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# Circular Economy Policies in China and Europe: A Systematic Literature Review

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## Abstract

Many governments have developed policies to drive the much-needed transition to a circular economy (CE). This systematic literature review covers CE policy progress and the state-of-the-art research in China and Europe. Combining content analysis and contingency analysis, we analyze 119 journal articles to identify the main policy interventions in China and Europe, challenges, outcomes, and their interrelationships. Our review shows that China diligently enforces “*cleaner production*” policies through a top-down approach, while Europe focuses more on “sustainable product” policies such as *ecodesign* and *extended producer responsibility*, relying more on a bottom-up approach. The two economies face some common challenges in policy development. The most prominent challenges lie in the difficulty in *formulating consistent, coherent, and stable policies*, *difficulty in formulating sector- and region-specific policies*, and *difficulty in formulating comprehensive policies*. Research in policy outcome is scant, especially in the social dimension. Our findings suggest that policymakers must consider integrated policy bundles in policy design, ensure consistency, coherence, and stability in policy development and implementation, incorporate the social dimension into CE policies, and customize CE policies for different contexts. Based on the identified knowledge gaps, we call for comparative studies across regions and shifting research focus from recycling to the higher tiers of the waste hierarchy. More attention is also required in secondary resource markets, policy design tailored to specific product sectors and regions, policy implementation challenges, and policy outcomes.

**Keywords** Circular economy · Policy · Waste hierarchy · Ecodesign · Extended producer responsibility · Literature review

## Introduction

Humanity is currently confronting a triple planetary crisis comprising climate change, environmental pollution, and biodiversity loss [20, 86]. As a response, the circular economy (CE) is increasingly recognised as a viable framework for mitigating these interrelated global challenges [20, 21]. Conceptually, the CE draws upon earlier paradigms such as

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industrial ecology, cradle-to-cradle design, and biomimicry each advocating for the optimisation of resource flows through closed-loop systems [27]. Since the early 2010s, the CE has gained prominence, particularly due to the efforts of the Ellen MacArthur Foundation, which formalised and promoted its underlying principles. These principles include: (1) designing out waste and pollution, (2) keeping products and materials in circulation, and (3) restoring and enhancing natural systems [60, 72].

In the policy space, the CE has gathered significant attention among international policy-makers. This shift is reflected in legislative initiatives such as the European Union's Circular Economy Action Plans, first introduced in 2015. Nevertheless, despite increasing policy efforts, the progress to the CE remain limited. Global circularity, for instance, was measured at 7.2% in 2023, a decline from 9.1% in 2018, representing a 21% decrease over five years [10].

Research on CE policies has gained momentum in recent years. However, the existing body of work remains insufficient, limiting our understanding of how policies can be designed, implemented, and enforced to support CE transitions [22]. While various studies explore specific aspects of CE, there is a lack of comprehensive, comparative analysis that studies CE policy development across different governance systems. This represents a critical gap, particularly in understanding how political, economic, and institutional factors influence policy formulation and outcomes across diverse national contexts.

This review specifically focuses on China and Europe, two leading jurisdictions in CE adoption and policy innovation. China was among the first Asian countries to integrate CE into national legislation and policymaking frameworks [42, 59, 69]. Similarly, European countries have long followed environmental policies that align with CE principles [69, 82]. The European Union has introduced two major CE Action Plans (in 2015 and 2020), which have generated a series of directives, regulations, and member state-level policies. The breadth, longevity, and policy maturity of CE frameworks in both China and the EU provide an ideal basis for comparative study. Such a comparative perspective is absent in existing literature and is central to this study's contribution.

Several review papers are related to the CE policy landscapes, as summarised in Table 1. For example, Jiao and Boons [38] focused on industrial symbiosis. Ghisellini et al. [29] focused on organisational success factors. Ghisellini et al. [30] covered cleaner production in construction and demolition sector in China. Other works have dealt with policy developments in specific regions—Mhatre et al. [60] and Arsova et al. [5] in the EU, and Luo and Leipold [51] in China. Although these reviews provide valuable insights, they tend to either focus on a single region or a narrow policy dimension. This limits their capacity to generate insights about CE policy development across diverse institutional environments.

This review distinguishes itself from the published CE policy reviews in two significant ways. First, it conducts a comparative review of CE policies in China and Europe, highlighting their distinct institutional characteristics. Second, it combines content analysis with contingency analysis, an approach not found in the earlier reviews, enabling a more in-depth exploration of how contextual variables are linked to CE policy interventions, challenges, and outcomes. These methodological and contextual distinctions are detailed in Table 1.

Our research questions are:

RQ1: How have CE policies been developed and implemented in China and Europe?

RQ2: What can we learn from research of Chinese and European CE policy interventions, challenges, and outcomes?

**Table 1** Comparing this article with other published CE policy reviews

Study	Topics/scopes	Databases/data	Sample & analysis methods	Review outcomes	Limitations/gaps addressed by this review
Jiao and Boons [38]	Policy intervention and facilitation of industrial symbiosis	Web of Science (WoS)	Content analysis of 37 journal articles	Policy process and mechanism of policy interventions on industrial symbiosis initiatives	Limited scope, no outcome analysis
Ghisellini et al. [29]	CE origins, principles, advantages and disadvantages, modelling and implementation worldwide	WoS, ScienceDirect	Content analysis of 115 journal articles from 2004–2014	Lessons learnt from successful CE transition experiences	No regional comparison
Ghisellini et al. [30]	Cleaner production in construction and demolition sector in China	ScienceDirect, ISI Web of Knowledge, China Academic Journal Data base	Content analysis of 52 journal articles from 1990 to 2018	<ul style="list-style-type: none"> <li>• Barriers and success factors to cleaner production</li> <li>• Refined construction and demolition waste policy</li> </ul>	Sector-specific, no cross-country insights
Mhatre et al. [60]	CE implementation initiatives in the EU	Scopus, ScienceDirect, WoS	Content analysis of 151 journal articles from 2010 to 2020	<ul style="list-style-type: none"> <li>• The trend of CE implementation in various industries</li> <li>• Business models and CE framework to facilitate suitable policy initiatives</li> </ul>	EU-specific, limited on policy outcomes
Arsova et al. [5]	CE implementations at regional level in the EU	Scopus, WoS	Bibliometric and content analysis of 82 journal articles from 1999–2021	A conceptual framework including the constructs of regional CE	Lacks challenges-outcomes linkage
Luo and Leipold [51]	Chinese CE policy development and implementation	WoS, Google Scholar & Chinese database CNKI	Content analysis of 104 journal articles till April 2018	Drivers and barriers behind Chinese CE upscaling process	Top-down bias despite noting multilevel complexity
This Review	CE policy implementation in China and EU	Scopus	Content analysis and contingency analysis of 119 journal articles till 2023	CE policy interventions, challenges, outcomes, and their interrelationships	

This review has several major findings about CE policies in China and Europe. It identifies the most researched interventions across six categories commonly found in the literature: regulatory interventions, government support and guidelines, economic interventions, social interventions, circular business models, and infrastructural and technological interventions. It reveals that while considerable attention has been given to the development of CE policies, significant challenges persist, particularly in achieving policy coherence, consistency, and context-specific design. Furthermore, research on policy implementation remains relatively underexplored, and studies evaluating policy outcomes, especially in the social dimension, are seriously underdeveloped. Our analysis highlights that the Chinese CE model tends to emphasize “cleaner production” through a top-down approach. In con-

trast, European strategies focus more on “sustainable product” policies such as eco-design and extended producer responsibility (EPR), driven largely by bottom-up initiatives.

The main contributions of this review are in three key areas. First, theoretically, it advances the understanding of CE policy development by utilizing the institutional theory perspective, explaining how different governance models shape CE implementation in varied contexts. Second, methodologically, it applies a distinctive combination of content analysis and contingency analysis to map patterns of policy interventions, offering a novel approach to identify trends, gaps, and interdependencies between policy design and outcomes. Third, practically, it pinpoints critical gaps in existing CE policies, particularly regarding the lack of attention to social equity and inclusive transitions, and offers comparative insights that can inform cross-contextual policy learning between China, Europe, and beyond. By doing so, the study not only synthesizes existing knowledge but also lays the groundwork for future research and policy development aimed at advancing more holistic, effective, and socially just CE transitions.

