

JUST2CE

A Just Transition to Circular Economy



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CHAPTER 16

**Using input-output
stock-flow consistent
models to simulate and
assess 'circular
economy' strategies**

Chapter 16. Using input-output stock-flow consistent models to simulate and assess 'circular economy' strategies

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Abstract: The CE paradigm has gained significant traction in both academic and industrial circles over the past decade. While there is an intuitive association between transitioning to a CE and achieving a more sustainable society, there has been limited scrutiny regarding its economic viability. To address this, macroeconomic tools are needed to assess the impacts of CE policies on society, the economy, and the ecosystem. The field of ecological macroeconomics can meet this need through various promising modelling approaches. This chapter has two main objectives. Firstly, it provides a brief overview of macroeconomic modelling developments that address CE issues, with a focus on the most widely used approaches and tools. Secondly, the chapter argues that combining input-output (IO) analysis with stock-flow consistent (SFC) modelling is one of the most promising methods for simulating, assessing, and comparing CE strategies. To support this argument, the main features of a simplified IO-SFC model for a capitalist economy are presented and discussed. In this model, money is endogenously created, production is demand-driven, and the macro-economy is divided into industries that produce goods and services while generating waste and CO₂ emissions. The results demonstrate that restructuring production and consumption patterns to adopt CE-driven practices is insufficient to ensure a transition to a more sustainable economy, as long as production decisions remain driven by private interests.

Keywords: Circular Economy, Stock-Flow Consistent Models, Input-Output Analysis, Waste, Carbon Emissions

This contribution emphasises the need for macroeconomic tools to assess the impacts of CE policies on society, the economy, and the ecosystem. It highlights the potential of combining input-output analysis with stock-flow consistent modelling for effective simulation and comparison of CE strategies.

16.1 Introduction

The concept of CE has gained significant traction in both academic and industrial spheres over the past decade. While transitioning towards a CE is intuitively associated with a more sustainable society, there has been limited examination of its economic viability. To address this gap, there is a need for macroeconomic tools that can assess

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the impacts of CE policies on society, the economy, and the ecosystem. The field of ecological macroeconomics can fulfil this requirement through various promising modelling approaches.

This chapter aims to achieve two objectives. Firstly, it provides a brief overview of the literature on macroeconomic modelling advancements in addressing CE issues, with a focus on the most widely used approaches and tools. Secondly, the chapter argues that combining IO analysis with stock-flow consistent SFC modelling represents one of the most promising methods to simulate, evaluate, and compare CE strategies. To support this argument, the main features of a simplified IO-SFC model for a multi-area capitalist economy under different exchange-rate regimes are presented and discussed. In this model, money is endogenously created, production is driven by demand, and the macro-economy is divided into one or two regions and industries that produce goods and services while generating waste and CO₂ emissions.

Before a systematic in-depth investigation of many CE scenarios, our preliminary results indicate that restructuring production and consumption patterns to adopt CE-driven practices alone is insufficient to ensure the transition towards a more sustainable economy, as long as production decisions remain driven solely by private interests. For instance, critical industries for the CE transition may employ more men than women, potentially reinforcing rather than weakening the gender income gap. Similarly, CE interventions limited to the GN might result in economic losses, unemployment, or over-extraction of natural resources in the GS, especially if the core-periphery structure of the international division of labour is neglected. In summary, a greater involvement of the government sector is indispensable in planning a just transition to a circular economy, as it cannot be solely left to market forces.

16.2 IO models for CE analysis: the state of the art

Although the CE has garnered significant attention in scientific literature, a comprehensive systematic review of key contributions on CE practices and strategies, along with their macro-level or societal impact, has not yet been published. Notably, Bimpizas-Pinis et al. (2022) stands out as an important exception, as the authors conducted a systematic analysis utilizing the SCOPUS database. They identified nearly 50 thousand unique articles based on 22 relevant keywords. To focus the literature, they selected papers that explicitly addressed macroeconomic *modelling* and/or provided an ex-post evaluation or ex-ante scenario analysis of CE interventions, along with an assessment of the impact on socio-economic variables such as GDP, employment, prices, costs, profits, and wages.

After this refinement process, a final dataset of 55 relevant studies was compiled. These studies can be categorized into three main groups: (a) IO analysis with exogenous determination of final demand (38 studies), (b) IO models with econometric estimation of the evolution of final demand (4 studies), and (c) Neoclassical models, including CGE models, dynamic stochastic general equilibrium (DSGE) models, and some Integrated Assessment Models (IAMs) (13 studies) (Bimpizas-Pinis et al., 2022).

It is worth noting that this review provides a comprehensive overview of the current literature on macroeconomic *modelling* and its relationship to CE interventions and impacts, making it an important reference for further research in the field.

16.2.1 Type I input-output models

Interestingly, the majority of IO-based CE publications assume an exogenous determination of final demand, which can be referred to as type I input-output models. IO analysis, pioneered by Leontief (1936, 1941) and discussed by Miller and Blair (2009), is an analytical tool that represents interdependencies among sectors or industries within a national or regional economy. IO tables are compiled by national statistical offices and depict transaction flows in an inter-industry table. An IO table shows the destination of sector-related outputs, which can serve as inputs for other sectors in production or be purchased as final products or services by households, firms, the government, or the foreign sector through consumption, investment, government spending, and exports.

The benchmark Leontief IO model determines the quantity of total output needed to meet each level of final demand based on relative prices and available technology. It enables the calculation of the impacts of fluctuations in final demand and technological changes on total output. The benchmark IO model relies on several fundamental assumptions: (i) constant returns to scale, meaning technical coefficients do not depend on production scale; (ii) fixed proportions of factors of production without substitution possibilities; (iii) use of a single technology per sector and production of a single homogeneous product; (iv) no impact of price changes on final demand (zero price-elasticity of demand); (v) absence of supply constraints on labour, capital, natural resources, and financial constraints.

However, it is possible to combine IO analysis with other modelling frameworks that endogenize final demand explicitly, such as: IO models with econometrically estimated evolution of final demand (type b) and IO models based on neoclassical principles like CGE models (type c). When IO tables are integrated with environmental accounts, such as waste flows, emissions, or material use, EEIO models and WIO tables can be derived. These models allow for the analysis of the impacts of changes in technology and final demand on the broader ecosystem. EEIO analysis combines conventional IO tables (expressed in monetary units) with environmental variables (emissions, waste, extraction, resource depletion) for each sector. These additional variables are typically measured in physical units and included in satellite accounts. WIO explicitly introduces waste treatment sectors (e.g., incineration, landfilling, recycling) in the columns of an IO table. These sectors demand waste generated by productive sectors and final demand as inputs and produce treated waste or recycled materials used as intermediate inputs by productive sectors. Therefore, the IO table is expanded in the rows. It is important to note that the total waste generation per sector is net of recycled waste. Increased recycling reduces the waste generation coefficient in each sector. Recycled materials, demanded as inputs by productive sectors, are represented by positive coefficients in the recycling sector.

This methodology can be applied to various CE interventions, including but not limited to alternative end-of-life strategies for electrical appliances, recycling, landfilling, and simple shredding (Kondo and Nakamura, 2004; Nakamura and Kondo, 2006).

16.2.2 Type II input-output models

In type II or macro-econometric input-output (MEIO) models, the level and composition of final demand are not exogenous but determined through econometric equations, with coefficients estimated from observed data. Once the final demands are determined for each sector, total outputs are defined using a standard Leontief IO table,

which operates on a quantity basis. MEIO models are categorized as demand-driven models, in contrast to neoclassical CGE, DSGE, and standard IAM approaches, which are supply-side models. MEIO models also

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econometrically determine labour market variables such as hours worked, employment rate, participation rate, etc. These variables are defined as functions of estimated real output, real wage costs, and other factors. Unlike most CGE models, MEIO models do not assume neoclassical conditions. The economy does not converge to a pre-defined equilibrium level of output, let alone full employment. Perfect rationality and perfect competition are also rejected. Economic agents in MEIO models are assumed to operate in imperfect markets under bounded rationality conditions.

Examples of MEIO models that address environmental issues include E3ME (Cambridge Econometrics 2014), PANTA-RHEI (Meyer et al., 2007, 2012), and GINFORS (Giljum et al., 2008; Distelkamp and Meyers, 2019). Overall, MEIO models tend to be optimistic about the possibility of achieving green economic growth, even when considering rebound effects. It should be noted that the demand-driven nature of these models implies that investment in new technologies associated with CE practices will generally stimulate economic growth, at least during the transition phase. Furthermore, the investigated CE practices in the reviewed papers typically involve high resource efficiency. On closer examination, what is being modelled is an increase in productivity that, coupled with the assumption of fixed mark-ups, influences prices. This, in turn, stimulates final demand both directly (through the price effect) and indirectly (through the income effect). Similarly, increases in recycling are linked to higher expenditures and employment requirements compared to other forms of resource waste management, resulting in higher income and employment multipliers. However, other CE strategies, such as product life extension or functional economy practices, are likely to be less effective in terms of output and employment generation.

16.3 SFC models for CE analysis: bridging the gap

SFC models can be considered a specific class of system dynamics tools, primarily developed by post-Keynesian macroeconomists since the early 2000s (Godley and Lavoie, 2006; Caverzasi and Godin, 2015; Nikiforos and Zezza, 2017). In the last decade, SFC models have gained traction in ecological macroeconomics due to their ability to integrate consistently and comprehensively the flows and stocks of the economy and the ecosystem (Carnevali et al., 2019). This feature makes them highly flexible and versatile for simulating, analyzing, and comparing alternative environmental policy scenarios. However, one limitation is that SFC models only consider aggregate output, neglecting the interdependencies between different industries.

Formally, SFC models are dynamical systems of discrete-time difference equations (or occasionally continuous-time differential equations), where accounting identities are coupled with equilibrium conditions and behavioral equations. These behavioral equations are typically based on post-Keynesian principles, including the following: a) economic agents have target stock-flow norms they aim to achieve; b) money is endogenously created by the banking sector; c) supply tends to adjust to demand in the short and long run, rather than the other way around.

In theory, SFC behavioral equations can be based on any theoretical framework. Notably, despite their focus on cost optimality, most CGE models are also stock-flow consistent, although they lack the dynamic aspect. Additionally, unlike SFC models, CGE models usually concentrate on the real economy and exclude the financial sector. While SFC models are often aggregative, they can also be microfounded by deriving the emerging behavior

of aggregate variables from the interaction of heterogeneous agents (AB-SFC) (Caiani et al., 2016) or mesofounded by explicitly considering the IO structure of the production sector (IO-SFC) (Berg et al., 2015).

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SFC analysis is particularly well-suited to capture the dynamic interactions between the economy and the environment (Dafermos et al., 2017, 2018), as similar theoretical models are already widespread in the natural sciences in the form of system dynamics models. SFC models offer a promising alternative to standard neoclassical tools (such as CGE models) for analyzing the institutional interaction between the economy and the ecosystem. However, there have been few applications of such models to test and compare CE practices, with exceptions being Veronese Passarella (2022) and Genovese et al. (2023). One reason for this is that standard SFC models only consider aggregate output and overlook the vertical interdependencies between different industries. Nevertheless, some hybrid IO-SFC models have been developed in recent years (Berg et al., 2015; Valdecantos and Valentini, 2017) that can be used to model the transition towards a CE system. The remainder of this chapter is based on the prototype IO-SFC model developed by Veronese Passarella (2022) and Genovese et al. (2023), which is used to test a simple CE experiment in a single-country economy and a two-country or two-area economy, respectively.

16.4 Main features of the model

Although IO-SFC models are still uncommon in macroeconomics and ecological economics, progress has been made in recent years. Veronese Passarella (2022) and Genovese et al. (2023) have transformed a standard aggregative SFC model (based on Godley and Lavoie, 2007) into meso-founded models that incorporate the endogenous creation of both fiat money and bank money. These models also feature market prices adjusting to Sraffa-like reproduction prices, and they disaggregate the economy both vertically (social sectors) and horizontally (production industries). Both models share the same theoretical assumptions and analytical structure. The main difference is that Veronese Passarella (2022) focuses on the impact of CE innovations on the domestic economy, while Genovese et al. (2023) extend the analysis to a two-area economy, explicitly considering the effects of cross-border trade and portfolio investment. In this section, we discuss the key findings associated with a CE innovation in a single-country model and then examine its implications for a multi-country economy.

Each national economy considered consists of five domestic macroeconomic sectors: a) households (which are further divided into wage earners and rentiers); b) private production firms; c) the government sector; d) commercial banks; and e) the central bank. The single-country model also includes a stylized foreign sector, which tracks trade and financial flows with the rest of the world. In the two-area model, each country shares the same institutional structure, and there are no barriers to trade or restrictions on capital flows. Households receive both labour incomes (wages) and capital incomes (profits and interest payments) and purchase consumption goods based on their disposable income and net wealth. Household savings consist of cash (currency), bank deposits, and government bills. The baseline scenario involves three industries (manufacturing, agriculture, and services) where firms produce three outputs (and waste) using the same products as inputs. For simplicity, real supplies always adjust to real demands, and firms do not hold inventories. However, firms accumulate fixed capital and finance their production plans through bank loans. As mentioned, corporate incomes are entirely distributed to households. Bank deposits are created as long as banks grant loans to firms and/or upon demand, while cash is

issued by the central bank when the government sector runs budget deficits and/or commercial banks obtain advances.

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Both models are coded and simulated in an R environment. Model parameters and exogenous variables have been selected to approximate the baseline scenario discussed by Vallès Codina and Fevereiro (2022). Initial values for endogenous variables are set to zero, and simultaneous solutions for endogenous variables have been obtained through 100 iterations per period. The economy is set in motion by an initial expenditure from the government sector. Private firms produce goods and services based on demand, leading to an increase in output, disposable income, consumption, investment, and imports (and exports). The economy experiences growth following the initial shock and eventually stabilizes at a new steady state, where private consumption equals disposable income and the stock of net wealth remains unchanged (ensuring that households achieve their target wealth-to-income ratio). Economic activity results in the production of waste and CO2 emissions. The models also consider its impact on the functional distribution of income and gender segregation in the labour market, accounting for variations in the share of female workers across industries (assuming that the female labour force is uniformly distributed across industries in both the baseline scenario and the experiments discussed here).

Tables 16.1 and **16.2** depict the balance sheets of the single-country model and the two-area model, respectively. **Tables 16.3** and **16.4** present the corresponding transaction-flow matrices. **Figure 16.1** and **Figure 16.2** illustrate cross-sector (and cross-area) payments and their effects on financial stocks, confirming the integrity of the models (where every payment originates from somewhere and goes to somewhere, and any changes in financial assets/liabilities of one sector are matched by opposite changes in financial assets/liabilities of other sectors). Lastly, **Tables 16.5** and **Table 16.6** and **Figure 16.3** display the input-output matrix of each domestic economy and the flows of inputs across industries in the single-country model.

