Pragmatism not only provides a philosophical foundation for understanding and action but also offers practical tools for fostering cooperation and innovation in the face of complex and dynamic challenges (Ansell & Geyer, 2017). This comes as a fundamental orientation for this thesis for two specific reasons. The first is the acknowledged lack of clarity within the CE economy and the apparent unwillingness of different communities of knowledge to come to an agreement and make the Circular Economy more usable. Different stakeholders with different perspectives and values should find a synthesis in the general interest of the Circular Economy concept, embracing the anti-dualist orientation of Pragmatism and creating a synthesis as broadly agreed as possible without diluting the reach and the power of the concept. The second reason concerns the necessity of shedding light on the necessity of a governance focus for the Circular Economy. Indeed, the complexity of the challenges

posed by a holistic Circular Economy, with its promises of dealing with wicked environmental, economic, and social problems could only be dealt with a strong focus on its governance. However, this necessity is not matched by both research and practice, in which techno-centric and economic approaches largely overlook the design, development, and implementation of collaborative governance approaches.

Moreover, Pragmatism significantly influences public administration by promoting flexibility and democratic engagement (Dieleman, 2017). Central to its contribution is the concept of fallibilism, which encourages administrators to make decisions based on the best available evidence while remaining open to new information that could necessitate policy revisions. This approach contrasts with positivist frameworks and acknowledges the complexities and uncertainties inherent in public governance. Moreover, Pragmatism advocates for a participatory administration model, emphasising the importance of engaging with the public and incorporating diverse perspectives into the decision-making process. This approach aligns with the concept of community inquiry, where stakeholders collaboratively address public issues, enhancing the legitimacy and responsiveness of administrative actions. By fostering environments where dialogue and community engagement are central, Pragmatism helps redefine the role of public administrators from mere policy implementers to facilitators of democratic deliberation. As underlined in the previous sections, public actors could not rely only on their resources to deal with all the challenges posed by the SDGs that CE promises to tackle holistically. They must involve all the societal stakeholders affected by these issues and engage them to invest their resources. This obviously involves the clash of different perspectives, in which the role of the public actor could not be limited to the use of hierarchical or market tools but must also be a facilitator and orchestrator of more complex and networked governance arrangements.

Central to Pragmatism is the concept of evolutionary learning, which integrates the evolutionary perspective with a robust theory of learning. This approach emphasises the dynamic and continuous improvement of knowledge through active inquiry, reflection, deliberation, and experimentation. Unlike Darwinian evolution, which highlights natural selection, Pragmatist evolution aligns more closely with Lamarckian ideas, emphasising adaptation through the cumulative acquisition of habits and knowledge (Nungesser, 2017). This evolutionary model stresses the importance of learning from experience and adapting

to new challenges, fostering an environment where knowledge and values are constantly refined and improved through practical engagement and problem-solving.

Pragmatism has identified three generative of the evolutionary learning cycle: a problem-driven perspective, reflexivity, and deliberation (Ansell, 2011). Problems serve as catalysts for learning by disrupting existing assumptions and prompting fresh discoveries. In Pragmatism, problems are not merely obstacles to overcome but essential drivers of inquiry and innovation. This problem-oriented approach aligns closely with Pragmatism's anti-dualism, breaking down rigid separations between theory and practice. Instead of viewing knowledge as a static set of facts, Pragmatism sees it as a dynamic process where practical engagement with problems continually reshapes and refines understanding (Ansell & Geyer, 2017). Reflexivity involves critically examining one's habits, assumptions, and existing frameworks. This self-critical stance enables individuals and groups to adapt and evolve their understanding in response to new challenges and information. Reflexivity is a form of continuous self-monitoring that ensures learning is not just about accumulating facts but also about using this knowledge to modify the approach and perspectives of individuals and communities eventually. In this way, reflexivity is a safeguard against dogmatism and stagnation, promoting a more flexible and responsive mode of thinking essential for effective problem-solving.

Deliberation, involving communicative inquiry and the collaborative construction of knowledge, ensures that diverse perspectives are integrated into the problem-solving process. Pragmatism places a great deal of importance on the input of various stakeholders, recognising that different viewpoints can provide valuable insights and lead to more comprehensive and robust solutions. Deliberation is not merely a means of reaching consensus but a process of mutual learning where participants engage in dialogue to explore and understand different aspects of a problem (Shields, 2003). This communicative process helps to uncover underlying assumptions, challenge preconceived notions, and develop more nuanced and informed solutions.

This cyclical interaction of problem-driven inquiry, reflexive examination, and deliberative dialogue forms the core of the evolutionary learning model in Pragmatism (Ansell, 2011). Each cycle of learning begins with identifying a problem, followed by a critical

reflection on existing knowledge and practices, and concludes with a deliberative process that integrates diverse perspectives to arrive at a solution. This solution is then tested in practice, generating new experiences and insights that feedback into the next cycle of inquiry. Through this iterative process, individuals and communities continuously grow and adapt, enhancing their capacity to address complex and evolving challenges. The evolutionary learning cycle in Pragmatism thus promotes a dynamic and adaptive approach to knowledge and problem-solving. It fosters continuous growth and adaptation, encouraging a proactive stance towards learning and engagement with the world by challenging facts and knowledge to deal with complexity properly.

In this study, I start from the three steps of Pragmatist evolutionary learning to model the inquiry and the development of proper and holistic answers to the main research questions and its three different facets outlined in the three sub-research questions. Indeed, the reason behind this thesis lies in the promises of the Circular Economy of dealing with several wicked challenges and the potential danger of ending up as previous mainstream environmental and sustainable approaches. This study seeks to build a common logical thread around the CE concept and how to effectively help the academic and practitioner communities enhance its conceptual clarity and improve the employability of the concept. From this problem-driven perspective, an evolutionary learning cycle begins with its premises unfolded in the two central ambiguities, the future of the CE concept highlighted in section 1.5. Starting from the definitional quagmire around the Circular Economy, the first two subquestions involve a deep reflection on the CE as an umbrella concept and the deliberation attempt to outline what are the theoretical and empirical challenges it has to deal with to evolve into a coherent concept and avoid permanent issues or collapsing into an insignificant and narrow technical concept.

Indeed, Chapter 2 presents the first holistic attempt to develop an extensive bibliometric analysis of the circular economy as an umbrella concept. The combination of performance analysis and science mapping will outline a complete inventory of the existing community of knowledge, the most employed perspectives, and the different facets of this composite phenomenon. This overview answers the first sub-question, clearing the fog around the CE concept and representing a reflexive endeavour to create usable knowledge to deal with its current and future challenges (Lindblom & Cohen, 1979). Indeed, still in Chapter 2, I exercise

the deliberation attempt to answer the second sub-research question by using the bibliometric findings to trace the different scenarios for the future of CE as an umbrella concept and what scholars and practitioners should do to avoid its loss of meaning and its magnitude and help its wide adoption and implementation.

The second problem-driven perspective stemming from the main research question concerns the lack of governance focus in the CE scholarship and practice, with the consequent unacknowledged necessity to carefully design, implement, and evaluate circular transition. Indeed, the third sub-question deals with the CE governance dilemma outlined in section 1.4. In Chapter 3, I reflect on the existing habits and assumptions in circular economy practice by analysing the empirical dynamics of CE governance in real life, providing data about interactions between policy-makers and other societal stakeholders involved in the CE transition (Fratini et al., 2019; Leipold et al., 2023). Specifically, I assess the effectiveness of network structural and management strategies on CE initiatives through the use of the Qualitative Comparative Analysis methodology. This exploration of the most effective governance practices implemented towards a circular transition will constitute a usable knowledge basis for the identification and deliberation of specific patterns of governance strategies that public actors should adopt and test in future CE initiatives. Indeed, in the discussion section of Chapter 3, I propose three paths for the future, composed of network structural and management conditions, that have been proven successful and effective in circular economy transition.

The lack of definitional clarity and the absence of a governance focus from Circular Economy scholarship and practice represent a starting point for reflecting on and reviewing the existing knowledge and assumptions. This work is represented by the reflexivity stage of the evolutionary learning cycle, in which I explore the existing knowledge and habits about the definitional quagmire around the concept of CE and the network governance approaches that exist and are possibly helpful to the circular economy transition.

Chapter 4 is divided into two parts. The first part provides a comprehensive answer to the main research question and the three sub-questions that guided this thesis, presenting the findings and results of the evolutionary learning cycle completed in this study. The second part uses the findings of the evolutionary learning cycle to suggest avenues for

future research, outlining how this thesis could help scholars and practitioners engaged in the circular economy.

1.7 Relevance

Theoretical contribution

As has been shown in this chapter, several frameworks try to address the need for sustainable development and achieve the Sustainable Development Goals. A first theoretical contribution of this work is to distinguish them on the basis of specific dimensions and create conceptual clarity. The second theoretical contribution lies in the bibliometric analysis conducted in Chapter 2. Indeed, that chapter systematically identifies the different CE communities of knowledge, providing additional data on its historical evolution and enhancing understanding of it as a current umbrella concept (Blomsma & Brennan, 2017; Calisto Friant et al., 2020; Reike et al., 2018). Linked to the second, the third input of this thesis concerns the future of the CE as an umbrella concept. Indeed, by depicting an extensive overview of the CE intellectual landscape, the actual knowledge base for considering what kind of trajectory the concept is undertaking and how to nudge it towards a more coherent transformation is provided. Finally, the lack of theoretical and empirical research upon the governance aspects of the CE is addressed, and the present research starts to fill the research gap on the most effective governance to achieve the CE, moving from theoretical considerations to find that network governance is the most suited to deal with wicked problems (Ferlie et al., 2011).

Societal contribution

The circular economy has rapidly become a prominent framework for approaching sustainable development, and is receiving increasing attention from governments and societal actors worldwide. In this regard, this study touches upon several points and collects substantial data and findings which may be relevant for practitioners. First, it is very useful for practitioners, and above all public actors, to be aware of the definitional debate around the CE, the existence of different knowledge perspectives on how to design and implement a circular transition, and what kind of outcomes should be prioritised. These findings could help policy makers to avoid potential conflicts for their circular transition, either by developing platforms for co-creation or connecting and disconnecting actors according to their perspectives. Secondly, this research explores the governance dynamics behind the CE, showing how network governance could be effective in implementing the circular transition. Indeed, the findings in Chapter 3 could be used as a blueprint by public actors dealing with governance dynamics in circular economy initiatives.

1.8 Summary and Outlook

This chapter started with an introduction to the subject of the study: the circular economy as a framework to achieve sustainable development. A historical overview was provided of the sustainability and sustainable development concept, underlining the freedom of means that the United Nations provides to achieve the 17 SDGs. It also analysed the CE approach along with three other main approaches to sustainable development, underlining the overlaps and differences in their general principles, approach to the economy, advantages and drawbacks, and the degree of their diffusion. The chapter then outlined the reasons why the CE is the most promising framework to achieve sustainable development, before exploring the CE's dynamics with wicked problems, pointing to network governance as the most suitable governance model to the CE. After that, the aims behind this thesis and the research questions guiding the following three chapters were outlined.

In the next chapter, a bibliometric analysis review is presented which explores the conceptual nature of the circular economy. It delves into the umbrella nature of the CE concept by identifying the intellectual community populating the CE field. In this way it is

able to map the current CE field and build a substantial knowledge basis to imagine the future trajectories of the concept. In Chapter 3, an empirical Qualitative Comparative Analysis study is set out, examining how 20 projects in the Italian context have adopted network governance for circular economy initiatives. In the final chapter, the thesis is concluded by summarising the answers to all the research questions. Several contributions that this research makes to the understanding of the CE, and its relationship with governance, and of network governance as a framework, are also outlined. In addition, some directions for future research are offered, and the usefulness of this thesis to practitioners dealing with the CE in their everyday lives is explained.

Chapter 2

Under the Circular Economy umbrella: perspectives, challenges, and future directions

2.1 Introduction

The Ellen MacArthur Foundation defined the circular economy as: "*an industrial economy that is restorative or regenerative by intention and design*" (MacArthur, 2013). This idea of the CE is strictly related to decoupling the environment from the expectation of perpetual growth, and it thus represents an alternative growth discourse to that of the usual linear economy (Ghisellini et al., 2016). This definition has become one of everyday use among practitioners and public actors, who employ it as a guide by which to build their policies and circular economy practices (Hobson, 2021).

On the other hand, a representative example of a definition developed in the academic field is that created by Geissdoerfer et al. (2017) p. 759, which is "*a regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling*". Several aspects differentiate this definition from the EMF's outlined above. Firstly, there is no specific focus on the economy and industry, as the authors prefer to include some core features of how to implement circularity concepts, such as slowing, closing, narrowing, or a great variety of R principles (Homrich et al., 2018). In addition, the definition seems more oriented towards an alternative to growth discourses, opening to acknowledging the impossibility of decoupling the environment and perpetual growth and the necessity of moving the entire economic system in new directions such as degrowth or new measurements such the level of happiness (Giampietro & Funtowicz, 2020).

These two definitions give a glimpse of the CE concept's definitional variety. Indeed, in recent years, practitioners and academics have provided hundreds of different definitions (see Kirchherr et al., 2017; Prieto-Sandoval et al., 2018). As outlined in the first chapter, CE is attracting an increasing number of stakeholders as a valuable means to manage the challenges and goals posed by the UN in the SDGs. In addition, the magnitude of the change projected by the CE, namely a complete overturning of the world's current economic system, involves all societal actors, whether they are interested or not. The wide variety of theoretical and empirical definitions is a consequence of the potentially broad impact and the interest

gathered over the last ten years by the CE, thus also representing a dangerous mix for the concept's survival and employability.

We have witnessed many concepts falling into the trap of becoming useless buzzwords, such as sustainability, artificial intelligence, and social innovation (Apetrei et al., 2021; Pollit & Hupe, 2011). The rhetorical advantage and the general implicit consensus on these magic concepts are often used for very different goals from the originally intended one by naïve or, even worse, malicious stakeholders. This has often led to a dilution of the theoretical strength and empirical scope of these buzzwords, rendering them almost meaningless (Cornwall, 2007; Magretta, 2002).

Regarding the circular economy concept, its potential transformation into a buzzword carries significant consequences, affecting both its perception and implementation. Initially, the CE concept promised a sustainable alternative to the linear "take-make-waste" model, emphasising the closing, slowing, and narrowing of material and energy loops through a variety of R principles such as reuse, repair, refurbishment, and recycling (Potting et al., 2017). However, an increasing number of companies are engaging in greenwashing CE initiatives, where they claim sustainable practices without meaningful action, merely to be on-trend (Kopnina, 2019). In addition, the oversimplification inherent to the nature of buzzwords can obscure the complexity of transitioning to a comprehensive CE. Doing so requires systemic changes in production, consumption, and waste management, goals which are not easily conveyed in a catchy term. Policymakers and industry leaders might therefore overlook the nuanced strategies needed for effective implementation, focusing instead on short-term, visible measures that fit the buzzword narrative but do not address the core principles of circularity (Calisto Friant et al., 2023; Hobson, 2021). The term's popularity also invites a wide array of interpretations, potentially leading to inconsistent applications in different sectors. Without a standardised understanding, the CE's effectiveness in reducing environmental impact may be compromised (Harris et al., 2021).

In order to clear the conceptual fog and help the concept to avoid ending up as a meaningless buzzword (or buzzphrase), scholars have generated an extensive corpus of literature reviews around the CE. In the first phase, indeed, several literature reviews tried to collect all the definitions of the CE in its initial rise to popularity, which mainly happened at

the beginning of the 2010s. Examples are the 114 definitions outlined by Kirchherr et al. (2017), the qualitative main path analysis by Ghisellini et al. (2016), and the systematic literature review of approaches which had been adopted by scholars towards the CE developed by Merli et al. (2018). Following that, several scholars systematically reviewed specific aspects of the CE, such as waste management (Meisam et al., 2021), big data uses (Nobre & Tavares, 2023), relationships with Industry 4.0 (Rosa et al., 2020), and performance assessment methods (Sassanelli et al., 2019)

However, there is a noticeable gap in the research on the historical evolution and present landscape of the CE concept. A complete comprehension of the evolution of the concept, its current theoretical and empirical relevance, and its potential trajectory is crucial. This chapter therefore aims to present a nuanced and in-depth exploration of the CE, both as a reaction to the dilution of the concept and as a proactive effort to establish a knowledge base for future scholars and practitioners to work on.

The chapter is organised in four sections. The first introduces the notion of the CE as an umbrella concept, identifying three scenarios for the future of the concept and reviewing the shadows cast over the external and internal clarity of the concept. Thereafter, it will explain the bibliometric methodology employed to analyse the actual state of the CE, and possibly enlighten hidden aspects of its umbrella nature. Thirdly, it outlines the results of the bibliometric analysis, sets out the performance analysis and an exhaustive science mapping of co-authorship and the bibliographic coupling networks of the CE intellectual structure. Lastly, the theoretical framework and the insights collected are combined through the bibliometric analysis in an extensive discussion of possible developments for the CE concept and what the different interested stakeholders (particularly scholars) should do to avoid the CE becoming a useless buzzword.

2.2 Theoretical Framework

Umbrella concepts can be defined as general ideas or conceptions that link together existing and possibly conflicting phenomena with no previous relationships, or at least change the existing relationships between them by forming a more organic connection (Hirsch & Levin, 1999). The umbrella nature of these concepts makes it possible to connect distinct phenomena through some standard features possessed by these broad concepts. In particular, umbrella concepts share a threefold nature: the capacity to group together different concepts, the creation of shared knowledge and discursive space through a catalytic function, and the predictability of its development through a series of stages (Blomsma and Brennan, 2017; Hirsch and Levin, 1999). Created and often employed within the organisational literature, with examples by Hirsch and Levin including *organizational performance* or *organizational culture*, it is possible to refer to the *sharing economy* (Acquier et al., 2017) and *public value* (Alford & O'Flynn, 2009) as instances of umbrella concepts outside organisational studies.

In this regard, the CE stands as a perfect example of an umbrella concept. Indeed, the metaphor of the cycle as an alternative to the linear economy, systematised by Pearce and Turner (1989), has linked different theoretical frameworks generated by academics and practitioners coming from different societal sectors, which all share the baseline of the 3R principles of reducing, reusing, and recycling materials (Geisendorf & Pietrulla, 2018). Some examples of these isolated concepts are Industrial Ecology, Cradle-To-Cradle, Sharing Economy, or Industrial Symbiosis (Korhonen et al., 2018). All these concepts had theoretical consistency before the emergence of the CE concept, but they acquired new life and meanings under the new theoretical and empirical umbrella developed by the cycle metaphor (Corvellec et al., 2022).

The umbrella nature of the CE is not limited to its ability to link different phenomena under the broad metaphor of circularity as an alternative to linear economy practices. Indeed, umbrella concepts can ignite fundamental discussion between these reunited perspectives through their catalytic function and the subsequent creation of a discursive space in which different discourses can thrive and confront each other (Calisto Friant et al., 2020). The creation of this discursive space is fundamental to the health of an umbrella

concept, and requires a great deal of variety of discourses and knowledge in order to achieve emancipation from its theoretical roots and become a helpful concept not only for academics but also for practitioners (Blomsma & Brennan, 2017). As the knowledge perspectives section below will highlight, the CE shows an important variety of discourses with different conversations happening under the circular umbrella.

However, the variety of perspectives in the discursive space triggered by the catalytic function of umbrella concepts could result in an overpopulation of theoretical frameworks and a multiplicity of different knowledge and definitions which raise the risk of lowering the umbrella concept into a vague and ambiguous quagmire (Corvellec et al., 2022). Indeed, the abundance of definitions and interpretations of circularity makes it difficult for the concept to achieve theoretical and empirical clarity (Castro et al., 2022). Furthermore, this lack of clarity makes the external theoretical boundaries of the umbrella CE vulnerable to the introduction of semi-scientific concepts that dilute any scientific relevance and the misuse of the concept for goals which are antithetic to the original meanings, as has happened, for example, to the concept of sustainability through green-washing initiatives (Giampietro, 2023).

A third defining characteristic is the predictability of its development, with umbrella concepts seeming to follow the same evolutionary trajectory (Blomsma & Brennan, 2017). It is possible to observe a period in which different theories develop separately without even being aware of the existence of similar theories moving in the same direction. This first phase is called the preamble period, in which the theoretical foundations of the umbrella are built (Hirsch & Levin, 1999). This is more an inductive period of investigation of phenomena, with no particular empirical application of theories but rather an exploration of reality in relation to certain concepts. After this knowledge construction, umbrella concepts usually experience an excitement period, a stage where different stakeholders begin to acknowledge a certain degree of similarity with other theories and frame it through a positive lens. The third phase, namely the validity phase, is the most delicate, in which the previously built theories fall under an umbrella concept, such as the CE. It is in this period that the communities around the umbrella concept determine its destiny, which could be as a coherent and employable concept, a permanent issue with unresolved theoretical and empirical problems, or collapse, becoming definitely unusable (Blomsma & Brennan, 2017).

Tracing the history of a concept is an arbitrary activity since social science phenomena lack irrefutable temporal boundaries (Weick, 1995). This ambiguity is also an inherent characteristic of the CE concept, with its development not following a straightforward linear progression but rather presenting as a complex interplay of ideas and theories evolving erratically over time. The delineation of the CE theory's history into three distinct phases is a subjective exercise, reflecting an attempt to impose a heuristic structure on its intricate evolution. Scholars generally agree that the seminal work of Kennet E. Boulding in 1966 marks the origin of the concept of circularity within the economic system. Boulding introduced the idea of a closed-loop system in contrast to the open-ended linear economy, laying the conceptual foundations for the CE (Henry et al., 2021; Webster, 2021).

During the preamble period, known as Circularity 1.0, the conversation did not specifically focus on the concept of circularity; instead, it involved the independent yet coincidental development of ideas centred on waste management. Primarily viewed as an undesirable but unavoidable byproduct of industrial and economic systems, waste was addressed through technical solutions rather than a holistic understanding of circularity (Reike et al., 2018). Examples of these ideas are the *Tragedy of the Commons* (Hardin, 1968), *Limits to Growth*, and the *Design for the Real World*, all of which depict this initial period of CE focused on waste management, with scattered ideas and unlinked concepts sharing a general concern around how to manage waste and other negative outcomes of the economic system (Blomsma & Brennan, 2017).

From the beginning of the 1980s, scholars and practitioners started to change their perceptions towards waste and how it could be transformed into a valuable asset (Calisto Friant et al., 2020). Indeed, waste is no longer framed only as a negative externality, but is now seen as a potential resource from which is possible to extract profit. This turnaround paved the way for the second phase of the CE, namely its excitement period, which temporally and theoretically partially overlaps with the growth of neoliberalism (Flynn & Hacking 2019). Indeed, the majority of the theories developed in this period have been influenced by the ideas of waste management and circularity being strongly linked to market-based solutions, and that industry, with appropriate management, could reverse the limits and negative outcomes of the economic systems outlined during the preamble period (Desrochers, 2000). In this regard, most of the theoretical roots of the CE were developed in

this period, such as Industrial Ecology, Industrial metabolism, or Industrial Symbiosis, which share a firm belief in market principles and technological development as a suitable way to deal with waste (Frosch & Gallopous, 1989; Chertow, 2000; Fischer-Kowalski, 2017). This renovated perspective on waste and the growth of the different CE theoretical roots was termed Circularity 2.0, where knowledge communities were guided by this sense of technological power capable of dealing with all societal challenges, including the waste produced by the economic system (Reike et al., 2018).

The excitement period was also the phase in which the sustainable development concept drew considerable attention, especially after the Brundtland Report in 1987 and the United Nations conference held in Rio in 1992 (Brundtland, 1987). The idea behind these conferences, still influenced by neoliberal theories, is that economic growth which is compatible with environmental limits is possible (Elkington, 1994). On the one hand, the three pillars of conceptualisation and the general focus on sustainability gave momentum to the CE concept and its theoretical roots. An example can be found in the first conceptualisation of circularity within an economic concept in the book by Pearce and Turner (1989).

During this stage, the CE concept not only solidified its theoretical foundations through the development of Circularity 2.0 discourses but also broadened its scope by embracing more comprehensive approaches. Indeed, during this period, there has been a proliferation of more holistic approaches, such as Cradle-to-Cradle (Braungart & McDonough, 2009) and Natural Capitalism (Hawken et al., 2013). These paradigms advocate for a more integrated and expansive view of the CE, asking for policies transcending a narrow technological focus. This period, called the Circularity 3.1 era, marks a critical phase in the evolution of the CE, where sustainability discourses began to acknowledge the need for a more nuanced and multidimensional understanding of the concept. This period is characterised by knowledge communities gravitating towards a reformist perspective of the circular economy concept that aligns with the existing capitalist system. On the other hand, the sustainability thrust developed a platform for all the technological and market-driven approaches outlined above, paving the way for a lack of focus on the necessary social dimension of a circular transition while promoting the use of the CE or sustainable development concepts for green-washing purposes, as outlined below in the section on the social dimension (Koppina, 2019).

The excitement period of CE theorisation, coupled with the enormous attention generated by the sustainable development concept, led to an overload of definitions of the CE and interpretations of how to implement it. This theoretical fog created confusion around the CE as a concept, casting a shadow over its future usefulness and employability (Blomsma & Brennan, 2017; Leipold, 2023). Indeed, the theoretical and empirical enrichment experienced during the excitement period morphed into a faceless *mare magnum* of theories and strategies, which were often conflicting. This initiated the validity phase of the CE concept, in which the academic and practitioner communities have had to deal with several challenges in order to transform the concept into a coherent framework and prevent it from becoming a permanent issue or collapsed construct (Blomsma & Brennan, 2017; Lehmann et al., 2023).

Based on the above, the CE as an umbrella concept must deal with what have been identified as its current three main challenges. The first concerns the internal clarity and the relationships between the discourses falling under its definitional umbrella (Giampietro, 2023). Indeed, practitioners and scholars must engage with the CE as a complex phenomenon, not a one-dimensional issue, while acknowledging the different perspectives of circularity legitimised under the CE umbrella. A prominent example is the development of Circularity 3.2 discourses within the validity challenge period, which aim to transcend the dominant reformist and Western-centric focus by focusing on transformational alternatives to growth discourses (Jackson, 2016; Latouche, 2009). For example, alternative growth and alternative to growth discourses are not interchangeable, and neither can be overlooked or neglected in any attempt at a circular economy transition. A lack of awareness of these discourses' ontological and epistemological differences will result in conflicts between societal stakeholders and inevitable policy failures.