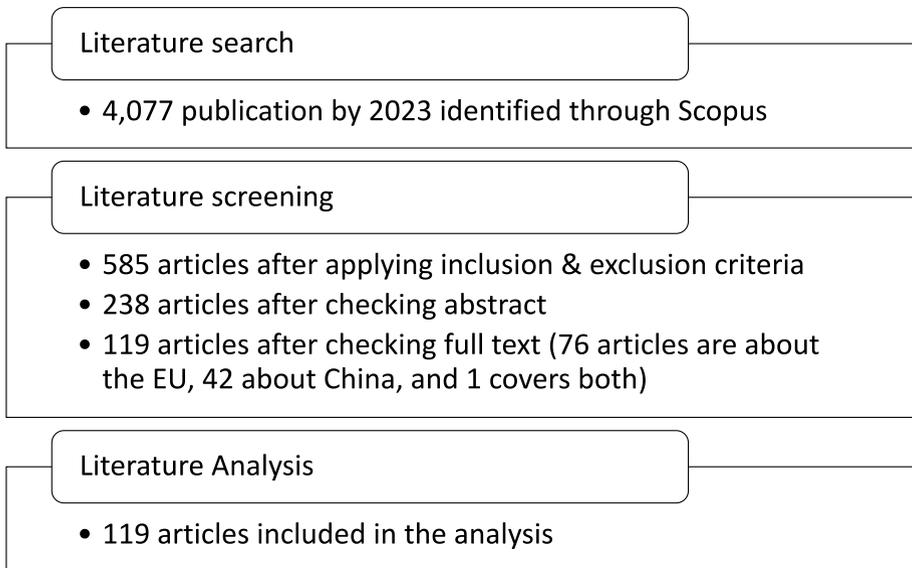
In this paper, we consider “policy” in its broadest sense to encompass all circularity interventions initiated by or requiring support from government. This includes binding legislative measures that implement and enforce circularity outcomes, including command and control regulations (e.g. bans, targets, mandates, product design specifications) and economic instruments (e.g. levies, taxes, deposit return systems). It also covers non-binding policy initiatives such as plans, strategies, public investment and procurement decisions, education and awareness-raising activities, and other voluntary incentives.

The rest of this paper is organized as follows. Sect. “[Methodology](#)” outlines our literature review methodology which encompasses content analysis and contingency analysis. Sect. “[Findings](#)” reports the review findings. Sect. “[Future research directions](#)” discusses future research directions. Sect. “[Conclusion](#)” concludes the study.

## Methodology

This systematic review covers research related to CE policies in China and Europe. According to [84], p207,p209), a systematic review adopts “a replicable, scientific and transparent process” to synthesize research for “enhancing the knowledge base and informing policy-making and practice”. We followed the general guideline provided by Tranfield et al. [84] and a combination of content analysis and contingency analysis methods employed by Sudusinghe and Seuring [83]. Figure 1 presents our literature sample selection and analysis process which is aligned with the classical PRISMA protocol [66].

In the literature search step, we performed keyword searches in Scopus on “title-abstract-keywords”. We consider all the available publications dated by 2023. We chose Scopus because it is one of the largest databases of academic literature, covering a wider range of recent articles than the Web of Science, another popular major database [35]. Using Scopus alone is acceptable for a review as evidenced in some recently published review papers related to the CE [23, 33, 92]. The search keywords were chosen to find publications related to CE policies in China or European. The search string used was (“circular economy” or “CE”) AND (“Policy” OR “Law” OR “Legislation” or “Regulation”) AND (“China” or “European Union” or “EU” or “Germany” or “United Kingdom” or “UK” or “Netherlands” or “Finland” or “Holland” or “Norway” or “Italy” or “Scotland” or “Greece” or “Switzer-



**Fig. 1** Literature sample selection and analysis process

land” or “Belgium” or “England” or “Ireland” or “Sweden” or “Austria” or “Belgium” or “Bulgaria” or “Croatia” or “Cyprus” or “Czechia” or “Denmark” or “Estonia” or “France” or “Greece” or “Hungary” or “Latvia” or “Lithuania” or “Luxembourg” or “Malta” or “Poland” or “Portugal” or “Romania” or “Slovakia” or “Slovenia” or “Spain”). The search string covers all European countries. As mentioned earlier in the introduction, we consider the term “policy” in a broad sense to include law, legislation, and regulation in the search string. This step identified 4,077 documents.

In the literature screening step, we included English publications only. To control quality of publications, we only kept research articles in journals listed in the Academic Journal Guide 2021 published by the Chartered Association of Business Schools or Journal Citation Report 2022 published by Clarivate™. We excluded conference papers, consulting reports, and all other non-peer reviewed documents. For the 585 articles that were left after the initial screening, we read their titles and abstracts to exclude those that were obviously not related to our study scope, i.e., CE policies in China, and/or European contexts. We had 238 articles after this further screening, of which we read the full texts, to retain 119 articles from Q1 ranked journals according to SCImago Journal Rank (SJR) 2022, that made up the final sample.

In the literature analysis step, we first performed a descriptive analysis to provide an overview of the sample. We then performed content analysis to code texts related to CE policies. The coding process applied an abductive approach: we first code text data according to the relevant constructs in the literature; in case no existing construct is a good match, we created new ones based on the contents of text data [76]. We classified CE policies into six policy intervention categories outlined in Table 2: regulatory interventions, government support and guidelines, economic interventions, social interventions, circular business models, and infrastructural and technological interventions [8, 40, 48, 71].

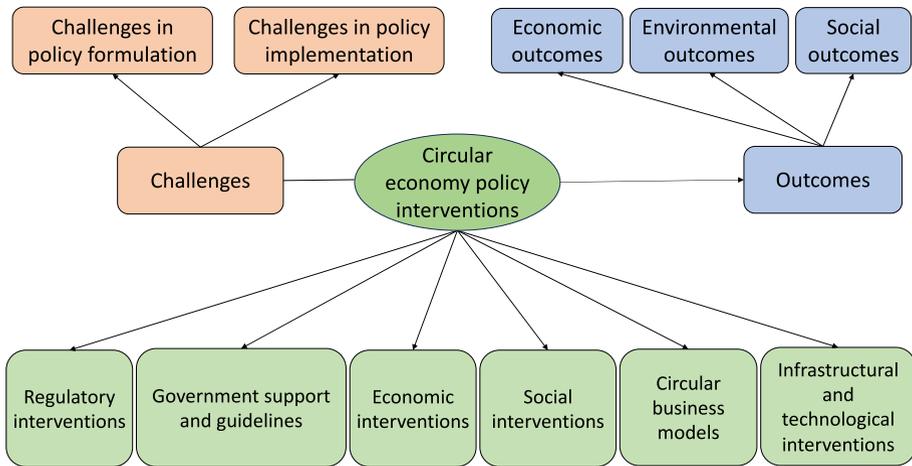
We identified two types of challenges: challenges in policy formulation and challenges in policy implementation [34, 71]. Policy implementation outcomes were classified into three dimensions: economic, social, and environmental. The final coding framework is reported in Fig. 2. The framework provides a theoretical foundation to cover the main variables of interest, which is in line with the analysis approach employed by some of the earlier reviews [2, 53] to ensure academic rigor.

The literature coding results were organized in Microsoft Excel for further analyses. We conducted frequency analysis of policy interventions, challenges, and outcomes to quantify the level of research interest [14, 91]. A frequency, presented as a percentage, was calculated by dividing the number of related articles by the total number of articles in the sample. The frequency of 10% has often been used as a threshold for keeping valuable elements [14, 79]. However, we applied a lower threshold of 5% to keep more categories in the results because our sample size (119) was not very large.