Table 16.1. Balance sheet in period $t = 20$, single-country model, baseline scenario

	Households	Firms	Government	Banks	Central Bank	Foreign sector	Total
Money	46.50	0.00	0.00	0.00	-46.5	0.00	0.00
Advances	0.00	0.00	0.00	0.00	0.0	0.00	0.00
Deposits	272.70	0.00	0.00	-272.70	0.0	0.00	0.00
Loans	0.00	-36.64	0.00	36.64	0.0	0.00	0.00
Bills	35.47	0.00	-367.63	236.06	46.5	49.61	0.00
Capital stock	0.00	36.64	0.00	0.00	0.0	0.00	36.64
Net financial wealth	-354.66	0.00	367.63	0.00	0.0	-49.61	-36.64
Total	0.00	0.00	0.00	0.00	0.0	0.00	0.00

Table 16.2 Balance sheet in period $t = 20$, two-area model, baseline scenario

	H1	F1	G1	B1	CB1	xr1	H2	F2	G2	B2	CB2	Tot
Money	78.46	0.00	0.00	0.00	-78.46	1	78.27	0.00	0.00	0.00	-78.27	0.00
Advances	0.00	0.00	0.00	0.00	0.00	1	0.00	0.00	0.00	0.00	0.00	0.00
Deposits	492.73	0.00	0.00	-492.73	0.00	1	479.60	0.00	0.00	-479.60	0.00	0.00
Loans	0.00	-121.88	0.00	121.88	0.00	1	0.00	-122.57	0.00	122.57	0.00	0.00
Area 1 Bills	22.46	0.00	-481.55	370.84	73.38	1	14.86	0.00	0.00	0.00	0.00	0.00
Area 2 Bills	15.22	0.00	0.00	0.00	5.07	1	21.82	0.00	-477.42	357.02	78.27	0.00
Capital stock	0.00	121.88	0.00	0.00	0.00	1	0.00	122.57	0.00	0.00	0.00	244.46
Net financial wealth	-608.87	0.00	481.55	0.00	0.00	1	-594.56	0.00	477.42	0.00	0.00	-244.46
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 16.3 Transactions-flow matrix in period $t = 20$, single-country model, baseline scenario

	Households	Firms (current)	Firms (capital)	Government	Banks	CB	Foreign	Total
Consumption	-523.70	523.7	0.00	0.00	0.00	0.00	0.00	0
Investment	0.00	11.07	-11.07	0.00	0.00	0.00	0.00	0
Government spending	0.00	180.17	0.00	-180.17	0.00	0.00	0.00	0
Export	0.00	73.34	0.00	0.00	0.00	0.00	-73.34	0
Import	0.00	-78.83	0.00	0.00	0.00	0.00	78.83	0
[Value added]	0.00	[709.45]	0.00	0.00	0.00	0.00	0.00	0
Wage bill	322.17	-322.17	0.00	0.00	0.00	0.00	0.00	0
Corporate profit	384.85	-384.85	0.00	0.00	0.00	0.00	0.00	0
Amortization	0.00	-1.35	1.35	0.00	0.00	0.00	0.00	0
Bank profit	4.68	0	0.00	0.00	-4.68	0.00	0.00	0
Tax revenue	-143.07	0	0.00	143.07	0.00	0.00	0.00	0
Interests on deposits	4.68	0	0.00	0.00	-4.68	0.00	0.00	0
Interests on loans	0.00	-1.08	0.00	0.00	1.08	0.00	0.00	0
Interests on bills	1.22	0	0.00	-11.19	8.28	0.00	1.70	0
Change in money stock	-6.94	0	0.00	0.00	0.00	6.94	0.00	0
Change in advances	0.00	0	0.00	0.00	0.00	0.00	0.00	0
Change in deposits	-38.80	0	0.00	0.00	38.80	0.00	0.00	0
Change in loans	0.00	0	9.72	0.00	-9.72	0.00	0.00	0
Change in bills	-5.08	0	0.00	48.29	-29.08	-6.94	-7.19	0
Total	0.00	0	0.00	0.00	0.00	0.00	0.00	0

Table 16.4 Transactions-flow matrix in period t = 20, two-area model, baseline scenario

	H1	F1(curr)	F1(kap)	G1	B1	CB1	xr1	H2	F2(curr)	F2(kap)	G2	B2	CB2	Tot
Consumption	-784.70	784.7	0.00	0.00	0.00	0.00	1	-779.48	779.48	0.00	0.00	0.00	0.00	0
Investment	0.00	6.09	-6.09	0.00	0.00	0.00	1	0.00	6.13	-6.13	0.00	0.00	0.00	0
Government spending	0.00	180.2	0.00	-180.20	0.00	0.00	1	0.00	180.2	0.00	-180.20	0.00	0.00	0
Export of Area 1	0.00	32.17	0.00	0.00	0.00	0.00	1	0.00	-32.17	0.00	0.00	0.00	0.00	0
Import of Area 1	0.00	-30.07	0.00	0.00	0.00	0.00	1	0.00	30.07	0.00	0.00	0.00	0.00	0
[Value added]	0.00	[973.09]	0.00	0.00	0.00	0.00	1	0.00	[963.72]	0.00	0.00	0.00	0.00	0
Wage bill	576.11	-576.11	0.00	0.00	0.00	0.00	1	472.15	-472.15	0.00	0.00	0.00	0.00	0
Corporate profit	386.01	-386.01	0.00	0.00	0.00	0.00	1	480.54	-480.54	0.00	0.00	0.00	0.00	0
Amortization	0.00	-6.09	6.09	0.00	0.00	0.00	1	0.00	-6.13	6.13	0.00	0.00	0.00	0
Bank profit	9.82	0	0.00	0.00	-9.82	0.00	1	9.61	0	0.00	0.00	-9.61	0.00	0
CB profit	0.00	0	0.00	3.14	0.00	-3.14	1	0.00	0	0.00	3.13	0.00	-3.13	0
Tax revenue	-196.88	0	0.00	196.88	0.00	0.00	1	-194.96	0	0.00	194.96	0.00	0.00	0
Interests on deposits	9.82	0	0.00	0.00	-9.82	0.00	1	9.61	0	0.00	0.00	-9.61	0.00	0
Interests on loans	0.00	-4.88	0.00	0.00	4.88	0.00	1	0.00	-4.9	0.00	0.00	4.90	0.00	0
Interests on Area 1 bills	0.90	0	0.00	-19.28	14.77	3.02	1	0.60	0	0.00	0.00	0.00	0.00	0
Interests on Area 2 bills	0.61	0	0.00	0.00	0.00	0.12	1	0.87	0	0.00	-19.05	14.32	3.13	0
Change in money stock	0.00	0	0.00	0.00	0.00	0.00	1	0.00	0	0.00	0.00	0.00	0.00	0
Change in advances	0.00	0	0.00	0.00	0.00	0.00	1	0.00	0	0.00	0.00	0.00	0.00	0
Change in deposits	-1.58	0	0.00	0.00	1.58	0.00	1	1.02	0	0.00	0.00	-1.02	0.00	0
Change in loans	0.00	0	0.00	0.00	0.00	0.00	1	0.00	0	0.00	0.00	0.00	0.00	0
Change in Area 1 bills	-0.07	0	0.00	-0.54	-1.58	2.15	1	0.03	0	0.00	0.00	0.00	0.00	0
Change in Area 2 bills	-0.04	0	0.00	0.00	0.00	-2.15	1	0.01	0	0.00	1.16	1.02	0.00	0
Revaluation effects	0.00	0	0.00	0.00	0.00	0.00	1	0.00	0	0.00	0.00	0.00	0.00	0
Total	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0

Notes: H = households; F = private firms; G = government; B = banks and financial intermediaries; CB = central bank; xr1 = exchange rate; 1 = Area 1; 2 = Area 2.

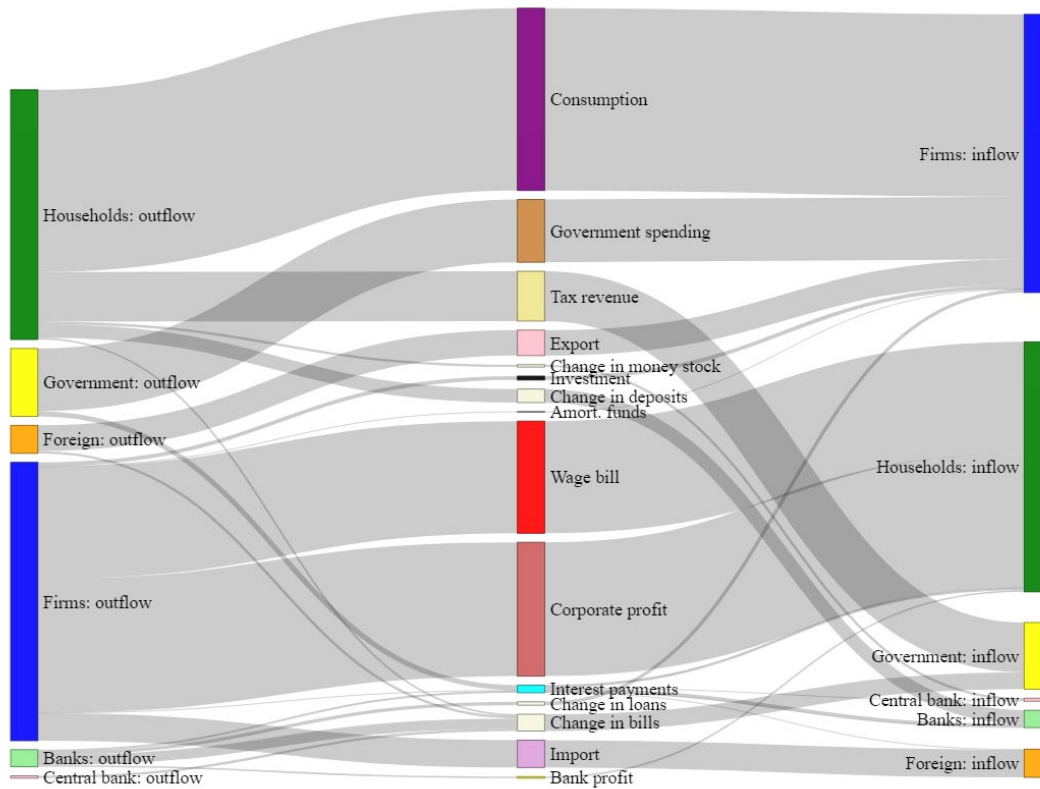


Figure 16.1 Sankey diagram of cross-sector transactions and changes in stocks in t = 20, single-country model

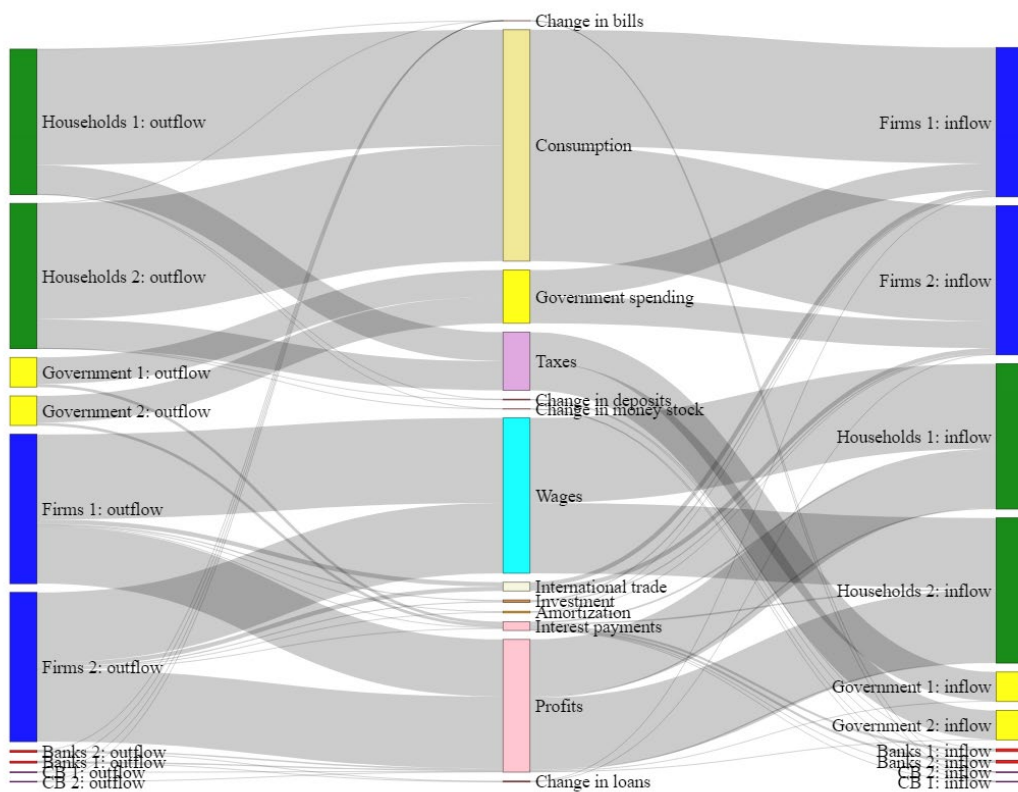


Figure 16.2 Sankey diagram of cross-sector transactions and changes in stocks in t = 20, two-area model

Table 16.5 Input-output matrix in period t = 20, single-country model, baseline scenario

	Manufacturing	Agriculture	Services	Recycling	Total	Final demand	Total output
Manufacturing (production)	67.72	67.70	67.74	0	203.16	248.31	451.47
Agriculture (production)	67.72	67.70	67.74	0	203.16	248.2	451.37
Services (provision)	67.72	67.70	67.73	0	203.15	248.41	451.57
Recycling (production)	0.00	0.00	0.00	0	0.00	0	0
Value added	236.48	236.43	236.53	0	709.45		
~ Compensation of employees	107.39	107.37	107.42	0	566.38		
~ G.O. surplus & mixed incomes	129.09	129.07	129.12	0	143.07		
Import (production)	11.82	11.82	11.82	0	35.47	-35.47	
Total output	451.47	451.37	451.57	0	1354.40	709.45	1354.4

Table 16.6 Extended input-output matrix in period t = 20, single-country model, baseline scenario

	Manufacturing	Agriculture	Services	Recycling	Total
Disposable labour income	85.91	85.89	85.93	0	257.74
Disposable capital income	105.60	105.58	105.62	0	316.79
Functional income inequality	0.19	0.19	0.19	0	0.19
Total employment	536.96	536.83	537.08	0	1610.87
~ Male employment	268.48	268.42	268.54	0	805.44
~ Female employment	268.48	268.42	268.54	0	805.44
Share of female employment	0.50	0.50	0.50	0	0.50
Waste production	220.90	220.87	220.92	0	662.69
Annual emissions of CO2	21.05	21.04	21.05	0	63.15

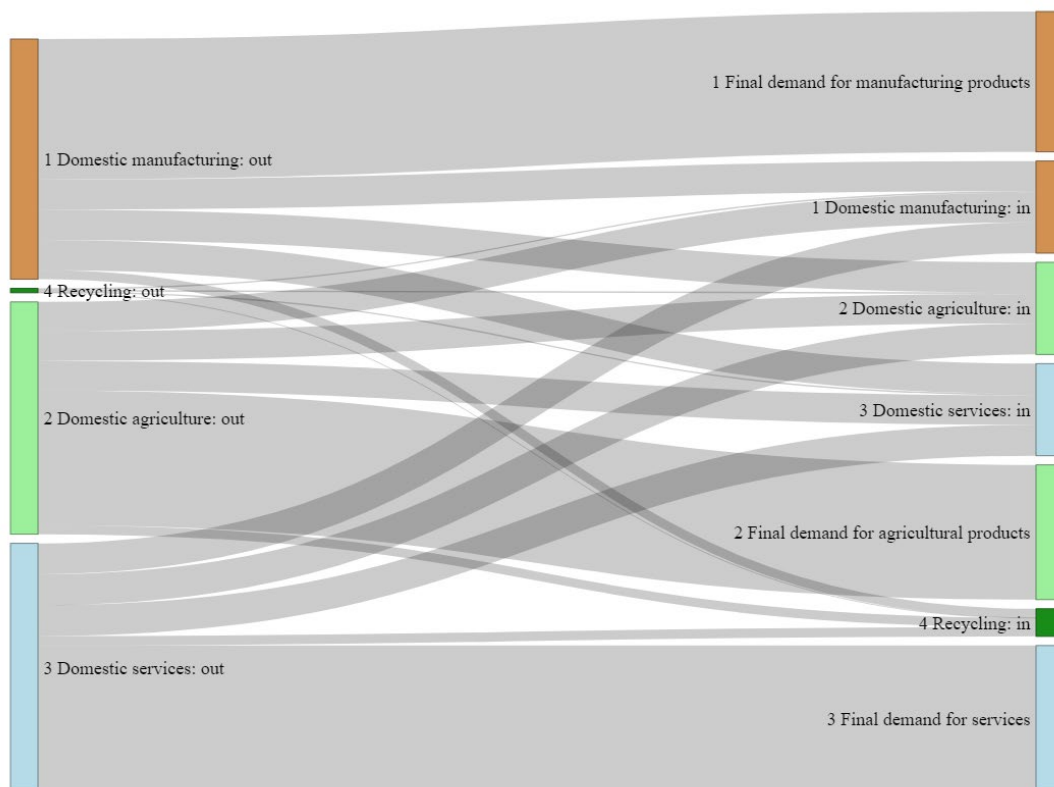


Figure 16.3 Sankey diagram of cross-industry input-output interdependencies in after CE innovation, single-country model

16.5 CE innovations in IO-SFC models: preliminary findings

The term 'circular economy' (CE) refers to a set of policies and practices aimed at reusing, repairing, sharing, and recycling products and resources to establish a closed-loop system, thereby minimizing waste, pollution, and CO₂ emissions (Bimpizas-Pinis et al., 2021). One way to introduce a CE innovation in the aforementioned model is to consider a domestic economy with four industries. The first three industries produce goods and provide services (e.g., manufacturing goods, agricultural goods, and administrative services), while the fourth industry focuses on waste recycling. Specifically, a CE innovation involves changes in the matrix of technical coefficients, resulting in the following:

Reduction in the quantities of manufacturing and agricultural products and services used as inputs within the same industries.