Secondly, the CE has been applied in diverse ways. The necessity of breaking down macro-level policies into meso- and micro-level CE initiatives involves adaptation to local contexts. This work of translation is full of intricate dynamics between general and inspirational national principles and local needs. Section 2.2.2 explores the top-down and bottom-up forces that move the CE and explains why they represent a fundamental prerequisite of knowledge for all the stakeholders engaging with the CE.

The last challenge is the neglect of the social and governance dimension of the CE. Indeed, as section 2.2.1 will show, the majority of the discourses developed in CE history are mainly focused on the economic and environmental pillar of the circular transition. However, several scholars have tried to draw attention to the necessity of extensive knowledge of the social and governance challenges that a holistic and comprehensive approach such as the CE must deal with in its design and implementation (Calisto Friant et al., 2023; Schöggel et al., 2023). What follows in the next sections is a thorough discussion of the three main challenges that the CE academic and policy community must deal with in order to avoid the collapse of the concept or its slip into a permanent issue, and to lay the foundations for the generation of a common knowledge basis and the transformation of the CE into a coherent concept.

2.2.1 Knowledge perspectives

As we have seen while tracing the historical development of the CE as an umbrella concept, there is no shared and common consensus on what the circular economy is, how to implement a circular transition, or which stakeholders should be involved in this transition. The umbrella nature of the concept reunites different perspectives on the aspects outlined above and more. In the CE literature, several attempts have been made to synthesise and systematise the different discourses. This theoretical and empirical richness of content shows the variety of solutions and knowledge accumulated over these years in relation to the concept, especially in the excitement and validity phases. This high attention and concentration of academic and practitioner efforts could be partly attributed to the pressing need to employ more sustainable schemes and behaviours in society (Bocken et al., 2017). Indeed, the CE and its empirical application are deeply rooted in sustainability and in addressing the environmental problems which have arisen in the Anthropocene era, in order to find a comprehensive solution to the SDGs listed by the UN in 2015 (Schroeder & Anggraeni, 2019).

However, the future coherence and empirical scope of the CE depend on reaching an equilibrium between this range and depth of knowledge and a necessary synthesis of the

relevant discourses (Calisto Friant et al., 2023). Indeed, it must be recognised that such an essential change to society as the transition from a linear model of consumption and production to a circular one cannot be achieved under just one flag (Chiappetta Jabbour et al., 2019). The complexity and extensiveness of a societal circular transition necessitate not only a technological revolution but also a transformation of the ethical principles of all societal stakeholders (Hobson, 2021). On the other hand, this variety of perspectives must also be reunited under specific and well-delineated collective frames, which are necessary for enabling collective action and giving a more coherent theoretical base to the CE concept.

As this thesis seeks to give the broadest overview of the different higher-level knowledge developed in CE history, it adopts the discourse typology outlined by Calisto Friant et al. (2020), which synthesises the different CE knowledge communities into four different circular discourses according to holistic and comprehensive topics. This approach was chosen for two specific reasons. Firstly, the review done by those authors aims to depict four different approaches to a whole circular transition, outflanking specificities by focusing on broader theoretical communities. The second reason is that the discourse typology was developed following the CE umbrella concept timeline, giving the possibility of combining different cognitive perspectives on the CE and understanding how the scattered theoretical roots merged into coherent knowledge discourses over time.

Among the different critiques of the CE concept, such as the relationship between the amount of materials, energy, and biodiversity necessary for the circular transition, the never-ending debate on how to evaluate the full impact of circular policies, and the alternative approaches to circular transition, the three authors employ the presence (or not) of social and governance dimension and of systemic thinking to build their discourse typology and to assess how different CE conceptual frameworks position themselves at the intersection of these two dimensions. Through these two axes, the authors achieve an interesting work of synthesis, which seeks to enucleate the fundamental principles of each framework, the theoretical roots, the interval of time on the CE historical development path, and the relationship with the other frameworks.

The first discourse is the "**Reformist Circular Society**", a combination of a holistic perspective of the CE in society and a firm belief in the combination of the participation of

societal stakeholders and technological change to comprehensively deal with several environmental challenges. The distinctive characteristic of this discourse is the assumption of compatibility between the CE and capitalism, with the stakeholders falling under the umbrella of this discourse employing the CE as an alternative growth discourse to the actual linear economy. Considering the CE's historical development, the creation and development of the concepts forming this discourse occurred during the Circularity 3.1 phase, with the enlargement of the CE loops with the inclusion of more ambitious R principles beyond simple management waste, such as Remanufacturing or even Reuse (Reike et al., 2018).

Overall, this discourse represents the predominant narrative in the CE literature and practice. As elucidated by the topic modelling analysis conducted by Mahanty et al. (2021), a substantial portion of the CE literature appears to endorse this reformist view, advocating for a circular transition that operates within the confines of the current capitalist system. This approach aligns with the SDGs' main interpretation of sustainable development, by suggesting that it is possible to foster economic expansion while simultaneously addressing environmental and social concerns. A prominent example is the Circular Economy Action Plan deployed by the European Union in 2022 as a part of the European Green Deal. This plan outlines a comprehensive strategy to transform the European economy into a circular one, with the ambitious goal of decoupling economic growth from the environment through a comprehensive reformist CE strategy (Johansson, 2021). Outside the public sector, another example comes from the Ellen MacArthur Foundation, a leading non-governmental organisation engaged in promoting a circular economy transition. The foundation embodies the reformist approach, encouraging the integration of circular principles into existing economic models by the promotion of innovation, efficiency, and economic growth while reducing waste and minimising environmental impact.

The second discourse developed by Calisto Friant and his co-authors is that of the "**Transformational Circular Society**", which shares with the reformist discourse the necessity of a holistic circular shift of our economic system, but diverges from it by antagonising capitalistic growth discourses and aiming at degrowth approaches. Stakeholders adopting this approach endeavour to shorten resource loops by using anti-consumerist R principles such as Refuse or Resell, with the intention of reducing the quantity of materials introduced into the economic system. In addition to the material and production side, transformational

stakeholders share solid political views on society and societal actors' participation, which reach far beyond a mere reactive participative approach as claimed by the reformist discourse, and embrace a proactive change of life practices. This discourse strongly resonates with Circularity 3.2 concepts, mixing more radical views on the future of society, such as the degrowth economy and non-Western approaches more conscious of the necessity of a global circular transition (Calisto Friant et al., 2023).

What emerges from transformational stakeholders is a blend of visionary dreams striving for a profound overhaul of the economic system, and more realistic and science-grounded critiques of alternative growth discourse to circularity. Indeed, the aim of overcoming the capitalist claim of perpetual growth is grounded in the scientific claim of incompatibility with thermodynamic laws (Giampietro & Funtowicz, 2020). Additionally, this community acknowledges the importance of incorporating diverse cultural viewpoints into the envisaged reformed society and economic system. This includes embracing alternative societal perspectives, such as the African philosophy of Ubuntu, which emphasises communal interdependence and shared humanity (Mutwarasibo & Iken, 2019; Van Niekerk, 2022).

Another synthesis of the CE discourses is the "**Technocentric Circular Economy**", a mix of segmented and optimistic narratives which is particularly evident in the concepts of Circularity 1.0 and 2.0 (Reike et al., 2018). This approach predominantly focuses on circularity's technological aspects, embracing an era of green growth and technological advancements that promise to enhance prosperity while reducing humanity's ecological footprint. This approach is grounded in the belief that circular innovations can enable absolute eco-economic decoupling and deal with any pressing environmental challenge. Its proponents promote a variety of solutions such as Extended Producer Responsibility (EPR), biomimicry, reverse logistics, industrial symbiosis, and more bolder solutions such as geoengineering or synthetic biology (Calisto Friant et al., 2020). This discourse's industrial and technical orientation is also distinguished by a focus on design- and product-related 9R principles such as refurbishing, remanufacturing, repurposing, recycling, energy recovery, and re-mining.

However, while being progressive in its promotion of technological solutions for CE, this technocentric discourse exhibits a lack of focus on holistic solutions. Indeed, the unconditional trust in technology and the limited attention to industrial innovations draw attention to the absence of suggestions for impactful solutions on a societal and systemic level. In addition, this narrow approach tends to perpetuate the same social injustices and environmental unsustainability already prevalent in society, thus ultimately falling short of achieving a genuine circular transition (Calisto Friant, 2022; Hobson, 2021). This limitation is rooted in the theoretical foundations of the CE, particularly in its 1.0 and 2.0 versions, as identified by researchers. Such a perspective fails to adequately address the multifaceted nature of circularity, which requires a more integrated approach that encompasses not just technical solutions but also a delicate equilibrium to be maintained between social, economic, and environmental dimensions (Flynn & Hacking, 2019).

The last discourse comes from the combination of segmented and sceptical discourses about the Circular Economy and goes under the name of "Fortress Circular Economy". The advocates of this knowledge community share a pessimistic and Malthusian sense about the future of environment and resource distribution, neglecting also the necessity of dealing with wealth distribution and social justice. Generally, the solutions offered are top-down resource-controlling measures and population control proposals (Corvellec et al., 2020). ecological concerns and resource limitations have spurred a form of "disaster capitalism," where green solutions and business models are seen as avenues for capital expansion (Hobson, 2021). This has led to land and resource acquisition in the Global South and the development of infrastructures for resource security, often under the guise of addressing climate change, scarcity, and overpopulation (Cafaro, 2022).

Diverging from other discourses, the "**Fortress Circular Economy**" takes a unique standpoint. Stakeholders within this discourse exhibit a pervasive pessimism, both towards alternative growth discourses and more ambitious transformational perspectives. These actors are linked by a collective sense of distrust and a profound scepticism regarding resource availability and political stability. At the roots of this approach is a broader narrative of geopolitical resource security, overpopulation, and economic competitiveness. It stands apart from the mainstream discussions on circularity often underpinning business and government deliberations, especially when framed in terms of national geopolitical

concerns (Dryzek et al., 2019). However, despite not always being at the forefront of mainstream debate, the influence of this perspective is subtly yet significantly present in many discussions of circularity, particularly in the context of global resource management and competitive economic strategies.

2.2.2 Geographical perspectives

The multiplicity of cognitive perspectives developed under the CE umbrella also involves a geographical dimension. Indeed, due to the strong empirical foundations of the concept, circularity has been frequently and differently applied on vertical geographical dimensions. Indeed, circular transitions spread through various societal levels, encompassing a broad scope from macro-level public policies to meso-level eco-industrial park initiatives right down to micro-level individual citizens' behaviours (Spekkink et al., 2022). This multilevel application highlights the adaptability and relevance across the interaction between these levels, with public actors and other societal stakeholders called upon to adopt a systemic and holistic approach to circular transition policies. Indeed, it is vital to understand and address the intricate top-down and bottom-up dynamics moving back and forth between public actors' holistic policies and the behaviours of single organisations or citizens. Scholars and practitioners must also be aware of the cascading effects that actions at one level have on other levels, ensuring the enactment of synchronised and mutually reinforcing initiatives.

The challenge for practitioners is to pursue the successful integration of circular principles and develop tailored strategies that recognise each level's unique characteristics and needs while fostering cooperation and alignment towards a shared vision of a CE (Prendeville et al., 2018). Indeed, fostering a shared vision under the diverse and multifaceted CE paradigm necessitates deliberate and collaborative planning and design. The myriad cognitive perspectives within the CE framework can only be reconciled and harmonised through concerted efforts, thereby enhancing the legitimacy and acceptance of

the collective vision. This process requires engaging a broad spectrum of stakeholders, from policymakers and industry leaders to academics and community members, ensuring that diverse viewpoints and expertise contribute to a comprehensive and inclusive approach. Through this collaborative process, the potential conflicts and tensions inherent in the variety of perspectives can be effectively addressed, paving the way for a CE vision that is not only shared - but also robust and widely endorsed.

At the macro level, CE initiatives usually focus on impacting society as a whole, presenting comprehensive initiatives and strategies promoting a transformative shift in how society relates to the current economic system. This level comprises the overarching policies and strategies which cities, governments, and international organisations implement to facilitate the CE transition. The goal is to develop regulatory frameworks, incentives, and infrastructure to encourage the alignment of consumption and production patterns towards the CE discourses chosen for the transition. One example is the Circular Economy Action Plan by the European Union, which aims to create a regulatory environment fostering innovation, economic growth, and environmental sustainability across its member states, and another example is the comprehensive strategy developed by the City of Amsterdam, which sets the ambitious goal of transforming its urban economy into a circular one by 2050.

Pivotal to the macro-level is its intricate connection with meso- and micro-level actions in order to be effective. Indeed, CE public policies must take into consideration the diverse range of applications and practices at the business and individual levels, ranging from eco-industrial parks to influencing the behaviour of individual citizens. The interdependency of these levels calls for a holistic approach to policy-making which recognises and exploits the potential of systemic thinking through multi-stakeholder collaboration. Public actors must design policies that are not only conducive to regulatory measures but which also foster a widespread and shared culture of sustainability and collaboration at all levels of society and the economy, steering a collective journey towards a more circular direction in the future.

At the meso level, CE is at the nexus where industry clusters, supply chains, and local communities unite to operationalise circularity. This level is fundamental to translating the general circular principles outlined in governmental policy into tangible practices. The most

common initiatives at the meso-level are eco-industrial parks and regional programs fostering collaboration between stakeholders, including businesses, local government, and non-governmental organisations. Eco-industrial parks exemplify meso-level CE applications by promoting symbiotic relationships between co-located businesses, transforming a business's waste into another's input and successfully applying the closing, slowing, and narrowing CE principles.

Success at this level strongly depends on the ability to create a favourable environment for a wide range of stakeholders, which can access advantageous knowledge exchange and the necessary infrastructure and markets. This level also serves as a critical link between individual micro-level actions and the broader systemic changes pursued at the macro-level. Indeed, it provides an actionable context in which the collective efforts of single actors can mix into a coherent and employable strategy for circular transition. Based on these premises, including a meso-level strategy in a comprehensive circular transition is crucial to fully realising the CE potential to drive sustainable development through the economic, environmental, and social pillars.

At the micro-level, CE is strictly linked to the behaviours of single stakeholders, ranging from businesses to single citizens or consumers. This level is where the CE principles are put into practice, manifested in product design, companies' business models, and individuals' consumption patterns. Indeed, beyond the general incentives and regulatory frameworks designed by macro-level policies and multi-stakeholder meso-level initiatives, every decision to design a product for durability or to choose a service over ownership cumulatively contributes to a broader circular systemic shift. An example from the production side could be a company adopting a business model based on product-service systems, where the focus shifts from selling products to providing services. This could include offering repair services, leasing products, or implementing take-back schemes to ensure that products stay in the material loops for as long as possible instead of being disposed of.

The micro-level is also where the challenges and the opportunities of the CE are most tangible. Businesses face the challenge of redesigning their products and services to be circular while remaining competitive in an economic system that they cannot change by

themselves. On the other hand, consumers face the challenge of changing their consumption habits, embracing new ways of accessing and using products, and changing their core values and beliefs. However, at the micro-level, stakeholders can engage in experimental innovation and creative initiatives by developing alternative and radical actions that truly align with CE principles. The aggregation of micro-level activities fuses with meso- and macro-level structures and policies in a relationship of mutual influence between levels. Therefore, understanding the dynamics at the micro-level is crucial to the adaptive scaling of CE principles and the successful implementation of a circular transition.

2.2.3 Neglecting the social and governance dimensions

Several scholars are warning about the dominance of technical knowledge in the CE debate and the consequent neglect of social and governance dimensions in the academic and policy literature (Calisto Friant et al., 2023; Geissdoerfer et al., 2017). Indeed, while rich in technical, economic, and environmental dimensions, the CE discourse has often underplayed the critical role of social and governance aspects. Prior academic work has underlined the necessity of a socio-institutional change, arguing that the comprehensive shift advocated by several CE discourses should reflect on the "how" of the implementation and not just focus on technical "what" questions (Blomsma & Brennan; Cramer, 2022). This oversight not only has theoretical consequences but also a practical impact, as the implementation of comprehensive CE approaches requires concerted efforts between several societal stakeholders across social, technological, regulatory, and economic dimensions (Termeer & Metze, 2019). In addition, the lack of focus on social equity and inclusion undermines the potential for the CE to fully address the three pillars of sustainable development and may result in fragmented initiatives (Kirchherr et al., 2017; Schögggl et al., 2020).

Several factors have contributed to the neglect of social and governance dimensions in the CE discourse, which are rooted primarily in its theoretical and historical development. Indeed, the initial Circularity 1.0 and 2.0 discourses were heavily inclined towards technical solutions aimed at closing material and energy loops. Drawing predominantly from fields like Industrial Ecology, Industrial Symbiosis, and Industrial Metabolism, these discourses focus on the utilisation of waste as a resource, without delving into social and governance issues (Calisto Friant et al., 2023; Murray et al., 2017). The integration of social and governance considerations into the CE narrative only emerged in later stages, marking a shift towards a more comprehensive and transformative framework that acknowledges the importance of these dimensions in achieving a genuinely circular transition. However, time is needed to build a relevant corpus of knowledge that also blends well with existing technical knowledge

Moreover, the mainstream CE discourses often prefer to gravitate towards depoliticised and uncontroversial issues, focusing on technical efficacy but also green jobs creation and economic revitalisation (Steenmans & Lesniewska, 2023). This preference stems from an understandable desire among policy-makers and lay actors to gain broad-based support and avoid confrontation with deeply entrenched power structures and vested interests. However, this approach tends to overlook the more transformative discourses that critically engage with the broader governance aspects of the CE transition (Millar et al., 2019). These more all-encompassing narratives challenge the status quo and question specific stakeholders' power dynamics and gatekeeping roles by highlighting the current inequalities within social and political structures and addressing them with a more equitable circular transition (Ashton et al., 2022).

The current trajectory of the CE discourse, while progressively integrating social and governance considerations, remains at a crossroads. The transition from a predominantly technical focus to a more inclusive and socio-governance-centric approach is imperative for the CE concept to realise its full potential. This shift does not relate solely to the theoretical realm but is also a practical necessity, as it directly impacts the effectiveness and sustainability of CE initiatives. As scholars advocate for a more balanced discourse, the challenge lies in harmonising the existing technical knowledge with emerging social and governance insights (Leipold et al., 2023). This integration is essential in fostering inclusive

and equitable CE strategies that genuinely address the complexities of sustainable development (Calisto Friant et al., 2023). The future of the CE discourse thus hinges on its ability to transcend technical confines and embrace a holistic approach that acknowledges and actively incorporates the diverse social, political, and governance dimensions, ensuring a more equitable and sustainable path forward.

2.2.4 Research problem and introduction to the method

The above overview of these three dimensions shows how unstable the validity phase is in the circular economy as a concept. Indeed, failure in each dimension will significantly hamper the CE's capacity to be a revolutionary concept capable of comprehensively dealing with sustainable development. Neglecting any of the four knowledge perspectives will have indefinite negative consequences in the CE definitional debate, leading to an inevitable collapse of the concept. In addition, denying citizenship to a discourse implies disengaging with a specific community of scholars and practitioners. This will eventually diminish the impact of the CE transition. From the geographical perspective, scholars and practitioners must fully understand the interaction between the three levels to deliver a comprehensive CE transition. Indeed, without a complete comprehension by single stakeholders of the role of micro-level actions, macro-level and meso-level initiatives will inevitably become empty policies. In contrast, single actions by stakeholders must be framed into macro-level policies guided by higher-order knowledge perspectives to avoid fragmentation and prevent CE from being reduced to a general buzzword used without precision. Lastly, persistently overlooking the social and governance dimensions will inevitably reduce the width and impact of CE policies, leading to an inevitable collapse of the CE concept and the fragmentation of practices into thousands of irrelevant and disconnected initiatives.

As outlined in in chapter 1, this chapter aims to explore the current state of the CE literature and to answer to the first two research sub-questions. Indeed, the goal is to understand whether the CE concept is still in its validity phase or, instead, has evolved into a coherent concept, become a permanent issue, or has collapsed. Different scholars have tried to summarise the theoretical perspectives on, and approaches to, the CE. The first approach to this synthesis operation is to deliver a subjective literature review with a high level of expertise (Geisendorf & Pietrulla, 2018; Ghisellini et al., 2016; Kirchherr et al., 2017). Another approach is to eliminate any degree of subjectivity as much as possible to try to ensure that themes and conceptual frameworks emerge inductively. This is the example of several systematic literature reviews, which have employed this kind of methodology to perform a comprehensive synthesis of several CE sub-topics, such as the relationship between CE and innovation (Suchek et al., 2021), the different variables influencing the supply chain (Govindan & Hasandic, 2018), the relationship with the Industry 4.0 concept (Rosa et al., 2020), and the policies implemented in the European Union (Mhatre et al., 2021).

As the performance analysis section will show, the sheer extensiveness of the CE literature has made it impossible to deliver a systematic literature review capable of restoring a comprehensive image of the field (Okoli, 2015). In addition to the systematic literature review methodology, some articles have employed machine learning and text mining methodology to make sense of the enormous quantity of articles produced in recent years and synthesise the literature with the lowest possible subjectivity (Mahanty et al., 2021; Singh et al., 2021). The methodological choice in the present study is the bibliometrics analysis approach, which allows a comprehensive analysis of the whole CE field, guaranteeing the necessary depth in terms of content analysis (Zupic & Čater, 2015). While there have been several previous attempts at performing a bibliometric analysis of the CE literature, these efforts have often fallen short due to overly restrictive filtering criteria that significantly narrowed the scope (Camón Luis & Celma, 2020; Goyal et al., 2021). Other bibliometrics have focused exclusively on specific facets of the CE, such as the geographical origins of the literature (Martinho & Mourão, 2020; Türkeli et al., 2018) or specific topics of interest (Dominko et al., 2023; Tsai et al., 2020). In departing from these approaches, the present bibliometric approach seeks to conduct a comprehensive analysis of the CE literature with the goals of unravelling how the different knowledge and

geographical perspectives outlined above have contributed to the historical evolution of the CE concept and of understanding the current state of its umbrella nature.

2.3 Methodology

Bibliometrics is "the application of mathematics and statistical methods to books and other media of communication" (Pritchard, 1969, p.348). The definition provided by Pritchard gives just a glimpse of the breadth of the bibliometrics methodology's scope and the variety of potential reasons for employing it (Donthu et al., 2021). Originally developed with the aim of indexing articles and their citations, the bibliometrics methodology has evolved to become a fundamental part of the "science of science", or more specifically, the study of science patterns through analysis of the impact, productivity, collaborative tendency, and several other research metrics of different research units ranging from individual scholars to countries (Fortunato et al., 2018; Mingers & Leydersorff, 2015). Indeed, even without any voluntary intention, scholars writing on a topic and submitting their work to one journal rather than another, or choosing to cite specific references, create an autonomous intellectual community whose theoretical boundaries and features can be identified and analysed through the different methodological perspectives offered by the data associated with the articles written (Wang & Barabási, 2021).

Additionally, the field of bibliometrics is not just limited to the analysis of citations and indexing but extends to various analytical techniques such as performance analysis and science mapping. Performance analysis involves assessing the productivity and impact of different research entities, including individual researchers, institutions, and countries. This aspect focuses on quantitative metrics such as publication counts and citation analysis to measure research output and influence. On the other hand, science mapping involves visualising scientific research's structural and dynamic aspects. This could include the study of co-citation networks, bibliographic coupling, and co-authorship patterns to understand the relationships and development within a scientific field (Zupic & Čater, 2015). These methods are crucial in providing a comprehensive understanding of the intellectual

structure of scientific domains and identifying emerging trends and potential research areas.

The bibliometric methodology has undergone a remarkable rise in popularity, having been increasingly employed beyond the scientometrics field and applied in all scientific areas (González-Alcaide 2021; Donthu et al. 2021). However, this popularity spike has often been accompanied by a general naivety in its use, raising an overall sense of suspicion around its rigour and usefulness (Hicks et al., 2015). Bibliometrics should not fall into the trap of being employed just for the sake of data availability but rather as part of a research design in which the quantitative analysis it offers should be accompanied by the qualitative analysis provided by scholars' expertise (Zupic & Čater, 2015). Moreover, scholars must resist the temptation to employ bibliometrics as an "accessible" version of a systematic literature review (SLR) or as a way to quickly get published (Bornmann et al., 2021). Indeed, while these two methodologies have partially overlapping goals and are increasingly conducted together, they have a different scope. Systematic literature reviews are adopted because of their ability to go deep into the literature about a specific and circumscribed concept. The price of this depth is the lack of breadth in terms of conceptual capture, with the balance of research moving more towards specificity. In contrast, bibliometrics allows a more holistic focus, with the possibility to draw a more comprehensive picture of a specific intellectual community (Ellegaard, 2018; Paul et al., 2021).

The approach taken in this chapter is aware of the specific features inherent to the bibliometrics method. Indeed, while widely used for evaluating academic literature, it presents several limitations. One significant limitation is its reliance on citation counts, which can be influenced by factors unrelated to the quality of the research, such as self-citations, collaboration networks, and varying citation practices across different fields. This can lead to skewed representations of the impact of different research units. Additionally, bibliometrics often fails to capture the nuanced intellectual contributions of individual researchers, as it primarily focuses on quantitative metrics rather than qualitative assessments. I tried to overcome this lack of qualitative insights by performing a thematic analysis of co-authorship and bibliographic coupling clusters. The method also struggles with the dynamic nature of scientific research, where citations can take time to accumulate, making it challenging to assess the immediate impact of newer publications. In the case of

Circular Economy as an umbrella concept, this could imply an underrepresentation of more recent approaches, such as Transformative discourses.