To gain additional insights, we performed contingency analysis to identify the potential patterns and interconnections between variables [14, 79]. The contingencies were calculated by using crosstab function in SPSS software. We only considered statistically significant associations between constructs by evaluating chi-square test p-value (equal to or small than 0.05). In addition, we included in the results only strong relationships by checking phi-coefficient ( $\Phi$ ) value, which measures relationship strength (equal to or higher than 0.3) [24].

**Table 2** Policy intervention categories

	Description	Key references
Regulatory interventions	Mandatory requirements enacted through laws and legislations	Bahn-Walkowiak and Wilts [8], Jimenez-Rivero and Garcia-Navarro [40], Rizos and Bryhn [71]
Government support and guidelines	Governmental body provided support and guidelines such as policy training and implementation guidelines	Bahn-Walkowiak and Wilts [8], Li et al. [48]
Economic interventions	Fiscal incentives (e.g., tax rebate, subsidy, grant) and disincentives (e.g., fine, levy)	Bahn-Walkowiak and Wilts [8], Jimenez-Rivero and Garcia-Navarro [40], Li et al. [48], Rizos and Bryhn [71]
Social interventions	Interventions related to the people dimension including citizen education, knowledge sharing, and multi-stakeholder collaboration	Jimenez-Rivero and Garcia-Navarro [40], Rizos and Bryhn [71]
Circular business models	Business models such as sharing economy and product-service system that improve resource circularity	Rizos and Bryhn [71]
Infrastructural and technological interventions	Interventions relate to public infrastructure support and enabling technologies	Bahn-Walkowiak and Wilts [8], Li et al. [48], Rizos and Bryhn [71]



**Fig. 2** Literature coding framework

Combining content analysis and contingency analysis in this review provides a holistic and structured understanding of CE policies and their implementation. Content analysis enables a systematic synthesis of existing knowledge, while contingency analysis identifies statistical patterns in policy interventions, challenges, and outcomes. Although contingency analysis reveals correlations without inferring causality [75, 83], its integration with content analysis allows for a more comprehensive exploration of potential causal relationships between variables. This approach, combining qualitative and quantitative analysis, strengthens the rigor and explanatory power of the review [83, 84], offering deeper insights and revealing significant knowledge gaps in the literature.

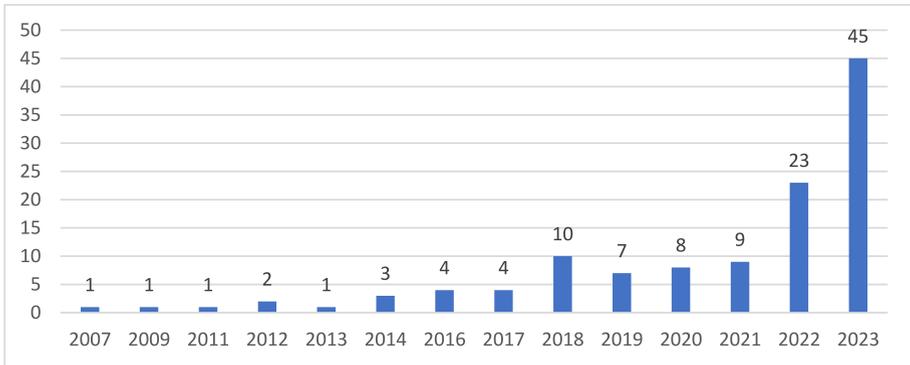
Our literature search and analysis followed a rigorous procedure. We used well-defined search criteria to ensure that all papers in the sample were relevant and were from quality journals. The process is repeatable. Categories for coding were adopted from the literature wherever applicable to enhance external validity and reliability. On internal validity wise, two researchers met fortnightly to discuss ambiguous texts. The third researcher reviewed the coding process and results multiple times.

## Findings

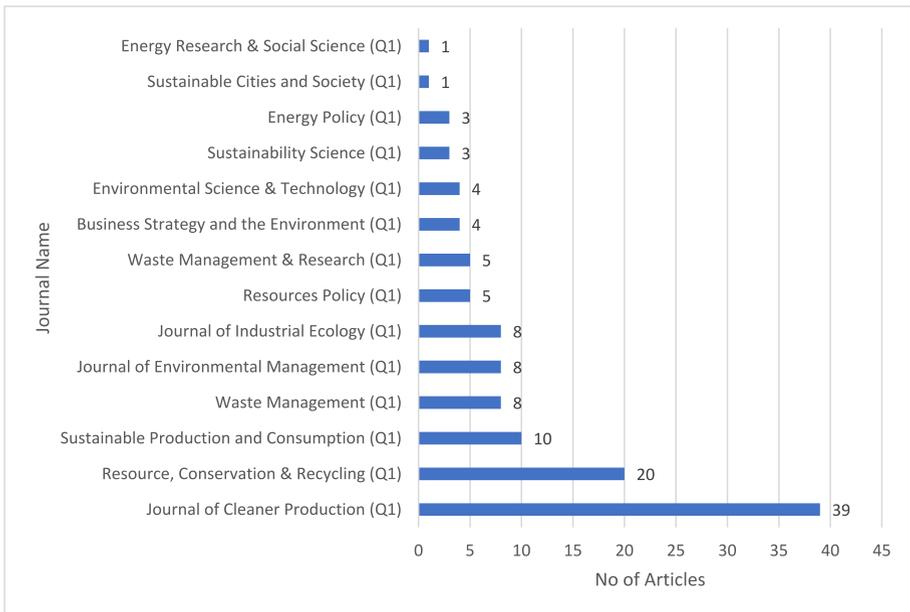
### Descriptive Statistics

Figures 3, 4 and 5 provide descriptive statistics about the literature sample. Research attention to CE policies has been increasing, which reflects wider society's interest. Year 2023 observed the highest number of articles being published.

The Journal of Cleaner Production published most (39) articles in the sample, followed by Resources, Conservation & Recycling (20), Sustainable Production and Consumption (10), Waste Management (8), Journal of Industrial Ecology (8), and Journal of Environmental Management (8). The distribution of publication outlets shows that CE policies draw interest from a wide range of academic disciplines including environmental management,



**Fig. 3** Distribution by publication years

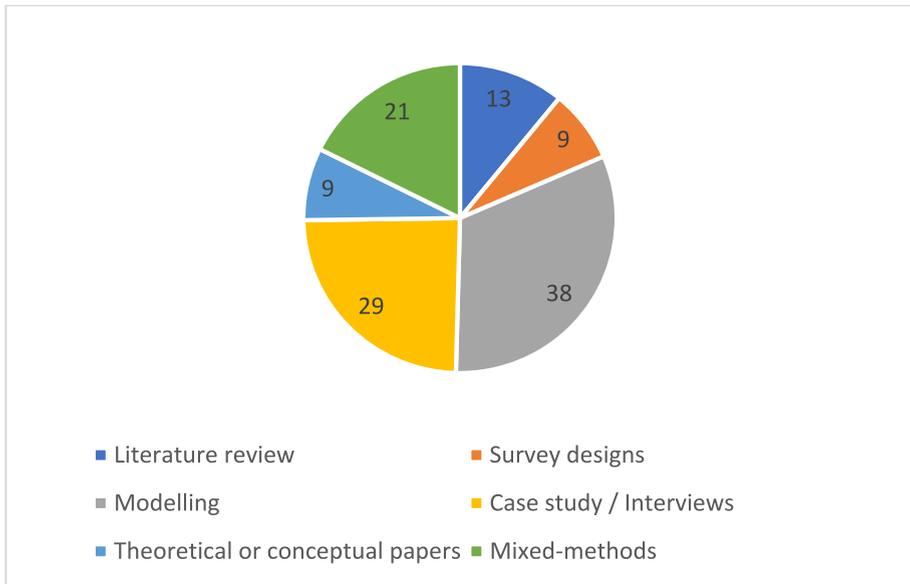


**Fig. 4** Distribution by publication outlets

operations management, environmental science and engineering, industrial ecology, waste management, public administration, and business ethics.

In terms of research contexts, only one article covered both Europe and China. This shows very limited comparative research of CE policies between different geographical regions. Among the studies that dealt with a single geographical area, Europe is associated with most (76) articles, followed by China (42 articles).