Incorporation of recycled waste into the production processes of manufacturing and agricultural goods and the provision of services.

Utilization of manufacturing and agricultural products and services as inputs in the waste recycling industry.

Regarding the source of the shock, the model assumes that technical change (i.e., the new or target coefficients) is influenced by policy makers. Additionally, the average speed at which technical coefficients converge to their target values is defined as a linear, positive function of government expenditures (as discussed in Veronese Passarella, 2022). In the following subsections, we will explore the implications of CE-oriented government spending in a single-country model and a two-area model, considering two different exchange rate regimes.

16.5.1 Single-country model

Figure 16.4 illustrates the impact of a CE innovation, triggered by increased government spending, on relative prices. Specifically, the adoption of new production techniques creates a fresh market for 'recycled waste', leading to a gradual increase in its unit price over time. In contrast, prices of other products and services decline. As expected, the combination of higher government spending and lower consumer goods prices results in an increase in real disposable income and consumption.

The improved production efficiency achieved using recycled waste as an intermediate good reduces the demand for traditional inputs such as manufacturing and agricultural products, as well as services. However, CO₂ emissions initially increase due to the overall increase in output, including recycled waste. Nevertheless, the use of more efficient techniques and the lower energy intensity assumed in waste recycling eventually lead to a reduction in emissions compared to the baseline scenario, particularly in the long run when the net product stabilizes and total output even declines. In our preliminary experiment, the temporary nature of the rebound effect is specific to the chosen parameter values. Additional experiments demonstrate that the increase in CO₂ emissions can be long-lasting (for a comprehensive discussion on rebound effects, refer to Zink and Geyer, 2017; and Bimpizas-Pinis et al., 2021).

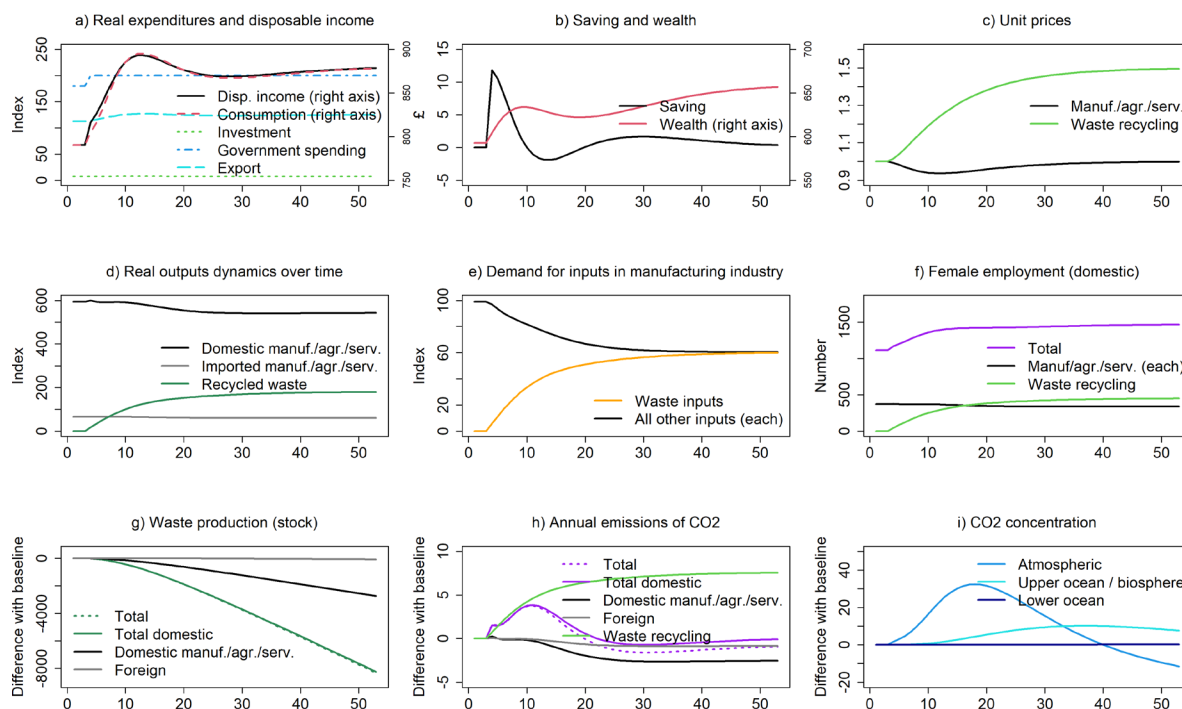


Figure 16.4 Selected variables after CE innovation, single-country model

Shifting focus to social variables, our analysis reveals that, all else being equal, the functional income distribution becomes more favourable to workers due to two opposing effects coming into play. On one hand, the higher stock of government debt leads to increased interest payments to rentiers, which influences the wage share of total income. On the other hand, the recycling industry is assumed more labour-intensive than traditional industries, and this effect prevails. Gender income inequality, however, remains unchanged, although female employment increases in absolute terms. Once again, this outcome is driven by the higher labour intensity of the new recycling industry. Income inequality in terms of class and gender would increase in the case the new recycling industry had a lower labour intensity and a lower share in female employment.

16.5.2 Two-area model with fixed exchange rate

Figure 16.5 illustrates the impact of a CE innovation triggered by increased government spending on selected variables in a 2-area economy model. The innovation only takes place in Area 1, and the currency exchange rate between the two areas is fixed: this scenario is critical as it applies to single-currency areas with regional economic diversity, such as the European Union, or the EU or the US with countries that maintain a fixed peg with the euro or the US dollar, such as Western Africa (e.g. the Financial Community of Africa, CFA) or China, Lebanon, Argentina, and Ecuador (which can also be considered as semi-floating in the next section). Despite the increase in government spending (quadrant (a)), the import of Area 1 falls sharply (quadrant (b)) due to the decline in the demand for (foreign) inputs due to the CE decrease in input requirements in production (quadrant (e)) and the trade balance becomes positive (quadrant (b)). The economy grows, and so does female employment, following total employment (quadrant (f)). The stock of accumulated waste reduces due to both recycling and the higher efficiency of domestic production processes (quadrant (g)). Despite the higher ecological efficiency, industrial CO₂ emissions

peak in the short run, although they fall below the initial level in the medium run (quadrant (h)). The same goes for CO₂ concentration in the atmosphere (quadrant (i)).

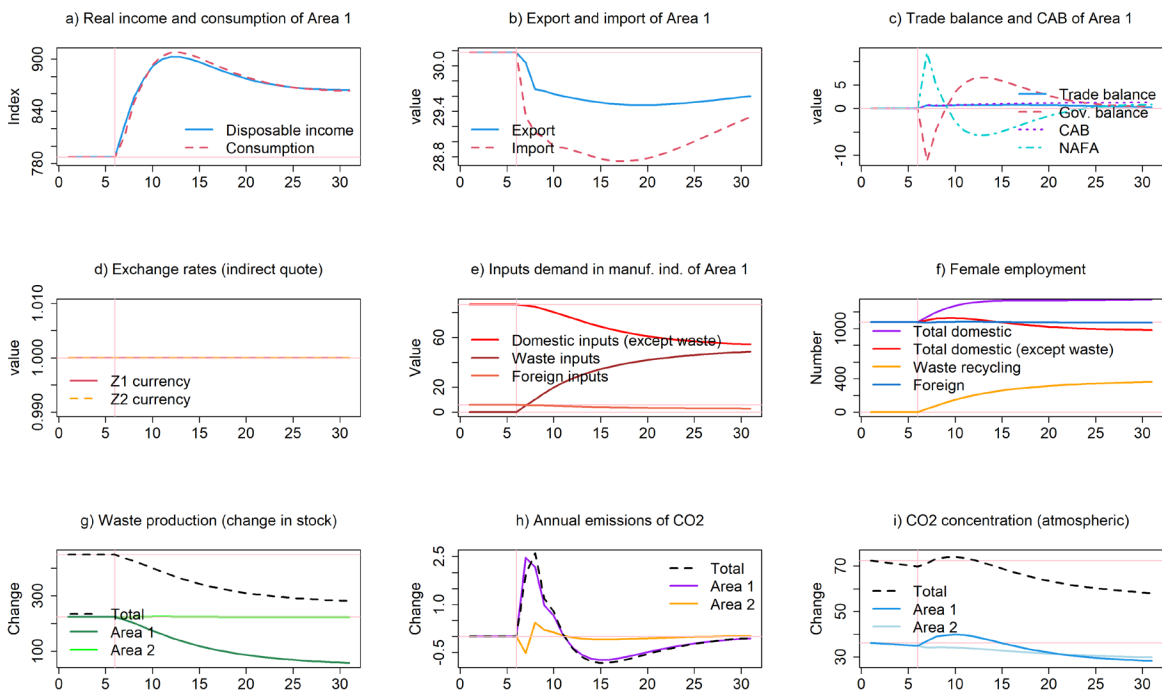


Figure 16.5 Selected variables after CE innovation, two-area model, fixed exchange rate

16.5.3 Two-area model with (semi) floating exchange rate

Figure 16.6 illustrates the impact of a CE innovation in Area 1 when the currency exchange rate between the two areas is free to adjust based on cross-country trade and capital flows (semi-floating exchange rate regime). The main difference compared to the previous case is that, this time, the initial fall in imports (e.g. an improvement in the trade balance) leads to an appreciation of Area 1's currency (quadrant (d)) and a slight decrease in economic output (i.e. GDP). This new effect, in turn, affects exports negatively, so that the net trade balance actually becomes negative (quadrant (b)) despite the reduction in the demand for inputs from Area 2. Some minor differences in contrast to the fixed exchange-rate regime occur on both ecological and social variables: employment, waste, and emissions all grow less than they would have under a fixed exchange rate regime, due to the negative impact of currency appreciation on the trade balance and, consequently, the output of Area 1. It should be noted that this also implies a larger share of world production taking place in Area 2, the area that has not introduced any CE innovation. While this paradoxical effect is negligible in this simple example, it may have relevant implications when considering a more complex scenario (Carnevali et al., 2020). At this stage, the scenarios investigated are substantially stylised, so that the actual size of each effect will become clear when empirically calibrated with their actual values.

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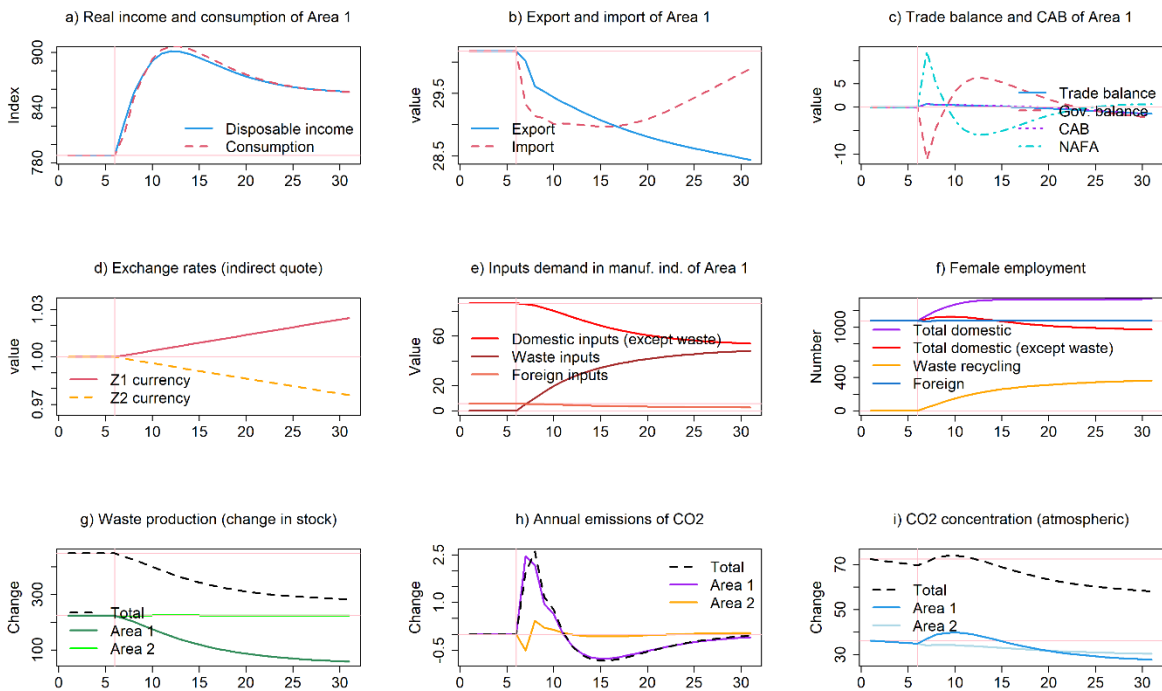


Figure 16.6 Selected variables after CE innovation, two-area model, floating exchange rate

16.6 Final remarks

The CE paradigm has gained momentum in both academic and industrial circles in the last decade. Despite the intuitive association of a transition towards a CE with a more sustainable society, there has been limited scrutiny about its economic viability. To address this, there is a need for macroeconomic tools to assess the impacts of CE policies on society, the economy, and the ecosystem. The field of ecological macroeconomics can fulfil this need through various promising modelling approaches. The aim of this chapter was twofold. Firstly, it provided a short overview of macroeconomic modelling developments addressing CE issues, focusing on the most widely used approaches and tools. Secondly, we argued that the combination of IO analysis with SFC modelling is one of the most promising methods to simulate, assess, and compare CE strategies. In order to support this, the main features of three IO-SFC models for a capitalist economy were presented and discussed. Unlike standard SFC models, the proposed models allow dealing with cross-industry interdependencies. Unlike traditional IO models, they allow endogenising technical innovations, by linking the changes in technical coefficients with other variables – such as policy decisions, the evolution of demand conditions, portfolio decisions, and the change in the ecosystem. As a result, a variety of feedback effects can be explicitly modelled. The simple exercises proposed here confirmed that the transition towards a CE system could not rely on higher production efficiency only, due to rebound effects. Its impact on social variables is also ambiguous, as it depends on several factors (such as foreign trade and financial flows), some of which are not under the direct control of the policy makers in a market economy.