However, this methodology is the most well-equipped to capture the actual state of the CE umbrella concept, tracing its past and its present to make some predictions and give some insights about its future. In addition, the present work employed a combination of quantitative bibliometrics analysis with a deep and enriched qualitative analysis of the findings. Indeed, as outlined below in greater detail, the data obtained through academic search engines is coupled with a detailed inspection of the relevant journal articles to connect the results and analysis to the research questions underlying this chapter. In addition to the bibliometrics analysis, a qualitative interpretive analysis is also performed on the six literature clusters obtained through a bibliographic coupling approach (Palumbo et al., 2022).

2.3.1 Data collection

In order to gather a comprehensive dataset of all the literature produced on the circular economy and to exclude parallel concepts such as sustainability, I launched the search query (“circular *econom*”) in the Title, Abstract, and Keywords contained in the Scopus database. I chose this database because of its extended coverage of academic literature and its high degree of metadata precision (Mongeon & Paul-Hus, 2016; Singh et al., 2021). As a filtering option, I included only peer-reviewed articles published in English. The idea behind this search query was to include only the articles explicitly falling under the circular umbrella, such as complementary and evolutionary concepts as “circular bioeconomy”, and exclude all the works that could be potentially related to the circular metaphor but preferred not to use it. This relates to the circular economy's catalytic function and researchers' deliberate choice to fall under the bigger umbrella of the circular metaphor. Indeed, while in Chapter 1 we have acknowledged the proximity and partial overlap of the CE concept with other sustainability and environmental concepts, our focus is strictly on the Circular Economy and its evolution as an umbrella concept. The search was executed on 24th January 2023 and returned a dataset of 14,727 articles

2.3.2 Data preparation

For the data preparation stage, I imported the database into an Excel file to prepare the set of records for the performance analysis and the science mapping. Exporting large datasets of records implies several disambiguities, especially concerning authors' names. Indeed, researchers might use different spellings of their names, causing inconsistency across their production. However, due to the extensiveness of the dataset, I created a thesaurus for adjusting surnames only for the most productive authors, namely those who have published more than ten documents (271 authors out of 46,440). The same has been done for the organisations, including only those with more than 15 documents (471 organisations).

2.3.3 Data analysis

Bibliometric methods are usually employed for their wide range of specific applications to review a domain, a theory, a methodology, or a journal (Paul et al., 2021). In order to build a comprehensive picture of the CE intellectual community and the knowledge accumulated over the years, I preferred a multifaceted approach by combining the performance analysis of several research units with two different science mapping analyses on authors and articles.

The performance analysis of a research unit is mainly focused on its productivity and impact, with a current debate about how best to measure these two characteristics (Mingers & Leydersorff, 2015; Ruiz-Castillo & Costas, 2015). On the impact, the literature is quite unanimous in using citations as the primary proxy, with different variations of the concept used to depict a complete picture of a research unit's impact that ranges from the raw number of citations received to various normalisation measures (Waltman, 2016; Mingers & Yang, 2017). On the other hand, productivity is the measure of the knowledge that a research unit brings to a field, with the number of publications often used as the primary indicator to evaluate how productive a research unit has been (Wang & Barabási, 2021).

I first analysed the citation structure of the CE field, trying to depict the evolution patterns in terms of the productivity and impact of the entire set of articles. Moreover,

attention focused on analysing the performance of the authors within the JPART community. Indeed, I identified the most influential authors using publications and citations and the overall evolution of CE authorship. In addition, I identified the most productive and impactful journals of the field, highlighting the different thematic areas they come from. Lastly, I explored the profile of institutions and countries that have contributed to building the CE community.

Secondly, I adopted a science mapping approach to identify any possible relational pattern between the research units under analysis (Chen, 2017). Indeed, alongside the evaluation profile offered by the performance analysis, bibliometric methods allow a holistic view of the intellectual structure of a specific community to be established by analysing the different relationships and connections happening within it (van Eck et al., 2010). This approach examines the relationships between a specific community's distinct research units to depict and analyse its cognitive structure (Cobo et al., 2011). This science map focuses on identifying the intellectual structure of a community from different perspectives by building different bibliographic networks based on the specific relationships between the research units of interest (Zupic & Čater, 2015).

A detailed and comprehensive science map must be built on a combination of different perspectives on an intellectual community (Bu et al., 2017). The science map toolbox includes several analyses: the co-authorship analysis, built on the co-authoring relationship between research units (Glänzel & Schubert, 2005); the bibliographic coupling analysis, with research units connected by references cited by themselves (Kessler, 1963); the co-citation analysis, where research units are linked by being referred together by the same research unit (Small, 1973); the co-word analysis, in which topics are identified by being cited together by the same research unit; and the main path analysis, which aims to identify how the knowledge flows in a specific intellectual community (Hummon & Dereian, 1989). All these analyses rely on the construction of a network in which the nodes represent the research unit under analysis, and the ties between them are the specific relationship in which researchers are interested, which can be analysed using a Social Network Analysis (SNA) methodology (Borgatti et al., 2018)

In order to draw a comprehensive map of the CE field and its intellectual structure, I decided to adopt two different science mapping analyses. The first one I performed was the co-authorship analysis focused on authors. This analysis is considered a reliable method to explore the collaboration patterns within a specific scholar community (Šubelj et al., 2019). Indeed, co-authorship is one of the possible ways to operationalise the composite phenomenon of research collaboration by clustering authors through their co-authoring, allowing the exploration of the existence of specific research communities (Henriksen, 2016).

For the co-authorship analysis, I created a weighted undirected network in which nodes represent the authors, and the ties between them are the documents. The weight of the ties is proportional to the number of documents published together and represents the strength of the relationship between two authors. The software employed for the analysis was VOSviewer for creating the network and the clusterisation, while I used Gephi for the network visualisation and analysis (van Eck & Waltman, 2010) (Bastian et al., 2009). I set a publication threshold of at least ten publications to reduce the huge number of 46,440 authors down to 393, which can be taken to represent the core of the most productive authors in the CE literature. I then set the minimum clusters size to at least three authors, deleting all the isolated nodes and the dyads from the network. I selected the Modularity option in VOSviewer (Newman, 2004) (Noack & Rotta, 2009) for the clusterisation algorithm. The selection of this criteria resulted in a network of 282 authors engaged in 771 co-authorship relations with other scholars within the CE community, distributed into 30 different clusters.

Once the network had been built, I analysed it both from a macro and a micro perspective. Regarding the former, I employed several network integrity measures to depict the global picture of the co-authorship network (see Tables 8, 9, and 10) (Diallo et al., 2016). A more detailed explanation of the measures employed is included in Table 1. Secondly, I analysed the titles and abstracts of the authors in their specific clusters to extract the main topics of these clusters and common themes. In addition to the macro level measures, I also explored the co-authorship community from an ego-network perspective, identifying the crucial nodes from different centrality perspectives. Centrality measures are usually

employed in an SNA to locate those nodes that occupy a more central position than others based on a specific phenomenon of interest.

The second analysis contributing to the depiction and exploration of the CE science map is the bibliographic coupling analysis. As was explained above, bibliographic coupling networks are formed by nodes representing a specific research unit of interest linked together by a common reference cited. In contrast to the co-authorship analysis, which is more focused on depicting the social side of a science map, the bibliographic coupling network analyses the knowledge side of an intellectual community (Boyack & Klavans, 2010). I selected bibliographic coupling analysis over co-citation analysis because it is based on static and time-independent signals, such as the references shared by the two articles are (Biscaro & Giupponi, 2014).

A bibliographic coupling analysis was performed by employing articles as nodes, creating a weighted undirected network as with the co-authorship analysis. I set two filter criteria to build a network analysable and meaningful relationships within it: first, a threshold of 100 citations was set for documents to be admitted, then a filter for an edge weight of at least five common references between two nodes was added. This allowed for reducing the number of articles admitted to the networks and analysing only the core of CE bibliographic coupling networks. Having set these criteria, I obtained a network of 232 nodes and 2211 edges, with the documents distributed into six different clusters. Unlike the co-authorship analysis, there is little interest in performing an SNA analysis on a bibliographic coupling network. Instead, I extracted the main themes and topics from the six clusters to picture the past and present research fronts of the CE knowledge community (Huang & Chang, 2014).

Table 1 - Network analysis measure

Measure	Definition
Density	Number of edges present in a network divided by the maximum possible number of edges
Diameter	Longest shortest path between any pair of nodes in a network

Component	Subset of the nodes of a network such that there exists at least one path from each member of that subset to each other member
Average Degree	Average value of degree centralities
Average Clustering Coefficient	Average of proportion of node's neighbours connected to each other
Average Path Length	Sum of the length of all shortest paths between pairs of nodes in the network, divided by the number of pairs of nodes
Closeness Centrality	Mean distance of from a node to other nodes
Betweenness Centrality	Number of times that a node lies on the shortest path between other nodes in a network

2.4 Results

2.4.1 Performance analysis

As the different cognitive perspectives outlined in the theoretical framework of this chapter have shown, the CE is a multifaceted phenomenon. This section aims to develop a holistic picture of the field, and attempts to match what is already known with some unknown patterns within and between research units.

The first research unit of the performance analysis section is the articles. Table 2 shows the citation structure of the CE literature as filtered with the inclusion criteria outlined above. The first interesting result is the beginning date of the literature, with the first research articles specifically mentioning the CE concept being written in 2004. This finding corroborates the historical development of the concept outlined above. Indeed, as the discussion above outlined, it was only after the construction of the CE theoretical roots and the emergence of the Circularity 1.0 and 2.0 discourses that the metaphor of CE was substantiated as an autonomous concept. This process happened outside the academic world in the early 2000s, with scholars continuing to analyse the phenomenon right after its empirical emergence. The evolution of field productivity confirms the evolution depicted by several literature reviews, as outlined in the CE umbrella concept evolution section. Indeed,

Figure 1 illustrates the skyrocketing increase in the number of articles related to the CE published in the 2010s, with 5074 articles published in 2022 alone, and 3261 articles already published in the first half of 2023.

Table 2 - Citation structure

Year	TP	TC	C/P	C/CP	TCP	AU/P
2004	3	25	8.34	8.34	3	1.7
2005	1	30	30	30	1	1
2006	8	697	87.13	99.58	7	3.2
2007	18	1352	75.12	75.12	18	2.1
2008	10	885	88.5	88.5	10	2.7
2009	17	1098	64.59	73.2	15	3.8
2010	14	1258	89.86	114.37	11	3.6
2011	12	1373	114.42	114.42	12	4.5
2012	27	1728	64	72	24	3.5
2013	35	2036	58.18	61.7	33	3.1
2014	55	3231	58.75	64.62	50	2.8
2015	87	6807	78.25	83.02	82	3.4
2016	222	19803	89.21	95.21	208	3.5
2017	471	35667	75.73	78.91	452	3.9
2018	877	51098	58.27	59.7	856	4
2019	1404	57485	40.95	42.43	1355	4.2
2020	2390	72120	30.18	31.53	2288	4.5
2021	4000	67143	16.79	17.68	3798	4.6
2022	5074	31723	6.26	7.51	4226	4.8
2023	3261	3414	1.05	2.78	1229	4.9

TP = Total Publication - TC = Total Citations - C/P = Citation per Publication - C/CP = Citation per Cited Publication - TCP = Total Cited Publication - AU/P = AAuthor per Publication

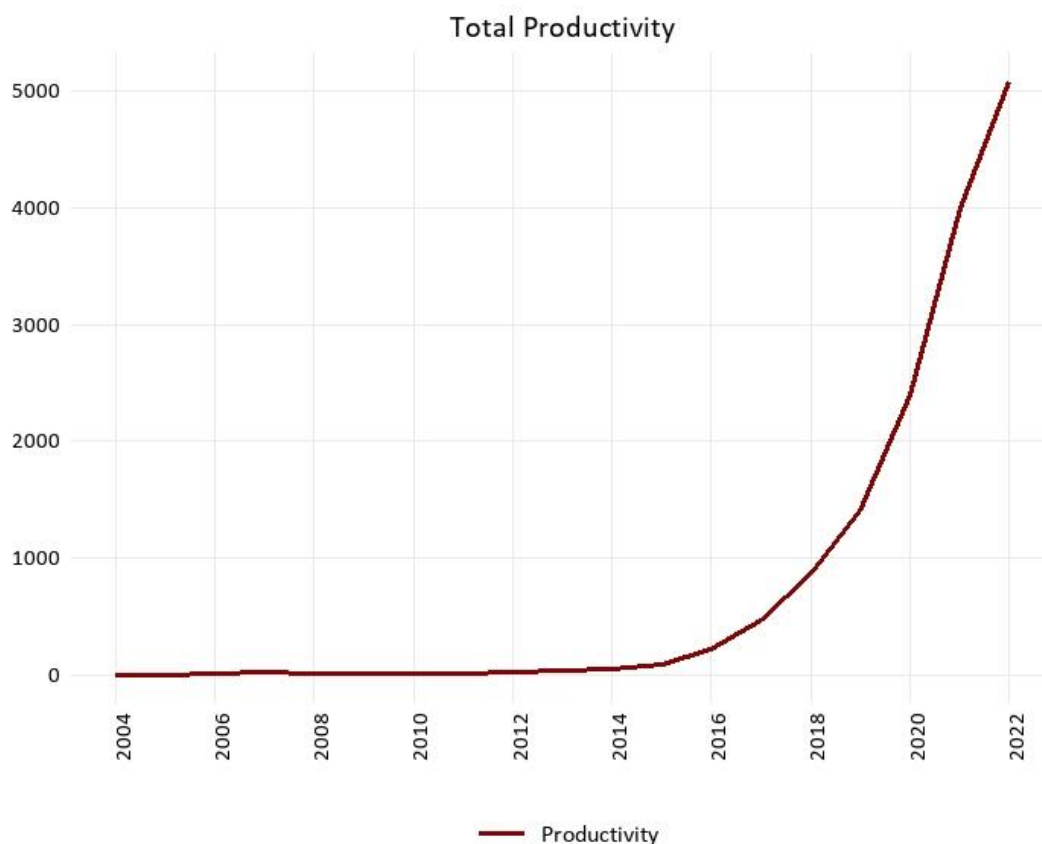


Figure 1 - Total productivity evolution

In addition to increased productivity, the CE field has also expanded in terms of impact. Figure 2 depicts the evolution of citations cumulated by the CE field over approximately the last 20 years. It shows how the evolution of the CE scholarship's productivity and impact follow the same soaring trajectory, expounding how the growth in terms of quantity of the CE field has occurred in parallel to its relevance. As further evidence of the increased impact of the CE as an academic concept, Figure 3 shows the citation means for each publication, with significant numbers for each of them. However, the inherently interdisciplinary nature of the CE concept hindered the possibility of conducting any citation normalisation to compare the impact of articles on annual scientific trends (Abramo and D'Angelo 2014).

An interesting finding highlighted by Figures 2 and 3 is the fall in impact, both in absolute and relative terms, in the last five years, which could be explained in several ways. A first, unrelated to the field explanation, is that citations need some time to accumulate. Indeed, it is common practice in the information science field to either exclude the last three to five years due to unreliability or to use a citation windows approach to gain a more stable dataset (Aksnes et al., 2019; Waltman, 2016). An alternative interpretation is that the overabundance of productivity witnessed during this timeframe has made it very difficult for researchers to be up-to-date with the literature, meaning they concentrate on the most well-known articles or authors and neglect the contributions of others. A third possible rationale is that the increased attention towards the CE and the rising number of articles have inevitably led to a decrease in the quality of research, with many papers not cited due to their poor quality.

A last comprehensive snapshot of the research articles in the CE field concerns the subject areas from which both the articles and their citations come. This analysis could represent additional evidence of the dominance of technical knowledge over the social dimension, or an empirical overturning of this assumption. While subject areas undoubtedly represent a simplification of academic knowledge, especially in light of the interdisciplinary nature of CE, they can still be useful as a proxy to understand the positioning of a concept (Ni et al., 2017). In Table 3, the dominance of STEM-related sciences is evident. Economic and social sciences represent just a tiny portion of the total percentage, accounting for 19.5% and 15.3% of research articles and their citations, respectively.

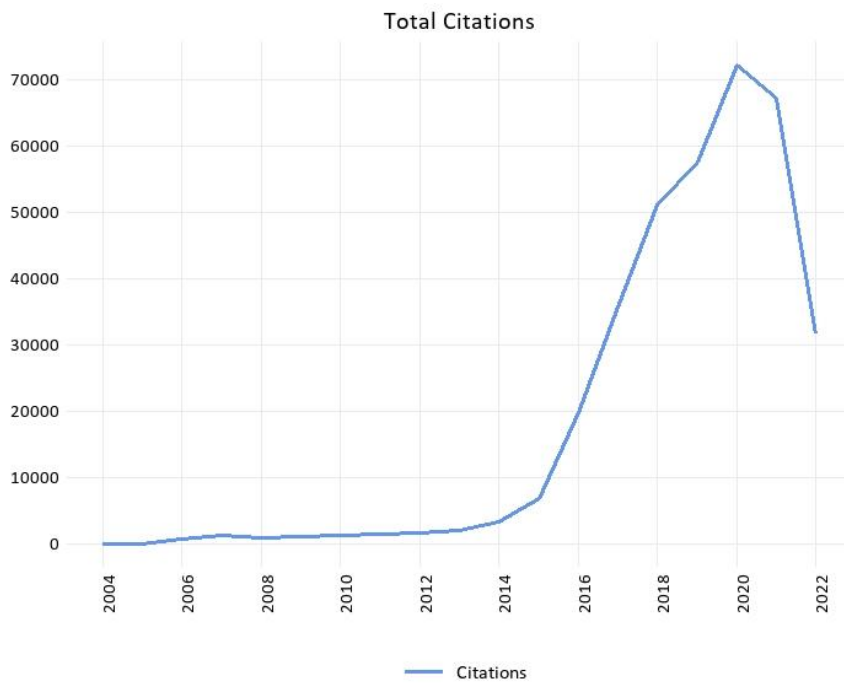


Figure 2 - Total Citations

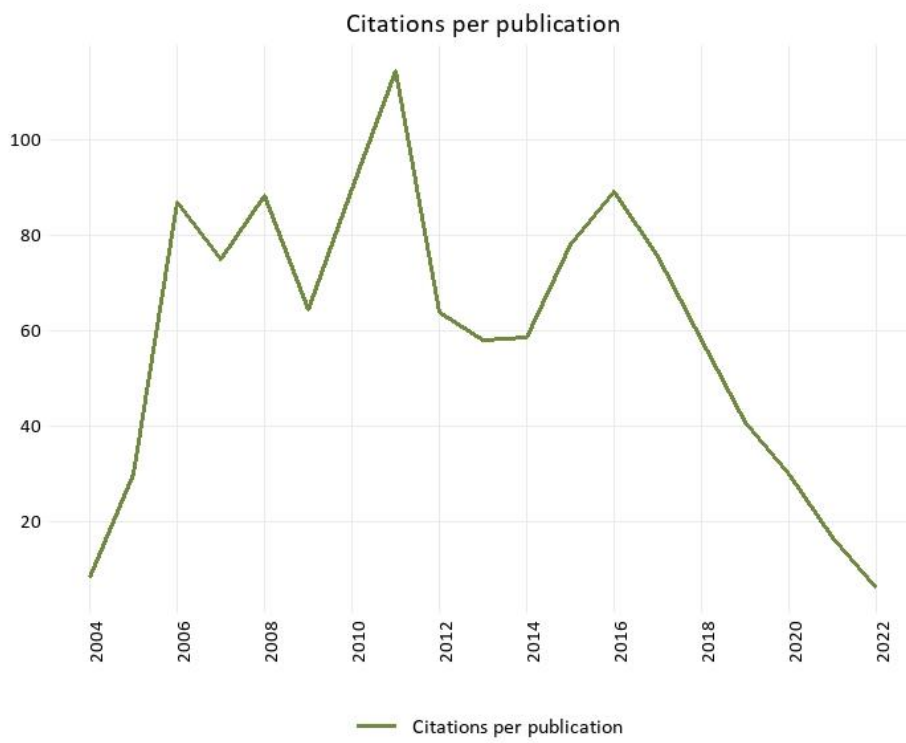


Figure 3 - Citations per publication

Table 3 - Subject areas

Subject area	TP	TC
Environmental Science	8335	35401
Engineering	4524	23848
Energy	4750	21329
Social Sciences	2984	12407
Chemical Engineering	1859	11704
Chemistry	1462	10063
Materials Science	1606	10038
Business, Management and Accounting	2522	9535
Agricultural and Biological Sciences	1311	8272
Computer Science	1139	7602
Biochemistry, Genetics and Molecular Biology	776	5001
Economics, Econometrics and Finance	1062	4089
Physics and Astronomy	567	4026
Mathematics	400	3375
Medicine	394	2671

In addition to a more holistic picture of CE articles, I identified the 15 most-cited articles. As Table 4 shows, the vast majority (nine out of 15) of these articles are reviews. Indeed, the plethora of research and the umbrella nature of the CE, with all its different cognitive perspectives outlined in the theoretical framework, mean that their reviews are valuable for several audiences: CE scholars who want to keep up with the literature, practitioners looking for periodical updates, and people outside the field wishing for a comprehensive depiction without the necessity of reading a vast amount of research. The other six articles are either theoretical papers exploring some conceptual aspects of the CE (4, 5, and 13) or papers engaged in empirical research (10, 12, and 15). Another key finding, which will be confirmed in the journals' performance analysis, is the subject area from which the articles come. Indeed, except for Murray et al. (2017), all the other papers are related to

STEM-related or hard sciences. This is further proof of the general neglect, or at least the common overlooking, of the social dimension and the dominance of technocratic or reformist discourses.

Table 4 - Most Cited Articles

Authors	Title	Source title	TP
Geissdoerfer et al. (2017)	The Circular Economy – A new sustainability paradigm?	Journal of Cleaner Production	2924
Kirchherr et al. (2017)	Conceptualizing the circular economy: An analysis of 114 definitions	Resources, Conservation and Recycling	2674
Ghisellini et al. (2017)	A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems	Journal of Cleaner Production	2632
Korhonen et al. (2018)	Circular Economy: The Concept and its Limitations	Ecological Economics	1513
Bocken et al. (2016)	Product design and business model strategies for a circular economy	Journal of Industrial and Engineering Production	1448
Murray et al. (2017).	The Circular Economy: An Interdisciplinary Exploration of the Concept and Application in a Global Context	Journal of Business Ethics	1317
Lieder & Rashid (2017)	Towards circular economy implementation: A comprehensive review in context of manufacturing industry	Journal of Cleaner Production	1302
Tukker (2015)	Product services for a resource-efficient and circular economy - A review	Journal of Cleaner Production	1087
Swain (2017)	Recovery and recycling of lithium: A review	Separation and Purification Technology	815
Grey & Tarascon (2016)	Sustainability and in situ monitoring in battery development	Nature Materials	806
Su et al. (2013)	A review of the circular economy in China: Moving from rhetoric to implementation	Journal of Cleaner Production	779

Sheldon et al. (2017)	The: E factor 25 years on: The rise of green chemistry and sustainability	Green Chemistry	768
Lewandowski (2016)	Designing the business models for circular economy-towards the conceptual framework	Sustainability (Switzerland)	739
Genovese et al. (2017)	Sustainable supply chain management and the transition towards a circular economy: Evidence and some applications	Omega (United Kingdom)	727
Mirabella et al. (2014)	Current options for the valorization of food manufacturing waste: A review	Journal of Cleaner Production	709

The authors who have built the CE community are the **second research unit under analysis**. An initial exploration of CE authorship concerned the number of authors per article. Multi-authorship is commonly considered a suitable proxy and a higher rung of the collaboration ladder (Laudel, 2002). Indeed, the last 20 years have witnessed a general increase both in multiauthored articles and the number of authors per article (Kuld & O'Hagan, 2018). The reasons for this phenomenon are multiple: the increasing accumulation of knowledge, the increasing scientific specialisation of researchers, the "publish or perish" mentality, and the diminished costs of collaboration due to ICT technologies, among others (Corley and Sabharwal, 2010; Fell and König, 2016; Katz and Martin 1997). As can be seen from the citation structure (Table 2), the CE field is not exempt from this phenomenon.

Indeed, taking 2016 as the first year in which the CE field amassed a significant number of articles, a rise from 3.5 authors per article to almost 5 in 2022 and 2023 can be observed. Furthermore, the overall proportion of single-authored articles is very low, with just 6.5% of articles, much lower than the findings of similar bibliometrics (Arroyo-Moliner et al., 2017; Larivière et al., 2015). A possible explanation drawn from the bibliometrics literature is connected to the dominance of technical knowledge within the CE field. Indeed, evidence shows how STEM-related articles generally have more authors per article than social sciences articles, confirming previous findings highlighting hard sciences dominance in the CE discourses (Rojko & Lužar, 2022).

In parallel to what was done for the research articles, I also identified the most productive authors in the CE field. Table 5 presents an overview of the institutions and countries associated with the most prolific authors. The first relevant finding is the massive presence of Asian countries, with the first five most productive authors coming from Asian institutions. This links with what was delineated in the "Geographical perspectives" section, with China identified as a leading country in the CE field. In addition, the presence of several European institutions confirms European countries' interest in the CE concept. British or Dutch institutions are unexpectedly absent.