From the research methods perspective, modelling methods including material flow analysis are most popular (38 articles), followed by case study/interviews (29 articles). 21 articles adopted mixed-methods such as using both interview and survey, survey and model-



**Fig. 5** Distribution by research methods

ling, or interview and literature review. The rest of the sample includes 13 literature review papers, 9 survey design papers, and 9 theoretical or conceptual papers.

We divided the literature by regional focus across Europe and China. Table 3 presents the results. In the European context ( $N=76$ ), a significant concentration is found in Western and Northern Europe, particularly in countries like Germany, the Netherlands, the UK, and Sweden. Only 12% of studies focus on Southern Europe, and a mere 6% on Eastern Europe. In the Chinese context ( $N=42$ ), more than 80% of the articles concentrate on national-level policies or highly developed coastal cities such as Beijing, Shanghai, and Shenzhen, with limited coverage of policy practices in Western or rural provinces.

## Content Analysis

We summarise in Appendix (Tables 4, 5 and 6) the content analysis results, including the frequencies of specific policy interventions, challenges, and outcomes. The frequencies provide a good indication on the level of research interest. Tables A1 shows *ecodesign* (47.4%) has attracted most research attention among regulatory interventions. In the context of CE, *ecodesign* considers future repair and reuse at the product design stage, and emphasises the importance of a product's durability, repairability, reusability, and recyclability to improve resource efficiency. For more than a decade, *ecodesign* has been a focus of the European CE transition. In recent years, China also started to emphasise the importance of *ecodesign* in its policy instruments [9, 97].

Among the specific policies related to government support and guidelines, *targets and measurements* (50.4%) and *government monitoring and policy enforcement* (35.3%) have received most research attention. Economic interventions such as *monetary incentives* (66.4%) and *financial punishment* (38.7%) are widely mentioned or investigated in the lit-

**Table 3** Distribution of regional focus

Europe-focused studies	Number of articles	% of Europe total	China-focused studies	Number of articles	% of China total
Western Europe (e.g., Germany, the Netherlands, the UK)	37	48.7%	Eastern urban centers (e.g., Beijing, Shanghai)	21	50%
Northern Europe (e.g., Sweden, Finland, Denmark)	18	23.7%	Western provinces (e.g., Sichuan, Gansu, Yunnan)	6	14.3%
Southern Europe (e.g., Italy, Spain, Portugal)	9	11.8%	National-level (China)	15	35.7%
Eastern Europe (e.g., Poland, Romania, Bulgaria)	5	6.6%			
EU-wide/supra-national policies	7	9.2%			
<b>Subtotal</b>	<b>76</b>	<b>100%</b>	<b>Subtotal</b>	<b>42</b>	<b>100%</b>

erature. From the social perspective, most studies emphasise the importance of *multi-stakeholder collaboration* (58%) and *citizen education and public awareness-raising* (53.8%). Relatively few studies identify circular business models, specifically, *sharing economy* (10.1%) and *product–service system* (16%), as policy interventions. Such circular business models require major changes in consumer behaviours and product/service offerings by businesses. From an infrastructural and technological perspective, the importance of *eco-innovation and technology development* (53.8%) and *information transparency* (41.2%) is widely acknowledged.

Table A2 categorises policy intervention challenges into two groups: challenges in policy formulation and challenges in policy implementation. The former mainly include *lack of deep understanding of CE by policymakers* (11.8%), *difficulty in formulating sector- and region-specific policies* (29.4%), *dominance of recycling* (8.4%), *difficulty in formulating comprehensive policies* (18.5%), and *difficulty in formulating consistent, coherent, and stable policies* (40.3%). The latter are mainly reflected in a *gap between policy implementation and concept* (11.8%), *high cost of secondary materials* (10.9%), *quality concern of secondary materials* (7.6%), *governmental inefficiency* (16.8%), *unclear stakeholder responsibilities* (7.6%), *inappropriate use of fiscal incentives* (16.8%), and *lack of recycling knowledge and technology* (13.4%). Overall, policy implementation challenges are less frequently studied compared to the challenges in policy formulation.

Table A3 summarises the very limited coverage of policy intervention outcomes in the literature sample. The most frequently mentioned outcomes are *increased waste treatment* (13.4%), *reduced resource use and higher resource efficiency* (9.2%), and *economic benefit* (8.4%), followed by *reduced gashouse gas emissions and pollution* (7.6%). The only outcome that does not have a positive connotation is *imbalanced achievements by geographical areas and sectors* (10.1%). It is worth pointing out that all the frequently mentioned outcomes are economic and environmental outcomes. Few studies discuss social outcomes such as *people skills and training* [70] and *increased public awareness* [4, 7, 71]. However, most of their frequency counts are below the 5% threshold, so they are not included in Table A3. This reflects the scarcity of attention paid to social perspectives in CE policies [26, 36, 87]. Only in recent years have social indicators started to appear in CE policies. For example, the European Green Deal made it a goal to improve people’s health and quality of life [19]. However, such social indicators are still very limited compared to economic and environmental indicators.

### Contingency Analysis

#### Contingencies Among Interventions

Figure 6 presents the relationships among key CE policy interventions identified across European contexts. Particularly, multi-stakeholder collaboration (7), ecodesign (7), and green public procurement (5) have most contingencies, i.e., correlation relationships with other interventions. These relationships reflect a strategic emphasis on cooperation among public, private, and civil society actors to drive CE transition. The importance of ecodesign in Europe aligns with the EU’s long-standing focus on sustainable product policies, includ-

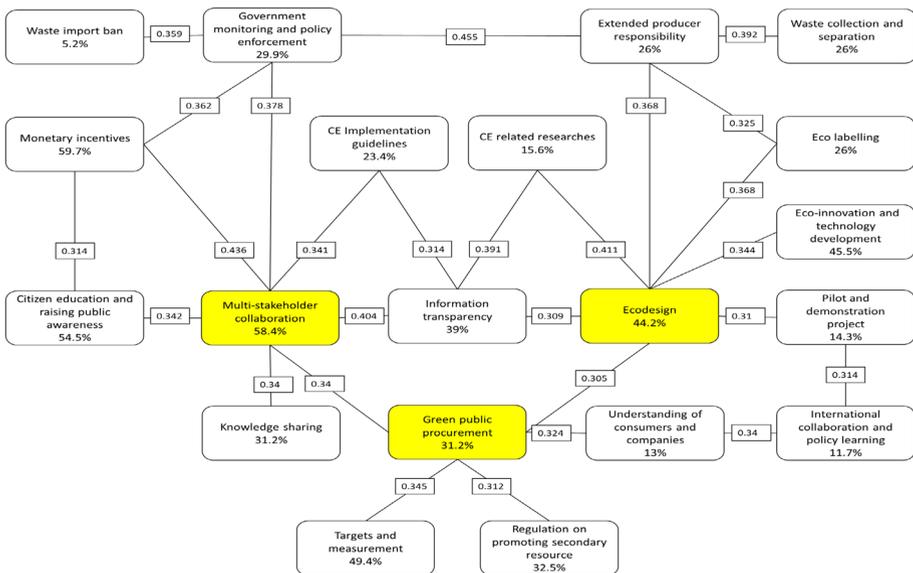


Fig. 6 Contingencies between interventions in Europe

ing the Ecodesign Directive. Its connection to eco-labelling and product-service systems suggests that regulatory mechanisms supporting product durability and repairability are often accompanied by market-based tools to influence consumer behaviour. For instance, eco-labelling serves as a signal to consumers, guiding environmentally responsible purchasing and disposal practices.

Multi-stakeholder collaboration also links closely with information transparency, CE-related research, and government monitoring, indicating that effective partnerships depend on access to data, academic insights, and regulatory oversight. The co-occurrence of monetary incentives and citizen education demonstrates Europe’s dual approach supporting industry compliance while cultivating public engagement. For example, Stockholm’s biogas policy, which combined tax incentives with road tolls, illustrates how positive reinforcement and penalties are often integrated within the same policy framework to encourage sustainable choices [3].