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PART III. ROADMAP TO A JUST CE: KEY CONCEPTS, GEOGRAPHICAL AREAS, NATIONAL PATHS AND SCENARIOS

Chapter 17. Global Environmental Justice and Circular Economy

Teresa Meira, Giacomo D'Alisa

Abstract

This chapter explores the intersections between the circular economy (CE) and global environmental justice (EJ), examining both conceptual and empirical levels.

The chapter begins by acknowledging the contribution of EJ research in highlighting the unequal distribution of environmental costs caused by industrial social metabolism. It argues that for the CE to promote global EJ, a degrowth approach is necessary. Current research reveals that prevailing CE policies and practices generate social and territorial impacts similar to those of a linear economy.

Furthermore, empirical evidence demonstrates that different social actors perceive the CE differently, depending on whether it is mobilized by EJ organizations or by state and corporate actors. The chapter delves into a case study analysis of waste-pickers in Rio de Janeiro (Brazil) as a significant group involved in repair-reuse-recycle activities, particularly in the GS, providing crucial yet undervalued services to the CE.

In conclusion, the chapter proposes key recommendations for a just CE: 1) recognizing workers, both paid and unpaid, as primary stakeholders in the transition; 2) addressing cost-shifting issues and ensuring equitable distribution of costs during the transition; and 3) promoting inclusive decision-making processes that involve marginalized groups and give their perspectives equal consideration.

Keywords: Global Environmental Justice; Social Metabolism; Ecological Distribution Conflicts; Ecological Debt; Working Class Environmentalism

The problem addressed by this contribution is the potential for the circular economy (CE) to perpetuate global environmental injustice (EJ) due to its current formulations, which generate unequal social and territorial impacts. This study highlights the need to consider environmental justice and address historical inequalities in CE policies and practices.

17.1 Introduction

The JUST2CE consortium focuses on the idea that transitioning to a circular economy (CE) should prioritize justice in all aspects. The main objective is to explore how the CE model can be a sustainable and socially just alternative to the traditional linear economy. Achieving this goal involves examining the research on Environmental Justice (EJ) and identifying its connections with CE research.

While there is a larger body of literature on CE compared to EJ (around 18,000 entries versus 8,000 entries in Scopus³⁰), EJ research actually predates CE research by about 15 years. The interdisciplinary field of EJ emerged in the United States in the mid-1980s, around the same time as the field of Ecological Economics. Scholars in both EJ and Ecological Economics have developed alternative theories that address the unequal and unsustainable impacts of material and energy flows associated with GDP growth on vulnerable communities and ecosystems (Martinez-Alier, 1987; Bullard, 1990).

It's worth noting that Kenneth Boulding (1966), one of the pioneers of Ecological Economics, wrote a paper titled "The Economics of the Coming Spaceship Earth." This paper influenced scholars D.W. Pearce and K.R. Turner, who were the first to use the term "circular economy" in their handbook of environmental economics (Pearce & Turner, 1990). Boulding criticized the linear "cowboy economy" and laid the foundation for research on the material balance of the economy (D'Alisa, 2019). Ecological economists have since demonstrated that viewing the economy as a linear system of endless expansion disregards the environmental limits and boundaries required for sustainable resource extraction and waste management (Daly, 1997). Concurrently, experts in Environmental Engineering, Innovation, and Technology Studies, specifically in the fields of industrial ecology and eco-design, have focused on practical research to enhance material efficiency and extend product lifespan. These efforts aim to address the ongoing demand for new resources and the urgent need to reduce the exponential growth of industrial waste (Ghisellini et al., 2016).

Since the early 2000s, a new approach to EJ has emerged, known as the Ecological Distribution Conflict framework. This framework, influenced by ecological economics, examines the unequal distribution of costs and benefits associated with the linear growth of the economy (Martinez-Alier, 2002). It specifically highlights the need to address environmental distributive injustice that is inherently linked to the "take-make-waste society" model. Notably, landmark literature focusing on waste conflicts and toxic disposal in impoverished, vulnerable, and racialized areas worldwide have played a crucial role in developing an EJ framework (Pellow, 2002; Pellow, 2007; D'Alisa & Armiero, 2012).

Both CE and EJ scholarship share two primary concerns: transitioning from a linear economic path to a circular one and addressing the escalating issue of industrial waste generation. However, the CE perspective often overlooks the unequal distribution of costs and benefits associated with the linear economy and potential transitions to a circular economy. For example, it fails to thoroughly consider how transforming the waste sector will impact different actors involved in formal and informal waste management globally. This partial neglect helps explain why CE and EJ scholars have not extensively incorporated each other's research findings, despite having

ample opportunities for collaboration. Bridging this knowledge gap necessitates a comprehensive exploration of EJ theories developed over the past three decades and identifying the most relevant conceptual tools for CE research and policy.

³⁰ Retrieved in September 2022

17.2 Global Environmental Justice: a conceptual toolbox

The EJ scholarship originates in the second half of the 1960s in the anti-toxic struggles of Black, Latino, and Native American communities in the U.S.A. (Bullard, 1993; LaDuke, 1999). The concept of EJ embodied community-led expertise that demonstrated the correlation between sites of pollution disposal and exposure, racial discrimination, and poverty. Statistical evidence of the existence of "environmental racism" was thus established via social science research (Bryant & Mohai, 1992), giving rise to a new body of scholarship, which has produced detailed analyses of the unequal distribution of social and environmental costs between different social groups.

This section introduces a conceptual toolbox with four key concepts related to framing the CE within the context of EJ: 1) social metabolism; 2) ecological distribution conflicts; 3) climate and ecological debt, and 4) working-class environmentalism.

The concepts covered are as follows:

1. **Social Metabolism:** Refers to the material and energy flows necessary for the functioning of societies. It highlights the connection between economic growth, industrial social metabolism, and the unequal distribution of environmental costs across social groups and regions. According to Martinez Alier (2012), addressing inequalities related to environmental justice requires an alliance between the concept of "degrowth" in wealthier nations and the "environmentalism of the poor" from regions in the GS.
2. **Ecological Distribution Conflicts (EDCs):** EDCs arise from the unequal distribution of benefits and costs related to the use of the biophysical environment. The Environmental Justice Atlas (EJAtlas) is an essential inventory of these conflicts, involving indigenous communities, rural populations, and marginalized workers (Temper et al., 2015). EDCs demonstrate that the current formulations of the CE can perpetuate global environmental injustices.
3. **Ecological and Climate Debt:** Signifies the unequal distribution of costs and benefits resulting from the increase in social metabolism between the GN and South (Martinez-Alier, 2020). It stems from historical and present resource plundering, waste disposal, and ecological damage caused by colonizing countries (Pigrau et al., 2014). Reparations for ecological and climate debt are demanded, highlighting the need to reformulate the CE as a response to ecological unsustainability and as a means of debt repayment.
4. **Working-Class Environmentalism:** From an EJ perspective, the working class can be defined as "those who make a living out of physical work performed in agriculture, industry or service, typically occupying the bottoms of the labour hierarchy, i.e. the lowest paying, highest risk jobs" (Barca 2012:2). Explores the environmental agency of workers engaged in struggles to defend both the environment and their labor conditions. It emphasizes the environmental injustices faced by working-class communities and recognizes the diverse actors involved in GEJ movements, including women, racialized individuals, and those in unwaged or informal labor.

These concepts provide a foundation for understanding the intersections between CE and EJ in a global context, and highlight the need to address social and environmental inequalities in the pursuit of a just transition to a circular economy.

17.3 Methodology

This study was conducted in three phases: a bibliometric analysis and literature review, an analysis of empirical data from the EJ Atlas, and complemented with a case study analysis.

For the bibliometric analysis, we searched the Scopus database, which contains a large collection of research papers. We looked for documents that discussed both the CE and EJ in their titles, abstracts, or keywords. After filtering out the results, we identified a set of 11 relevant documents. Using bibliometric software (VosViewer), we analyzed the connections between different items mentioned in these papers, such as keywords and concepts. This helped us identify clusters of related topics within the literature, and understand the distribution of topics and research trends within the fields of CE and EJ. By examining how often certain keywords appear together in different papers, we gain insights into the relationships and structures within these research areas.

We conducted a co-occurrence analysis to examine the relationships between concepts based on bibliographic data such as journals and scientific areas. We assigned different colors to clusters of keywords, and the size of the circles represented their frequency in the dataset. The strength of the links between keywords indicated how often they appeared together in the same papers (**Figure 17.1**).

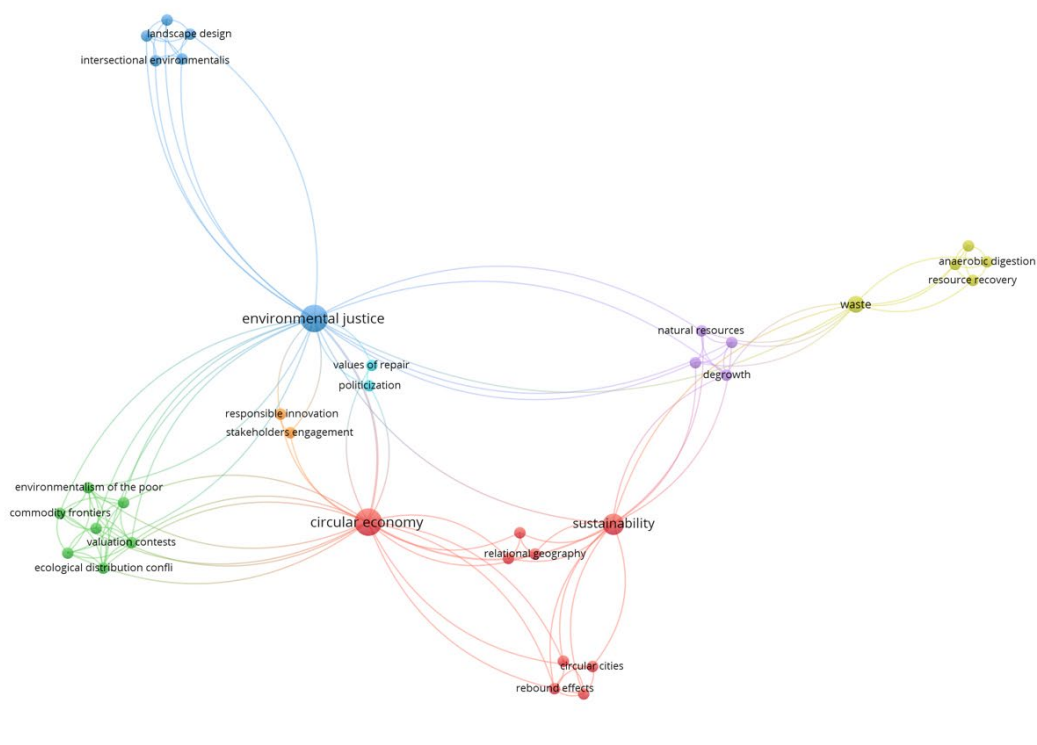


Figure 17.1 Bibliometric network based on keywords

After the bibliometric analysis, we proceeded to conduct a critical review of the selected papers (**Table 17.1**). We qualitatively and analytically grouped them based on concepts such as social metabolism, environmental conflicts, ecological/climate debt, and working-class environmentalism. This allowed us to explore the intersection of labor, gender, and just transition, which has been largely overlooked.

Table 17.1 Selected papers from Scopus database

#	Title	Authors	Year	Source
1	"Nobody" matters in circular landscapes	(Wuyts & Marin, 2022)	2022	Local Environment
2	Scientists' warning against the society of waste	(Marín-Beltrán et al., 2022)	2022	Science of the Total Environment
3	Mapping ecological distribution conflicts: The EJAtlas	(Martinez-Alier, 2021)	2021	Extractive Industries and Society
4	Future-proofing capitalism: The paradox of the circular economy for plastics	(Mah, 2021)	2021	Global Environmental Politics
5	Clarifying rebound effects of the circular economy in the context of sustainable cities	(Chen, 2021)	2021	Sustainable Cities and Society
6	Repair for a broken economy: Lessons for circular economy from an international interview study of repairers	(Niskanen et al., 2021)	2021	Sustainability (Switzerland)
7	Politicising Circular Economy: what can we learn from Responsible Innovation?	(Pansera et al., 2021)	2021	Journal of Responsible Innovation
8	The trilemma of waste-to-energy: A multi-purpose solution	(Malinauskaite & Jouhara, 2019)	2019	Energy Policy
9	Conceptualizing waste as a resource: Urban biosolids processing in the rural landscape	(Mason-Renton & Luginaah, 2018)	2018	Canadian Geographer
10	Interrogating the circular economy: the moral economy of resource recovery in the EU	(Gregson et al., 2015)	2015	Economy and Society
11	Waste Picking as Social Provisioning	(Velasco et al., 2021)	2021	Academy of Management 81st

	Constructing a Socially Regenerative Circular Economy		Annual Meeting (26 July 2021): 1-6.
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In addition to the bibliometric analysis, we also explored empirical data using the Environmental Justice Atlas database (<https://ejatlas.org/>). This database is the result of collaboration among scientists, citizens, and activists and documents cases of environmental conflicts. These conflicts are categorized based on the type of activity involved, such as nuclear, mineral extraction, waste management, and more. The EJ Atlas allows filtering and browsing the cases based on various criteria, providing valuable insights into the dynamics of environmental justice.

17.4 Results

Out of the 3740 cases in the EJ Atlas, only 13 mentioned the Circular Economy in their descriptions or as an alternative solution³¹. By analyzing these case studies, we aimed to understand how the concept of CE is integrated into public policies, business criteria, or proposals from environmental justice organizations and affected communities.

We present the main features of the selected cases according to three criteria: 1) if CE is being mentioned as part of a policy goal proposed by public authorities; 2) if it's presented as a business solution, or 3) if it is emerging as an alternative proposed by the communities/EJOs.

We are aware that this result is not a representative sample, for example, the overrepresentation of China cannot be used as a conclusion for how CE practices are more relevant there. Nevertheless, this sample is a useful entry point into the different ways in which CE intersects with EJ mobilizations.

These cases are distributed across different regions: seven in Asia (China), two in Africa (Tunisia and Mozambique), one in Europe (Poland), two in North America (Canada), and one in South America (Argentina).

Out of the thirteen cases, eight are classified as waste management conflicts, two as mining conflicts, and three as fossil fuel extraction conflicts. However, upon examining the specific conflict types, it becomes apparent that all of them have a direct relation to waste. Mining conflicts involve landfills, toxic waste treatment, and uncontrolled dumpsites, while fossil fuel conflicts are associated with emissions.

The analyzed conflicts range from 2009 to 2020, with only four of the thirteen cases having been updated within the 2022. It is noted that time is an important factor in analyzing the EJAtlas, as temporary wins can sometimes result in permanent losses. Projects may eventually be approved if protests subside or new legislation is ratified, even after years of opposition from Environmental Justice Organizations (EJOs).

It's important to note that the EJ Atlas is a complementary knowledge tool that enriches our understanding of the justice dimension in the CE. While the EJ Atlas may have representation biases and not capture all relevant cases, we acknowledge these limitations and provide in the next section a discussion of a case study that is not referenced in that database but also highlights the global environmental justice challenges associated with the transition to a CE.