Table 5 - Top 15 productive authors

Author	TP	Institution	Country
Seeram Ramakrishna	42	National University of Singapore	Singapore
Geng Yong	37	Shanghai Jiao Tong University	China
Ashok Pandey	36	Indian Institute of Toxicology Research	India
Jo-Shu Chang	34	Tunghai University	Taiwan
Wei-Hsin Chen	33	National Chenmg Kung Unviersity	Taiwan
Jiří Jaromír Klemeš	33	Brno University of Technology	Czech Republic
Yigit Kazancoglu	32	Yasar University	Turkey
Sergio Ulgiati	31	Parthenope University of Naples	Italy
José Luis Cortina	30	Polytechnic University of Catalonia	Spain
Pau-Loke Show	30	University of Nottingham Malaysia	Malaysia
Mohammad J. Taherzadeh	39	University of Borås	Sweden
Vincenzo Torretta	29	University of Insubria	Italy
Antonis A. Zorpas	29	Open University of Cyprus	Cyprus
Tânia Forster Carneiro	28	State University of Campinas	Brazil
Daniela C.A. Pigozzo	28	Technical University of Denmark	Denmark

Moving onto a more structured level, I picked journals as the third research unit under analysis. Publishing in one journal rather than in another is a deliberate choice of an author or a group of authors, which demonstrates their desire to engage with and contribute to a specific scholarly community actively. In line with the previous methodology, I singled out the top 15 most productive and cited journals in the CE literature to gain insights into the critical communities within this field. Table 6 confirms the evidence from the previous research units, with the overwhelming majority of most productive and impactful journals found in the "Physical Sciences" subject area of Scopus. However, it is notable that the two

most-cited journals are also in the “Social Sciences” area, namely the “Journal of Cleaner Production” and the “Journal of Industrial Ecology”. If citations are accepted as a meaningful way of measuring the impact in a field, then this is promising evidence that scholars to engage in interdisciplinary research on CE and not focus solely on technical knowledge. This result is not surprising, as six of the 15 most cited journals analysed above were published in the “Journal of Cleaner Production”, with review articles attracting the most significant number of citations.

Table 6 - Top 15 most cited and productive journals

Source	Subject Areas	TP	TC
Sustainability Switzerland	Social Sciences; Environmental Sciences; Computer Science; Engineering; Energy	1364	17886
Journal Of Cleaner Production	Business, Management and Accounting: Strategy and Management; Environmental Science: General Environmental Science; Engineering: Building and Construction, Industrial and Manufactural Engineering	1321	56743
Resources Conservation And Recycling	Economics, Econometrics and Finance: Economics and Econometrics; Environmental Science: Waste Management and Disposal	466	21329
Science Of The Total Environment	Environmental science: Environmental Engineering, Pollution, Waste Management and Disposal, Environmental Chemistry	271	6757
Waste Management	Environmental Science: Waste Management and Disposal	265	7124
Energies	Mathematics: Control and Optimization; Energy: Energy Engineering and Power Technology, Energy (miscellaneous), Fuel Technology, Renewable Energy, Sustainability and the Environment; Engineering: Engineering (miscellaneous), Building and Construction, Electrical and Electronic Engineering	264	2478
Journal Of Environmental Management	Environmental Science: Management, Monitoring, Policy and Law, Environmental Engineering, Waste Management and Disposal	212	4399

Bioresource Technology	Environmental Science: Environmental Engineering, Waste Management and Disposal; Energy: Renewable Energy, Sustainability and the Environment; Chemical Engineering: Bioengineering	202	7929
Applied Sciences Switzerland	Engineering: General Engineering; Physics and Astronomy: Instrumentation; Computer Science: Computer Science Applications; Chemical Engineering: Fluid Flow and Transfer Processes, Process Chemistry and Technology; Materials Science: General Materials Science	179	1444
Materials	Materials Science: Materials Science (miscellaneous); Physics and Astronomy: Condensed Matter Physics	169	1806
Sustainable Production And Consumption	Engineering: Industrial and Manufacturing Engineering; Environmental Science: Environmental Engineering, Environmental Chemistry; Energy: Renewable Energy, Sustainability and the Environment	163	2017
Journal Of Industrial Ecology	Social Sciences: General Social Sciences; Environmental Science: General Environmental Science	149	5239
Environmental Science And Pollution Research	Environmental Science: Health, Toxicology and Mutagenesis, Pollution, Environmental Chemistry	143	1495
Business Strategy And The Environment	Social Sciences: Geography, Planning and Development; Environmental Science: Management, Monitoring, Policy and Law; Business, Management and Accounting: Strategy and Management	142	2340
ACS Sustainable Chemistry And Engineering	Chemical Engineering: General Chemical Engineering; Environmental Science: Environmental Chemistry; Chemistry: General Chemistry; Energy: Renewable Energy, Sustainability and the Environment	141	2127

On a macro-level of analysis, institutions and countries become helpful in identifying the most engaged organisations and where they are located, and testing what is outlined in the “Geographical perspectives” section. The expectation of finding European and Chinese institutions was mostly confirmed, as shown in Table 7. Indeed, the most productive institutions are all European, except for the Chinese Ministry of Education, the Chinese Academy of Science, and the Universidade de São Paulo in Brazil. Turning to countries, the most productive in the academic field of CE are generally more engaged in the circular transition. Indeed, Italy, the United Kingdom, China, and the Netherlands host the most productive academic communities.

Table 7 - Top 15 productive institutions

Organization	Country	TP
Delft University of technology	The Netherlands	214
Consiglio Nazionale delle Ricerche	Italy	189
Technical University of Denmark	Denmark	140
CNRS Centre National de la Recherche Scientifique	France	136
Universita degli Studi di Napoli Federico II	Italy	130
Politecnico di Milano	Italy	130
Universidade de Aveiro	Portugal	130
Universidade do Porto	Portugal	128
Aalto University	Finland	128
Chinese Academy of Sciences	China	124
Universiteit Gent	Belgium	118
The Royal institute of Technology KTH	Sweden	117
Consejo Superior de Investigaciones Cientificas	Spain	117
Ministry of Education China	China	115
Alma Mater Studiorum Unviersita di Bologna	Italy	115

2.4.2 Science mapping

Co-authorship

As outlined in the data analysis section, the co-authorship network of authors built in this study comprises a total of 282 authors, with 771 edges distributed in 30 clusters. The size of the giant component is 257 authors with 741 edges, with 91.1% nodes, which is much larger than the networks in previous bibliometrics (González-Alcaide 2021; Tang et al., 2017). This is mainly the result of the filter applied to the initial network. Indeed, setting a

threshold of at least ten publications to be admitted to the network and eliminating all the dyads to identify just the core of the CE authorship was done to create a better analysable network and focus on the most prominent authors in the field. The disadvantage of this approach is the danger of possibly overlooking new research fronts and clusters composed of authors with less than ten publications.

The first measure used to analyse the co-authorship network of authors was density. As Table 8 shows, the density of the whole network is 0.019, which means that only 1.9% of all possible relationships between nodes actually exist. The situation is similar for the giant component, with a density of 0.0023. Nevertheless, these results are not dissimilar from the other bibliometrics and social network analyses (Arroyo-Moliner et al., 2017). Indeed, networks in real life are usually very sparse, and density values are inversely proportional to the size of a network (Newman, 2018)

Following the density, another two macro-properties of a network are the diameter and the average path length, which measure the efficiency and the ease within a network for faster and more direct communication between nodes. As Table 8 illustrates, the results from these measures depict a community of authors who are very sparse and not highly efficient in communicating between clusters, very far from achieving a small-world effect (Watts & Strogatz, 1998). Indeed, a comparison with other bibliometrics results shows that the CE community is still highly siloed, with clusters highly specialised in specific themes without any movement towards a more holistic pictures of the CE concept (Liu & Xia, 2015; Tang et al., 2017).

Moreover, this study also analysed the average degree of the CE authors' co-authorship network, which measures how many co-authors each node has on average. The value of 4.88, as shown in Table 8, means that each node has, on average, almost five co-authors, with very similar numbers between the whole network and the giant component. This is because the overwhelming majority of authors belong to the giant component, with just 25 authors outside it. This result confirms the findings of the multiauthorship analysis outlined above.

Table 8 – Co-authorship network measures

	Whole Network	Giant Component
Size (nodes)	282	257
Size (edges)	771	741
Density	0.016	0.023
Diameter	18	18
Components	8	1
Average Degree	5.47	5.78
Average Clustering Coefficient	0.573	0.536
Average Path Length	5.98	5.98

Moving on to take a more detailed perspective, networks could also be analysed from the perspectives of single nodes through the use of several measures. Generally, the most employed ones are the centrality measures that aim to identify the central nodes from different angles (see Table 1 for a more detailed explanation). When comparing the tables of the most productive authors (see Table 5) with those of betweenness and closeness centrality measures (see Tables 9 and 10), almost no overlap is observed between them. Indeed, only Ashok Pandey appears both as one of the most productive authors in the CE community and as a pivotal node within the CE co-authorship network, both in terms of closeness centrality and betweenness centrality. A possible interpretation of these results could be that the authors who publish the most are more focused on their specific topics and clusters, without recognising the need or the possibility to act as a bridge, as in the case of betweenness centrality, or as a catalyst, as with the closeness centrality.

Table 9 - Top 15 authors for Betweenness Centrality

Author	Betweenness centrality	Institution	TP	TC	Cluster
Archana Jain	0.171778	Zuniy Medical University	11	466	3
Su Shiung Lam	0.135337	Unviersity Malaysia Terenggan	20	313	7
Mohammad J. Taherzadeh	0.134776	University of Borås	22	869	1
Shahbaz Khan	0.130316	GLA University	12	319	3

Paolo Rosa	0.11937	Politecnico di Milano	18	1494	4
Piergiuseppe Morone	0.105109	University of Sapienza of Rome	13	335	4
Andrea Urbinati	0.104361	LIUC Università Cattaneo	15	1116	4
Ashok Pandey	0.085465	CSIR-Indian Institute of Toxicology Research	27	871	1
Pau-Loke Show	0.076126	University of Nottingham, Malaysia	17	529	18
Mukesh Kumar Awasthi	0.073621	Northwest A&F University	17	801	1
Davide Chiaroni	0.073334	Politecnico di Milano	13	1080	4
Daniel C.W. Tsang	0.065337	The Hong Kong Polytechnic University	20	941	1
Morten Birkved	0.064273	University of Southern Denmark	15	409	7
Evina Katsou	0.062532	Brunel University	125	685	11
Tim C. McAloone	0.062532	Technical University of Denmark	21	1143	14

Table 10 - Top 15 authors for Closeness Centrality

Cluster	Closeness Centrality	Institution	TC	TP	Cluster
Su Shiung Lam	0.394718	Unviersity Malaysia Terenggan	313	20	7
Ashok Pandey	0.39164	CSIR-Indian Institute of Toxicology Research	871	27	1
Mohammad J. Taherzadeh	0.366166	University of Borås	801	17	1
Mukesh Kumar Awasthi	0.365236	Northwest A&F University	869	22	1

Pau-Loke Show	0.362662	University of Nottingham, Malaysia	529	17	18
Sindhu Raveendran	0.356228	TKM Institute of Technology	285	17	1
Ranjna Sirohi	0.355283	University of Petroleum and Energy Studies	496	15	1
Wei-Hsin Chen	0.352631	National Cheng Kung University	578	23	6
Meisam Tabatabaei	0.349515	Universiti Malaysia Terengganu	448	17	7
Binod Parameswaran	0.345454	CSIR-NIIST	223	12	1
Sunita Varjani	0.342755	City University of Hong Kong	615	20	1
Archana Jain	0.341667	Zuniy Medical University	466	15	3
Daniel C.W. Tsang	0.339833	The Hong Kong Polytechnic University	941	20	1
Mortaza Aghbashlo	0.335192	University of Tehran	409	19	7
Karthik Rajendran	0.332758	SRM University-AP	297	11	1

Lastly, a thematic analysis was performed on the 30 clusters composing the co-authorship network of CE authorship. First, the main topics within each cluster were extracted, and the titles and abstracts of authors belonging to a specific cluster were analysed. After that, the analysis attempted to summarise the findings by identifying some cross-topics, reconducting them to the knowledge perspectives outlined in the theoretical framework sub-section. As is seen in Table 11, three main topics could be extracted, around which CE authorship focused their knowledge production. The most significant and influential topic unites all the clusters that focus on how to use waste as a resource and on developing the necessary technical knowledge to recycle waste most efficiently from a CE perspective. This topic is strongly linked to the theoretical roots of the CE, in particular to the technocentric Circularity 2.0 discourse and to a limited view of the R principles. Indeed,

the 20 clusters in this topic focused on recycling perspectives and the primacy of scientific knowledge in a limited and partial CE transition in the agricultural, biochar, or construction industries, with little mention or consideration of any social dimension or framing of these industrial transitions into systemic thinking.

The second main topic, composed of eight clusters, conveys a more comprehensive image of the CE, by focusing on how to help businesses and industries to develop more circular business models. In particular, the two main focuses of this main topic are how to redesign the supply chain circularly and how specific new industrial models, such as Industry 4.0, could help a circular transition. These topics fall under the umbrella of a reformist Circularity 3.1, where proponents of this vision are conscious of the necessity of systemic changes such as the complete redesign of business models, but fail to incorporating other stakeholders or any social and governance discussion. The last topic is formed by just the fifth and twenty-eight clusters, and takes a broader and systemic perspective on how several stakeholders and places could change to move towards a circular transition. These two clusters do not pertain to a specific discourse, but rather, they try to encompass the CE field and practice as a whole.

Table 11 - Co-authorship network clusters

Cluster	Description of the cluster	Representative papers
Cluster 1	The cluster is focused on how to use waste from the agri-food industry in a more circular way.	Kumar et al. (2021) "A critical review on biochar for enhancing biogas production from anaerobic digestion of food waste and sludge";
Cluster 2	This cluster explores the dynamics of businesses and models in adapting to circular models	Jabbour et al. (2019) "Unlocking the circular economy through new business models based on large-scale data: An integrative framework and research agenda"
Cluster 3	As with the Cluster 2, the authors in this cluster work on how to change actual supply chains and businesses for a circular transition	Mangla et al. (2018) "Barriers to effective circular supply chain management in a developing country context";
Cluster 4	The cluster's authors investigated multiple aspects of businesses moving towards CE, like performance and Life Cycle Assessment evolution	Sassanelli et al. (2019) "Circular economy performance assessment methods: A systematic literature review"
Cluster 5	This cluster portrays a broader perspective on CE, analysing different aspects for a holistic CE transition	Kirchherr et al. (2017) "Conceptualizing the circular economy: An analysis of 114 definitions"; Calisto Friant et al. (2020) "A typology of circular economy

		discourses: Navigating the diverse visions of a contested paradigm”
Cluster 6	This cluster concentrates on how to deal with marine and seafood waste	Leong et al. (2021) “Reuniting the Biogeochemistry of Algae for a Low-Carbon Circular Bioeconomy”
Cluster 7	The authors of this cluster analyse both the CE transition of agricultural waste and the LCA of several kind of waste	Chia et al. (2020 “Sustainable utilization of biowaste compost for renewable energy and soil amendments”;
Cluster 8	The cluster production revolves around how to make waste management more circular	Usmani et al. (2021) “Minimizing hazardous impact of food waste in a circular economy – Advances in resource recovery through green strategies”
Cluster 9	This cluster’s authors focus specifically on food industry waste	Faustino et al. (2019) “Agro-food byproducts as a new source of natural food additives”
Cluster 10	The cluster is prevalently focused on food waste and WEEE	Isildar et al. (2018) “Electronic waste as a secondary source of critical metals: Management and recovery technologies”
Cluster 11	The cluster concentrates on different types of waste and how to valorise and manage them in a more circular way	Ferronato et al. (2019) “How to improve recycling rate in developing big cities: An integrated approach for assessing municipal solid waste collection and treatment scenarios”
Cluster 12	Authors in this cluster dedicate to municipal solid waste, both from a recycling and reducing perspective	Kurniawan et al. (2022) “Transformation of Solid Waste Management in China: Moving towards Sustainability through Digitalization-Based Circular Economy”
Cluster 13	The cluster focus is on the reducing and the recycling of food waste	Osman et al. (2019) “Reusing, recycling and up-cycling of biomass: A review of practical and kinetic modelling approaches”
Cluster 14	The authors in this clusters are mainly focused on the business side of CE and how to measure the performance of business in a CE	Pieroni et al. (2019) "Business model innovation for circular economy and sustainability: A review of approaches."
Cluster 15	This cluster explores the relationship between waste (especially agrifood and seafood waste) and businesses	Koutinas et al. (2014) “Valorization of industrial waste and by-product streams via fermentation for the production of chemicals and biopolymers”
Cluster 16	This cluster revolves around the bioeconomy, in particular on how “circularize” algae and biomass	Ruiz et al. (2013) “Hydrothermal processing, as an alternative for upgrading agriculture residues and marine biomass according to the biorefinery concept: a review”
Cluster 17	The authors in this cluster split their focus between seafood waste and housing efficiency	Hertwick et al. (2019) “Material efficiency strategies to reducing greenhouse gas emissions associated with buildings, vehicles, and electronics—a review”
Cluster 18	The knowledge production of this cluster is mostly similar to the Cluster 16	Shanmugam et al. (2021) “Circular economy in biocomposite development: State-of-the-art, challenges and emerging trends”

Cluster 19	This cluster generally deal with the waste as a potential resource for the economy, ranging from Municipal solid waste to food	Chojnacka et al. (2023) "Management of biological sewage sludge: Fertilizer nitrogen recovery as the solution to fertilizer crisis"
Cluster 20	The authors of this cluster are specialized in analysing on how to use mining waste as a potential resource	Tesfaye et al. (2017) "Improving urban mining practices for optimal recovery of resources from e-waste"
Cluster 21	The authors of this cluster adopt a broader perspective on how businesses could change towards a more circular business model, beyond mere recycling	Barros et al. (2021) "Circular economy as a driver to sustainable businesses"
Cluster 23	Similar to Cluster 21, this cluster revolves around several organizational and business aspects of a CE transition	Gusmerotti et al. (2019) "Drivers and approaches to the circular economy in manufacturing firms"
Cluster 24	A cluster mostly focused on how to deal with the waste produced within cities, with a focus on how to measure the urban metabolism	Zorpas et al. (2021) "Waste strategies development in the framework of circular economy"
Cluster 26	The authors of this cluster try to understand the role of fuel in a sustainable circular transition	Shehata et al. (2022) "Role of refuse-derived fuel in circular economy and sustainable development goals"
Cluster 27	The knowledge of this cluster is focused on how to deal with byproducts in the waste management process	Terrones-Saeta et al. (2020) "Study of the incorporation of ladle furnace slag in the manufacture of cold in-place recycling with bitumen emulsion"
Cluster 28	The authors in this cluster try to go beyond technical knowledge of CE, adopting broader perspective such as the urban circular transition or the future of CE as an academic field	Petit-Boix and Leipold (2018) "Circular economy in cities: Reviewing how environmental research aligns with local practices"
Cluster 29	This cluster mainly focuses on byproducts of building industry and how to deal with them in the CE	Mabroum et al. (2020) "Elaboration of geopolymers based on clays by-products from phosphate mines for construction applications"
Cluster 30	This cluster couples with clusters 16 and 18 on biomass and algae research	Bilal et al. (2013) "Waste biomass adsorbents for copper removal from industrial wastewater—a review"
Cluster 32	The knowledge developed in this cluster vary from waste management to broader perspective on CE such as government and systemic thinking	Sompláka et al. (2019) "Implementation of circular economy through the mathematical programming for the complex system evaluation"
Cluster 33	This cluster mostly resonates the Cluster 32	Walmsey et al. (2019) "Circular Integration of processes, industries, and economies"

Bibliographic coupling

Regarding the bibliographic coupling of the CE field, articles were chosen as the unit of analysis, as outlined in the methodology section. Following the application of the 100 citations threshold for articles to be admitted and the five references in common for a relationship between two nodes, it was possible to identify six different clusters. As can be seen from the Table 12, the six clusters are equally distributed between a reformist Circularity 3.1 discourse and a technocratic Circularity 2.0 framework. This finding contrasts with the most impactful documents identified in Table 4, where it is possible to observe that the overwhelming majority of the most-cited articles in the CE field are reviewed and do not often present any specific technical knowledge. A potential explanation for this finding is the necessity for authors to form tight communities to develop specific and technical knowledge. Indeed, authors producing a literature review are not required to have already written and developed a theoretical framework about the topic reviewed. On the contrary, the development of theories and potential empirical applications of specific materials require the production of several papers among a tight community, for example, with the Orange Cluster and the Red Cluster.

Moving onto the analysis of the single clusters, it is notable that the six clusters are split between the reformist Circularity 3.1 discourses and technocratic Circularity 2.0 discourses. Indeed, the Violet, Blue, and Yellow clusters are all related to analysing and helping private stakeholders transition towards a CE. The authors' perspectives are quite narrow on the several challenges that industries and businesses face in changing their production and selling models from a linear mentality to a more circular one, possibly but not necessarily integrated with other societal stakeholders. This represents a broader and more comprehensive picture of what CE represents, but several critics have argued that such small and not revolutionary steps are not enough to deal with the sustainability issue that the CE promises to tackle, and that they will certainly continue to reproduce incoherent growth capitalist discourse and existing inequalities between different social classes and countries (Calisto Friant et al., 2020). The second group of clusters is strongly related to the co-authorship clusters' topic of the necessary technical knowledge to transition towards a CE. This finding confirms the dominance of current majority of technical knowledge and production-oriented perspectives within the CE scholarship. Indeed, what emerges from the

bibliographic coupling network analysis is also the absence of any formal knowledge community focused on a more transformational vision of a circular transition.

Table 12 - Bibliographic coupling network clusters

Cluster	Brief description of the cluster	Representative paper(s)	TP	TC
Violet Cluster	The larger cluster is focused on analysing how businesses and industries could redesign their model for a CE transition	Ibn-Mohammed et al. (2021) "A critical analysis of the impacts of COVID-19 on the global economy and ecosystems and opportunities for circular economy strategies"	81	12876
Green Cluster	The cluster is mostly oriented towards Circularity 2.0 discourses, with authors focusing on how to use and transform different types of waste to wealth	Ubando et al. (2020) "Sector perception of circular economy driver interrelationships"	69	10433
Blue Cluster	This is a multifaceted cluster, in which authors split between the performance assessment of several industries in the CE, agricultural waste recycling, and a broader perspective on sustainable development through CE	Moraga et al. (2019) "Circular economy indicators: What do they measure?"; Hartley et al. (2019) "Policies for transitioning towards a circular economy: Expectations from the European Union (EU)"	67	10675
Orange Cluster	The authors in this cluster dedicated their research to develop specific knowledge to the recycling of plastics, polymers and carbon fibres in the CE	Vollmer et al. (2020) "Beyond mechanical recycling: Giving new life to plastic waste"	59	9845
Yellow Cluster	A cluster strongly oriented at exploring new business models and advantages for businesses in a CE transition	Pieroni et al. (2019) "Business model innovation for circular economy and sustainability: A review of approaches"	43	7078
Red Cluster	This is a close-knit knowledge community focus on lithium and its possible use in a CE	Yang et al. (2021) "On the sustainability of lithium in battery industry—A review and perspective"	17	2556

2.5 Discussion and Conclusion

This chapter has aimed to explore the current umbrella concept nature of the CE and whether the concept has a future as an employable concept or is on its way to becoming a permanent issue or even a narrow and collapsed concept. Scholars and practitioners require a fundamental overview of the CE concept to understand its current state and future usability. Indeed, the idea behind this chapter was not only to build that comprehensive overview of the academic landscape but also to provide a knowledge base upon which to understand what kind of future the CE academic and practitioners' community might expect from the umbrella concept. In order to do that, the historical evolution of CE as an umbrella concept was traced, starting from the preamble period before eventually arriving at the validity phase. The chapter then outlined the three main challenges that CE as an umbrella concept must address if it is to transform into a coherent concept and avoid collapsing or becoming a permanent issue. Facing this challenge, I had several possible scientometrics methodologies suited for such deep and broad analysis. A Systematic Literature Review, while offering depth of qualitative analysis and insights, lacks the necessary capacity to welcome such a vast field of research as the CE. I then decided to adopt a bibliometric analysis approach to get a comprehensive but detailed picture of the current CE field and to grasp how the concept is holding up with the validity phase being challenged. I therefore carried out a performance analysis of the set of records to identify the most productive and impactful research units that have contributed to the CE literature. Furthermore, I employed an extensive science mapping approach, portraying different communities of authors and knowledge within the CE field.

Hereafter, I first analyse some general patterns identified during the analysis, referring to the main ones described above. I then seek to understand the future of the CE concept, picturing the three scenarios facing its umbrella nature. First, the analysis confirms the growing importance of the CE concept and its enrichment in different theoretical directions. Beyond the evident growth in terms of quantity, both performance analysis and science mapping confirm previous empirical evidence underscoring the emergence of diverse perspectives beyond the initial technocentric focus in the field (Calisto Friant et al., 2020; Ghisellini et al., 2016; Kirchherr et al., 2017; Reike et al., 2018). Indeed, while the CE was

initially predominantly technocratic and primarily concerned with waste and recycling management, scholarship then started to embrace broader systemic considerations and develop parallel perspectives such as the reformist or the transformational discourses. Regarding the performance analysis, most of the most-cited articles reflect on the CE as a paradigm to holistically deal with sustainability challenges. In addition to the quality, a notable number of non-specifically technical journals are heavily engaged in the CE literature, demonstrating an interdisciplinary interest in the concept. Beyond the mere quantity of performance analysis, co-authorship and bibliographic coupling networks show several communities working on the analysis and promoting the reformist approach.

However, despite the encouraging presence of reformist discourses, the technical discourse still dominates the CE literature, and the original focus on waste management and material recycling originated during the Circularity 2.0 phase. Indeed, the majority of the co-authorship and bibliographic coupling clusters are communities of scholars who specialise in the management and exploitation of specific materials and byproducts, such as food waste, lithium, or municipal solid waste. Their mainly technical orientation suggests that the current body of CE literature is primarily driven by pragmatic work on improving resource utilisation and waste reduction. While this path could be beneficial in terms of the technology developed to make industry more efficient, this approach has the inadvertent consequence of narrowing the scope of, and diminishing the interest in, the concept. Indeed, the predominance of the technical discourse and, in general, the knowledge perspectives more associated with Circularity 2.0 discourses are driving some scholars to question the actual comprehensiveness and capacity of the CE concept to fulfil its promises to simultaneously deal with the environmental, social, and economic challenges posed by the SDGs. Furthermore, too strong a focus on technical knowledge does not help practitioners to adequately develop CE macro-level policies, as it causes a fragmentation of micro- and meso-level initiatives and inevitably duplicates efforts without collaboration between industrial stakeholders.