Figure 7 illustrates the formation of CE policy instruments in China, highlighting a different pattern of connection compared to Europe. Here, government monitoring and policy enforcement (8), targets and measurements (6), cleaner production (6), and eco-industrial parks/industrial symbiosis (5) stand out as having most contingencies with other interventions. These elements highlight China’s top-down governance model, where regulatory control and state-led planning play a leading role in CE development. The significance of eco-industrial parks (EIPs) and pilot and demonstration projects reflects the central gov-

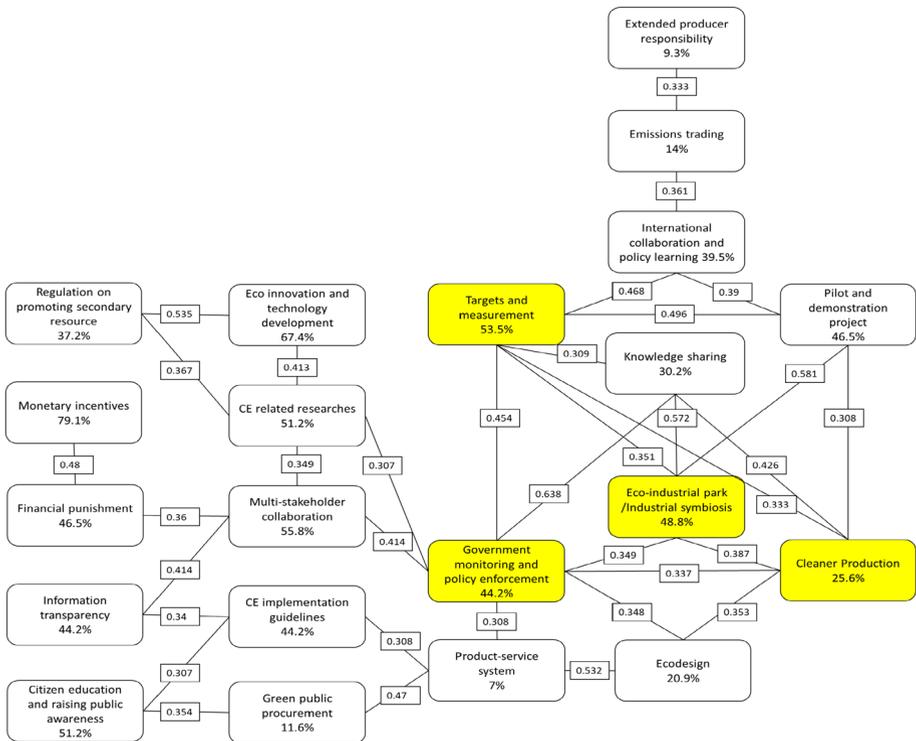


Fig. 7 Contingencies between interventions in China

ernment's reliance on trial-based learning to scale CE initiatives. A prime example is the Nanjing Chemical Industrial Park, which began as a pilot CE project focused on cleaner production and later evolved into a nationally certified EIP [54].

Cleaner production links closely to eco-innovation and technology development, suggesting that environmental performance improvements are frequently driven by technical advancement. The presence of CE-related research, financial incentives, and information transparency within this framework points to a growing appreciation of data and scientific evidence, though within a controlled, state-coordinated system.

Comparing Europe and China, the divergence in their CE policy governance aligns with DiMaggio and Powell's (15) institutional theory. China's CE transition is characterized by coercive isomorphism, where policy adoption is driven by top-level governmental mandates [77]. In Europe, CE initiatives reflect a blend of normative isomorphism (e.g., civil society pressure for sustainability) and mimetic isomorphism (e.g., policy diffusion among EU member states). These institutional pressures help explain why Europe places more emphasis on participatory mechanisms and policy bundling, while China emphasizes enforcement, targets, and measurement.

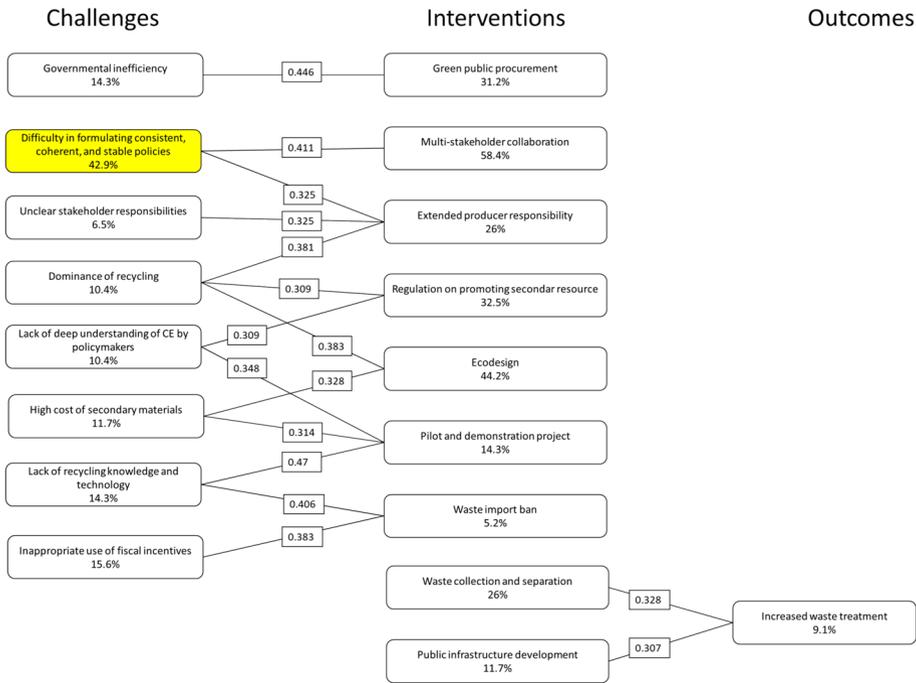
### Contingencies Between Challenges, Interventions, and Outcomes

Figure 8 illustrates the key challenges, policy interventions, and outcomes shaping the CE transition in Europe. Waste treatment was increased which directly results from coordinated waste collection and separation efforts alongside public infrastructure development. These interventions reflect Europe's systematic approach to improving resource management and supporting sustainable waste handling. The dominance of recycling remains a challenge. Although recycling is a widespread strategy, it is energy-intensive and often leads to the degradation of materials, limiting the effectiveness of achieving a truly circular system [44, 50]. This challenge highlights the need to match recycling with upstream policies emphasizing reduction, reuse, and product longevity.

The effectiveness of European CE policy also depends on multi-stakeholder collaboration and citizen education and public awareness-raising, which facilitate behavioural change and support policy uptake. Persistent issues such as difficulty in formulating consistent, coherent, and stable policies complicate long-term planning and stakeholder confidence [8, 39]. These insights highlight that Europe's CE transition is a multi-dimensional process requiring joined efforts across policy design, public engagement, and infrastructure investment to overcome technical and governance barriers.

Figure 9 presents an overview of the challenges, interventions, and outcomes shaping China's CE transition, revealing the distinct top-down governance model underpinning policy implementation. Central interventions include targets and measurements and government monitoring and policy enforcement, which actively promote cleaner production and resource efficiency. Despite these strengths, several challenges remain. There is a lack of deep understanding of CE among policymakers, which delays effective policy design and adaptation. In addition, governmental inefficiencies, such as split responsibilities and poor interdepartmental coordination, reduce the efficacy of waste management initiatives [37].

China also grapples with unclear stakeholder responsibilities and inappropriate use of fiscal incentives, which can challenge citizen education and public engagement efforts. Evidence suggests that monetary incentives often fail to motivate behaviour change, particu-



**Fig. 8** Contingencies between challenges, interventions, and outcomes in Europe

larly in urban settings with higher income populations [41, 49]. China’s CE transition is marked by strong government-led enforcement complemented by pilot projects and EIP initiatives. Overcoming knowledge gaps and improving institutional efficiency are crucial to advancing its CE agenda.