The case of waste-pickers in Rio de Janeiro – Brazil

The study of waste-pickers³² in the GS can bring important insights to the discussion about how circular activities already in place are not recognized as such, and how they can be jeopardised by the implementation of CE policies. Waste-pickers are important enablers of sorting, repairing and recycling activities, not to mention the environmental services conveyed by them. In Brazil they represent 1 million workers (MNCR, 2022); in India, this activity represents 1% of the informal sector, which means around 2 million workers; in Ghana, waste-picking is one of the top 5 occupations in the informal sector. Generally speaking, waste-pickers form a numerous workforce in countries where the large majority of workers are informally or self-employed (WIEGO, 2020). In this section, we draw from previous research (Meira, 2017) to offer an overview of a CE-related environmental conflict involving informal waste-pickers in Brazil.

In the background of this case is the landslide in a waste dumpsite inside Morro dos Prazeres, a favela in the center region of Rio de Janeiro, Brazil, that killed almost 50 people in 2010 (IAI, 2010; Meira, 2017). This tragic incident was followed by a series of protests drawing attention to the severe risk the location was under, and the potential equivalent episodes that could happen due to the same reasons – the accumulation of huge quantities of solid waste in a number of areas within the favela. In that same year (2010), the Brazilian National Policy on Waste was published and included important changes in the legislation, among which: the formal recognition of waste-pickers as workers; the obligation to include those workers in the municipal waste management plans; and the obligation to shut down all the illegal dumpsites in Brazil. The new regulatory framework introduced the principle of shared responsibility for the life cycle of products, a CE-like policy, and highlighted the need to include waste pickers as “agents of change”. Their service and “economic emancipation” should have been considered as a priority in the municipal waste management plans.

The National Movement of Waste-Pickers, founded in 2001, offered fundamental support to the workers impacted by the national policy. In fact, the actions undertaken by the government in implementing the new policy left many waste-pickers behind, either by restraining access to the dumpsites (and therefore the recyclables), or by imposing the high costs of formalisation upon the workers themselves (e.g. health insurance and insalubrity costs), resulting in an insufficient inclusion of these workers in the municipal waste management plans.

In Rio de Janeiro, ¼ of the total population lives in favelas, home of most waste-pickers. In addition to the high population density, dwellers are subject to eviction threats, and to the drug traffickers and paramilitary factions that control the supply of basic services (e.g. electricity and gas). After the 2010 landslide, a women-led movement in the Morro dos Prazeres community founded an organisation called “Reciclação”, which resorted to collective action to encourage the participation of residents in the waste sorting and environmental preservation of the favela. The financial support came from both the state and the private sector, the organisation achieved much

³² For the purpose of this chapter we use “waste pickers” as general term to represent the workers in the waste sector as defined by the International Alliance of Waste Pickers: “a) individuals involved in the collection, segregation, sorting, and sale of recyclables in an informal or semi-formal capacity as own-account workers; b) itinerant waste pickers, informal/semi-formal waste collectors engaged in transporting, sorting, and selling recyclables, informal workers engaged in transporting or sorting within the informal or semi-formal sorting/recovery/recycling sector, or any of the above who are integrated into municipal waste management systems and continue to sort and sell recyclables; c) Former recyclers who occupy new roles in their recycling organisations in environmental promotion, caregiving, health programs, gender programs, etc.” (p.1, Globalrec, 2022).

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higher rates of separation of recyclable materials than the rest of the city (71% against 3%) (Meira & Muradian, 2016).

The uneven distribution of the costs and benefits of public services allows us to characterise favelas as "sacrifice zones" (Bullard, 1994). As the workforce with the lowest income is concentrated in these territories, the environmental loads tend to be concentrated there (Cunha et al., 2015); in some cases, such as that of the Morro dos Prazeres, this spatial injustice causes the emergence of "working-class environmentalism". In this case, a women-led, bottom-up model of CE involving waste pickers and local cooperatives was developed - even though it has not been officially recognized as CE.

17.5 Discussion

The literature on the intersection of CE and EJ has focused on several key topics, including cities, rebound effect, commodity frontiers, territorial approaches, recycling and waste, degrowth, politicization, and responsible innovation. However, rather than indicating a common approach, these themes reflect the fragmented and dispersed nature of the literature. The articles cover a wide range of topics and utilize different case studies, often at incompatible geographical scales (local, national, and global). Furthermore, they are published in diverse scientific journals, drawing on heterogeneous pieces of literature.

Geographically, the fragmentation of the EJ/CE debate is evident. Some papers adopt a global scale and examine various objects such as waste increase, environmental conflicts, plastic recycling, and machine repair work. Other papers focus on specific regions or local scales within countries, while some articles have a theoretical or conceptual dimension without specific geographical references. Due to the wide scattering of these texts, it becomes challenging to compare them as they differ significantly in terms of geographical basis and topic.

In terms of journals and literature mobilization, there is also a significant fragmentation. The papers can be classified into three main fields: social sciences, management and innovation, and sustainability and environmental science. Each field has its own methodological requirements and approaches to the transition. While some articles within each field share common references, others have no overlap with any other article. The literature fragmentation is apparent in the diversity of journals and approaches utilized.

Despite the dispersion of references, there are some common points that can be analyzed comprehensively. The encounter between CE and EJ emerged relatively recently, with articles focusing on topics such as global social metabolism, consumption patterns, waste, and the inclusion of informal CE actors. The unequal impacts of CE policy implementation strategies and the expansion of waste disposal frontiers are also recurring themes across the papers.

It is worth noting that the main topics addressed in this literature directly align with the conceptual toolbox presented in the first section, including global social metabolism, inclusion/invisibilization processes, unequal impacts of CE policies, and EDCs.

The selected articles in this section provide a critical analysis of the intersection between EJ and CE. They highlight the absence of justice concerns in the CE literature and explore how concepts such as social metabolism, ecological debt, ecological conflicts, and working-class environmentalism could be integrated into CE debates.

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One perspective presented by Martinez-Alier (2021) argues that achieving a fully circular economy is impossible due to the reliance on economic growth, which leads to increased extraction, pollution, and waste. Only a circular economy based on degrowth can be socially and environmentally just. This challenges the techno-optimistic view of CE and emphasizes the need to address environmental justice concerns.

The literature review also addressed questions about the role of technology in addressing the ecological crisis. While some articles suggest that new technologies like waste-to-energy can contribute to the circular economy, concerns are raised about the potential negative impacts. For example, the use of patented technology like the Home Energy Recovery Unit may exacerbate social inequalities and lead to rebound effects where increased individual waste processing may result in more overall waste.

The concept of justice is explored in the context of CE, with some articles highlighting the importance of recognition, distributive justice, procedural justice, and restorative justice. In particular, Wuyts and Marin (2022) discuss how the CE can perpetuate social inequalities if it fails to recognize the diverse social identities of stakeholders and value certain activities practiced by marginalized groups.

The review also addresses the need to recognize and analyze social and environmental conflicts in the context of CE. This dimension is often overlooked in the literature, but understanding conflicts over resource access, use, and distribution is crucial for achieving environmental justice.

Lastly, the perspective of working-class environmentalism is discussed, emphasizing the importance of repair and challenging the dominant focus on recycling in the CE discourse. The political and social dimensions of repair are highlighted, and the need to consider existing autonomous circular practices that are not profit-oriented.

Overall, this critical review of the literature on CE/EJ intersections highlights the need to incorporate justice concerns, address social and environmental conflicts, and recognize the diversity of stakeholders and practices in the pursuit of a more sustainable and just circular economy.

The EJ cases found in EJ Atlas showed that in terms of CE as a policy goal, China stands out as a country that has implemented CE models to address issues like waste management, resource efficiency, and low-carbon cities. However, conflicts have arisen due to conflicts with local communities, as seen in cases such as the Guiyu National Circular Economy Industrial Park and the Asuwei waste incinerator. These conflicts highlight the importance of considering EJ in CE policy implementation.

There are also cases where CE is presented as a business solution. In Tunisia, a public-private partnership was established to integrate the informal waste sector into municipal solid waste management, with the goal of realizing a circular economy. In China, the Chenjiachong landfill site and the proposed waste-to-energy plant project aim to address waste management issues through a circular economy approach. However, these projects are still under negotiation and face opposition from local communities. It is important to notice that the CE models found in the Atlas, that address CE both as business solution and as policy goal, are based on technocratic approaches and their main goal is resource efficiency.

EJOs have also made claims related to CE. In Canada, EJOs mobilized against mining projects in Quebec, proposing CE as a solution to limit the impacts of the transport electrification process. The cases of Nouveau Monde's Matawinie graphite mine and Sayona Mining's Authier Lithium Project demonstrate how EJOs advocate for social acceptability and the reduction of environmental impacts through CE approaches.

Furthermore, EJOs in Mozambique and Argentina have used CE to highlight the importance of integrating informal waste workers into the formal waste management system and recognizing their contributions to CE. The cases of

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the Hulene Dump Site protests in Mozambique and the ban on animal-drawn carts in Berazategui, Argentina, shed light on the struggles faced by waste pickers and their demand for social inclusion and recognition.

The case study of waste-pickers in Rio de Janeiro, Brazil, underscores the critical role these workers play in the context of CE policies and are not recognized as such. The landslide tragedy exposed the complex dynamics of inclusion and exclusion of non-value-based circular practices, and spatial injustices in working-class environmentalism.

Overall, these cases illustrate the complex intersections between CE and EJ, highlighting the need for inclusive and equitable approaches to CE implementation that consider local contexts and address EJ concerns.

17.6 Conclusions

The current formulations of the CE have two major shortcomings:

1. The transition to CE can result in unequal distribution of benefits and costs, impacting different groups due to existing power asymmetries and historical injustices. Without addressing these inequalities, new conflicts may arise. CE policies must consider social dimensions and historical injustice to achieve a just transition.
2. Many circular activities, such as informal repair, waste picking, and unpaid reproductive work, are not recognized as part of the CE. These activities contribute to waste reduction and circularity but are excluded from CE design and policies. This exclusion perpetuates colonialism of knowledge and disregards sustainable practices that have never been described in circular terms.

In summary, mainstream CE models focus on resource efficiency and technocratic projects, while non-value-based circular practices remain unnoticed. This includes subsistence-oriented practices, unpaid labor, and marginalized workforces. To achieve a just transition to the circular economy, it is crucial to recognize and include these overlooked aspects.

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Chapter 18. The relevance of gender justice: How gender is shaping sustainability and circular economy

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Abstract

Through approaches such as Feminist Ecological Economics (FEE) and Gendered Innovation (GI), and specific examples based in concrete case studies we will try to address: 1) What gender and gender justice means and 2) how gender is shaping sustainability and Circular Economy (CE), and what are the implications of this to dimensions of justice. The two mentioned approaches allow a broader definition on gender justice: FEE through a deep and intersectional discussion of economic valuation mechanisms and GI through gender considerations throughout the research process. To illuminate these approaches to circularity and justice in terms of gender we will introduce two case studies based on non-corporate, i.e. community-oriented CE practices developing what we call a value transformative approach to CE (a community composting in New York City and reuse communities in Maine). Finally, since these two examples and others that we found in the literature review are contextualized in GN we add a final subsection discussing the importance of addressing CE experiences from the GS with a decolonial perspective.

Keywords: Gender justice, circular economy, sustainability, gendered innovation, feminist ecological economics

Our aim in this chapter is to investigate the meaning of "gender justice" for the CE and to offer conceptual tools for expanding our understanding of gender in the context of CE.

18.1 Introduction

The basic question we want to tackle in this chapter is: how is gender shaping the CE and what are the implications of this to dimensions of justice?

To address this issue we need to clarify first what gender and gender justice means. First, gender is not a synonym for the female sex, but a social construct which determines norms and expectations about people's position in society, and about their behavior. Social norms shape social performance, including the division of labour in

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society, and economic valuation (Martínez Álvarez and Barca, 2023). Moreover, women are an internally differentiated category, intersected by class, race/ethnicity, ability and other differentiations.

Gender justice is understood as an approach aimed at tackling the discrimination of women as they intersect with various different lived experiences. This involves unpacking the root causes of gender discrimination and of unequal valuation, as well as an understanding of how other intersecting categories are shaping the CE and women's position in it. Consequently, gender justice does not coincide with gender equality and can only be achieved by taking all of these factors into account.

In Feminist political economy, gender is understood as a function of the social division of labour – that is, of the division between so-called productive and so-called reproductive or care work. This division determines the value attributed to each type of work, and their association with specific social groups. In other words, in most societies a patriarchal value system predominates, which consists in devaluing reproductive work and assigning it to women. This means that the social division of labour comes with not only gender differentiation, but also with a broader set of social hierarchies. Devalued reproductive work is typically associated with women who find themselves in the lower position in these other social hierarchies.

This perspective is crucial when looking at dimensions of justice, given that the most common approach in economic policies and planning is that of overlapping gender with women, where 'women' are understood as a pre-determined and homogeneous category. And so, the findings from one group of women can get generalised to all women, and have detrimental impacts for gender justice. Thus, the category of gender requires careful consideration in research and practice.

Approaches like gendered innovation focus on including gender considerations throughout the research process, from the formulation of the research questions, methodologies, data collection, interpretation, and application. According to scholars, projects that focus on gendered innovation have a number of advantages for disciplines "by ensuring excellence and quality in outcomes and enhancing sustainability and adds value to society by making research more responsive to social needs."

Although gendered innovation approaches would also be championed for how it can lead to technological and scientific breakthroughs (Schiebinger, 2021), our focus on this chapter is on how gendered innovation, as a framework for embedding gender throughout the research process, could be a useful tool if it was coupled with a justice approach.

We start with a broad review of the larger sustainability agenda and how gender has been framed within this discourse, to then unpack gender in the CE. We illustrate the multiple ways in which gender can be approached, and our focus on feminist ecological economics as the framework for incorporating dimensions of justice. We then present some examples of CE experiences that can shed light into what a gender justice approach to CE would look like in practice.

18.2 Literature review

Our literature review search strategy was based on three dimensions. First, we drew on a previous literature review for the gender justice report elaborated for the JUST2CE project. This literature review was based in a search of

Feminist Ecological Economics (FEE) documents, but also in articles who related CE with gender and care in their title, abstract or keywords. We searched for these concepts in relevant databases such as WOS or SCOPUS but also in specific journals, such as Feminist Ecological Economics or Ecological Economics Journal. Second, we also wanted to broaden the scope of this chapter by connecting the gender dimension in CE with the broader notion of sustainability. Our notion of sustainability was informed by the Sustainable Development Goals (SDG's), so we searched for studies that looked at literature on the gender dimension within the SDGs. We then complemented this with the notion of gendered innovation, as a framework for embedding gender throughout the research process.

18.3 Sustainability and gender

The agenda for sustainability and the attainment of the Sustainable Development Goals (SDGs) have become a global priority, influencing policy and planning for decades (Connelly, 2007). The United Nations defines sustainability as a multidimensional and integrated approach to addressing environmental challenges alongside socioeconomic development. Due to their all-encompassing nature, the SDGs and broader sustainability agenda have been a concern across countries, industries, and fields, including the more traditional environmentalist and development disciplines as well as engineering, physics, data science, and more (Leavesley et al., 2022).

The SDGs and broader agenda for sustainable development have also been at the centre of more recent theoretical approaches to sustainability, including the circular economy (Schroeder et al., 2019; Suárez-Eiroa et al., 2021). For some, the circular economy has emerged as the most important concept for achieving the SDGs, as it is viewed as providing market-based, technological, and political solutions (Alonso-Almeida et al., 2020). In addition, it seeks to be fit for transforming both public policy and offer individualised solutions to local sustainability challenges. Overall, a synergistic relationship appears to exist between sustainability and the circular economy.