Moreover, the bibliometric analysis also highlights a pronounced focus on business and industry within the CE literature, with a considerable community of scholars solely dedicated to the production side of the economic system. This is the result of the impressive growth of literature and the empirical application of reformist and, in general, Circularity 3.1

discourses. Indeed, these perspectives push the idea of a tool for incremental change within the existing capitalist framework. Business models and supply chains must strategically redesign themselves to integrate circular principles like recycling, but also more advanced R principles such as remanufacturing and reuse (Bocken et al., 2016; Govindan et al., 2018). This focus on developing new business and industry models is clear from the co-authorship and bibliographic coupling networks analysis, in which the majority of the clusters that are not purely technical are related to reformist business discourses. It is notable that the largest bibliographic coupling cluster, together with the fifth, is composed of publications and scholars focused on analysing how the different stakeholders belonging to the production side can readjust their models by using the circular metaphor and decouple their economic growth from the environment.

The final general insight emerging from the present bibliometric analysis concerns the lack of any cohesive scholarly community engaging with transformational and Circularity 3.2 discourses. Despite increasing recognition of the need for systemic changes to effectively manage SDGs and their associated environmental, economic, and social challenges, there is a notable shortage of literature advocating or analysing radical overhauls of the current economic paradigm. As mentioned above, the holistic narrative within the CE literature is dominated by a reformist and incremental perspective, which primarily aims to optimise the existing system in order to achieve environmental decoupling through technical innovation. The scarcity of transformational and non-Western approaches is evident in these results, which show no distinct cluster within the co-authorship and bibliographic coupling networks dedicated to critiquing limitations of reformist approaches or proposing alternative growth models.

This absence may result in a potential blind spot within the CE community, which could point to an underestimation of the depth and scale of change required to achieve the CE. This gap raises several critical questions. For example, the notion of perpetual growth advocated from reformist perspectives has been disputed by several scholars, which highlights its incompatibility with the fundamental laws of thermodynamics. This contradiction casts a shadow on the efficacy of Circularity 3.1 in addressing challenges and poses several doubts as to the intellectual honesty of their proponents (Giampietro & Funtowicz, 2023). Furthermore, reformist and incremental discourses have been accused

of just rebranding existing practices under the circular metaphor (Hobson, 2021). These critiques underscore the need for more robust and diverse discourses within the CE community, researching beyond incremental improvements and advocating for transformative shifts and alternative growth models to move towards true sustainability.

This extensive overview of the current state of the CE literature offers an opportunity to deliberate on the potential scenarios for its nature as an umbrella concept. Indeed, the guiding research problem of this chapter, and the rationale behind employing the bibliometric analysis, was to ascertain whether the CE is still in its validity phase, and if it has evolved into a coherent concept, or a permanent issue, or has collapsed. Based on the findings, it appears that the CE scholarship is indeed still in the validity phase. The emergence of more holistic discourses, whether reformist or transformational, is a relatively recent development. Thus, the extent of their impact both on the academic literature and on practical CE implementation remains to be fully understood. The following paragraphs discuss the three possible scenarios for the CE, identifying the potential challenges and drivers pertinent to each (Blomsma & Brennan, 2017; Hirsch & Levin, 1999).

The first possible scenario after the CE concept's validity phase is the collapse of the concept. Generally, the collapse of a concept means that it can no longer encompass a broad and diverse set of ideas and phenomena. The main cause of this is the collapse of its coherence across its constituent parts. In the CE scholarship, a great deal of the interest in the concept is due to the ability to group several different approaches under the metaphor of circularity. This ability could fade if some communities of knowledge cease to recognise circularity as a helpful metaphor to foster their idea of sustainable development. Indeed, the dominance of specific discourses, such as technical and reformist knowledge, and the difficulty for communities of knowledge to advocate alternative approaches could cause the latter to leave the field. The natural consequence of this collapse would be a decline in the use of the CE concept, leaving it destined for a narrowing scope limited to micro- and meso-level initiatives without holistic impact and no capacity to comprehensively deal with the wicked challenges posed by the SDGs.

One alternative to the collapse of the concept is the transformation of the CE into a permanent issue which is bogged down in a definitional quagmire (Corvellec et al., 2022).

This is a conceptual state in which the different knowledge communities engage in a perpetual scholarly debate without reaching a definitive consensus (Hirsch & Levin, 1999). As outlined in the theoretical framework, the development of different discourses about the CE beyond its original theoretical roots requires a delicate equilibrium between a positive enrichment of its knowledge basis and the negative deadlock between different perspectives failing to agree on shared points. The results of the present bibliometrics depict a vibrant community, with several different communities of knowledge advocating for different and occasionally contrasting approaches to how the CE should be conceived and implemented. However, these discourses may not constructively talk to each other, standing firm on their position without attempting to build a shared theoretical basis as a common starting point. The consequence of this will be a CE which is still mainstream as a concept, but used with very different meanings, often diluted, and employed as a buzzword.

The third and last scenario to follow the validity challenge stage of CE as an umbrella concept is that it ends up as a coherent concept. The status of a coherent concept can be defined in contrast to the other two scenarios. Indeed, a coherent concept witnesses the flourishing of different communities that agree on a functional and useful debate, involving all the different perspectives and successfully developing a common shared knowledge base (Hirsch & Levin, 1999). The bibliometrics in this thesis have shown all the premises for a possible evolution of CE into a coherent and helpful concept to support comprehensive sustainable development. Indeed, a great variety of perspectives, and the seemingly unstopably growing productivity and impact of the field are a strong basis for positive evolution. However, in the next few years, academics and practitioners must be open to different and possibly radical approaches such as transformist discourses, by acknowledging their importance as employable frameworks and their place in the broad CE conceptual landscape.

Chapter 3

Network governance for the Circular Economy: several paths for effectiveness

3.1 Introduction

As outlined in the introductory chapter, the circular economy is usually adopted as a means to achieve several sustainable development goals (Corona et al., 2019; Schögggl et al., 2020;). Examples of these are Zero Hunger (SDG 2), to which a circular transition contributes by dealing with food waste (Usmani et al., 2021); Clean Water and Sanitation (SDG 6) through a more aware reuse of water (Smol et al., 2020); Affordable and Clean Energy (SDG 7) with the production of energy from renewable sources (Chia et al., 2020); Decent Work and Economic Growth (SDG 8) through the creation of sustainable business and jobs (Barros et al., 2021); Responsible Consumption and Production. (SDG 12) with products being specifically designed for circular production and consumption (Bocken et al., 2016), and even more ambitious aims such as working towards more Sustainable Cities and Communities (SDG 11) (Bolger et al., 2019).

The challenges posed by environmental goals and the increasing complexity of societal problems over the past three decades have led public actors to reconsider their governance models (Mayne et al., 2020). As outlined in Chapter 1, traditional models like the hierarchical Weberian Public Administration and the market-oriented New Public Management have proved inadequate in addressing these complex issues (Weber & Khademian, 2008). As a result, there has been a shift towards experimenting with more horizontal and collaborative forms of governance (Geuijen et al., 2017; Hoppe, 2011; Liddle, 2018). The main differences of these new governance models lie in their emphasis on renewed participation and accountability, with societal stakeholders much more involved and far beyond just voting, and the consequent but necessary pooling of resources from a broader range of stakeholders to deal with the increased complexity of societal challenges (Klijn & Koppenjan., 2015; Pollitt & Bouckaert, 2017).

Among these new governance paradigms, such as Public Value Governance, New Public Governance, or Collaborative Governance, network governance has emerged as a well-equipped paradigm with which to deal with complex and wicked problems (Ferlie et al., 2011). Network governance is characterised by its ability to facilitate collaboration and resource-sharing among diverse groups of stakeholders, enabling more effective and adaptable solutions to complex societal problems (Krogh, 2022; Raab et al., 2015). This model recognises the limitations of traditional hierarchical and market-based approaches, and offers a more flexible and responsive framework for tackling the multifaceted challenges of today's world (Isett et al., 2011).

This chapter will explore how combining specific network structural and functional features could lead to network effectiveness. In particular, moving from empirical evidence already identified in previous studies (Cristofoli et al., 2019; Hovik & Hanssen, 2015; Verweij et al., 2013; Wang, 2016; Yi et al., 2021; Ysa et al., 2014), it will analyse the interactions between the connectivity of stakeholders, levels of trust in the network, the sustainability of the network and its manager(s), and the management strategies enacted by public actors. The methodology chosen for this study is that of Qualitative Comparative Analysis (QCA) (Ragin, 2014; Rihoux & Ragin, 2009). The configurational approach of the QCA allows the identification of different combinations of variables (conditions in QCA terminology) leading to the same outcome, which in this case is network effectiveness.

Data were collected from a survey conducted in March 2023. I administered the questionnaire to 53 public network managers leading circular economy projects with the involvement of different societal stakeholders, in an attempt to go beyond the logic of PPPs and focus specifically on the phenomenon of networks. Twenty public managers participated in the survey, with a response rate of 37.73%.

The QCA analysis showed the existence of three different combinations of conditions leading to network effectiveness. The first one, called the *far-sighted* path, highlights the role of long-term planning and a forward-thinking perspective on the part of the public actor in achieving network effectiveness, even without high levels of management from the network manager. The second approach identified is a more *traditional* one, with the cases showing this combination confirming the previous empirical evidence about the importance

of network management strategies if combined with high levels of trust and connectivity between stakeholders. The last approach is the *emergent* path, shown here by a single case. This path could be a promising avenue of research, exemplifying how public administrators could leverage existing relationships within society without a massive investment of material and human resources.

The results contribute to the public administration and CE literature in several ways. Firstly, they represent a theoretical and empirical exploration of the contributions that the field of public administration can make to the transition towards a CE. Indeed, while the field has been dedicated to how to foster more sustainable development and what kind of role public actors should play, the CE as a topic is severely underdeveloped, with no attempts to analyse the features of CE governance. The second contribution of this work is the enrichment and enlargement of the empirical evidence base on the role of specific network features, confirming the importance and the complementarity of trust, connectivity, and network management. Lastly, a future research avenue is opened up by identifying the *emergent* path, which potentially recognises that public actors can be effective by only leveraging existing connections between societal stakeholders.

The chapter is structured as follows. First the evolution of network governance literature is reviewed, then the network determinants included in the analysis are outlined. Thereafter, I describe the QCA methodology and the empirical setting in which I conducted the analysis. Further, I analyse the findings and the results from the QCA analysis. Lastly, I discuss the results, the future research directions, and the limitations of the study.

3.2 Theoretical Framework

Scholars have written extensively about networks. Indeed, since Granovetter published "The Strength of Weak Ties" in 1973, the theoretical interest and empirical analysis of this "new" organisational form has spread like wildfire across all social science disciplines. In the public administration literature, the early research about networks appeared in the mid-1990s, with the start of the network literature within this field found in the work of Provan

and Milward (1995). Several PA scholars have periodically committed to reviewing and systematising the literature about networks, their structure, external influences, determinants, and effectiveness and performance (Agranoff & McGuire, 2001; Isett et al., 2011; Klijn, 2020; Koliba et al., 2018; Provan & Kenis, 2008; Scott & Ulibarri, 2019; Smith, 2020).

This thesis defines networks as a group of three or more goal-oriented interdependent but autonomous stakeholders connected to produce an output or outcome that would have been impossible for single stakeholders to produce on their own (Klijn & Koppenjan, 2016; Nowell & Kenis, 2019; Provan & Lemaire, 2012). A significant reason for the emergence of networks, both in theoretical and empirical terms, has been to respond to and counter the insufficiencies of already existing governance paradigms, such as the traditional Weberian public administration and the New Public Management (NPM). Indeed, during the 1990s, the increasing complexity of public service delivery and the unkept promises of efficacy without losing effectiveness made by NPM proponents led to calls for new governance forms and a renovated toolbox for the public actor. The initial core of the network literature within the PA field focused on the delivery of services and, in general, on the implementation phase of public policies, also following the path traced by the rising co-production literature (O'Toole, 1997; Lecy et al., 2014; Fadda & Rotondo, 2022).

Thereafter, networks as a governance form and as a literature strand became emancipated from the public service delivery realm to represent a pervasive phenomenon in both public administration literature and practice (Isett et al., 2011). Firstly, the use of networks has been extended to the entire policy cycle, with public actors employing this new governance model beyond just the implementation phase (Edelenbos et al., 2013; Wang, 2016). In addition, network governance provides a major alternative to top-down paradigms, with the possibility of involving all the stakeholders affected by a problem (Klijn & Koppenjan, 2016). Indeed, the formation of more or less stable and formalised networks of different societal actors through voluntary contractual agreements or any other forms of agreement has responded to the increased fragmentation of the public sector and societal stakeholders, with public actors also reverting to it to decrease the hidden transaction costs in the use of hierarchical tools (Krogh, 2022; Lemaire et al., 2019). Moreover, it is widely recognised in the PA literature that networks are the most suitable governance paradigm to

deal with wicked problems. Public actors are increasingly acknowledging the impossibility of dealing with societal problems' growing complexity only with their resources. Through network governance, it is possible to engage societal stakeholders so that they voluntarily pool their financial and non-financial resources (Cristofoli et al., 2015; Dimitrijevska-Markoski & Nukpezah, 2021; Klijn & Koppenjan, 2016).

However, network governance is not without some downsides despite its usefulness and capacity to fill the gaps left by previous governance models. In its initial development stage, network governance and horizontal relationships in general were often framed as a panacea for all the problems of public administration. A consequence of this naivety has been an initial overlooking of the potential pitfalls in the use of networks and the lack of detailed analysis of network functioning, its determinants, and overall performance (McGuire & Agranoff, 2011; Raab & Milward, 2003). Indeed, a new wave of scholars have since started to examine the network governance phenomenon, contributing to getting the concept out of its magic concept status and establishing it as an autonomous literature strand (Isett et al., 2011; Pollitt & Hupe, 2011; Raab & Milward, 2003). Networks started to be questioned for being expensive in terms of coordinating resources, and not ensuring the delivery of effective outcomes in all kinds of situations (Raab & Kenis, 2009). In addition, networks are also in contrast to, or at least expand, the traditional notions of democracy, transparency, and accountability (Klijn & Skelcher, 2007; Sørensen & Torfing, 2005). The dissection of the potential dark sides of network governance and the potential compatibility of its characteristics with already existing governance models have led several scholars to frame its use from a meta-governance perspective. Indeed, networks should be treated and employed for what they are, namely a governance model with unique features that should be used only to address specific problems (Gjaltema et al., 2020; Sørensen & Torfing, 2009).

Furthermore, in this phase, a range of studies have focused on single network determinants and their relationships with network performance. Indeed, scholars began to analyse the different facets of the network phenomenon, singling out the determinants and conditions possibly leading to or hindering the network effectiveness. Several scholars elaborated macro-categories for network determinants, to impose order on a fragmented network literature and help scholars via a more structured and comparable analysis (Hu et al., 2022; Smith, 2020). The most shared classification of network determinants is a

threefold typology that divides them into structural, functional, and contextual network determinants (Turrini et al., 2010). Network structural determinants contain all the characteristics pertaining to the architecture and patterns of connections between actors. This could be the number and diversity of participants, the nature of the formal and informal relationships between them, and the structure of the network as a whole, whether centralised, decentralised, or distributed. These characteristics crucially influence the flow of resources and information, the ease of network members' coordination, and the potential for innovation within the network.

Secondly, the functioning of network governance depends on the roles, processes, and activities making up its life. This includes mechanisms of decision-making and coordination, strategies for conflict resolution, collective learning processes, and resource allocation methods. The study of networks' functional determinants allows understanding of how networks achieve effectiveness, adapting and managing the complexities inherent to collective action with different stakeholders. In contrast to a network's structural and functional characteristics, contextual determinants relate to environmental factors external to the network itself. The list of contextual determinants is virtually infinite, encompassing the political, economic, legal, or socio-cultural factors that can significantly influence a network's structure, function, and performance (Hu et al., 2022; Medina et al., 2022; Smith, 2020; Turrini et al., 2010).

Drawing from these studies, this chapter explores the interplay of the key network determinants contributing to high network performance, focusing on networks transitioning to a circular economy. It focuses on three critical aspects of network governance recognised for their substantial impact on network management strategies used by public administrators. In addition, it identifies the various management strategies that can be implemented within a network to guide it towards effectiveness.

3.2.1 Network connectivity

"The basic building block of any network study is the linkages among the organisations that make up the network" (Provan & Milward, 1995, p.10). This definition from the seminal work by Provan and Milward identifies the relationships between the nodes as a foundational feature of network structure and a pivotal determinant of overall network performance. Network scholars, including those beyond the PA field, have developed several measures to analyse how network members are connected and how different relationships influence the processes and outcomes of the network (Newman, 2018; Smith, 2020). In this study, I decided to use network-level connectedness as a proxy for analysing the network structure, which could be defined as the density and strength of relationships between network stakeholders (Hu et al., 2022).

The benefits of high levels of network connectedness can take either a direct or an indirect form. Usually, they are associated with the creation and sustaining of trust and social capital within the network (Bodin et al., 2017; Wang, 2016). Research has also identified that dense connections between actors help to reduce transaction costs, with better coordination among stakeholders and facilitating information and resource exchanges (Provan & Milward, 2001). Regarding the direct effect of network connectedness on network performance, scholars are divided (Hu et al., 2022). Indeed, high connectedness within the network seems to have a positive direct effect on network performance, especially in the realm of environmental management (Hu et al., 2022). However, some of the network literature has contested this direct effect, with several scholars claiming the importance of a centralised structure for achieving network performance (e.g., Smith, 2020). In addition, one risk of a high level of network connectedness is falling into the group thinking trap, hindering the circulation of innovation and new ideas (Sørensen & Torfing, 2007). A possible remedy is the implementation by network managers of boundary-spanners or the purposeful creation of structural holes within the network (van Meerkerk et al., 2015).

In conclusion, I decided to include network connectedness as a network determinant for its capacity to gather information about general relationships between network members and its potentially positive effect on network effectiveness (Hu et al., 2022).

3.2.2 Network trust

Trust plays a pivotal role in network functioning and performance, as the network governance literature in particular has found (Edelenbos & Klijn, 2007). Unlike the organisational literature, which tends to focus more on dyadic relationships and reputations between network members, network governance scholars are more concerned with the distribution of trust among stakeholders and its measurement at the whole network level (Provan & Kenis, 2007). In this study, I define trust as "a stable positive expectation that actor A has (or predicts he has) of the intentions and motives of actor B in refraining from opportunistic behaviour, even if the opportunity arises" (Klijn et al., 2010a, p. 116). This expectation of specific behaviours from other stakeholders has numerous beneficial effects on network performance and other determinants.

Firstly, a high level of trust fosters collaboration by reducing uncertainty among stakeholders, making them more inclined to invest their resources to address complex and challenging problems (Van Meerkerk & Edelenbos, 2014; Klijn et al., 2010a). Secondly, trust can uphold the promises of network governance of going beyond traditional hierarchical arrangements by offering an alternative to traditional legally binding instruments, allowing stakeholders to engage voluntarily while maintaining their freedom to exit the network (Agranoff & McGuire, 2001). Additionally, trust encourages the exchange of information and knowledge among stakeholders, contributing to their learning and enhancing overall network performance (Klijn et al., 2010b). Finally, previous empirical evidence has consistently demonstrated a positive relationship between the trust levels within a network and perceived outcomes (Huxham & Vangen, 2005).

In addition to its direct impact on network performance, the literature reveals that high trust also engenders positive interactions with various other network determinants. Specifically, the combination of trust and the implementation of network management strategies has been associated with improved network performance (Ysa et al., 2014). Additionally, trust has been shown to enhance overall network stability (Wegner & Verschoore, 2022). However, it is essential to note that trust carries some costs. Network

managers must deliberately invest in trust-building activities over an extended and continuous period (Bryson et al., 2006). Furthermore, the presence of institutional complexity, characterised by clashes between the rules of different organisations, can have a detrimental effect on trust levels among stakeholders, and may impede efforts to increase trust (Ysa et al., 2014).

To summarise, due to the relevance of its direct and indirect effect on network structure, functioning, and performance, I included trust as a potential network determinant for the outcome of the cases under analysis in this study.

3.2.3 Network sustainability

The sustainability of a network in the long run is a pivotal structural determinant with far-reaching implications for network performance (Provan & Sebastian, 1998). Broadly defined, it refers to the stability of the managerial or administrative structure operating within a network (Turrini et al., 2010). A network's inner stability, when maintained at high levels, exerts both direct and indirect effects on its performance, serving as a lynchpin for several critical network dynamics (Provan & Lemaire, 2012).

Firstly, high levels of inner stability directly impact network performance by fostering the development of shared norms and rules. This, in turn, reduces the transaction costs associated with achieving consensus on goals, sharing resources, and effectively dealing with the strategic complexity inherent to wicked problem management (Provan & Kenis, 2008). Furthermore, stability and long-term sustainability serve as catalysts for experimentalism and innovation within the network, as Termeer et al. (2015) highlighted. Secondly, the influence of inner stability on network performance also manifests indirectly by nurturing and enhancing other network determinants. A financially sustained and enduring managerial presence significantly contributes to developing trust and legitimacy towards the network manager. As previously discussed, these elements are foundational to achieving high levels of network effectiveness (Van Meerkerk & Edelenbos, 2014). Moreover, the enduring presence of a network manager facilitates the establishment and

strengthening of connections and engagement among the stakeholders involved. This aspect is indispensable for the collaborative development of impactful solutions to wicked problems.

In summary, I regard network sustainability as a valuable proxy for assessing the network structure, particularly in the context of the presently selected case studies centred on circular transition within network frameworks.

3.2.4 Network management strategies

Network management strategies are a definitional umbrella for all the management activity within a network that has been theorised and empirically analysed by governance scholars (Cristofoli & Markovic, 2016; Klijn et al., 2010b). In this chapter, we define them as the deliberate guidance of complex governance processes in networks without intentionally employing hierarchical control instruments (Hovik & Hanssen, 2015; Klijn, 2020; Meier & O'Toole, 2001). The focus of our definition is twofold. Indeed, the first is about the specific intent of the network manager to implement management strategies to govern and drive the network towards specific goals (Popp et al., 2014). This acknowledgement is connected to the second focus of the definition, namely avoiding hierarchical instruments. Indeed, from a metagovernance perspective, the usefulness of networks comes from the ability to coordinate actors without necessarily recurring to the use of hierarchy or legal instruments (Provan & Kenis, 2008).

Indeed, the network literature produced a remarkably extensive catalogue of strategies to implement and roles to cover for the network manager (Popp et al., 2014; Smith, 2020; Turrini et al., 2010). In one of the most renowned categorisations of network management strategies, Agranoff and McGuire (2001a) developed a POSDCORB approach, trying to cover the whole range of strategies implementable using the four categories of activation, framing, mobilisation and synthesising.

Moreover, a pivotal categorisation has been made by Koppenjan and Klijn (2004) and then refined in their latest coauthored book "Governance Networks in the Public Sector" (2015). The two authors, indeed, have elaborated a set of three macro-categories of strategies to deal with different layers of complexity. They have, firstly, identified several strategies to deal with the substantive complexity of networks, namely the variety of perceptions brought by the different stakeholders in the network and the production of shared knowledge. Secondly, they have outlined specific management strategies to manage the strategic complexity of networks, which revolves around the unpredictable and uncertain dynamics of governance processes. Lastly, they listed the different strategies at the disposal of network managers to deal with the clash of norms and rules of network members and how to foster the creation of the network's own rules.

More recently, Wegner and Verschoore (2022) focused on analysing the black box of network governance, moving more to the micro-level on which strategies could be enacted. Indeed, they identify six different strategies that network managers could implement in dealing with the challenges posed by the day-to-day activities within a network. The strategies listed by the two authors are most similar to the ones presented by Klijn and Koppenjan (2016) to deal with the strategic complexity of networks.

An interesting and popular high-level categorisation of network management strategies has been outlined by Klijn et al. (2010b) and synthesised by Klijn (2020), focused on distinguishing between process management strategies and institutional design strategies. All the strategies falling under the first category aim to facilitate the interaction between stakeholders, taking the network structure as given. Specifically, the authors focus on the activity of arranging temporary organisational arrangement, the exploration of available information for the outcome, the connecting and disconnecting activities between stakeholders, and the establishment of temporary rules to facilitate the interactions. On the contrary, the institutional design strategies focus on the network structure and the outcomes. In this regard, network managers have the power to shape the network composition by allowing specific stakeholders to be part of the network (Ansell & Gash, 2008)

However, the effectiveness and the advantages of employing network governance and its wide range of management strategies have their costs. Indeed, the lack of hierarchy and the impossibility of recurring to legally binding instruments represents a costly obstacle for network managers (Head & Alford, 2015; Meier & O'Toole, 2001). The whole weight and responsibility for the network effectiveness fall on the network manager's ability to coordinate and route stakeholders towards a common goal, often convincing them to accept sub-optimal solutions for the single actor through the enactment of voluntary or behavioural mechanisms such as trust and reciprocity (Milward & Provan, 2023). In addition, the capacities required to manage a network successfully are entirely different and more time and resource-consuming than managing a single organisation. Agranoff and McGuire (2001) highlight that the current conceptual stage of network management strategies poses significant challenges for both the future advancement of the academic literature and its practical applicability in real-world policy contexts. While numerous network management strategies have been linked to improved outcomes, there remains a question about how effectively this concept can be translated into actionable guidance beyond the academic sphere (Cristofoli et al., 2019; Klijn et al., 2010b)

Moving from these considerations, we aim to understand the role of process management strategies in leading networks engaged in circular economy transitions. More specifically, our focus will be on whether managers have deliberately used process management strategies in effective networks to steer the actions of stakeholders and the network.