### Summary of Findings

The results presented above provide a comprehensive understanding of up-to-date research about CE policies in China and Europe. In summary, our content analysis shows the most researched regulatory intervention is *ecodesign*. *Targets and measurements* and *government monitoring and policy enforcement* dominate the discussion of government support and guidelines. *Monetary incentives* and *financial punishment* are the most popular economic interventions. The social perspective highlights the importance of *multi-stakeholder collaboration* and *citizen education and public awareness-raising*. Circular business models as policy interventions have been understudied. The infrastructural and technological viewpoint extensively acknowledges the significance of *eco-innovation and technology development* and *information transparency*.

There are major differences between China and Europe in how and what policies are bundled. China diligently enforces policies centered around “cleaner production”, supported by *eco-industrial park/industrial symbiosis*, *pilot and demonstration project*, and *international policy learning* through a top-down approach. Europe gives more attention to “sustainable

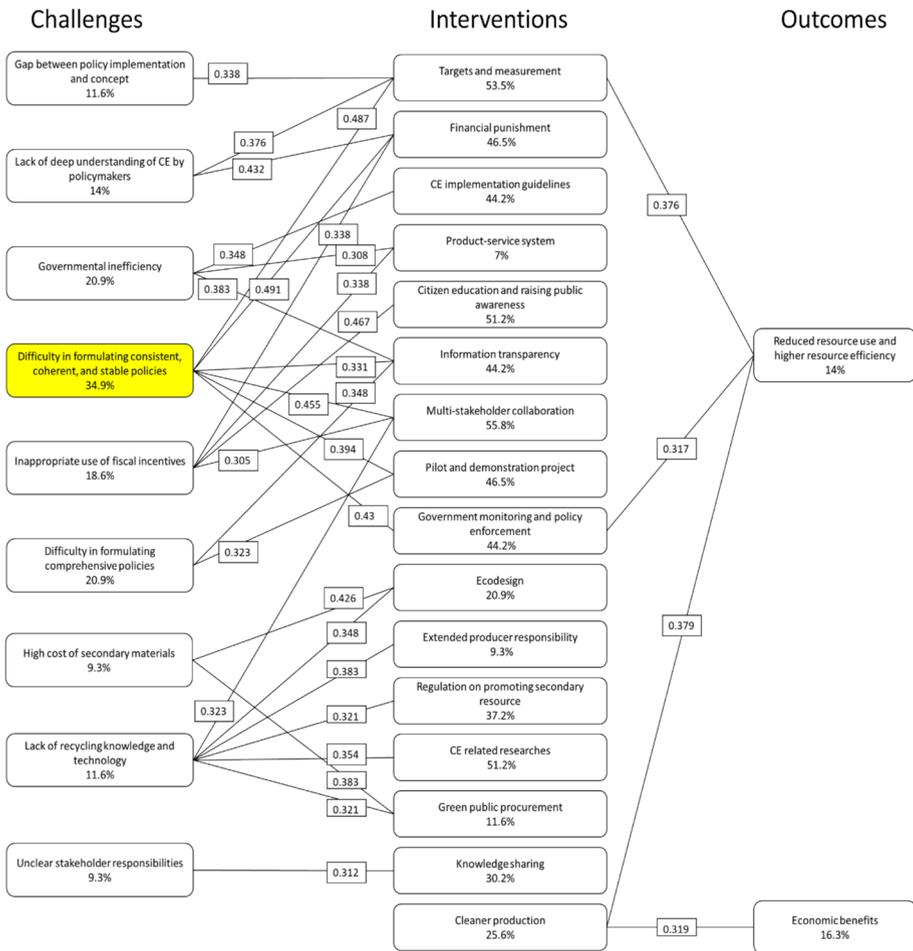


Fig. 9 Contingencies between challenges, interventions, and outcomes in China

product” policies such as *ecodesign* and *extended producer responsibility*, relying more on *multi-stakeholder collaboration* through a bottom-up approach.

China and Europe face some common challenges. The most prominent challenges lie in the various difficulties in policy development (*difficulty in formulating consistent, coherent, and stable policies*, *difficulty in formulating sector- and region-specific policies*, and *difficulty in formulating comprehensive policies*). On the policy implementation front, both economies are challenged by *governmental inefficiency*, *inappropriate use of fiscal incentives*, and *lack of recycling knowledge and technology*. Nevertheless, *dominance of recycling* is more of a challenge in Europe as it hinders the efficacy of sustainable product policies, while China is greatly confronted by *lack of deep understanding of CE by policymakers* and *governmental inefficiency in its top-down approach*.

In terms of policy outcome, *cleaner production* has helped China achieve *reduced resource use and increased resource efficiency*, simultaneously delivering *economic benefits*

by saving energy and material costs. *Pilot and demonstration projects* and *international collaboration and policy learning* have wide-reaching positive effects. In Europe, supported by *public infrastructure development*, EPR schemes have been most successful in optimizing *waste collection and separation* and recovering the costs for recycling, leading to *increased waste treatment*. However, there is a lack of evidence in their efficacy in stimulating *ecode-sign* and greater uptake in *circular business models* such as *product-service system*, *sharing economy*, and product reuse, to achieve the greatest reductions in material consumption. Overall, research of policy outcome is very limited, especially in the social dimension of the CE.

## Future Research Directions

Building on the review findings, we discuss several important directions that warrant further research to improve CE policy design, implementation, and outcomes.

### 1) Integrated Policy Bundles and Systemic Approaches

Future research must focus on the design and evaluation of multi-faceted policy packages that address the complexity of CE transitions. For example, EPR effectively improves waste collection but has limited impact on upstream innovations such as eco-design. Research should explore how bundling diverse policies—spanning product design, consumption, and waste management—can produce synergistic effects and avoid unintended consequences like the entrenchment of low-tier waste practices. Investigations into policy coherence within these bundles, including how overlapping incentives, enforcement mechanisms, and stakeholder engagement interact, are crucial. Moreover, studies should assess how integrated approaches perform across various governance contexts, testing the adaptability and scalability of bundled policies. This systemic view will inform more holistic frameworks that can accelerate transitions beyond incremental change and embed circularity deeply into economic systems.

### 2) Policy Coherence and Stability Across Governance Levels

Research must critically investigate mechanisms to enhance policy coherence and stability across multiple governance layers, addressing the prevalent tensions between CE goals and conventional economic priorities. Policy inconsistency—such as simultaneous promotion of secondary resource use and subsidization of extractive industries—creates uncertainty that deters investments and stakeholder engagement. Future studies should explore institutional arrangements and coordination strategies that align CE policies with broader economic and social frameworks, minimizing conflicting signals. This includes analyzing how coherence can be fostered between national directives, regional regulations, and local implementation practices. Stability over time is equally important to build trust among industries and citizens; therefore, longitudinal research should examine policy durability and adaptive capacity in response to evolving market and technological conditions. Understanding how governance models influence coherence and stability will provide critical insights for effective CE transitions.

### 3) Incorporating Social Dimensions Into CE Policy and Research

Addressing the social dimension remains a critical gap in CE research and policy, necessitating dedicated investigation into how CE strategies affect employment, equity, and community well-being. Despite the recognized connections between CE and job creation particularly in sectors like waste management, social indicators are often omitted from policy frameworks. Mies and Gold [61] highlight this oversight, emphasizing that social aspects such as labor practices, human rights, and community well-being have been only peripherally integrated into the CE concept. Their study identifies collaboration, education, participation, and legislative support as central leverage points for transforming towards a sustainable CE. Future research should integrate social justice and ‘just transition’ concepts, analyzing how policies can promote fair labor practices, workforce development, and inclusivity. Particular attention is needed on informal labor sectors, where vulnerabilities may be exacerbated by CE transitions. Furthermore, research into the role of education and public awareness in shaping circular behaviors could guide more effective social interventions. Interdisciplinary approaches combining socio-technical systems theory, labor economics, and public policy will be essential to ensure that CE transformations do not reinforce inequalities but foster equitable sustainability outcomes.