Although the SDGs and sustainability agenda seek to examine multiple dimensions, there are certain transversal tenets that can be found throughout the targets and indicators. Issues such as a focus on impoverished populations, the focus on the GS/developing nations, and inclusive practices are reiterated frequently throughout the SDGs. Amongst there, gender is a cross-cutting theme. Not only is SDG 5 wholly concerned with achieving "gender equality and empower all women and girls" (UN, 2015 14), but the SDGs' discourse places a strong emphasis on gender as a cross-cutting theme (Leal Filho et al., 2022). The global goal for SDG 5 is to achieve gender equality, and to empower women and girls by eliminating gender disparities, discrimination, and violence against women (UN, 2015).

The SDG5 focuses on reducing and eliminating all forms of discrimination and violence against women and girls (5.1, 5.2, 5.3), recognising and valuing unpaid care and domestic work (5.4), and ensuring that women have equal economic opportunities and access to healthcare (5.5, 5.A, 5.6). These objectives illustrate a variety of intervention areas. The remaining targets (5.B and 5.c) place a greater emphasis on empowering women and girls through the improvement of digital technologies and the promotion of sensible policies. In addition to these, there are 45 gender-related SDG targets and 54 indicators (Filho et al., 2022).

While the inclusion of a gender element in the Sustainable Development Goals (SDGs) is a significant step towards addressing gender inequalities, it is important to note that the emphasis is frequently placed primarily on women's empowerment and leadership, as it is assumed that this will have positive effects on individuals, communities, and

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nations (Odera & Mulusa, 2020). Less attention is paid to how the SDGs could resolve the structural factors that have historically perpetuated gender disparities (Esquivel 2016). Indicators for measuring the impact of SDG 5 include "number of women in political positions" and "number of women in managerial positions," among others. It also encompasses "mobile telephone ownership" and "female lands rights and ownership." These indicators indicate a strong emphasis on attaining gender equality by ensuring that women have the same opportunities as men to attain economic stability and power positions (Struckmann, 2018).

By focusing primarily on women's empowerment and leadership, the gender component of the SDGs risks regarding gender as an individual issue as opposed to a structural issue that seeks to challenge patriarchal norms and oppressive systems (ibid). Importantly, it suggests that the emphasis should be placed on transforming women rather than systems. Much of this represents a liberal/neoliberal approach to gender that has been extensively critiqued by feminist scholars.

Moreover, another issue lies within the notion of gender. Scholars have argued that the SDGs run the risk of homogenizing women and girls' experiences. Some have called for the need to disaggregate data to make it more representative of the diversity of women's experiences across the world (Devakumar et al., 2023).

A broader approach to sustainability and gender: Feminist Ecological Economics

Feminist Ecological Economics (FEE), has systematically linked the ecological crisis with gender inequalities, specifically the devaluation of reproduction (i.e. not taking into account reproduction as an essential element to reproduce societies and their environment, and for market production.). From this perspective, the concept of sustainability is discussed with a critical approach that questions the neoliberal framework of sustainable development, which promotes GDP growth as the only way to achieve prosperity, despite the fact that this ignores the foundations of every eco-system. (Waring, 1988; Gottschlich and Bellina, 2017; O'Hara [1999] 2010; Berik 2018).

In fact, by adopting the lens of reproduction and care work, the relationship between human beings and the biosphere appears substantially different than when focusing on production or consumption. When the production of / care for people is connected with the production of / care for healthy environments, the positive, i.e. nurturing, restoring, repairing and life-sustaining potential of housework becomes evident.

This positive link raises the question of bringing care work center-stage in sustainability, and thus in CE practices and policies. It also raises the question of how to organize environmental care in gender-equal terms so that it does not fall exclusively upon women's shoulders (Paño Yanez, 2021). According to Gottschlich and Bellina (2017), the mainstream sustainability discourse has failed to address the structural significance of (unpaid) care work, not only for the economic system but also for the reproduction of society as a whole. They argue that sustainability needs to be based on a "critical-emancipatory" conceptualization, driven by environmental justice and feminist political economy.

Since the late 1990s feminist ecological economists noted how Quality of Life indicators also continued to ignore social and environmental sustainability (O'Hara, 1999; Gottschlich and Bellina, 2017; Berik, 2018; Streimikiene 2015). From a FEE perspective, the dominant discourse on sustainability neglects the crisis of social reproduction, as well as the "interconnectedness" between the spheres of production and reproduction. In other words, human,

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social and ecological reproduction is necessary to develop the productive dimension intended as formal employment in the market. For this reason, some authors find it pertinent to bring up the concept of “sustainability of life”. This concept allows us to overcome the boundary between the monetized economy and the devalued care work and the ecosystem functions (Dengler and Lang, 2022: 7) and to consider social and biological reproduction as key elements of sustainability. “Sustainability of life” is related to notions such as good life or well-being, hence also to the Buen Vivir conception so important in Latin America. The demand for FEE scholars is to find alternative languages of valuation that put the sustainability of life in a prominent position putting “life in the centre” (“la vida en el centro”) of valuation mechanisms. One of these alternative propositions is to “(re)integrate” production in its social and ecological context, encompassing all reproductive functions and conceiving all these processes as unity (Biesecker and Hofmeister, 2010). Likewise, for FEE sustainability must focus on closing the loop between production and reproduction. The key question then becomes how to rethink and reorganize the CE in a way that it incorporates care work and reproduction.

18.4 Circularity and gender Justice

This section starts by taking into account a recent study from the Industrial Development Organization of the United Nations (UNIDO 2022), which shows that women are mostly associated with “low-value added, informal and end-of-pipe activities of the circular economy”, while they form a very minority group in the “higher value-added circular activities involving greater use of advanced technologies”.

Our intention is to take this previous finding as an entry point into a broader, intersectional discussion of economic valuation mechanisms, based on a broader definition of gender justice, which aims at questioning and ultimately reframing both gender and value inequalities.

To delve into this discussion, as in the section on sustainability, we took into account the literature based on Feminist Ecological Economics. Central to this field of studies is the premise that production, intended as formal employment in the market, is only one small part of the economy, which would collapse without human, social and ecological reproduction, which largely take place outside the market, and mostly via unpaid work. This idea is represented by the diverse economies iceberg (**Figure 18.1**), which comes from feminist economic geographers J.K. Gibson Graham; The sea level, discriminating between the two parts of the iceberg, represents valuation in GDP accounting. This figure shows how GDP growth is (literally) based on the devaluation of all the work that is necessary to reproduce not only societies but also their environments.

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Figure 18.1 The Diverse Economies Iceberg (Source: Community Economies Research Collective)

In addition to the dimension of sustainability, there are two other elements of analysis in FEE that allow the development of a broader definition of gender justice: care work and Social Provisioning. Care work in FEE refers to all tasks that are essential for individual wellbeing and the functioning of society, including care for nature (Martínez Álvarez and Barca, 2023). This literature focuses on how to (re)organize care work from a perspective that takes into account both social and ecological sustainability, as well as class/race and gender justice (Dengler and Lang, 2022; Hanacek, Roy, Avila and Kallis, 2020; Gottschilch and Bellina, 2017; Power, 2004). Social Provisioning in FEE refers basically to the capacity to provide for others, including the biophysical environment, through unpaid and nonmarket activities and is also the key parameter of economic valuation – rather than a marginal dimension of “the economy” – precisely because it is key to human well-being (Power, 2004). In fact, the Social Provisioning approach has driven FEE scholars towards researching wealth indicators that are alternative to GDP, i.e. capable of including both social and environmental dimensions of long-term sustainability (Berik, 2018). In the FEE literature, the elements that should appear as fundamental when measuring QoL are precisely those functions that are invisible in current value systems: the services that are provided in households, the community and nature.

Focusing on these elements that are invisible in the current value systems, coming from the mentioned contexts (households, community, nature), we find in the literature case studies referring to CE practices that fit into these premises and that are centred on alternative ways of understanding gender justice and valuation mechanisms (Van der Belden, 2021; Berry, 2022; Morrow and Davies, 2021). At the same time, as we found in some of these articles, since neither production nor consumption, are gender neutral, the implementation of a gender-just CE implies profound changes at multiple levels. Some of these authors emphasize how a proper consideration of gender issues is still missing from research on CE and how most of the systematic ways of approaching production processes from a life cycle perspective, do not contemplate gender differences, and much less a value

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transformation based in gender justice principles. One of the main propositions is to change the focus from value creation and reorienting CE around the ethics of care. Not considering domestic activities and care work inside households as productive or value-making leads to inadequate policies.

18.5 A value-transformative approach to CE: Reuse communities and community composting

To illuminate our approach to circularity and justice in terms of gender we will introduce two case studies based on non-corporate, i.e. community-oriented CE practices – specifically, reuse and composting – developing what we call a value-transformative approach to CE. Community-oriented CEs are described as the most fertile terrain for value transformation; however, they are also shaped by the currently dominant gender/value constructs.

Investigating community composting in New York City, Morrow and Davies (2021) highlight how the main values in reuse and repair communities are related to enhancing social cohesion as well as individual and environmental wellbeing, but most of all it is the importance of the social, material and affective relations related to care work that is done in these contexts. The authors trace the lack of consideration for social values in CE discourse 'back to the emergence of political economy as a scientific approach'. Studies of the CE in the food waste sector, they argue, tend to concentrate on technical and managerial efficiency, while overlooking aspects such as the 'labour, health, equity, care, education, and participation' involved in composting programmes (ibid) – or else, the social reproduction basis of the CE iceberg. Adopting the non-capital centric perspective of Gibson-Graham's 'diverse economies' approach, they develop an alternative framework of sustainability, based on 'a radical rethinking of economy and waste' to look beyond efficiency, privileging 'the affective, material, and ethical doing of care'. The authors define community composting as an activity based in "the notion that organic food waste is processed as closed to the sources where it was generated to capture the benefits of both the process and the finished product for the community".

In Morrow and Davies case study, transforming waste into commons facilitates collective forms of care, which contrasts market-oriented CE approaches based on revalorizing waste as commodity – i.e. as individual profit-maximization. The authors criticize mainstream CE approaches for privileging economic productivity and efficiency or commodity production and exchange, and limitless growth. As they write: "Closing loops, without attending to social impacts, equity, justice, ethics, practices, or values, will not spur the just transitions that are so urgently needed" (539). This framing marginalizes and devalues care work (the paid and unpaid labours of caring for people and the planet). This study considers four community composting sites in New York City. All of them imply a significant involvement of municipal agencies: located on public property of the city of New York, these initiatives rely on not only unwaged but also waged labour, paid for by the municipality. Nevertheless, they are all run by non-profit organizations, and work with donated waste, which they give back to the community as gifted compost, co-produced and shared with the communities who are usually at the receiving end of toxic waste from the linear economy, but also of large municipal composting infrastructures (e.g. youth from communities of colour).

By processing food waste in the places where it is produced and collected, community composting allows to bypass the spatial injustice of centralized municipal composting facilities, which inevitably end up moving large

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quantities of waste into poorer communities of colour. Community composting is not only about closing material loops in urban metabolism, but also about countering environmental injustice, and 'circulating resources where they are most needed, according to the logics of care, social justice, and solidarity'. The authors argue that 'In direct contrast to the commercial and municipal kerb-side collection of organic waste and the mega-facility composting infrastructures which are exacerbating socio-environmental injustices, community composting ensures the value of end-of-life food remains within the territorial communities that create it.

However, following mainstream CE discourse, municipal assessments of composting tend to focus on economic efficiency rather than care and justice. As a consequence, turning waste into a common, rather than a commodity, makes community composting's contribution to sustainability largely invisible in GDP accounting. In short, this study describes New York City community composting as an example of the unvalued and invisible caring labour that sustains the CE iceberg, but also of already existing alternative, justice-oriented ways of practicing CE.

Drawing on theories of gendered social reproductive labor, Berry (2022) investigates reuse communities, predominantly formed by volunteer women. The author proposes framing CE as an effort at closing the loop between production and reproduction by expanding our understanding of CE towards including care work, specifically that which takes place outside the household, in community-based reuse organizations. Investigating, through ethnographic fieldwork, community thrift shops in rural Maine, the article highlights the labour of managing the daily overwhelming flow of used stuff, which the author defines as 'donation dumping', i.e. a practice that frees consumers of guilt, implicitly encouraging more consumption (thus keeping production going), and, in the process, depleting the labour of reuse volunteers.

From a feminist political economy perspective, donation dumping represents the valued production that grows unsustainably over the unvalued labour of reproduction, understood here as caring for the environment by taking care of discarded objects. Berry argues that, just as it happens with reproductive work carried out within the household, community-based reuse tends to be underacknowledged and devalued compared to other kinds of labour, because of its gendered dimension. Reuse is characterized as an invisible care work because it is unpaid work mostly done by women volunteers and does not generate market value. 'If the unpaid care work volunteers perform is not seen as labour – the author argues – and the negative effects of this work on laborers are not counted among the potential harms of a linear system of production-consumption-disposal, then policies designed to address such systems will fail'.

They call for 'a need to shift burdens onto producers' through 'extended producer responsibility programs', i.e. shifting our understanding of producers' responsibility from one centred on the environment, to one centred on both the environment and labour, including unpaid labour. Nevertheless, they conclude, 'Questions about the monetary value of this gendered, voluntary labour here elide the overarching problem: there is simply too much stuff'. Thus, the emphasis would be on setting limits to growth and production rather than economically valuing this gendered volunteer work, which, as observed in the analysis of the FEE or degrowth literature, can lead to the individualization of collective problems and the commodification of social and common practices and resources. Once again the focus is on reframing economic valuation mechanisms.

The invisibility of the GS and the implications for justice

As we mentioned at the beginning of this section, these two case studies are important because they show practices that develop a value-transformative approach to CE. But both are contextualized in countries of the GN. In our literature review, we have observed how a large part of the case studies focused on this approach are

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contextualized in Europe or the United States (Coghlan *et al*, 2022; McQueen *et al*, 2022; Berry 2022; van der Velden, 2021; Morrow and Davies, 2021), when there are numerous examples throughout the GS (especially in Latin America) of practices with this approach and generally located in alternative and transformative economies. As Pablo Paño Yañez (2021) argues, there are already some embedded CE practices in numerous regions in the South, based on better rates of re-utilization and repair, as well as lower consumption, which equals to decrease.

Paño Yañez (2021) points out that capitalism does not manifest itself with such expansion in the habits of these territories, while the continuity of other production, exchange and consumption systems also show other practices. Urban recycling, agroecology and permaculture initiatives would be specific examples that provide livelihood to many people through popular and social economy (2021:290). As Paño Yañez (2021) puts it, it seems important to highlight the connection of these practices with deeply rooted conceptions in territories of the GS such as the conception of *Buen Vivir* in Latin America (2021), also linked to central elements in CE such as the sustainability and specifically the concept of "sustainability of life". Both, the latter and *Buen Vivir* conception deviate from a rational, productivist logic and offer alternative approaches to social justice and aspiring to live through values of reciprocity, complementarity, and relationality (Jimenez *et al.*, 2022). For both, the main purpose is the satisfaction of direct human needs and the reproduction of life (a good life) in the widest sense. *Buen Vivir*, when grounded on the lived experiences of indigenous and marginalised peoples in the GS, can be understood as a *mobilising utopia* that embraces CE practices and justice (*ibid*).