3.3 Methodology

Collecting data, measuring, and analysing formal and informal networks is considered a puzzling challenge, especially within the Public Administration literature (Isett et al., 2011;

Scott & Ulibarri, 2019). Network governance scholars usually deal with at least three orders of challenges. The first concern lies in the definition of the unit of analysis of the network. Indeed, even with a legal agreement between stakeholders, it is not always straightforward to identify the network members and actors who are just external and occasional collaborators with the network (Provan et al., 2007). This also calls for the meaningful distinction between formal and informal networks and the possible interplay between what happens in public forums and official documents and what goes on behind the curtains. Still related to the definition of the unit of analysis, scholars must decide if the analysis should focus on the single nodes or the network as a whole. This last decision is often question-driven and concerns if the researchers are more concerned with understanding the dynamics between single actors or the general functioning of the network. Secondly, collecting data on networks is often tricky, especially if there is a need to capture the different perspectives of actors through a multiple-constituency approach (Provan & Milward, 1995). In this sense, a proper and detailed analysis of a public network represents a significant challenge concerning the necessary response rate from the nodes within the network. Indeed, there is a general agreement in the literature on the necessity of collecting responses from at least 80% of respondents for a Social Network Analysis to be considered reliable (Borgatti et al., 2006; Huisman & Steglich, 2008). The difficulty of collecting exhaustive data is one of the major reasons for the lack of large-N studies on network governance, with a few rare examples (Cristofoli et al., 2019). Thirdly, for a long time, the network governance literature has limited its methods to a descriptive Social Network Analysis, often conducted with partial data about nodes within networks. Only recently has a renovated and expanded toolbox for PA network scholars emerged, with the use of Qualitative Comparative Analysis, Exponential Random Graph Analysis (ERGM), and Structural Equation Modeling (Guo, 2023; Klijn et al., 2023; Raab et al., 2015; Scott & Thomas, 2017).

This study moves from considerations about the wickedness of problems with which CE practitioners deal to the complexity of managing networks and their multifaceted determinants, allowing for the possible existence of multiple paths for achieving network effectiveness (Cepiku et al., 2020). Networks represent a complex phenomenon to create and sustain, with public network managers adapting their strategies according to several dimensions, such as their environment, the institutional paths that occurred before the

networks, or the quantity and variety of resources at their disposal (Klijn & Koppenjan, 2016). This complexity in creating and sustaining the network calls for a methodology capable of identifying how network structure, management strategies, and context interact and mix to achieve network effectiveness (Cristofoli et al., 2019; Callens & Verhoest, 2023). Moving from these considerations, I decided not to use traditional statistical approaches due to their difficulty in analysing the combined effects of different variables. Instead, I chose to adopt a methodological fuzzy-set Qualitative Comparative Analysis (QCA) approach, which allows the causal complexity of the paths leading to network performance to be captured (Ragin, 2014).

The Qualitative Comparative Analysis is a research approach that combines the case-oriented and nuanced analysis offered by the qualitative methods with the variable-oriented approach typical of quantitative research. QCA is usually employed to analyse real-world and complex social phenomena. The QCA enables researchers to incorporate specific variables (called conditions in the QCA terminology) into their analysis while still being able to study them simultaneously and capture their combined effects (Ragin, 2009). In addition, the QCA allows for incorporating qualitative and quantitative empirical evidence sources to display a more comprehensive picture of cases under scrutiny. In referring to the books on QCA by Schneider and Wagemann (2012) and Mello (2021), I limit the discussion here to outlining the main characteristics that drove the choice of the QCA as the methodological approach for the analysis. The first characteristic is conjunctural causation, which is the ability to analyse the combined effects of necessary and/or sufficient conditions, going beyond the focus on the net effects of single variables. Indeed, a QCA approach frames the effect of a single condition developing only in combination with other variables. The existence of necessary but not sufficient conditions represents the fundamental premise for conjunctural causation due to the fact that this necessary condition needs to be combined with other conditions to produce an effect and achieve the outcome. The second characteristic is equifinality, or the chance to identify different but equally valid paths leading to the outcome. While the conjunctural causation is based on the notion of necessity, the equifinality moves from the sufficiency considerations of single conditions or configurations of conditions. Indeed, the sufficient nature does not preclude the existence of alternative paths for how a case or multiple cases could achieve the outcome of interest. Lastly, QCA features the causal asymmetry of the presence and absence of the outcome, which means

that a specific configuration of conditions leads only in a particular direction and does not explain much of the outcome non-occurrence (Fiss, 2007; Thomann et al., 2022). This is particularly relevant for social phenomena with their inherent subjectivity and elusiveness of being determined by strict natural laws. Taking the aim of this work as an example, being aware of specific paths conducive to network effectiveness in the realm of Circular Economy projects doesn't also represent a handbook of what network mechanisms should not be implemented to avoid network ineffectiveness. Indeed, the exploration and analysis of the conditions and configurations of conditions with possible negative effects on network effectiveness must start from different research assumptions, with specific theories and hypotheses guiding researchers towards that specific direction. This also implies that rather than change the outcome from network effectiveness to network ineffectiveness, we must use different conditions, collect new data, and build a new truth table (Mello, 2021).

A QCA analysis investigates the relationships between the membership of cases to a specific set of conditions (which, in this case, are the trust in the network, the network management strategies employed, the connectivity between actors, and the long-term sustainability of the network) and the outcome (Rihoux & Ragin, 2008). Specifically, I adopted a fuzzy-set QCA (fsQCA) approach, which allows for partial membership of cases ranging from 1 (full membership) to 0 (full non-membership), with the possibility of partial membership at specific points like 0.67 or 0.33. A key point in this membership scale is the crossover point of 0.5, which represents the maximum ambiguity of membership or non-membership of a case in a specific set. The process of assigning membership scores is called calibration, and it transforms the empirical evidence into usable scores for the fsQCA analysis. The option of assigning partial memberships makes the fsQCA a particularly appropriate approach for research employing survey data, with questionnaires allowing the measurement of "qualitative statements of agreement, disagreement, and indifference" among the respondents (Emmenegger et al., 2014). The possibility offered by a fuzzy-set approach to assign partial membership of cases to the set of pre-established conditions perfectly aligns with the anti-dualist nature of the Pragmatist philosophical tradition. Indeed, allowing for degrees of membership, a fuzzy sets approach recognises that social phenomena happen and could vary in terms of qualitative and quantitative intensity within two dualist extremes.

Empirical setting

The empirical setting was constructed by considering two orders of factors. The first was the multifaceted nature of CE given that, as explained in the Introduction and Bibliometric Analysis chapters, it is a challenging task to specify whether an initiative, an action, or a policy can be ascribed to the CE realm or not. This variety of perspectives makes it difficult to build a baseline to identify the population from which the cases are drawn. Indeed, one of the main challenges is to decide whether to select networks that employ only specific R principles, such as recycling or refurbishing principles, or rather group these different experiences under the broader umbrella of circular economy transition. I have chosen the second option due to the fact that CE initiatives often are focused on combining different principles, making it impossible to make sharp definitional choices, and also the internal lack of definitional clarity of what single R principles represent in theory and practice (Blomsma & Brennan, 2017). I, therefore, selected all the initiatives that explicitly refer to the CE and whose action could fall under the comprehensive umbrella of the 9R principles.

In addition to the means and the aim of the CE networks under analysis, another specific problem concerns how to evaluate the CE effectiveness. Indeed, as outlined in the second chapter, one of the main problems of CE scholarship and practice is the lack of agreement about evaluating CE effectiveness. This is due to the variety of knowledge perspectives and no apparent willingness to establish a profitable dialogue on what a circular transition represents and against which criteria should be evaluated. Indeed, if an improvement in the energy efficiency of an industry plant could be considered an important achievement for Technocentric discourses, it could be considered a lack of focus and a deviation from more important and deep changes in our economic system from Transformative proponents. Looking forward to the concepts of CE and its dimensions in acquiring coherence, I believe there is no point in building an empirical bottleneck without any theoretical justification for the construction of boundaries of the empirical setting.

Still related to the nature of CE, I opted for Italy as the geographical context from which to pick the cases. Indeed, although I am aware of the limitations on external validity imposed by confining a study to one national context, I preferred to ensure the greater internal validity of the case selection and results, which is in line with the explorative nature of this study.

On the contrary, the Italian CE context represents a peculiar empirical setting, as Italy is considered a leading nation in the European CE transition. As underlined by the Circular Economy Network 2023 report, Italy holds the first place in the CE according to several parameters such as waste recycling, soil consumption, or resource productivity (Circular Economy Network, 2023). However, the CE policies enacted in the past seven years by Italian governments and the funds provided in the Recovery plan are mainly directed to less efficient CE principles, such as recycling, without a systemic effort to narrow and close economic loops. Italy thus faces a policy deadlock in developing a radical and effective CE transition, enjoying the benefits of an efficient waste management policy but so far not following the possibility of shifting to more sustainable R principles (de Jesus & Mendonça, 2018). On the one hand, the standardisation of Italian CE initiatives towards a Recycling approach partially deals with the R principles variety issue outlined above. On the other hand, however, it represents a lack of variety in experiences and approaches that could potentially undermine the validity of the QCA findings.

The second factor to consider was the population I wanted to study. As explained in the Introduction and Theoretical Framework sections, the present goal is to identify and analyse the possible paths through which a network focused on the CE transition can be effective. Specifically, the present focus is the combination of the network management strategies enacted by the public actors and other network characteristics, such as trust and connectivity between stakeholders and long-term sustainability. In this regard, the choice was to select networks led by public actors engaged in CE actions within an urban dimension, based on the choice of including a place-based dimension for the study's setting. A significant obstacle in the case selection was the lack of systematic effort to identify and catalogue the CE initiatives in the Italian setting, either by public actors or other societal stakeholders. In order to address this shortcoming, I have conducted an extensive documentary analysis of several public policy documents and non-profit and private reports on the CE in Italy to identify cases corresponding to the population described above and build a dataset of experiences potentially eligible as cases for the QCA analysis. In order to build this dataset, I have first collected and analysed all the public policy documents developed about Circular Economy initiatives in Italian. To achieve this, I have used Overton, which is considered to be the most extensive policy document database available. This led to the collection of more than 400 policy documents strictly focused on CE in Italy, ranging

from more programmatic and general policy documents to specific regional and urban policy documents more focused on describing the implementation of circular transition initiatives. Following the public policy documents, I have identified all the Italian think tanks and research institutions focused on CE or, more generally, interested in sustainability and environmental issues and collected their annual reports. Lastly, I have also found several awards dedicated to CE initiatives in Italy, with a particular mention of the “Verso un’economia Circolare” award established by Fondazione Cogeme, which offered a considerable amount of public networks engaged with a CE initiative.

The database built by collecting policy documents and websites dedicated to the CE was then analysed to detect existing networks engaged in circular transition led by public actors. I have found two main difficulties in this identification work. The first concerned drawing a distinction between networks led by public actors and networks in which the public actor was just a stakeholder among others, often involved with just patronage or other less significant policy instruments. When the distinction was not obvious, I conducted an additional documentary analysis of cases in doubt to solve any ambiguity. After identifying networks managed by public actors, the second difficulty involved understanding the person acting as a public network manager. Indeed, for several networks, the identifiable public actor was an entire department without any specific reference to the person managing the network. To solve this issue, I identified the leadership positions of the public actor branch involved and asked in the contacting email if she/he was the public network manager and, if not, to get hold of who was responsible for the network. The documentary analysis and construction of the database led to the identification of 53 networks led by public actors engaged in CE activities with the active involvement of other societal stakeholders.

I have then decided to collect data for the QCA analysis by administering a survey. The questionnaire was built to collect information from public managers about the level of trust within the network, the connectivity between the stakeholders, the network management strategies employed, the sustainability of their position and that of the network as a whole, and the network performance. I obtained complete and usable responses from 20 public managers, with a response rate of 37.73%. This rate was higher than for surveys sent to CEOs or managers of specific organisations registered by previous research (Fiss, 2011).

The limitations of the present dataset must be acknowledged. Firstly, I cannot be certain that I have traced all the cases of the target population. Indeed, despite the several steps taken to identify all the possible public networks engaged with CE in Italy, the lack of a systematic catalogue by the Italian public actor affects the dataset's exhaustiveness in population identification. In this regard, I am aware of the limitation that the forced purposeful sampling of cases limits the external validity of the results. However, I preferred to ensure greater internal validity in the case selection and results, which was more in line with the explorative nature of this study. In addition, I used the perceptions of the network managers, which came with all the possible limitations of employing self-reported measures (Cristofoli et al., 2019). This is a result of twofold reasons. Indeed, the lack of common and shared measures against which to evaluate CE initiatives forced us to focus on network measures. In addition, there is an increasing debate among scholars about the necessity of using perceptual data to fully capture organisational dynamics and outcomes (Abouassi et al., 2024). Managers have greater control over the steering and the governance of the network, with their decisions deeply affecting the network and the stakeholders. In addition, they have a privileged view of what happens within the network, and without the possibility of getting responses from all the stakeholders involved, their responses can be said to represent a reliable proxy for analysing the network. Lastly, I also opted for anonymous responses to increase the response rate (Edwards et al., 2009). The fact that the performance of these networks could influence the job stability of the actors who responded could have either introduced a positive bias in emphasising the effectiveness of the networks or in contrast, have dramatically reduced the response rate.

Operationalisation and calibration

Operationalisation within QCA refers to the process of defining and measuring the concepts and conditions used in the analysis. This transformation is crucial for ensuring that abstract theoretical concepts are turned into measurable conditions, allowing for the identification of patterns and configurations of conditions across cases under analysis. In the process of operationalisation, researchers engage in an empirical translation of the concepts of interest, ensuring that these definitions are clear and consistent with the

theoretical framework. In fsQCA, operationalisation allows for degrees of membership of cases, addressing the limitations of binary categorisation by permitting partial membership in sets. Concepts are translated into conditions with scores ranging from 0 to 1, representing varying degrees of membership. For example, a country's level of democracy might be scored as 0.8, indicating it is mostly, but not entirely, democratic. Effective operationalisation is essential for the validity and reliability of QCA results. It ensures that the conditions accurately represent theoretical concepts, allowing for meaningful comparisons and robust causal inferences. Without proper operationalisation, the analysis may be inconsistent and inaccurate, undermining the explanatory breadth of QCA results.

As outlined above, I operationalised network determinants and performance through questionnaire items (see Table 1). Respondents were asked to answer questions using seven-point or five-point Likert-type scales ranging from a position of total disagreement to one of total agreement (see Table 1). All conditions were constructed as the sum of specific items and built based on previous literature.

The first operationalisation and calibration concerned the network performance. Generally, performance measurement within the public sector has always been a significant challenge for practitioners and academics due to the inherently contested nature of the concept (Van Dooren et al., 2015). Indeed, there are several perspectives through which it is possible to measure the action of public actors that decisively determine its operationalisation and calibration in different ways. In addition, the involvement of several stakeholders with different goals and perspectives makes reaching a joint agreement on what represents good performance even more challenging. The first challenge concerns the choice between objective and subjective performance measures (Andrews et al., 2006). This thesis defines performance through the perceived effectiveness of the CE actions implemented. As mentioned above, I acknowledge the limitations of using self-assessment measures for network performance. However, I also had to deal with the lack of standardised CE evaluations (Calisto Friant et al., 2020) and the different CE approaches taken by the cases under analysis, which made any performance standardisation impossible.

Measuring network effectiveness remains contentious, with definitions and criteria varying significantly across studies. Network effectiveness at a network level is the “attainment of positive network-level outcomes that could not normally be achieved by individual organizational participants acting independently” (Provan & Kenis, 2008, p.230). This definition highlights the importance of collective outcomes over individual organisational performance. Taking networks seriously involves thoroughly evaluating their effectiveness, which requires moving beyond traditional substantive outcomes and considering procedural outcomes (O’Toole, 1997). This shift in focus is crucial when dealing with complex, wicked problems where solutions are not straightforward and require collaborative and continuous efforts. An evaluative framework for network effectiveness can be proposed at three levels: community, network, and organisation. At the community level, networks are evaluated based on their contribution to the broader community, often satisfying a specific group of clients and contributing to social capital. At the network level, the focus is on the network as an autonomous organisation, considering factors such as the range of services provided, the strength of relationships, and the administrative structure. Lastly, at the organisation/participation level, the evaluation considers the benefits to individual network members, including client outcomes, legitimacy, resource acquisition, and cost efficiency (Provan & Milward, 2001). In this thesis, we evaluate the effectiveness at the network level, measuring the effectiveness of the whole network in achieving specific circular transition goals.

In addition to the level of analysis, the public administration literature distinguishes structural, procedural, output, and outcome network performance measures. Structural measures might include the network’s design and governance model, while procedural measures could involve the processes and interactions within the network. Outcome measures focus on the tangible results achieved, and output measures look at the immediate products of the network’s activities (Cristofoli & Markovic, 2016). Given these complexities, assessing network performance is not straightforward. Governing a network is a complex endeavour where public managers have to deal with several conditions and constraints simultaneously, strongly interacting with each other. For instance, the network governance model can significantly impact its effectiveness, with different models being more suitable for different contexts based on factors like trust, size, or goal consensus. Additionally, the balance between efficiency and inclusiveness, internal and external

legitimacy, and flexibility and stability are crucial tensions that must be managed effectively to ensure network effectiveness (Provan & Kenis, 2008).

Based on these considerations, I operationalised network performance as a sum of four items, building on the measure elaborated by Klijn et al. (2015) (see Table 1). The usefulness of this scale lies in its comprehensiveness, covering several aspects of the network complexity and its management and focusing on the solutions adopted by the network stakeholders. Indeed, the first two items measure how the network deals with the substantive and strategic complexity of CE actions, namely the integration between different perspectives and the involvement of different societal stakeholders. The last two items record the adequacy of the CE solutions adopted and the long-term sustainability of those solutions (AbbouAssi et al., 2023).

Secondly, I operationalised the network management strategies based on the scale developed by Klijn et al. (2015), which is composed of 12 items (see Table 1). As outlined in the subsections dedicated to network management strategies, this study focuses primarily on the process and management strategies used to deal with the uncertain and unpredictable dynamics within networks. These items cover the network functioning characteristics elaborated by Turrini et al. (2010) and the whole range of network management strategies elaborated by Klijn and Koppenjan (2015) to deal with the strategic complexity within networks. In the questionnaire, public managers were asked four questions about the degree of quadruple helix stakeholders' involvement, creating a facilitating platform for stakeholders' interactions. Therefore, the respondents answered on the strategies enacted to incorporate the variety of perspectives offered by stakeholders and the creation of collectively agreed information as a starting point for discussion and solutions development. Thirdly, public managers responded to the possible strategies implemented to manage the strategic complexity that arises from stakeholders' interactions, such as the complex relationships between actors, possible deadlocks, and the degree of involvement in relevant decisions. Lastly, the scale explored the established rules, focusing on creating a plan and the degree of freedom to divert from or abandon the plan.

The operationalisation of sustainability was strictly connected to the necessary long-term horizon inherent to the CE transition. Indeed, as explained in Chapter 2, circular

solutions and a more comprehensive circular transition require a long-term vision, with stakeholders buying in to invest their resources and deeply engage in a significant shift in the economic system (Williams, 2019). I also believe in the need for a management tenure long enough to plan, implement, and readjust a circular transition. Taking the work of Mueller and Jungwirth (2016) as a starting point, I developed a three-item scale to capture how strong the network manager position is, and the benefits the network could achieve in the long run (See Table 1). Specifically, the first and the third items of the scale focus on the privileged perspective that network managers have regarding the stability and sustainability of their position, combining the objective funding they have at their disposal and the subjective willingness to continue that particular work. The second item focuses on the network as a whole, to capture if the network can plan and effectively generate more significant benefits in the long run.

The theoretical framework emphasises trust as a crucial factor in enhancing network effectiveness and promoting positive performance. Scholars in the Public Administration literature including Bouckaert (2012) and Grimmelikhuijsen & Knies (2017) have created measurement scales to assess trust. I adapted the five-item scale developed by Klijn et al. (2010a), which has been further tested by Nederhand and Klijn (2019) and Warsen et al. (2019), to quantify the level of trust among the stakeholders in the network (See Table 1). This scale aims to evaluate the network manager's and stakeholders' proactive actions towards others, and the reactions to other stakeholders' behaviour.

The last condition in the analysis is the connectivity between actors. Unlike trust, this network determinant is about how integrated stakeholders are with each other, guaranteeing a certain level of cohesiveness and a possible role of mediator of the network manager. I employed the four-item scale developed and tested by Cristofoli et al. (2019) to investigate how much and in which way network stakeholders interact with each other.

The QCA calibration is the operation through which researchers use empirical information to assign set membership to cases (Schneider & Wagemann, 2012). Calibration is a prerequisite for any QCA analysis, ensuring that data are transformed into crisp or fuzzy sets before analysis begins. This process involves setting empirical anchors—fully in, fully out, and the crossover point—to translate raw data into meaningful fuzzy scores, with the

crossover point representing the point of maximum ambiguity about set membership (Mello, 2021). Calibration is not merely a mechanical process; it requires the researcher to apply external knowledge, including undisputed facts, generally accepted notions in social science, and specific expertise in the field of study. This approach ensures transparency and reduces subjectivity in the calibration process. Following the condition-oriented approach of this chapter, I used the direct calibration method to assign set membership to the cases. The direct method is particularly suitable for numerical raw data collected through surveys, which fits well with the explorative nature of this study and the necessary guarantee of anonymity given to the respondents. This method involves employing software to assign scores based on predefined empirical anchors (Cristofoli et al., 2019; Mello, 2021; Oana et al., 2021). Indeed, the direct method of calibration involves defining specific a priori empirical anchors to ensure consistent and accurate set membership assignment. An effective calibration process distinguishes between significant and less significant variations in raw data, allowing for a robust analysis (Mello, 2021). In this study, I established the full membership anchor at 0.95, the crossover point at 0.5, and the full non-membership point at 0.05, providing transparent and interpretable scores for each case (See Table 1). These anchors reflect a nuanced understanding of the data, ensuring that the calibrated measures provide meaningful insights into the set memberships.

Table 1 - Operationalization and calibration

Condition	Items	Calibration approach and thresholds
Trust	<p><i>Questionnaire items (based on Cristofoli et al., 2019; Nederhand and Klijn, 2019) [1= Completely disagree/7 = Completely agree]</i></p> <p>(1) In general, all the network partners (including me) fulfil their agreements with each other.</p> <p>(2) All of the partners (including me) give each other the benefit of the doubt.</p> <p>(3) All of the partners (including me) keep in mind the interests of the other parties.</p> <p>(4) All of the partners (including me) refrain from using the contributions of other parties to their own advantage.</p>	<p>Direct method</p> <p>- Equal to 35: Fully in (1)</p> <p>Equal to 31.5: Crossover point (0.5)</p> <p>Equal or below to 23.7:</p> <p>Fully out (0.05)</p>

	(5) All of the partners in this project (including me) can assume that the intentions of the other parties are good in principle	
Connectivity	<p><i>Questionnaire items (based on Cristofoli et al., 2019; REFERENCE) [1= Completely disagree/7 = Completely agree]</i></p> <p>(1) Network partners contact each other's to achieve the project goals</p> <p>(2) Network partners collaborate with each other for the project goals</p> <p>(3) Some relationships exist among the network partners</p> <p>(4) Network partners normally interact to achieve the project goals</p>	<p>Direct method</p> <p>- Equal to 28: Fully in (1)</p> <p>Equal to 24.5: Crossover point (0.5)</p> <p>Equal or below to 16.95: Fully out (0.05)</p>
Network Management	<p><i>Questionnaire items (based on Klijn et al., 2015; REFERENCE) [1= Completely disagree/7 = Completely agree]</i></p> <p>(1) Groups of public stakeholders are involved in negotiation and debate</p> <p>(2) Groups of private companies are involved in negotiation and debate</p> <p>(3) Civil-society groups are involved in negotiation and debate</p> <p>(4) Groups of academic actors are involved in negotiation and debate</p> <p>(5) In this project, special attention has been paid to sharing diverse points of view</p> <p>(6) During information collection, emphasis was placed on establishing starting points and common information</p> <p>(7) The leaders of the project consulted the people who carried it out. Decisions were made collectively</p> <p>(8) The leaders of the project took into account existing interpersonal relationships, their basis, and how they were generated and developed</p> <p>(9) When deadlock was reached or problems arose in the project, management tried to find common ground between the conflicting interests</p> <p>(10) In this project, explicit agreements were reached about the organization of cooperation</p> <p>(11) The agreements for this project consciously envisaged the possibility of diverting from the plan, in the event that it proved advantageous to do so</p>	<p>Direct method</p> <p>- Equal or above to 78.25: Fully in (1)</p> <p>Equal to 66: Crossover point (0.5)</p> <p>Equal or below to 47.55: Fully out (0.05)</p>

	(12) Parties were enabled to abandon the project if necessary to protect their interests	
Sustainability	<i>Questionnaire items (based on Mueller and Jungwirth, 2015) [1= Completely disagree/5 = Completely agree]</i>	Direct method
	(1) As a network facilitator, I see myself in this position for at least the next five years	- Equal or above to 12: Fully in (1) Equal to 9.5: Crossover point (0.5)
	(2) As a network facilitator, I think that the network will generate more advantages in ten years than it does now	Equal or below to 3: Fully out (0.05)
	(3) The funding for my position and for my team is secured for the long term	
Network Performance	<i>Questionnaire items (based on Klijn et al., 2015 CHANGE REFERENCE AND THE WORDING OF QUESTIONS) [1= Completely disagree/5 = Completely agree]</i>	Direct method
	(1) Do you think that the various aspects of the problem were sufficiently integrated into project plans?	- Equal or above to 19: Fully in (1) Equal to 16: Crossover point (0.5)
	(2) Generally speaking, do you think that the various stakeholders in the project have contributed to achieving results?	Equal or below to 10: Fully out (0.05)
	(3) Do you think that the solutions developed are sufficient to address the problems?	
	(4) Do you think that the developed solutions will be long-lasting?	

3.4 Findings and Results

The QCA analysis was conducted with R Studio, specifically using the packages QCA and SetMethods (Duşa, 2018; Oana & Schneider, 2018; R Core Team, 2021). As Table 2 shows, the majority of the cases analysed display high network performance.