### 4) Comparative Regional Studies

Future research should intensify efforts to conduct rigorous comparative analyses between regions, particularly between major CE actors like China and Europe. This review reveals significant governance and policy design divergences in China’s top-down, enforcement-centric model and Europe’s bottom-up, participatory approach which merit detailed comparative study. Such research would elucidate how cultural, legal, economic, and institutional contexts shape CE policy effectiveness and stakeholder engagement. Investigating differences in policy coherence, stability, and social integration across regions can uncover transferable lessons and context-specific barriers. Moreover, cross-regional collaborations informed by comparative insights can accelerate global CE transition efforts, fostering policy diffusion, mutual learning, and joint initiatives. Empirical studies employing mixed methods, including qualitative case studies and quantitative policy outcome assessments, will be critical in advancing this agenda, ultimately supporting the design of more responsive and globally relevant CE policies.

### 5) Strengthening Secondary Resource Markets

The review findings underscore the critical challenge of underdeveloped secondary resource markets, characterized by high costs, quality concerns, and inefficient infrastructure. Future research must investigate innovative policy and technological solutions to stimulate these markets and improve their competitiveness relative to virgin resources. This includes exploring regulatory frameworks for chemical safety, standardized quality assurance for recycled materials, and the potential of digital technologies—such as digital product passport [92] and AI-enabled waste sorting to enhance traceability and trust. Studies should also analyze incentives that effectively motivate industry adoption of secondary materials and identify mechanisms to reduce cost barriers. Furthermore, research should assess how these market

developments influence broader circularity goals and environmental outcomes, ensuring that strengthening secondary resource markets contributes holistically to CE transitions.

## 6) Addressing Policy Implementation Challenges

Implementation remains a critical bottleneck in CE policy effectiveness, yet it is under-explored relative to policy formulation. Future research must focus on identifying and addressing barriers to enforcement, compliance, incentives, and behavioral change among organizations and consumers. This includes evaluating how governance structures, capacity constraints, and stakeholder collaboration impact implementation success. Studies examining failed and successful CE projects can provide vital lessons on risk factors and enabling conditions, informing strategies to improve policy delivery. Additionally, interdisciplinary approaches integrating insights from organizational behavior, policy studies, and technology adoption can generate comprehensive frameworks to support effective implementation. Real-time monitoring systems and adaptive governance mechanisms also warrant investigation to enhance responsiveness and learning during the implementation phase. As demonstrated in recent analyses of China's "Zero waste" strategies for copper waste management, overcoming economic and organizational barriers is essential to fully realize reductions in primary resource demand and environmental impacts, highlighting the need for coordinated policy action and robust institutional capacity [16].

## 7) Advancing CE Measurement, Target-Setting, and Policy Outcome Evaluation

Robust measurement and comprehensive evaluation frameworks are critical for guiding CE policy design and assessing effectiveness. The transition from linear production systems to circular supply chains, inspired by CE principles, introduces multiple challenges and uncertainties that directly affect sustainability outcomes [14]. Future research should prioritize developing multidimensional indicators that capture not only recycling rates but also higher-tier strategies such as reduction, reuse, remanufacturing, and resource efficiency. These indicators must be realistic, measurable, binding, and adaptable across diverse contexts to support transparent progress tracking. Equally important is the longitudinal evaluation of CE policy outcomes, encompassing environmental, economic, and social dimensions including job quality, equity, and public health. Such evaluations should integrate interdisciplinary methods to holistically assess real-world impacts and provide actionable feedback for adaptive policy management. Addressing this gap will enable more accurate performance monitoring, enhance policy learning, and support the iterative refinement of CE strategies to ensure systemic and just transitions toward sustainability.

## 8) Context-Specific Policy Design and Growing Geographic and Sectoral Representation

The complexity of CE transitions demands context-specific policy design that accounts for regional, economic, infrastructural, and social diversity. Generic "one-size-fits-all" policies often fail to address local realities, as demonstrated by uneven CE performance across different regions and sectors. Future research should focus on co-creating adaptable frameworks with local stakeholders, incorporating context-sensitive performance indicators to improve policy feasibility and effectiveness. Concurrently, expanding research focus to

underrepresented geographic areas such as Southern and Eastern Europe and less-developed regions in China is essential to capture a fuller spectrum of CE dynamics. Enhancing geographic and sectoral inclusivity will increase the generalizability of findings, reveal unique challenges, and foster equitable CE transitions. Strengthening collaborations and funding targeting these gaps will be critical to developing inclusive, effective policies that address diverse socio-economic and environmental conditions.

## Conclusion

The world is in a dire need of combating the deepening triple planetary crisis by transitioning to the CE. Following the forerunners such as China and Europe, many countries have developed CE-related policies to drive the required transition. However, the efficacy of such policies is under question because global circularity has continued to decrease. Research in the domain has been growing, but it remains unclear what the state-of-the-art is in CE policies in practice and research. To fill this knowledge gap, this study conducts a systematic review of CE policies in China and Europe.

This study makes important original contributions. First, it is believed to be the very first systematic literature review that compares CE policy research in China and Europe, forerunners and active innovators in the CE transition. It analyses a sample of 119 quality journal articles to map out the state-of-the-art in CE policy research. Second, it employs contingency analysis in conjunction with content analysis to acquire in-depth understanding on the relationships between policy interventions, challenges, and outcomes. Such a rigorous literature analysis methodology helps uncover more knowledge gaps and offer valuable insights for future research. Last but not the least, it discusses future research directions to guide CE policymakers and researchers.

Despite offering substantial insights into CE policies in China and Europe, this study has limitations that might affect the interpretation and generalizability of the results. The literature search was limited to the Scopus database and English publications. Although Scopus has the most comprehensive coverage of academic literature in the relevant academic disciplines, it may omit some valuable publications in other databases such as China's CNKI. Local research repositories and non-English journals could offer unique views on the formulation and implementation of CE policies.

Moreover, this review included only the studies that explicitly referenced CE in their titles, abstracts, or keywords. While this approach ensured a focused and manageable dataset, it also risks overlooking research that is relevant but framed under different concepts. However, given the widespread adoption of the CE terminology by policymakers, academics, and practitioners in both China and Europe over the past decade, it is unlikely that this limitation significantly impacts the comprehensiveness of the review. Additionally, while some grey literature, including policy reports and official government documents, was consulted to provide contextual understanding, the review did not systematically analyze the broader body of non-peer-reviewed materials. Future reviews could benefit from incorporating a more extensive range of policy documents, industry reports, and regional case studies, particularly in non-English languages, to capture localized policy discourses and implementation practices that are often underrepresented in academic databases.

Another limitation relates to the geographical scope of this study. The focus on China and Europe is justified by their status as global leaders and early adopters of CE frameworks, which provides a rich context for comparative analysis. However, this focus excludes other regions where CE policies are rapidly emerging, such as the United States, Australia, New Zealand, South Korea, and various countries in South America and Africa. These regions are developing unique CE strategies that reflect their distinct governance systems, economic structures, and cultural values. Including a broader range of economies in future research would enhance the global relevance of CE policy analysis and provide more comprehensive lessons for policymakers worldwide. Methodologically, this study employed contingency analysis to explore the associative patterns between CE policy interventions, implementation challenges, and outcomes. While contingency analysis offers a robust statistical approach for identifying significant correlations, it does not establish causal relationships. The relationships depicted in the association diagrams should therefore be interpreted as correlations rather than causality. Future research could advance this work by employing longitudinal and experimental design methods to investigate the potential causal relationships. Such approaches could provide deeper insights into how and why specific policy interventions succeed or fail in different governance contexts.