A relevant example that Paño's article points out, which appears in the little literature focused on the GS and also in the numerous contents of gray literature, is that of waste pickers. For Paño, these are central agents linked to practices located in the orbit of CE, but which are made up of sectors of the population that are precarious and little recognized at the social and institutional level, and of course also at a salary level. These people usually work within the framework of an informal and feminized job. This article also points to the passage of waste collection for recycling at the hands of large companies as a process that led to a significant worsening of inequality in this context, eliminating a form of maintenance that was historically assumed in a decentralized manner by thousands of families that end up lacking this form of income.

The importance of waste pickers is also mentioned in an article by Gammage, Kabeer and van der Meulen Rodgers (2015) in which the question of agency is explored from the perspective of feminist economics. These authors point out the Global Alliance of Waste Pickers (GAWP) as an example of important initiatives in the GS "to raise consciousness about the role of waste pickers as important players in mitigating climate change and contributing to a sustainable development" (2015:15). GAWP also fights for promoting waste picker right to be included in urban policy development. One of the GAWP achievements has been to support claims-making by waste picker organizations and increase their influence over waste policy management, recycling programs and pricing. In fact, the Packaging Act in Uruguay in 2007 was influenced by the organizing strategies of waste pickers supported by different NGOs such as WIEGO (Women in Informal Employment Globalizing and Organizing) and GAWP (2015).

Along the same lines, but focused specifically on the implementation of the circular economy, is the article by Valencia *et al* (2023). This article highlights the importance of these actors (specifically female waste picker leaders from Ecuador and Colombia) and their demands for dignity, care-work counting and environmental justice when proposing a guide policy and practice for a just transition to a circular economy

Overall, it is surprising that there is a substantial lack of literature that frames gender dynamics in CE in the GS. The lack of literature, however, should not be confused with lack of real-world examples. It just demonstrates the coloniality of knowledge that is embedded in CE research (Pansera *et al.*, 2021). We argue that there is a need to

focus on these experiences if we are to develop a gender justice approach to CE, where the experiences of women in the GS are acknowledged.

18.6 Conclusions

This chapter has concentrated on dissecting how gender has been positioned within CE research and the implications of this framing for justice dimensions. Our starting point is that, rather than applying an uncritical gender lens to CE, these lenses must be framed from a gender justice perspective. Our position has been to adopt FEE given the important aspect of social division of labour which is crucial for looking at CE practices. We acknowledge that other gender approaches that are grounded in justice would also provide interesting insights into this area.

The literature review conducted for this chapter has revealed two important aspects. First, gender is not at the core of CE research, which risks invisibilising women experiences's but also, devaluing the importance of social and reproductive work. Importantly, the way in which gender is embedded in sustainability and the SDGs should serve as a cautionary tale for what occurs if our approach to gender is not framed by a logic of justice, but rather by neoliberal values that emphasise empowerment while ignoring structural inequalities.

The second aspect is that the majority of literature that examines the gender dimension of CE focuses on Northern experiences. As previously mentioned, it is essential that this disparity be viewed as a broader problem with the production of knowledge, in which the GS is largely ignored or viewed with a precarious mindset. It is not the case that there are no examples of feminist CE initiatives; however, more research is required to investigate these initiatives and determine what the GN can learn from them.

Both these aspects suggest a missed opportunity for understanding just transitions to CE. They need to be addressed if we are to truly have a gender justice lens to CE. In order to do this, the following are some recommendations:

Explicitly embrace a gender justice perspective. Otherwise, you could adopt a gender perspective that homogenises women's experiences and emphasises individual rather than structural dimensions.

Adopt a gendered innovation strategy that integrates a gender perspective throughout the research process. To avoid neoliberal framings, it is essential, however, that this be viewed through a gender justice lens.

Embrace a decolonial perspective when producing knowledge. CE experiences of women exist in the GS. It is imperative to explore what it means that these experiences are not informing our way of understanding CE

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Chapter 19. LABOUR IN THE TRANSITION TO THE CIRCULAR ECONOMY

A CRITICAL LITERATURE REVIEW ON JUST TRANSITION AND CIRCULAR ECONOMY

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Abstract

The Circular Economy (CE) is an economic project based on object design, reuse, recycling and transformation that aims to limit the extraction of resources, waste and pollution to a minimum. It is a mode of production that seeks to respond to the challenges of the Anthropocene, namely global warming and the ecological crisis. Nevertheless, it is not always obvious to what extent CE practices and models take into account the social aspects of transitioning, in terms of decent wages or working conditions for a dignified and healthy life. In this chapter, we aim to show the importance of the perspective of labour to design circularity. Recent Just Transition (JT) literature, on the other hand, emphasizes how workers themselves can lead or design social transformation from a CE perspective, creating high-quality employment. This is a social justice requirement in line with both JT as demanded by workers' organisations and international trade unions, and Sustainable Development Goals (SDGs) as preached by the United Nations. On the one hand, CE could benefit from workers' knowledge about productive processes. On the other hand, a marginalisation of labourers would put CE at risk of entrenching – if not deepening – social inequalities. Thus, rethinking CE from the perspective of workers implies respecting five fundamental pillars of the JT: 1) Maintaining a high level of employment (quantitative approach); 2) Ensuring decent jobs and wages (qualitative approach); 3) Taking into account the capability of workers themselves to design CE-inspired labour processes (subjective approach); 4) Rethinking CE models from the perspective of women's informal or unpaid subsistence work (feminist approach); 5) Including to migrants, racially discriminated people and non-citizens in the composition of the workforce (decolonial approach).

Keywords: Labour, Just Transition, Circular Economy, Workers, Employment, Trade Unions.

This chapter explores the role of labour in CE literature, emphasizing how workers themselves can lead or design a viable and effective ecological transition, fulfilling social justice requirements – in line with both JT and the SDGs.

19.1 Introduction

This chapter explores the role workers play in the academic and “grey” literature on CE, with the aim of measuring the effects of a hypothetical ecological transition on labour and. Moreover, the chapter elaborates on how such CE-inspired transformation can be supported - or even led - by workers and their unions. Its goal is to expand social sciences' contribution by offering a systematic and critical review of the literature on labour in connection to that on CE, analysing both bibliometric data and contents of a selection of particularly relevant papers. It starts from two main questions:

1. are workers' subjectivity and trade-unions' agency taken into account in CE models and practices?
2. If not, what would CE look like from the labour's point of view?

To begin, it is useful to clarify our definitions of two main concepts:

Circular Economy (CE) is a regenerative system of production and consumption, closing the loop of economic cycles of inputs and outputs preserving natural resources, limiting pollution and regulating waste (Pansera, Genovese and Ripa 2021). Circular activities include sectors such as repair, reuse, and recycling.³³ Activities that aimed to reduce the use of materials, pollutant emissions, waste, and remanufacturing industrial goods are also included.

Just transition [JT] introduces the issue of social justice into the technical reflections on ecological transition and has recently become a central concept in climate discussions (Stevis 2023). Since the early 1990s, labour organisations have forged the concept to claim that an ecological transition could not happen if all its social burdens fell onto workers' shoulders (Mazzocchi 1993). Since then, JT has been first formalized (ETUI 2011), then - in 2015 - included in the Paris Agreement. JT is nowadays one of the watchwords of many international organisations and trade unions - the so-called *Global Stocktake*, namely the concluding decision of 2023 COP 28, mentions it ten times! (UNFCCC 2023). JT seeks to overcome the fear that addressing the monumental challenge of transitioning will require us to choose between either protecting the planet or protecting workers and the economy (Ciplet and Harrison 2020; Rätzl and Uzzel, 2012). The problem is how to support the most ambitious objectives for ecological transition in a way that is at the same time ecologically *effective* and socially *fair*, which is to say attentive to workers and their communities. In its current, official definition (ILO, 2018), JT must guarantee decent working conditions for all, quality green jobs, including for workers in sectors that must be abandoned.

19.2 Different approaches to Labour

As we are specifically looking for a labour-oriented CE perspective based on JT principles, it is also useful to define what we mean by “labour”. We adopt a broad understanding that includes all forms of work, namely the whole set

³³ According to the Circular Economy Action Plan and in the Monitoring Framework for Circular Economy of the EC (European Commission 2020).

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of activities which are socially coordinated to produce what is useful to satisfy human needs. This includes the practices of all waged and unwaged workers, who re/produce all that is necessary to the development of life on Earth: people, food, commodities, infrastructures, services, knowledge, art, and the biophysical environment itself. In the specialized academic literature, however, labour is typically approached in a significantly more restricted way; as waged work - jobs - in industry or service sectors. In the following paragraphs we identify and develop five different approaches we have encountered, respectively based on: quantity, quality, agency, gender, and "race".

19.2.1 A focus on quantity: Number of jobs

The most common approach to labour in the transition to CE is the quantitative one. It aims to evaluate the effects of public policies on employment and job creation within circular activities. The European Commission's New Circular Economy Action Plan is based on such a quantitative approach. Effects are measured in terms of numbers of jobs created per sector, often linked to econometric projections of GDP growth in the context of a transition to the CE. For example, it gives much emphasis to a study by Cambridge Econometrics estimating that "applying circular economy principles across the EU economy has the potential to increase EU GDP by an additional 0.5% by 2030 creating around 700.000 new jobs" (European Commission 2020). The same plan also exemplifies how these quantitative approaches tend to measure the effects of capital composition on employment by calculating the ratio between capital intensity and labour intensity in circular activities (Llorente-González and Vence 2020). Overall, the quantitative approach can certainly be useful to understand some of the effects of labour market restructuring between different economic sectors on a global scale, but should be complemented by other perspectives, in a pluralistic effort.

19.2.2 A focus on quality: Decent work

An approach that takes into account the way in which labour is performed, rather than the sheer number of jobs, can be considered qualitative. It has a particular focus on working conditions, including their social and environmental determinants. The quality of labour is generally formulated in terms of "decent work" or "quality jobs" (Poschen 2017; van der Ree 2019). Decency has been defined as being "productive work for women and men in conditions of freedom, equity, security and human dignity" (UNEP 2008). Decent work is productive and delivers a fair income; it provides security in the workplace and social protection for workers and their families; it offers better prospects for personal development and encourages social integration; it gives people the freedom to

express concerns, to organize and to participate in decisions that affect their lives, guaranteeing equal opportunities and treatment for all (ILO 2008).

A similar qualitative dimension is present in the recommendations of the Agenda 2030 and its Sustainable Development Goals (SDGs), which "promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all" (United Nations 2015). Both definitions nevertheless mix a quantitative and a qualitative approach. Both, in fact, presuppose that an increase in the number of jobs is socially

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desirable. Yet, it is important to keep in mind that an increasing number of jobs does not automatically guarantee their quality, nor their environmentally beneficial performance.

Labour can - and actually does - "disturb" the biosphere. It often involves the extraction of raw materials beyond the regenerative capacity of ecosystems, resulting in resource depletion or biodiversity collapse. It also usually requires an input of energy. Therefore, in a fossil economy, job creation tends to lead to an increase in greenhouse gas emissions, hence an acceleration of global warming. Finally, there is the problem of waste (Armiero 2021), which can be reduced - but never totally eliminated - while maintaining an increase in production of goods at current technology levels. This is particularly the case in the construction and clothing industries.

This raises the problem of economic growth: if an expansion of GDP presupposes a system that seeks to produce more commodities to satisfy ever-increasing human needs, then it will be accompanied by an enlargement in the disturbance of natural environments. In a situation fully inspired by CE principles, we can imagine producing as many goods as in the previous cycle, but not more, since that presupposes extracting more resources, consuming more energy and producing more waste. It is difficult to conceive of an economy that aims to limit extraction, pollution and waste by producing more goods.

The necessary increase in the number of jobs should thus be questioned. Green jobs are mainly linked to the sectors of reproductive labour - in the broad sense, including agricultural and care work - and services, while jobs linked to the production of new material goods tend to deteriorate the relations with the environment by extracting raw materials, emitting greenhouse gases or producing additional waste.

19.2.3 A focus on subjectivity: The agency of the workers

A third approach focuses on workers as a potentially active subject of a CE-inspired transition. A classic example of the input and creativity of workers in the restructuring of industry in ecological terms is the famous Lucas plan of 1976. Threatened by thousands of jobs losses, workers of Lucas Aerospace in the UK published an alternative plan for the future of their company, which involved electric bicycles, wind turbines, energy conservation services, heat-pumps, re-manufactured products (Räthzel, Uzzell and Elliot 2010).

A more recent, but equally relevant example is that of the ex-GKN occupied factory in Campi Bisenzio, near Florence. In July 2021, facing massive layoffs due to delocalisation, the workers of this automotive factory first called a permanent assembly (which is still operational) and then built an alliance with the climate justice movement (Gabbriellini and Imperatore 2023). Through the direct involvement of many solidary researchers, the Factory Collective was able to produce an innovative reconversion plan. It claims the intervention of the national Government to enable an automotive value chain no longer subordinated to car-centred private mobility, but rather oriented - in line with CE objectives - towards public and sustainable bus-centred mobility (Feltrin and Leonardi 2023).

More generally, worker's agency not only gives meaning, pride and recognition on the job, it is also important to initiate the transition to CE at different scales. At the enterprise level, workers should have a role to play in general decisions, enterprise strategies, occupational health and safety, and production processes. At the national level, workers' proposals for social and environmental measures should find expression through unions and social dialogue – no matter how difficult and problematic such perspective may prove (Keil and Kreinin 2022).

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The approach of eco-design - of objects and technical systems - centred on labour (White 2020; Valencia, Koppelmäki, Morrow et al. 2020) seem to us particularly useful in the transition to a circular economy. It combines the concept of workplace design - born in the 1970s in the Scandinavian trade unions, aimed at implementing workers-friendly modes of design and innovation, with eco-design. Eco-design (Ceschin and Gaziulusoy 2020) refers to the design for reuse, reemployment and recycling but should also take into account the type of labour process involved and the relationship to the environment in workplaces. A workers-based view should also include all actors involved in determining the function of an object or a technical system. Domestic workers or workers in the reuse or recycling sectors have an important role - often invisible - in the use of objects: informal waste-pickers know best the different transformations an object can undergo (Archer and Adelina 2021). Such participatory workers' design strategies require new forms of industrial eco-democracy, to be achieved through social dialogue via trade unions, cooperative enterprises or direct and participatory democracy (White 2021).

19.2.4 A focus on gender: The eco-feminist perspective on labour

Income from paid labour is not the only material resource for well-being and dignity (Barca 2019; Barca 2020; Gibson 2020). Unpaid labour, as an important part of social and environmental reproduction, can play a key role in the development of a circular society. Taking care of living beings, be them children or parents, cooking, sorting waste: all these are activities that ensure the reproduction of society within the domestic sphere. A gendered approach to labour focuses on these invisibilized spheres to rethink work as a whole. It uncovers a huge amount of unpaid labour, mostly done by women and/or racialized people (Dombroski 2020). Examples are: care work for people or the natural environment, domestic labour and reproductive work more generally, to ensure the subsistence conditions of communities. Many circular activities, such as volunteering in recycling centres, are carried out by unpaid workers. Some authors therefore propose to shift the focus from paid labour and consumption to unpaid care work for other humans and environments (Gibson-Graham, Cameron and Healy 2013). Questioning the sexual division of labour inherited from early modernity (Salleh 2004) allows for a critique of gender inequalities in income, hygiene, health and safety at work. It also allows us to envisage a low-carbon economy that aims at the wellbeing of human and non-human communities instead of devaluing unpaid reproductive tasks and overvaluing paid productive activities. Waste sorting – or environmental domestic labour (Farbotko 2017) - is often free labour, mostly performed by women. Reuse, remanufacturing and recycling rely both on ecological conditions that need to be maintained and on domestic tasks without which products cannot be reintroduced into CE (Battistoni 2020; Ravenswood 2022). Domestic labour should thus be at the heart of reflections concerning CE.