Table 2 - Set membership of the cases for the outcome

Network performance		Number of Cases	Cases
High Performance	Above 0.5	12	CE18, CE14, CE6, CE3, CE1, CE16, CE8, CE20, CE15, CE12, CE5, CE2
Low Performance	Below 0.5	8	CE10, CE4, CE7, CE17, CE19, CE13, CE11, CE9,

Following the protocol elaborated by Schneider and Wagemann (2012), I first proceeded to analyse the necessary conditions. This analysis investigated if any of the conditions could be considered necessary for the appearance of the outcome. For this to happen, a condition must be present or absent in all cases exhibiting the outcome (Fiss, 2007). Secondly, we applied a raw consistency of at least 0.9 for a condition necessary for the outcome (Oana et al., 2021). Consistency is a measure through which we can see how much empirical evidence aligns with a set relation (Schneider & Wagemann, 2012). As can be seen from the Table 3, none of the conditions shows a sufficient level of consistency to be considered necessary, either for the presence or the absence of the outcome. This finding confirms the absence of any necessary network determinants in assessing network performance (Cepiku et al., 2020; Cristofoli & Markovic, 2016; Wang, 2016).

Table 3 - Analysis of necessary conditions

	Cons.Nec	Cov.Nec	RoN
TRUST	0.746	0.821	0.846
trust	0.472	0.53	0.685
CONNECTIVITY	0.784	0.789	0.793
connectivity	0.439	0.546	0.731
NETWORK	0.764	0.815	0.832
MANAGEMENT			
network management	0.492	0.572	0.718
SUSTAINABILITY	0.742	0.785	0.808
sustainability	0.503	0.589	0.729

The next step was the analysis of sufficiency, which involved establishing whether the presence or absence of sufficient conditions or configurations coincided with the presence or the absence of the outcome. The standard for the sufficiency analysis is the construction of a truth table (Mello, 2021; Ragin, 2009; Schneider & Wagemann, 2012) which contains all the possible logical combinations of the conditions under analysis. This study included four conditions, which equals 16 possible causal combinations (following the rule of 2^k combinations, with k representing the number of conditions). First, I included only the rows

covering at least one case, leaving ten rows out of 16. Secondly, I set the raw consistency threshold at 0.9 (with PRI above 0.5) for a truth table row to be included in the fuzzy minimisation process. The consistency value is a numerical expression of the degree to which the empirical information deviates from a perfect subset relation (Schneider & Wagemann, 2012). After applying these filters, I was left with six rows in the truth table, covering 11 cases out of 20 (see Table 4). The truth table rows not appearing in the truth table are not discarded, but are used as reminders for developing parsimonious and intermediate solutions. The following operation in the QCA standard procedure is the application of the logical minimisation process. I reduced the truth table rows to a set of logic statements that describe the underlying causal patterns (Ragin, 2009).

Table 4 - Truth Table

	TRUST	CONN	MANG	SUST	PFM	N	Raw consist.	PRI
15	1	1	1	0	1	1	0.99571	0.982236
12	1	0	1	1	1	2	0.940867	0.825056
16	1	1	1	1	1	4	0.925488	0.852133
5	0	1	0	0	1	1	0.913551	0.748814
10	1	0	0	1	1	1	0.908612	0.665068
14	1	1	0	1	1	2	0.90404	0.748599
2	0	0	0	1	0	1	0.798035	0.396501
7	0	1	1	0	0	2	0.883149	0.750791
3	0	0	1	0	0	2	0.83439	0.586731
1	0	0	0	0	0	4	0.470656	0.079038

Tables 6 and 7 show three different solutions obtainable through the process of logical minimisation, including the notation system developed by Ragin (2009) (Schneider & Wagemann, 2012). Following the recommendations of Maggetti and Levi-Faur (2014), I used all three solutions in interpreting the QCA results (see Table 5 for the legend). Researchers use several parameters in the QCA toolkit to interpret solutions and single configurations (Mello, 2021; Oana et al., 2021). Firstly, the solution coverage and consistency must be considered, which measure how much of the outcome is explained by the whole solution,

and the proportion of cases with the same condition or configurations present in the outcome, respectively.

Table 5 - Legend of Table solutions

Condition or Outcome	Presence	Absence
Trust	TR	tr
Connectivity	CO	co
Network Management	NM	nm
Sustainability	SU	su
Network Performance	PF	pf
Logical Operator "and"		*
Logical Operator "or"		+
Necessary Condition		←
Sufficient Condition		→

Table 6 - Overview of the configurations leading to the network effectiveness

	<i>Conservative solution</i>			<i>Intermediate solution</i>			<i>Parsimonious solution</i>	
	TR*SU+TR*CO*NM+tr*CO*nm*su → PF			TR*SU+TR*CO*+CO*nm → PF			TR+CO*nm → PF	
Configuration	Path 1	Path 2	Path 3	Path 1	Path 2	Path 3	Path 1	Path 2
	TR*SU	TR*CO* NM	tr*CO* nm*su	TR*SU	TR*CO	CO*nm	TR	CO*nm
Consistency	0.898	0.907	0.914	0.898	0.844	0.861	0.821	0.861
Raw Coverage	0.674	0.530	0.227	0.674	0.627	0.418	0.746	0.418
Unique coverage	0.178	0.021	0.058	0.116	0.024	0.061	0.389	0.061
Solution consistency	0.883			0.842			0.813	
Solution PRI	0.813			0.755			0.716	
Solution coverage	0.766			0.804			0.807	

Table 7 - Overview of the configurations leading to network effectiveness (Ragin 2009)

	Conservative solution			Intermediate solution			Parsimonious solution	
	1	2	3	1	2	3	1	2

Trust	●	●	○	●	●	●
Connectivity		●	●		●	●
Network		●	○		○	○
Management						
Sustainability	●		○	●		

All three solutions present high levels of coverage and consistency, confirming the empirical significance and the moderate loss of empirical validity. In addition, specific parameters must be applied to the single configurations of conditions composing the whole solution. The first is the raw consistency, a parameter focused on the proportion of cases consistent with the outcome with a specific configuration of conditions (Oana et al., 2021). All the configurations (or conditions) here are above 0.8, which aligns with similar QCA work about network effectiveness and its determinants (Thomann & Ege, 2020). Turning to the coverage, I first considered the raw coverage, which measures how much of the outcome is covered by the entire solution, regardless of any empirical overlap. As previously mentioned, all configurations present satisfactory levels of raw coverage, meeting the standard of the previous QCA works on network determinants. In addition, I also considered the unique coverage, which shows how much empirical evidence is explained by a single path, excluding all the other sufficient configurations.

I decided to analyse the complex solution for two different factors. The first concerns the parameters of fit of the complex solution. Indeed, as Table 6 shows, both the raw and unique coverage and the solution and single paths consistency are higher than the other solutions. Secondly, due to the lack of substantive qualitative data on the cases under analysis, I also preferred to include logical reminders for the logical minimisation process (Mello, 2021) .

Following Table 6, we could observe that the first path of the complex solution is composed of the intersection of Trust and Sustainability (TR*SU). This combination suggests that a distributed trust between stakeholders and the general stability and funding for long-term planning makes it possible to achieve high levels of network effectiveness. This path covers nine cases with a consistency score of 0.898, which means that 89.8% of

the cases with this configuration performed well. The second path is the most complex, combining three determinants leading to network effectiveness. In six cases, the intersection of high levels of trust, well-connected stakeholders, and a successful implementation of network management strategies (TR* CO* MA) led to network effectiveness. As with the first path, this combination also has a high level of consistency, with 90.7 % of the cases showing this configuration also achieving the outcome. The last path, which covers only one case, displays a peculiar intersection. Indeed, in that case, in which there are no high levels of trust between stakeholders, network management strategies have not been particularly successful; with the lack of a sense of stability in the network manager position and low confidence in the long-lasting solutions adopted, high levels of connectivity (CO) appear to be sufficient to lead the network to the outcome. This path shows an even higher consistency score (91.4%).

3.5 Discussion and Conclusion

Despite the growing prominence of the circular economy as a means to simultaneously deal with multiple environmental challenges, there has been little empirical research into the role that governance and public actors play in facilitating this transition (Corvellec et al., 2022). This chapter has therefore aimed to explore how the network governance approach could help public actors to transition towards a more circular economy by collaborating with other societal stakeholders. I introduced several distinctive features of the network governance approach in order to identify combinations of network management strategies, network sustainability, trust, and network connectivity which most successfully lead to network effectiveness. I collected data through a survey, using the answers of public managers from 20 different networks engaged in circular transition projects in Italy. I used a fsQCA approach, which allowed the study to capture the existence of multiple paths of different features to achieve the same outcome. Since the data originated from a survey, it has limited generalisability (Cristofoli et al., 2019). The questionnaires registered public managers' perceptions, both concerning the network determinants and the network effectiveness. Therefore, in order to avoid any confusion, throughout the discussion, I will use the adjective "perceived" when referring to network effectiveness.

Regarding some general considerations about QCA and our analysis, confirmation of the equifinality and the causal asymmetry principles could be observed. Indeed, the presence of three different paths leading to the same outcome shows how complex real-life situations, such as the success of a network of different stakeholders in achieving any kind of circular transition, cannot be reduced to a one-size-fits-all recipe, but are open to several paths and approaches. In addition, it was not possible to identify any consistent and covered path leading to the absence of the outcome. This shows that merely identifying the three paths does not explain what not to do to avoid bad network performance, and that it is necessary to refer to different theories and probably different data to explain the non-occurrence of the outcome (Schneider & Wagemann, 2012).

Another interesting pattern that emerged is the necessity of stability for a high level of network performance. Indeed, all three paths show a structural factor as a condition for the occurrence of the outcome, namely sustainability or connectivity. This corroborates what has already been highlighted in previous empirical evidence (Edelenbos et al., 2013; Hu et al., 2022; Provan et al., 2009; Raab et al., 2015) and substantiates the necessity of a firm network structure to deal with wicked problems and achieve complex solutions, as is the case of a network engaged in the circular economy transition. Indeed, without precise and long-term planning from the network manager, external political support, and the serious engagement of societal stakeholders, networks will not be able to fully adapt to new circumstances of uncertain problems, learn from a necessary process of trial and error, or adopt innovations over time.

Moving to the three paths uncovered through the QCA, the insights which may be of use to practitioners and potential directions for future research can be delineated. Additionally, I acknowledge and discuss the inherent limitations of the study, providing a transparent overview of its scope and boundaries.

The first insight from the analysis comes from what I call the *far-sighted* approach, as exemplified by the first path (Table 6). I believe that the perceived effectiveness of the configuration of Trust and Sustainability can be attributed to the long-term vision and strategic foresight exhibited by the stakeholders involved in the network's formation and management. Indeed, a key aspect of this approach is the pivotal role of conveners played

by political actors and network managers. They carefully select stakeholders based on pre-existing trust and the social capital between them, or on the potential trust that could arise. This exercise could also be done using several instruments not included in this study, such as stakeholder analysis (Ansell et al., 2022; Bryson, 2004).

In addition, the long-term perspective is also evident from the high levels of sustainability. These networks first secured the necessary resources to guarantee longevity. The resources can come from the willingness of political actors to secure the necessary funds for network managers' position and their teams, and/or from the successful pooling of resources by the stakeholders involved. Moreover, network managers also have the intention and the necessary confidence to stay at the top of the network for an extended time. Furthermore, the network manager has a distinct perception of the long-lasting life of the network, with relative confidence that not only will the network last at least ten years, but that it will also provide more benefits after ten years. An unexpected observation is the relative absence of intensive network management strategies, which are traditionally emphasised as fundamental in the literature and empirical evidence (Medina et al., 2022; Smith, 2020). This finding suggests that networks can be effective through alternative means beyond conventional network management strategies. It points to the need for public actors to recognise the challenges and costs associated with implementing successful management strategies and the viability of networks performing effectively through different approaches (Han & Kang, 2021).

Thus, the present study shows alternative paths to traditional network management strategies, which highlight the importance of public actors acknowledging the difficulty and the cost of implementing successful management strategies and the possibility that networks could effectively adopt different paths. However, policy practitioners must be aware of the excessive closure that this approach adopts in choosing what stakeholders should be involved in the project to avoid conflict within the network, potentially leading to limited resources, lack of democracy and accountability, and a limited scope and reach of solutions. In addition, stakeholders who are too similar could lead to a group-thinking phenomena, and thus hinder the network from developing innovative solutions.

The second path that emerged during the analysis reflected a more *traditional* approach, with the confirmation of previous evidence about the importance of network management strategies, with some network structural characteristics necessary to achieving the outcome (Bashir et al., 2022; Cremers et al., 2023; Cristofoli et al., 2019). Indeed, as Table 6 shows, the second path presents a network management configuration together with high levels of trust and highly connected stakeholders. Unlike the *far-sighted* approach, this approach does not include sustainability as an INUS condition to achieve the outcome. An explanation for the absence of sustainability is that already highly connected and trusting networks do not necessarily need the external support of political actors or explicit commitments from network managers. Indeed, this kind of network will survive regardless of external actors' financial backing or network managers' substitution. This insight further suggests that practitioners should use network and stakeholder analysis instruments to decide the necessary amount of resources to invest for the emergence and livelihood of the network, by identifying the pre-existing levels of trust and connectivity between the stakeholders to be involved.

The final configuration discussed here is characterised by the presence of connectivity as the sole condition for the outcome's occurrence, alongside the explicit absence of trust, management, and sustainability. I call this the 'emergent approach,' which appears to challenge the established theoretical and empirical understanding of network governance. In contrast to prior studies which indicate that a network's perceived effectiveness typically arises from configurations of different conditions (Cristofoli & Markovic, 2016; Cepiku et al., 2020; Turrini et al., 2010; Warsen et al., 2019; Ysa et al., 2014), this approach suggests that tight, continuous relationships among stakeholders, all aligned towards a common goal, may be sufficient for effective network performance. Acknowledging the limited empirical evidence upon which this path is built, I offer two possible explanations and insights for those interested and/or involved in forming and managing networks.

The first interpretation aligns with the 'far-sighted' approach, highlighting the public actors' pivotal role in selectively connecting stakeholders with similar perspectives on problem framing and solution approaches (Hovik & Hanssen, 2015; Johnston et al., 2011). While wicked problems, such as those addressed by CE solutions, necessitate resource pooling from a broad spectrum of stakeholders, the inclusion of too many diverse and

possibly conflicting actors can lead to deadlocks and irreconcilable differences. Thus, public actors face the difficult task of striking a balance between stakeholder diversity and minimising the possibility of conflicts. However, unlike the far-sighted approach, the emergent path does not necessitate reciprocal trust among stakeholders. A possible explanation is that such stakeholders acknowledge that they share a common destiny, and can work with stakeholders they do not necessarily trust. The potential downside is a risk-averse approach by the convener, resulting in a narrowly defined stakeholder composition, both in quantity and quality. Due to diminished accountability, this could render the resource pool inadequate and the solutions less effective.

The second explanation delves into the substantive complexity of the problem, namely the diversity of interpretations and the extent of the divisive knowledge surrounding it. Complex challenges, or 'wicked problems', typically exist at the higher end of this complexity spectrum, featuring varied perspectives on problem definition and resolution and a robust debate over the types of knowledge to be employed. While such complexity is to be expected in the context of wicked problems, there may be exceptional situations influenced by external factors where such problems become less substantively complex. In such scenarios, trust, network management strategies, and sustainability might not be critical to achieving perceived network effectiveness.

In summarising the research, I now acknowledge three primary limitations and propose future avenues for investigation. The first limitation pertains to the theoretical framework and the conditions selected for analysis. This study has aimed to discern whether network management, along with certain structural and functional conditions, influences perceived effectiveness in networks engaged in CE transitions. However, this focus inherently excluded other potentially significant network features from its scope. For instance, I did not consider governance modes, such as whether a public actor governs the network externally or through its members, which could have provided additional insights (Provan & Kenis, 2008; Cristofoli & Markovic, 2016).

Furthermore, while other researchers have considered network age and size as influential factors (Cepiku et al., 2020; Verweij et al., 2013), I omitted the network's age due to the emerging nature of CE concepts and excluded size due to incompatibilities between

the selected case studies. Additionally, there is a rich body of literature focusing on actor attitudes and network centrality through social network analysis measures (Hu et al., 2022; Medina et al., 2022) that was not explored here. These omissions underscore the need for a more comprehensive approach in future research to encompass a broader range of conditions and factors that may influence network effectiveness in the context of CE transitions.

In addition to the choice of the determinants under analysis, there is a second set of limitations to the analysis set out in this chapter concerning how network conditions were measured and analysed. Indeed, as was already outlined in the methodology section various different methodologies and methods can be employed to analyse networks, their internal functioning, and how they perform. An example is the use of social network analysis or any other form of network analysis, such as the exponential random graph analysis (Raeymaeckers & Kenis, 2016; Ulibarri & Scott, 2017). The difficulty of reverting to these methodologies lies in the data collection, due to the necessity of collecting data from as many nodes of the network as possible (Newman, 2018). As the methodology section covered, such response rates are improbable. In addition to the possible methodology, another main limitation is the use of the *perceptions* of network managers in collecting data on networks' *perceived* effectiveness, introducing a potential positive bias. However, as was already explained above, the lack of shared circular economy indicators, the relative shortage of cases, and the potential resistance of network managers to respond to the survey and being judged on external criteria was why I chose to use their perceptions.

The last main limitation concerns the generalisability of the results and the insights obtained throughout the QCA analysis. The first problem relates to the number of cases under study. Indeed, while 20 cases are enough to conduct a QCA analysis with four different conditions, this could be considered insufficient for generalising the paths obtained through their analysis. In addition, the chapter lacks comparability due to the cases having the same national origin. However, due to the lack of shared outcome indicators on CE and of a catalogue classifying the different CE experiences, internal validity was preferred over external validity, limiting the study to a specific national setting.

Chapter 4

Charting the future of Circular Economy: conclusions and reflection

4.1 Introduction

This research has delved into the circular economy and its role as a vehicle for sustainable development, positing that to fully harness its potential, the concept must navigate a plethora of challenges. Its goal has been to enrich the understanding of the CE both as a theoretical construct and as an employable means. Accordingly, this thesis addresses three research aims: 1) Map the perspectives and communities of knowledge that make up the CE field mosaic; 2) Examine the future employability and comprehensiveness of the CE; and 3) Explore the CE's governance dimension and understand if the network governance model is the most suitable framework to help to ensure its comprehensiveness and holistic promises. This concluding chapter synthesises the key findings of this investigation and reflect on them by moving from the Pragmatist philosophical stance outlined in the first chapter. Indeed, in the next section I systematically address the research questions, providing the results of the evolutionary learning cycle started in this work with a further elaboration on the broader academic discourse. Thereafter, in section 4.3, we propose a spectrum of research pathways sparked by this thesis, spanning from conceptual explorations of CE to considerations of governance and public administration. Section 4.4 delineates the possible practical implications of our research, outlining intersections between theory and practice. We conclude this chapter and the thesis with reflective closing remarks, summarizing our journey and its contributions to the field.

4.2 Addressing the research questions

In this research, we decided to answer to the following main research question:

Can the circular economy effectively contribute to sustainable development, and if so, how?

This broad research question is moved by an inherent problem-driven perspective, which consists in the acknowledgement of the peculiar moment that Circular Economy as a concept is living and the challenges that must deal with to become fully employable and avoid the 'buzzword' fate of other environmental concepts. Indeed, among the several issues that such a broad concept is trying to address, I have identified in its definitional quagmire and the lack of focus on governance in the CE scholarship and practice the two main obstacles for its full development. This problem-driven perspective has activated an evolutionary learning cycle that translated the main research question into the three following sub-questions:

1. What is the current state of the circular economy as an umbrella concept?
2. What kind of future conceptual scenarios can the circular economy expect to reach?
3. How can network governance contribute to the circular economy transition?

The choice of breaking the main research question down into three specific aspects offered the opportunity to develop a complete evolutionary learning cycle, in which I have collected and reflected on the existing knowledge about definitions and governance of CE and deliberate on its future and what scholars and practitioners should to help CE in holding its promises of being an effective and holistic contribution to the sustainable development.

The following sections provide answers to each of these sub-questions, intending to answer the different aspects of the evolutionary learning cycle and thus constituting the answer to the main research question.

4.2.1 What is the current state of the circular economy as an umbrella concept?

The first research question of this evolutionary learning cycle is motivated by the reflexivity promoted by the Pragmatism and its dynamic approach to knowledge, which is

intended to be provisionary and most often useful when practically engaged with reality. Indeed, while scholarship was already aware of the definitional quagmire that affects the nature of Circular Economy as an umbrella concept, there was no explicit attempt to build an evidence base to confirm this insight. The aim of this research question is to reflect on the existing assumptions and frameworks of the Circular Economy scholarship, with the twofold intent of confirming or not the existence of the definitional quagmire around the CE and creating usable knowledge for the second question, in which I attempt to deliberate about what scholars and practitioners should do to develop a coherent and employable umbrella CE concept.

Therefore, Chapter 2 analyses the academic conceptualisation of the circular economy, with the aim of discovering the layers of its theoretical construction and future practical implications. The first objective was to scrutinise the notion of the CE as an umbrella concept, a claim posited by several scholars in the field (Blomsma & Brennan, 2017; Calisto Friant et al., 2020; Homrich et al., 2018). Umbrella concepts are distinctive in their ability to group a diverse range of ideas under a single metaphor, thereby catalysing the formation of a cohesive cognitive unit and fostering the emergence of a novel discursive space. They are also characterised by a predictable developmental trajectory, typically evolving from an initial preamble phase to a more established validity phase (Korhonen et al., 2018; Reike et al., 2018). The present findings corroborate these theoretical delineations, demonstrating that the CE's circular metaphor has indeed exerted a profound influence across various fields and concepts, including industrial Ecology and Cradle to Cradle (Braungart & McDonough, 2002; Erkman, 1997). This influence has not only rejuvenated existing discussions, but has also spawned a new discursive space where diverse strands of the sustainable development literature converge to forge and refine holistic frameworks for an economic system in transition under the metaphorical flag of circularity. Furthermore, the performance analysis carried out in Chapter 2 confirms the typical trajectory of umbrella concepts. Indeed, after a protracted preamble period characterised by a main focus on technical aspects, this study pinpointed a significant tipping point in around 2015. This pivotal moment, spurred by the advent of the Sustainable Development Goals by the UN and the CE's potential to comprehensively address them, marked a shift in the concept into a period of excitement. This phase saw an exponential increase in scholarly activity, indicating a burgeoning interest and engagement with the concept. The subsequent development of

comprehensive frameworks aimed at reimagining and restructuring our economic system under the CE paradigm signifies the onset of its validity phase. During this period, the academic and practitioner communities grapple with a multitude of interpretations, striving to distil a shared understanding and cohesive vision of CE.

The second aim of this analysis was to understand if the CE is still in its validity phase - and if not, what kind of trajectory it has experienced. The findings reinforce the notion that the CE is indeed navigating its validity phase, without specific clues on which direction the field is pointing towards. The recent surge of interest and scholarly activity, particularly evident during the excitement period, has not provided sufficient temporal breadth for the emerging communities of knowledge, identified through co-authorship and bibliographic coupling, to engage in extensive discourse and reach a consensus. This nascent stage of development precludes the CE from having already crystallised into a coherent concept with universally accepted notions, upon which different stakeholders could build their own circular transition approach. Moreover, the relatively brief and still evolving nature of the debate surrounding the CE have so far prevented it from becoming a permanent issue, with different communities not communicating with each other, and actors and scholars using the concept in very different ways. Lastly, the current and ongoing growth in the impact and productivity of the CE literature rules out the collapse of the concept, as this would have meant that a shrinking of the field would have been observed.

These findings represent a comprehensive reflection on the existing frameworks, habits, and assumptions of CE as an umbrella concept and the different knowledge discourses under it. The bibliometric analysis findings have indeed confirmed the definitional quagmire of the CE, with the existing community of knowledge not talking to each other and developing their idea of what is Circular and how to achieve and evaluate the circular transition. In addition, this reflection has also endorsed the supposed dominance of technocentric and reformist approaches, with more radical and transformative approaches that are too recent and few scholars researching them. Moreover, it has also proved that the Circular Economy as an umbrella concept is still in its validity phase, representing the usable knowledge for the second research question and deliberate about what paths scholars and practitioners should pursue for the transformation of CE into a coherent concept and avoid its collapse or its involution in a buzzword.

4.2.2 What kind of future scenarios can the Circular Economy expect to reach?

The second question addressed in this thesis is inherently linked to the first one. Indeed, umbrella concepts always maintain a delicate balance between a diversified theoretical and empirical basis and a messy, overabundant field with too many definitions and frameworks competing for intellectual supremacy over the concept. As already outlined above, there is no specific indication of which trajectory the CE concept will undertake. After ascertained that the CE concept is still in its validity phase, this section uses the reflexivity findings produced in Chapter 2 to deliberate about the possible future scenarios for CE. Indeed, it elaborates on what kind of steps CE scholars and practitioners should take to make it a coherent concept and avoid its regression into a permanent issue or a collapsed concept. This deliberation is strictly connected to the main research question, laying the definitional foundation to make CE an effective contribution to the sustainable development.

The first scenario under analysis concerns the possibility of the CE becoming a permanent issue. In this trajectory, the CE would solidify its position as a foundational and enduring element in academic and practical approaches to sustainable development. That status would be marked by the continuous but fragmented engagement of diverse communities of knowledge, each contributing to the evolution and application of the concept from their own unique perspectives. In this scenario, the CE would maintain its relevance and continue to influence policies, business models, and academic research (Leipold et al., 2023), but without a unified or coherent framework which is universally accepted by all stakeholders. Different strands of CE, from the technically focused to the more holistic and transformative, would coexist and continue to develop, sometimes in parallel and at other times in conflict. This permanent issue status, while offering the benefit of keeping the concept alive and adaptable to changing conditions and new insights, also carries the risk of the potential dilution of its core principles and the absence of a firm direction. The possible evidence suggesting this future are the growth of different communities, even radical ones such as the transformative discourses, but in a disconnected way so that they are almost unaware of each other. The failure of any possible debate between them will result in the CE being given different and possibly contrasting meanings, moving the concept towards the unavoidable destiny of becoming a buzzword (Dzhengiz et al., 2023).