## Appendix

**Table 4** Content analysis results of CE policy interventions

	Specific policy and frequency	Brief description	References
Regulatory interventions	Cleaner production (10.1%)	To increase energy utilization efficiency and minimize pollution during production by adopting advanced technologies	Geng et al. [28], Zhu et al. [97]
	Ecodesign (35.3%)	To consider the possibility of repair and reuse during the product design stage, and emphasise the importance of a product's durability, repairability, reusability, and recyclability	Milios [62], Friant et al. [26], Polverini [68], Shittu et al. (78)
	Eco/Energy Labeling (18.5%)	To enhance the energy utilization information sharing between manufacturers and consumers	Kalmykova et al. [41], Polverini [68]
	Extended producer responsibility (20.2%)	To reduce waste production, improve waste collection and waste management by allocating responsibilities to producers	Chambbell-Jognston et al. [11], Rubio et al. [73]
	Waste import ban (5%)	Banning waste import from other countries	Wubbeke and Heroth [90], Silva et al. (80)
	Landfill ban and control (9.2%)	Certain wastes are banned or controlled from being sent to landfills	Giorgi et al. [31], Magazzino et al. [52]

**Table 4** (continued)

	Specific policy and frequency	Brief description	References
Government support and guidelines	Green public procurement (24.4%)	Buying goods and services on behalf of a public authority, including office supplies, government buildings, etc	Bahn-Walkowiak and Wilts [8]
	Emissions trading (6.7%)	A market with limited allowances for emissions	Lazarevic et al. [47]
	Government monitoring and policy enforcement (35.3%)	Monitoring, inspection and auditing of CE practices and enhancement to CE policy implementation	Matus et al. [55], Soo et al. (81)
	CE implementation guidelines (31.1%)	Detailed implementation guidelines from government	Gunaratne et al. [32], Dong et al. [16]
	Targets and measurement (50.4%)	Goals to achieve in a policy plan should be realistic and specific, along with quantitative indicators to help achieve targets	Geng et al. [28], Milos (63)
	Pilot and demonstration project (25.2%)	Setting up pilots and demonstration projects before officially promoting certain CE practices in order to gain practical experience	Zhu et al. [97], Hong and Gasparatos [36]
	Regulation on promoting secondary resources (34.5%)	Encourages businesses to explore the potential of reused/renewable resources to help against resource scarcity	Khanna et al. [43], Wubbeke and Heroth [90], Zhang et al. [94]
	Eco-industrial park/ industrial symbiosis (24.4%)	To achieve win–win in company economic and CE performance by collaborating with each other,	Jiao et al. [39]
Economic interventions	Monetary incentives (66.4%)	To motivate the public and the companies by monetary incentives such as tax reduction and exemption, funding, subsidy, etc	Bahn-Walkowiak and Wilts [8], McDowall et al. [56]
	Financial punishment (38.7%)	All monetary punishments such as fines, increased tax, landfill levy, etc	Huang et al. [37], McNeill et al. [57]
Social interventions	Multi-stakeholder collaboration (58%)	The collaboration between central government and local authorities, and the collaboration with external parties including NGOs, industrial experts, and universities	Geng et al. [28], Khanna et al. [43], Zhu et al. [97]
	Citizen education and public awareness-raising (53.8%)	To improve the level of citizens' knowledge and understanding of CE	Friant et al. [26], Mhatre et al. [60]
	International collaboration and policy learning (21%)	Countries and regions can learn from each other regarding CE policy formulating and implementation to keep up the international trend	Jiao et al. [39], Luo and Leipold, [51], Bleischwitz et al. [9]
	CE related research (28.6%)	Research related to CE regarding how to implement CE policies and practices, etc	Salminen et al. [74], Su et al. [82]
	Knowledge sharing (30.3%)	Knowledge and experience sharing and transferring between stakeholders	Rubio et al. [73], Trigkas et al. [85]
	Understanding of consumers and companies (11.8%)	Policy makers should have deep understanding of the real customer need and company demand before making CE policies or taking actions	Lazarevic et al. [47]

**Table 4** (continued)

	Specific policy and frequency	Brief description	References
Circular business models	Sharing economy (10.1%)	Sharing resource to reduce waste generation and the demand for goods	Ghisellini et al. [29], Klein et al. [45]
	Product-service system (16%)	Change from product based to service-based business models, such as using a leasing model and providing repair service to consumers	Knott et al. [46], Rizos and Bryhn, [71]
Infrastructural and technological interventions	Waste collection and separation (28.6%)	The efficiency of waste collection and separation before landfilling can help convert wastes to valuable resources	Andersson and Stage [4], Huang et al. [37]
	Public infrastructure development (14.3%)	The development of public transport, road construction, urban infrastructure, etc	Wen et al. [88], Salminen et al. [74]
	Eco-innovation and technology development in resource and material efficiency (53.8%)	The advancement of technologies in waste converting, waste treatment, energy utilization efficiency	Khanna et al. [43], Wu et al. [89], Milios [62]
	Information transparency (41.2%)	The technology development, including ICT, AI, big data to enable information transparency, sharing business model, to facilitate waste traceability	Polverini [68], Mhatre et al. [60], Ali et al. [1], Rizos and Bryhn [71]

**Table 5** Content analysis results of policy intervention challenges

	Challenge and frequency	Brief description	References
Challenge in policy formulation	Lack of deep understanding of CE by policymakers (11.8%)	Some policymakers show a superficial understanding of CE	Su et al. [82], Ammenberg et al. [3], Milius [62]
	Difficulty in formulating sector- and region-specific policies (29.4%)	CE policies should be tailored for specific sectors and different regions	Su et al. [82], Bleischwitz et al. [9], Luo and Leipold [51]
	Dominance of recycling (8.4%)	Most countries/regions focused on recycling only rather than prevention, reuse, recover as recycling is more achievable	Mhatre et al. [60], Cole et al. [13], Friant et al. [26]
	Difficulty in formulating comprehensive policies (18.5%)	Some CE policies lack measurements or targets on the social dimensions such as health, income equality, biodiversity, etc	Friant et al. [26], Arsova et al. [5]
	Difficulty in formulating consistent, coherent, and stable policies (40.3%)	CE policies are inconsistent or contradicted, which can confuse the public	Peiro et al. [67]
Challenge in policy implementation	Gap between policy implementation and concept (11.8%)	The concepts/talks about CE are optimistic, however, the real-world practices are segmented, such as lack of specific means/guidelines of how to achieve the goals	Ammenberg et al. [3], Trigkas et al. [85], Friant et al. [26]
	High cost of secondary materials (10.9%)	High cost for recycling materials and producing secondary materials	Mehta et al. [58], Salminen et al. [74], Aslam et al. (6)
	Quality concern of secondary materials (7.6%)	Lack of comprehensive quality assurance for secondary materials	Zhang et al. [94], Salminen et al. [74]
	Governmental inefficiency (16.8%)	Complex government structure and inefficient cooperation between governmental departments can lead to ineffective CE policy implementation	Milius [62], Silva et al. (80)
	Unclear stakeholder responsibilities (7.6%)	Unclear responsibility allocation between stakeholders can cause confusion during CE policy implementation	Zhijun and Nail-ing [95], Friant et al. [26], Ghisellini et al. [30]
	Inappropriate use of fiscal incentives (16.8%)	Insufficient monetary incentives or the incentives are not efficiently applied	Huang et al. [37], Campbell-Johnston et al. [12], Klein et al. [45]
	Lack of recycling knowledge and technology (13.4%)	The lack of recycling knowledge and technology can cause difficulty in following CE policies	Hartley et al. [34], Knoth et al. [46], Peiro et al. [67]

**Table 6** Content analysis results of policy intervention outcomes

	Outcome and frequency	Brief description	References
Economic Outcomes	Economic benefits (8.4%)	Fiscal and monetary benefits are gained	Zhang et al. [93], Hong and Gasparatos [36]
Environmental Outcomes	Reduced resource use and higher resource efficiency (9.2%)	Less resource is used, or resource efficiency is higher	Su et al. [82], Ghisellini et al. [29]
	Reduced gashouse gas emissions and pollution (7.6%)	Less greenhouse gas emission that causes less pollution	Friant et al. [26], Bleischwitz et al. [9]
	Increased waste treatment (13.4%)	More waste is appropriately treated	Augustsson et al. [7], Zhou et al. (96)
	Imbalanced achievements by geographical areas and sectors (10.1%)	The CE results are different by location and section	Wu et al. [89], Bleischwitz et al. [9]
Social Outcomes	Job creation (5%)	New job positions are created, less unemployment is achieved	Moalem and Kerndrup [64], Moalem et al., [65], Entsaló et al., [18]

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## Declarations

**Conflict of interest** On behalf of all authors, the corresponding author states that there is no conflict of interest.

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