In the scenario where the CE concept collapses and evolves into a narrower framework, the absence of a vibrant, diverse debate and a shared knowledge base could lead to the alienation of various stakeholders and knowledge communities. These groups might gravitate towards other concepts that better cater to their needs and are more open to constructive dialogue. This would not signify the complete disappearance of the CE, but rather, would mark a decline in its scope and ability to holistically address the UN's Sustainable Development Goals (SDGs). The dominance of technical perspectives in CE theory, as noted in Chapter 2, without the significant inclusion of transformational and consumption-oriented perspectives, raises concerns about the concept's evolution and its ability to integrate diverse viewpoints. The risk of the CE becoming more limited and less comprehensive is considerable, especially if the current trends in the field persist.

The third scenario is the achievement of the coherence of the CE concept. Connecting to the main research question of this thesis, the transformation of the CE into a coherent concept is a fundamental prerequisite for its real-life employability and ability to fully contribute to sustainable development. As I outlined in analysing the two other options for the future of CE as an umbrella concept, the bibliometric analysis in Chapter 2 is not discouraging of an evolution into a coherent concept, but is not fully supportive either. Indeed, the growth in terms of the quality and quantity of CE scholarship in recent years is particularly encouraging, at least in terms of interest in the concept from an increasingly broad range of societal stakeholders. This variety of perspectives lays the foundation for the necessary debate behind the creation of a common knowledge basis. The recency of the arrival of these new perspectives has hindered the full development of this debate, and scholars and practitioners can still engage in an exchange of ideas and agree on some shared points which may depart from their own perspective. Indeed, a coherent concept is not a collapsed concept with a specific narrow focus, but rather is populated by different communities of knowledge, each proposing their view but all building on a common starting point. However, the transformation of the CE into a coherent concept must pass through an active engagement with the internal reflections of all the stakeholders interested in designing and implementing a circular transition (Hartley & Kirchherr, 2023; Kirchherr et al., 2023; Leopold et al., 2023).

4.2.3 How can network governance contribute to the circular economy transition?

The third sub-research question purposefully deals with the lack of focus and research on the governance dimension of CE. In Chapter 3, the in-depth examination of 20 case studies on network governance within the CE transition reflects upon the existing CE governance practices and offers compelling evidence of the model's efficacy. Employing Qualitative Comparative Analysis, this research analyses what public actors have done to achieve a successful circular transition and reveals multiple effective pathways in network governance, highlighting its pivotal role in the CE. In this sense, Chapter 3 represents a detailed and empirically based reflexivity process on the CE's effective contribution to sustainable development, responding to the academic call for the empirical exploration of the governance dimensions in the CE and significantly enriching the academic CE discourse (Dzhengiz et al., 2023; Hobson, 2020). The findings underline the diversity and adaptability of network governance strategies, which are crucial in transitioning towards circularity. This expands our understanding of how governance frameworks can be tailored to suit varied CE contexts, offering valuable insights for both theory and practice. Overall, these findings confirm the potential and adaptability of network governance as a paradigm for a CE transition and represent a usable knowledge base to deliberate about what could be effective in the realm of CE governance. Indeed, the analysis of the 20 network governance case studies identifies the effectiveness of specific paths and configurations of conditions available for public actors when engaged in managing a circular transition successfully.

The first aim of Chapter 3 was indeed to verify that the CE responds well to the adoption of more horizontal, collaborative, and inclusive governance approaches. The need to involve different stakeholders to shift the linear economy to a circular one, even at a local level, requires the involvement of all the societal stakeholders affected by that transformation and the pooling of their resources (Klijn & Koppenjan, 2015). This confirms the claims of several governance scholars about the suitability of network approach to wicked challenges, which in the case of the CE result from the holistic achievement of several sustainable development goals (Dzhengiz et al., 2023; Geissdoerfer et al., 2017).

In addition, the results of the QCA study confirm the inherent equifinality of network governance (Cristofoli et al., 2019; Fedorowicz et al., 2018; Lucidarme et al., 2016; Medina et al., 2022). The analysis of 20 case studies highlighted the existence of three possible combinations of conditions to achieve network effectiveness within the CE context. Trust and sustainability, or trust with connectivity and management strategies, or just connectivity, are equifinal configurations that lead to strong network performance. This is particularly relevant for CE governance, as it shows the flexibility of the network governance approach in employing a place-based perspective and adapting to local needs and resources (Bowden & Liddle, 2017; Sancino et al., 2022).

4.3 Future Research Agenda

As underlined in Chapter 1, Pragmatism defines knowledge as a provisional and dynamic basis that is valid until it is useful in dealing with the complexity of problems and societal challenges. The usable knowledge basis and the deliberation accumulated in this thesis' evolutionary learning cycle don't represent an unchangeable and axiomatic truth but only a contextual and circumstantial tool to deal with the main two ambiguities affecting CE at this moment. What I explicit in the following sections goes back to the acknowledged necessity within the Pragmatism philosophy of constantly revising our knowledge and engaging in an exercise of imagination to be prepared for future challenges and new kinds of complex problems (Gümüşay & Reinecke, 2024). Indeed, the following sections engage with CE scholars by suggesting potential research paths that either start from the findings of the evolutionary learning cycle of this thesis or from specific insights and hunches that I found on the road of this research journey.

4.3.1 Enhancing the conceptual clarity of the circular economy

This research represents a major effort in enhancing the conceptual clarity of the circular economy. Chapter 2 marked a first attempt to explore the umbrella nature and possible conceptual trajectories of the CE. Claims about the nature of the concept have been mostly theoretical, with previous reviews relying on the subjective expertise of their authors (Calisto Friant et al., 2020; Geissdoerfer et al., 2017; Ghisellini et al., 2016; Kirchherr

et al., 2017; Murray et al., 2017). The present analysis opened up the possibility of establishing some firm points upon which scholars and practitioners may build the future of the CE concept. In this section, we propose different review approaches to further explore the internal dynamics of the CE as an umbrella concept. The first suggestion is to replicate the bibliometric approach taken here in the future. Indeed, as outlined in Chapter 2, the CE is still in the validity phase in which different frameworks are fighting to conquer the field and impose their view. However, I argue that in the next five years, the concept will emerge from its validity phase and start its transformation into a coherent concept, permanent issue, or collapsed concept.

The next bibliometrics should focus on two main findings. The first is the variety of topics in the co-authorship and bibliographic coupling clusters. Indeed, if Chapter 2's results are confirmed, it could be confidently argued that the CE is collapsing towards becoming a narrow and technological-focused concept. The second finding, if the bibliometrics show a rich variety of communities of knowledge beyond technological and only reformist holistic discourse, is to observe if the different clusters have connected with each other, and if the CE communities of knowledge are engaging in a common debate and building shared points of departure about circular transition. On the contrary, if the increased variety does not correspond to an increased connection between these various communities of knowledge, it can be assumed that the concept is becoming a mainstream but permanent issue. In order to increase the quality and depth of the results and findings, I suggest enriching the bibliometric approach with additional methods. There is an increasing trend in the bibliometrics field to adopt topic modeling analysis on abstract or even full text, as a substitute or a parallel complementary method to bibliographic coupling thematic analysis (Chen et al., 2021; Jiang et al., 2016). This machine learning approach can further decrease the degree of subjectivity in the thematic analysis and can also analyse incomparably larger amounts of text (Blei & Lafferty, 2009).

In addition to the knowledge analysis of the academic domain, I also suggest an exploration of how practitioners have framed the CE concept. Indeed, an alternative approach to bibliometrics is the incorporation of, or a sole focus on, exploring policy documents on a specific topic (Bornmann et al., 2016). By using altmetrics and a topic modeling approach, researchers could use policy documents databases, such as Overton

or Altmetric, to explore both the impact of science in practice but also how practitioners have conceptualised the CE (Szomszor & Adie, 2022; Yin et al., 2021).

Another possible approach is a problematising review, as a critical alternative to traditional integrative reviews such as bibliometrics or systematic literature reviews (Alvesson & Sandberg, 2020). This approach emphasises the need to challenge the existing literature rather than merely synthesising it. It involves a broad but selective process of reading, aimed at problematising rather than accumulating knowledge. Scholars engaged in problematising the CE research could challenge the optimistic view that CE practices are inherently sustainable and have the capacity to simultaneously deal with economic, environmental, and social challenges (Dzhengiz et al., 2023). Such a review could explore the claim of the poor scientificity of the CE, which has been accused of not being in line with thermodynamic laws (Giampietro & Funtowicz, 2020). A problematising review would be able to prompt a more conscious approach to the CE, potentially avoiding future rebound effects or green-washing uses (Castro et al., 2022; Kopnina, 2019).

4.3.2 Circular economy and wickedness

Throughout this thesis, I have emphasised the potential of the circular economy (CE) to simultaneously address the three pillars of sustainable development and, by extension, the wicked challenges that arise from these complex issues (Calisto Friant et al., 2020). However, this relationship between the CE and wicked problems has predominantly been explored at a theoretical level, with a notable absence of empirical evidence to substantiate the claims being made. I therefore propose that future research should undertake an empirical exploration to understand the practical efficacy of the CE in addressing these challenges. A promising starting point could be conducting multiple case studies to investigate whether real-life circular transition projects are being implemented with the explicit aim of tackling the multifaceted challenges posed by the SDGs, and to ascertain if CE practices are effectively managing real levels of complexity in practice. In addition, scholars could seek to understand if this relationship is widespread within the academic domain, or is just a thesis sustained and promoted by a few scholars. Following a previous

example in the CE field, a first study could adopt the Delphi methodology, structuring a panel of expert scholars engaged in the CE who hold different knowledge perspectives (Landeta, 2006; Leipold et al., 2023; Okoli & Pawloski, 2004). The Delphi technique can be instrumental in steering the conversation towards a more coherent understanding of the CE as an umbrella concept. In addition to Delphi, a survey experiment targeting scholars from various academic disciplines can provide insights into the perceived complexity of the problems addressed by the CE. By utilising the 'scale of wickedness' developed by Peters and Tarpey (2019), such a survey could gauge academic opinions on the level of complexity associated with typical CE applications. For practitioner perspectives, applying Peters and Tarpey's (2019) scale within a quadruple helix sampling framework (Carayannis & Campbell, 2010) could be revealing. This approach could explore whether the linkage between the CE and wicked problems is a construct of academic discourse or a phenomenon acknowledged by stakeholders in the private, public, and non-profit sectors. Such a study could also find differences in perceptions across these sectors, to provide more nuance in understanding the CE's role in addressing complex sustainability challenges.

4.3.3 Exploring network governance

The Qualitative Comparative Analysis study set out here provided valuable insights into the role of network governance in facilitating a circular transition. However, as acknowledged in Chapter 3, the network governance literature identifies a vast array of potential determinants that influence network effectiveness. To further enhance understanding of this phenomenon, future research should explore the impact of additional network determinants on the CE transition. First, scholars could investigate the influence of contextual conditions on the network, which were not explicitly incorporated into this study. These encompass the internal and external factors that shape a network's environment and its ability to operate effectively (O'Toole & Meier 2015, Wegner & Verschoore, 2022). By considering these contextual factors, such as the regulatory framework, the availability of resources, and the socio-economic conditions, researchers may gain a more comprehensive understanding of the factors that influence CE initiatives (Shumate et al., 2023). Second, researchers could investigate the impact of additional network management

strategies, complementing the strategies already identified here. While this study has covered a wide range of strategies, such as goal setting, resource allocation, and conflict resolution, there are undoubtedly other strategies that could be employed to steer and guide networks towards effectiveness (Medina et al., 2022; Smith, 2020). By exploring these additional strategies, researchers may refine the understanding of the repertoire of tools available to network managers. Third, researchers are encouraged to examine the role of boundary spanner individuals in networks engaged in circular transition (Van Meerkerk & Edelenbos, 2014). Boundary spanners act as intermediaries between the different parts of a network, facilitating information sharing, knowledge exchange, and collaboration (Van Meerkerk & Edelenbos, 2018). Their presence is particularly crucial in complex networks, such as those involved in CE transitions. By analysing the influence of boundary spanners, researchers can gain insights into how these individuals contribute to the success of CE initiatives (Conteh & Harding, 2021).

In addition to the above theoretical suggestions, future research should employ a range of methodologies to explore the network governance phenomenon in CE. Specifically, social network analysis (SNA) offers a valuable tool for examining the structure and dynamics of networks. SNA can provide detailed insights into the relationships between network members, their roles, and their influence. By combining SNA with other methodologies, such as Q methodology, researchers can add nuance to understanding of the perspectives and behaviours of the different stakeholders involved in CE transitions. By incorporating these suggestions, future researchers can significantly advance our understanding of network governance as a key enabler of circular transition. By exploring a wider range of network determinants, strategies, and methodologies, researchers can ultimately provide valuable guidance for policymakers, practitioners, and stakeholders seeking to promote sustainable and circular economies.

4.3.4 Different outcomes for network effectiveness

Chapter 3 explored the dynamics between network governance determinants and their impact on overall network effectiveness. However, one of the main limitations was the

reliance on perceived outcomes, based on using the perceptions of network managers to evaluate the effectiveness of network structural and management determinants. As was outlined in Chapter 3, there were several reasons behind this choice: the goal of maximising responses from managers, the absence of shared circular economy indicators, the difficulty in comparing the outcome of cases with different goals and scales, and the increased acceptance of perceptions as a reliable indicator of effectiveness. However, future network research should attempt to test different outcomes to assess the effectiveness of network governance. Indeed, there is a debate within the governance field about the adequacy of existing outcomes in evaluating the effectiveness of new governance models (Head, 2008). Several scholars have pointed out that imposing evaluation measures, such as efficacy of efficiency, developed for the Weberian Public Administration and New Public Management governance models, is inadequate to evaluate the performance of governance models used for other purposes, such as to deal with high degree of wickedness and high levels of conflicts between stakeholders involved (Klijn & Koppenjan, 2015; Koliba et al., 2018)

Therefore, future scholars should develop and adopt tailored measures with which to evaluate the effectiveness of networks, to adhere to the goals for which this governance model is usually adopted. First, a possible study could implement a three-level system of evaluation, understanding the different impact of network governance on the community, the network itself, and the single participants (Provan & Milward, 2001; Medina et al., 2022; Shumate et al., 2023). Taking the CE as a possible topic of this three-level effectiveness evaluation, the impact of networks engaged into circular transition could be evaluated by considering the isomorphic pressures from outside the network on behaviours of external stakeholders, the network itself, and the circular change of specific organisations and individuals taking part in the network. Furthermore, future studies could explore the impact of network governance on procedural outcomes (Hovik & Hanssen, 2015; Provan & Kenis, 2008). Starting from the assumption that network governance is employed not only to guarantee a certain level of performance but also to deal with the wickedness of specific challenges and overcome conflicts between different stakeholders, the learning of collaborative skills and the general coordination achieved between the stakeholders and by the network itself could also be measured (Callens & Verhoest, 2023; Klijn & Koppenjan, 2015). Future studies could also reflect on the capacity of network governance and specific

network determinants configurations to settle conflicting perceptions, strategic complexities, and institutional clashes between different organisational norms and values.

4.3.5 Place-based leadership for circular economy implementation

The theoretical framework of Chapter 2 underlined three vertical geographical dimensions involving a holistic CE implementation. Indeed, several scholars have highlighted the need for all stakeholders engaged in CE to be aware of the bottom-up and top-down forces that control such a comprehensive and systemic approach. Future research could therefore adopt a place-based leadership perspective to analyse the evolvement of a CE policy from the national macro-level to several micro-level applications, comparing how geographical and historical factors influence the adaptation of general CE principles to a local context (Budd et al., 2017). The place-based perspective highlights the importance of leadership in places and how it can shape the context, thus affecting environmental, social, economic, and governance dimensions (Hambleton, 2015). In addition, leadership is considered the 'missing variable' in the wicked problem literature, with a need to acknowledge how it contributes to the governance of complex challenges (Liddle, 2010).

Adopting a place-based leadership perspective, this study proposes a comparative analysis of micro-level CE initiatives stemming from the Dutch Government's National Circular Economy Programme 2023-2030. By examining the implementation of CE principles across numerous local projects funded under this program, scholars will gain insights into how place-based leadership interacts with contextual factors to influence CE governance and address the complex challenges associated with its adoption (Sotarauta et al., 2012). This comparative approach would provide a valuable opportunity to identify the unique contextual elements that shape the effectiveness of place-based leadership in different locales. By analysing the interactions between political, managerial, business, and civic leadership, light can be shed on the tensions and synergies that arise in the pursuit of CE implementation. Additionally, the impact of leadership on overall CE outcomes, including resource efficiency, waste reduction, and economic sustainability, can be assessed. The

Dutch National Circular Economy Programme serves as an ideal empirical setting for study due to its comprehensive national framework and the extensive network of local projects it has supported. The program's focus on collaboration and knowledge exchange among municipalities, businesses, and civil society organisations offers a rich tapestry of leadership interactions that can be studied comparatively. Through this research, scholars will contribute to a deeper understanding of how place-based leadership can effectively navigate the complexities of CE implementation and contribute to sustainable development at the local level. By identifying the key factors that influence leadership effectiveness in different contexts, valuable guidance can be provided for policymakers, practitioners, and stakeholders involved in promoting CE initiatives across diverse communities.

4.4 Implications for Circular Economy Practice

4.4.1 Moving towards a holistic circular economy

The results of the bibliometric analysis in Chapter 2 showed an academic domain mostly focused only on the technological innovation and production sides of the CE. As I have stated, this narrow focus is detrimental to an effective circular transition, as it hinders the capacity of the CE to achieve all the social, environmental, and economic SDGs and to resolve the wicked challenges resulting from them. This section underlines the imperative for practitioners to adopt a holistic understanding of the CE, thus recognising that effective implementation goes far beyond mere technological and production-focused initiatives. Indeed, embracing a holistic perspective involves acknowledging that the CE is fundamentally a societal endeavour that requires the active involvement of a diverse array of stakeholders. This approach necessitates moving beyond the confines of technical solutions and manufacturing processes to include broader societal, cultural, and political dimensions in CE strategies. For practitioners, this translates into actively seeking engagement and collaboration across various sectors and societal groups. It involves creating platforms for dialogue and partnership with not only industry peers and

technological experts, but also with community leaders, policymakers, educators, and consumers.

Such inclusive engagement ensures that the diverse needs, values, and perspectives of different stakeholders are considered, leading to CE initiatives that are more equitable, contextually relevant, and sustainable in the long run. Moreover, practitioners must be aware of the interdependencies that exist between the macro, meso, and micro levels in the implementation of the CE. This awareness is crucial when designing strategies that are not only effective at a local or organisational level but also align with broader economic and policy frameworks. Practitioners need to understand how macro-level policies and market dynamics influence meso-level industrial networks and micro-level consumer behaviours, and vice versa. This understanding enables them to identify leverage points and opportunities for intervention at different levels, and to develop CE strategies that are coherent and integrated across these scales.

4.4.2 Defining and standardising the circular economy

The transformation of the CE into a coherent concept is a fundamental challenge that cannot be left in the hands of academics alone, but must be dealt with by all the stakeholders engaged in a circular transition in any sort. The challenge of defining and standardising some common points about the CE concept carries significant implications. This transformation into a coherent and universally understood concept is a crucial step in preventing its potential collapse into a narrow concept or its stagnation as a permanent issue with fragmented and disjointed applications. This definitional process involves distilling the essence of CE into a set of shared principles and frameworks that stakeholders with different perspectives can build upon and adapt. Practitioners must navigate this process by fostering a consensus on the fundamental aspects of the CE while preserving the flexibility that facilitates contextual adaptations. This requires an inclusive approach to gather inputs from a wide range of stakeholders, including businesses, policymakers, academics, and community groups. The objective is to identify and articulate the core elements that define the CE – such as the R principles, the connection between production

and consumption, and metrics – in a way that is applicable to different communities of knowledge and different contexts.

4.4.3 Consumer engagement and education

The lack of focus on the consumption side of the economic system could harm the overall effectiveness of the CE transition. Indeed, consumer and citizen engagement and education are pivotal both for policy-makers and all practitioners working in the CE space and aiming to implement a comprehensive circular transition. This engagement should not stop at informing and persuading individuals of the potential benefits of the CE, but should promote a shared understanding of the CE principles and active participation in sustainable behaviours. Practitioners must recognise consumers and citizens as essential stakeholders in the CE ecosystem, not just as end-users. This means creating avenues for active involvement and feedback, fundamental to translating general macro-level CE policies in more citizen-friendly and effective CE initiatives. Thus, this study suggests that practitioners should extend informational efforts beyond traditional marketing or informational campaigns to include experiential and participatory learning opportunities. These could involve community workshops, collaborative projects, and educational programs that demonstrate the principles of the CE in practical, tangible ways.

The first aim of such initiatives would be to help translate CE concepts into more practical initiatives, making them more accessible and relatable to everyday life. Another aim would be to empower consumers and citizens not just as informed decision-makers but as active contributors to the CE. This implies a shift from seeing them as passive recipients of products, services, or knowledge to partners who are also engaged in co-creating a more sustainable future. Through such efforts, practitioners would be able to integrate consumer and citizen perspectives into the design and implementation of CE initiatives, ensuring adherence to their reality. Practitioners should also cultivate a general cultural shift towards sustainable development and circularity, which would involve challenging deeply ingrained consumption patterns and perceptions of value. This requires a nuanced understanding of consumer behaviour, societal norms, and the barriers that prevent or discourage people

from adopting more sustainable practices. Strategies could include incentivising sustainable consumer choices, providing clear and transparent information about the environmental impact of products, and showcasing the tangible benefits of participating in the CE.

4.4.4 Monitoring and evaluation by metrics beyond a technological and economic focus

Throughout this thesis, a common thread has been the lack of shared understanding of what the CE means, and how to agree on the design and implementation of a circular transition. A main challenge in the definitional debate around the CE concept is the development of a consensus on metrics. Indeed, the decision on how to measure the effectiveness of circular transition involves the whole process of design and implementation and will inevitably favour specific stakeholders. This study therefore suggests that practitioners engage with stakeholders across various sectors to determine what aspects of CE are most crucial and how they can best be quantified. The focus of these indicators should extend beyond the traditional technological and economic metrics, as while these are important, they often fail to capture the full scope of the CE impact and leave behind several communities of knowledge which are more focused on other aspects. For instance, an economic indicator might measure cost savings from resource efficiency, but it may not account for the environmental benefits of reduced resource extraction. Similarly, technological metrics might quantify recycling rates but overlook the societal impacts of waste reduction. Therefore, the developed indicators should be multidimensional, capturing not only economic and technological aspects but also environmental and societal impacts.

In this regard, social dimension metrics are particularly critical in CE monitoring and evaluation. They might include measures of community health and well-being and the advancement of social equity through more inclusive and sustainable resource use practices. By incorporating these social metrics, practitioners can provide a more nuanced and comprehensive evaluation of CE initiatives. Enriching the variety of dimensions being

measured is particularly critical in evaluating whether or not the CE is keeping the promises of simultaneously dealing with the environmental, economic, and social SDGs.

4.4.5 Embracing a problem-oriented approach

Chapters 1 and 3 posited the relationship between the CE and wicked problems and the necessity for public actors to adopt an adequately equipped governance model to deal with the level of complexity inherent to a circular transition and to overcome the challenges stemming from it. This study therefore suggests the adoption of a problem-oriented governance approach for dealing with the CE and in general with complex societal challenges. Embracing a problem-oriented approach requires public actors to fundamentally shift their perspective and strategy. Indeed, public actors must be able to build a deep understanding of the complex nature of modern challenges and adapt public institutions and public policy to the needs of the problem, rather than vice versa. This overturns the standard approach of implementing a governance model for path-dependent and isomorphic pressures, which are often not tailored to the real demands of the problem.

Embracing a problem-oriented approach in the context of the CE requires practitioners and public actors to deeply understand and address the multifaceted nature of sustainability challenges. Drawing from the insights in the provided text, this approach involves acknowledging the interconnectedness and complexity of issues within the CE, such as waste management, resource use, and social equity. Practitioners must engage in collaborative, multi-stakeholder dialogues, harnessing diverse perspectives and resources for effective solutions. This strategy requires a shift from rigid governance models towards establishing adaptive, responsive frameworks that can accommodate the evolving nature of societal and environmental problems. This approach is crucial in the CE context for creating strategies that are not only technically feasible but also socially and environmentally responsible, ensuring a holistic and sustainable impact.

4.5 Closing remarks

This research is dedicated to exploring the Circular Economy as a comprehensive framework for achieving sustainable development. The Circular Economy is increasingly recognized as a holistic model capable of addressing both environmental and social challenges while promoting economic growth. The thesis delves into the necessity for various Circular Economy communities of knowledge and practice to closely follow this concept's theoretical and empirical developments. It also investigates how Public Administration, as an academic field, can contribute to advancing the Circular Economy model. Indeed, this thesis has successfully mapped out the diverse perspectives and knowledge discourses that form the intricate mosaic of the Circular Economy field. It critically examines the current state and potential future trajectories of the Circular Economy as an umbrella concept, underlining the need for a coherent conceptualization to ensure its effective utilization (Hirsch & Levin, 1999). Subsequently, this research underscores the importance of systematically and periodically mapping the Circular Economy as an umbrella concept by scholars to gauge its current theoretical and empirical status. Additionally, the thesis explores network governance as a viable model for facilitating the transition to a Circular Economy, providing empirical confirmation of prior research and identifying a new avenue for achieving network effectiveness. It stresses the significance of a collaborative and context-aware approach, which may encourage a fruitful integration of governance and place-based strategies (Bowden & Liddle, 2018). Nevertheless, this thesis highlights the urgent need for a qualitative leap in academic research on the Circular Economy. The complexity of the challenges that the Circular Economy aims to address requires the involvement of all societal stakeholders, even those with potentially conflicting perspectives. In this context, the Circular Economy as an umbrella concept displays a tendency towards a lack of diversity in knowledge, with an overemphasis on technical and reformist perspectives. Furthermore, scholars should take a keen interest in how theoretical Circular Economy knowledge is translated into practical applications, particularly concerning its role as a political issue and a matter of public policy. Hopefully, this thesis will pave the way for more interdisciplinary and holistic research and practice in the Circular Economy, integrating technical, social, and governance dimensions to achieve sustainable

development. It calls for active engagement from all stakeholders to collaboratively define and standardize the Circular Economy concept effectively."

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