19.2.5 A focus on "race": The postcolonial critique

Postcolonial approaches to labour (Chakrabarty 2007; Mezzadra 2011) show how the Eurocentric focus on the white male wage-earner obscures the history of a whole section of male and female workers (Spivak 2015). Post-colonial theories focus on non-manufacturing activities outside the Northern metropolitan centres. At the epistemological and political level, post-colonial approaches to labour give voice to those who do not have. Furthermore, they take into account types of work that were often disregarded by modernist theories, which often focus on productive labour, namely: the activity of transforming natural matter by natural human agency, in order

to satisfy specific social needs. Such definition of labour excludes care and reproduction activities, agricultural eco-regulation work and most of the service sector, particularly in the informal economy. Moreover, it neglects illegal workers, especially women (Farris 2020) and the international division of labour which devotes certain areas of the world economy entirely to certain forms of labour (Mies 1982, van der Linden 2008).

This, with regard to this literature, two important issues emerge: the place for racially discriminated, immigrant and non-citizen workers; and the international division of labour required by a CE-inspired transformation. Although such issues are very rarely addressed, a transition that truly leaves no one behind - starting with people in migratory situations, people of colour in Northern countries, and frontline communities in Southern countries - should not ignore them.

19.3 A systematic literature review

In order to better analyse the intersecting literature on CE and JT, and to be able to develop new theoretical perspectives, we enriched our critical literature review with bibliometric and content analysis of the collected papers (Grant and Booth, 2009). We followed the methodology used in Circular economy and social inclusion: a systematic literature review by Oliveira, Vincenzi and Souza Piao (2021). Our critical bibliography consisted of 232 academic papers and reports from international organisations, NGOs or trade unions; most of them were published after 2015.³⁴

19.3.1 CE in the academic literature

There is a generalized lack of interest in labour issues within the academic literature on CE. Out of 14,825 references on "Circular Economy" in Web of Science, only 73 mention "Labour" (most of which are actually irrelevant). This already uncovers a way of thinking about CE that focuses on economic and ecological flows without taking into account working conditions and workers' agency. In the few cases the literature mentions labour, it is mainly through quantitative approaches, although there is also an increasing consideration of its qualitative dimension.

As job creation is one of the assumed objectives of the conventional CE (Stahel 2016), it is unsurprising that it forms the focus of about one third of the academic literature; sometimes as the sole social indicator (Mies and Gold 2021). The literature seems to show an overall, albeit minimal net increase of jobs (Mitchell and James, 2015; Wijkman and Skånberg, 2015; Larsson and Lindfred 2019; Wiebe et al., 2019)³⁵. The results of an overall increase in employment have however been criticized.

The results of these calculations are often uncertain, due to the complexity of concrete situations or because of the diversity of economic models. It is difficult to calculate the number of jobs of an hypothetical policy without considering monetary and fiscal regimes, and to measure indirect effects on employment in sectors that are not

³⁴ Further details on our methodology can be found in Guillibert, Barca and Leonardi (2022).

³⁵ The assessments of the overall increase in employment are more positive in reports from public and private organisations than the academic literature on the subject (Stavropoulos and Burger 2020).

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directly affected by the transition. Moreover, most studies are based on ex-ante macro-economic models. There are very few ex-post studies of actual CE-inspired transitions.

Moreover, what is needed is an international, global approach - as regional or national borders do not correspond to real material flows in a global value chain economy (Geng, Sarkis, Bleischwitz 2019). The academic literature is nevertheless very little concerned with the international division of labour or with global capitalism. Less than 0.4% of papers on CE mentions "International" in their title or abstract; even less mentions "Global value chain" or "International trade". Studies on global value chains - for example in the textile industry - have nevertheless shown that transition to CE in the GN may be accompanied by a decrease of jobs in the production countries (Repp, Hekkert, Kirchherr, 2021), reinforcing social and spatial inequalities (Schroeder, Dewick, Kusi-Sarpong, Hofstetter, 2018).

Finally, we believe important consideration should be accorded to working conditions - wages, length and intensity of the working day, type and duration of contracts, access to social security and union representation, decent and equal treatment of workers. Academic literature on CE generally takes little account of the variation in the amount and type of employment created in different sectors. A rare exception is the study of Llorente-González and Vence (2020), which compares capital-intensive - such as recycling and waste recovery - and labour-intensive sectors - like remanufacturing and repair - to show that not all sectors of CE produce the same number or quality of jobs. Capital-intensive sectors appear to be creating more well-paid jobs, but in smaller numbers. Conversely, the labour-intensive sectors create more jobs, but those more precarious, with lower wages and a higher rate of unpaid labour.

In this context, JT has gained increasing attention since the Paris Agreement in 2015 and the ILO's 2018 report. In parallel, the idea of "green jobs" has become popular as a means of balancing economic growth with environmental and social concerns (Sulich and Soloduch-Pelc 2022). The formula green jobs differs from decent and quality jobs insofar as the former seeks to reconcile ecological transition and economic growth and rarely challenges the organisation of labour, while the latter involves a reflection on the decision-making power within the company and tends to focus on working conditions, wages, the length and intensity of the working day, social protection, and the presence of trade union representation. The challenge for a fair and sustainable decision-making system is both to give workers a central place in the company's management and to integrate environmental standards. With very rare exceptions (Buch et al. 2021), academic papers disregard the agency of workers, the effects of the transition on reproductive and unpaid labour or the potential role of non-citizen immigrant workers in CE. Workers are generally depicted as passive, in contrast to organisations - which are deemed active.

19.3.2 Labour in institutional reports

In our analysis of the interconnections between CE and labour issues within institutional reports, we distinguish three types of institutions: trade unions, public organisations (national, regional and international), and the third sector (NGOs, private foundations, think-tanks, activist groups). While in most countries trade unions are governed by private law and are legally assimilated to private non-profit organisations, they represent the voice of workers, so we dedicate a separate section to them.

19.3.3 Trade Unions and CE

Trade Unions generally do not seem interested in CE. At best, some trade-union reports mention it in passing or devote a scarce paragraph to it. Local and national unions hardly ever talk about the concept. Even the International

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Trade Union Confederation (ITUC) - most dedicated to JT - has never devoted a full report to CE. ITUC only notes that JT does not involve a phase-out but rather a transformation of certain sectors, implying the need for massive skills training for workers.

The transition to the CE thus is not a demand from workers themselves, although some international confederations of unions are beginning to understand it as an opportunity for employment and social dialogue (Gough 2022). It might be that CE is perceived as detrimental to workers' interests as too top-down, business-oriented, academic, or technocratic - ultimately inadequate to express the views and interests of workers and their representatives. Further empirical research is needed, however, to discover the reasons for such indifference towards CE, or even rejection of it.

In the few occasion trade unions mention CE, their reports mention the focus on quantitative aspects of labour but rapidly move on to include qualitative aspects, such as working conditions, decent jobs, fair wages and the length of the working day. For example, in Waste management in Europe. Good Jobs in the circular economy? the European Public Service Union criticizes that employment conditions are severely under-researched. Regarding the first EU package on CE (European Commission 2022) - which proposes to make almost all physical goods on the EU market more environmentally-friendly, circular, and energy-efficient throughout their whole lifecycle -, the ETUC welcomes the opportunity "to fight climate change, reduce our environmental impact and create new jobs", but criticizes the "missed opportunity to integrate a just transition into a much-needed climate policy". The EU, it is claimed, allegedly focuses on job opportunities - concentrated in sectors of waste management and repair - without mentioning the job losses in extractive or manufacturing sectors. It insufficiently considers the need for workers' retraining, and neglects working conditions and sufficient trade-union representation. Trade unions' reports tend to establish the link between ecological change and social justice both in terms of supporting workers in the transition and of limiting inequalities that may emerge from it. Trade unions are especially concerned with labour conditions, health and safety at work and economic, racial and gender inequalities. This is particularly the case in the waste management sector, where exposure to certain materials represents specific health risks.

Until very recently, CE was not seen as an overall transformation of the economy and society (EPSU 2017, ITUC 2017) in trade unions' literature, but rather framed in terms of waste reduction and the possibility of recycling. For example, the Campaign Against Climate Change - Trade Union Group in the United Kingdom (CACCTU 2021) sees

an important opportunity for developing decent, well-paid and well-protected jobs, but the chapter on CE in their report - Building a workforce for climate emergency - is in fact, solely dedicated to the waste sector.

However, a more thorough understanding of CE is recently emerging. The latest report of the European Social Partners' Project on Circular economy and the world of work (Cihlarova, Forestier and Zibell 2021) marks an important turning point. Here, CE is both understood as a general transformation of production and consumption, and as a political lever for workers. Like other studies (Laubinger et al. 2020), it assumes a limited but positive overall impact on employment volumes (0 to 2%), differentiated among economic sectors. The report stresses the requirement of higher skills for workers - who, managing a more irregular input off recycled materials, need to be more flexible, needing "Works Councils and Health and Safety Committees" to collect information and develop concrete measures to move towards circular business models. It is also concerned about the level of social dialogue and precariousness in CE (especially regarding informal work).

19.3.4 What do International Public Institutions say?

Being largely developed by economists in public institutions, the literature on the CE from those institutions is huge. Basically, all reports do mention the issue of labour. We therefore mainly dealt with those where the issue of labour appears as central, or those in which it assumes a remarkable position - either because it was a commonly shared position; or because it stood out from the rest; or else because it was released by a particularly important institution (e.g. the European Commission or ILO).

Public institutional reports mostly assume a quantitative approach to labour. All the reports on how to implement the first Circular Economy Action Plan (2015) talked about job creation, but scarcely addressed the quality of the jobs and the working conditions. In each of the few mentions of employment in the EC's report to Parliament (European Commission 2019), only a net increase in employment is mentioned, ignoring working conditions, social dialogue or decision-making opportunities. Similarly, another report (Cambridge Econometrics, European Commission et al. 2018), titled Impacts of circular economy policies on the labour market, develops a quantitative-only approach to labour issues. The latest publication of the Green Deal (European Commission 2022) emphasizes "empowering the consumer", while employment and JT are barely mentioned. In a new Eco-design for Sustainable Products Regulation³⁶, the only reference to labour concerns the number of jobs created, without even acknowledging conditions and longevity, not to mention opportunities for workers-led design.

The public institution which is most attentive to working conditions and the development of decent work is the International Labour Organisation (ILO). Their 2022 report takes into consideration the effects of CE at a global scale, but also the number of quality and decent jobs that have been created by attempts at CE transitions in different countries. As for the former, the employment effects of industrial symbiosis are positive, in particular if the impacts are taken into account along an entire value chain. The quality of the jobs created, however, is not guaranteed. Some decent work deficits exist where industrial symbiosis schemes are in place.

In some countries, circular activities related to reuse, repairing or re-cycling are largely carried out by informal workers. If informal workers are defined as those who have no pension insurance, the ILO considers that the share of informal labour can be as high as 90%.

While still underdeveloped, some public institutions' reports on labour and CE do consider gender disparities, women's labour, reproductive and unpaid work (Laubinger, Lanzi, Château 2020). A feminist approach to work is still, however, extremely rare. In its 2019 report Skills for a greener future, the ILO was the first public institution to evaluate the possible effects of a global transition to CE on the gendered division of labour (ILO 2019). It concluded that, as new jobs are dependent on appropriate training, and since women tend to receive less training in new technologies, women are likely to benefit less than men from such possible transition. Without appropriate training policies, a global transition to CE could increase social inequalities between men and women and between skilled and precarious workers. Unless measures are taken to train women in relevant skills, current occupational gender stereotypes are likely to persist and women will get only a small fraction of the jobs created (ILO 2019).

Other dimensions of labour - such as workers' agency in the reorganisation of production and corporate decisions, the effects on domestic and reproductive work, the place of racially discriminated or non-citizen workers - are still completely absent from institutional reports on the transition to circular activities.

³⁶ https://environment.ec.europa.eu/publications/proposal-ecodesign-sustainable-products-regulation_en

19.3.5 Labour according to the “Third sector”

Reports issued from third sector - actors such as NGOs, private foundations, activist groups - have a wide variety of political and ideological positions. The variety is much larger than in trade-unions' and public institutions' reports. This can be explained by their different nature and funding. The 2018 UN Research Institute for Social Development distinguishes four political approaches to the JT: Status quo approaches which propose the greening of capitalism through voluntary, bottom-up corporate and market-driven changes; Managerial reform approaches which seek greater equity and justice within the existing economic system through modification of certain rules and standards of employment, safety and health; Structural reform approaches in which both distributive justice and equitable decision-making processes by the different stakeholders guide the transition; Transformative approaches which imply an overhaul of the existing economic and political system built on continuous growth and imply profoundly different human-environment relations (Morena, Krause and Stevis 2019).

Most reports we discussed before - from trade unions and public institutions - can be classified in the first two categories. The reports from third sector actors, on the other hand, are distributed among all four positions. Reports by the Ellen McArthur Foundation and McKinsey (2015), or the Green Alliance in the United Kingdom (Coats and Benton 2015) have, for example, strictly quantitative visions of labour, and are therefore Status quo approaches. Reports from Chatham House (Schroeder, Albaladejo, Ribas, MacEwen and Tilkanen 2020) and the International Institute for Sustainable Development (Echeverría, Roth, Mostafa and Gass 2020), with their focus on social and geographical effects of the inclusion of countries in the GS, can be classified within the Managerial reform approach. The Circular Jobs Initiative (Goodwin, Schröder, Bachus and Bozkurt 2020), which is attentive to democracy at work, takes a Structural reform approach. The Stockholm Environment Institute (2019; Atteridge and Strambo 2020; Aung and Boyland 2020), exemplifies the Transformative approach insofar as it testifies a desire to change power relations by re-establishing workers' power over their working conditions.

Many third sector reports tend to emphasize the positive effects - and, conversely, to downplay the negative effects - of a transition to CE. For example, the report by the International Institute for Sustainable Development notes that: “All measures present positive net benefits in job creation (direct and indirect) and induced economic impacts. However, [... some] more as enablers than direct job creators” (Echeverría, Roth, Mostafa and Gass 2020, 21).

Another report suggests that “the circular economy could create 200,000–500,000 gross jobs, reduce unemployment by 50,000–100,000, and offset 7–22 percent of the expected decline in skilled employment by 2022” (Ellen MacArthur Foundation and McKinsey 2015, 34).

However, macro-economic models are much more contradictory. In most studies, it is difficult to measure indirect employment effects in sectors that are not directly affected by the transition to CE (Laubinger, Lanzi, Chateau 2020). Third-sector reports tend to favour the results of certain scientific studies, which are more consistent with their own public strategies, rather than reporting on the complexity of calculations. Third-sector reports also favour ex-ante macroeconomic studies over geographically situated case studies in specific sectors. This methodological difference leads to a low degree of testing of the models against the reality on the ground of economic actors in a globalized economy.

Many reports from third-sector organisations take seriously gender and racial inequalities, discrimination and the social inclusion of precarious workers. NGOs' literature makes strong links to social economy and informal sectors. Some reports assume that participatory organizations are more inclusive, emphasizing the importance of workers'

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cooperatives for JT (Goodwin, Schröder, Bachus and Bozkurt 2020; Mugambi, Windberg, Ddiba, Ogot, Andersson, Gicheru and Akinyi 2020; Miguel, Martinez, Pereira and Kohout 2021). Many reports focus also on gender inequalities and how a transition to CE can either limit or accentuate them (Johnson, Han, Knight, Mortensen, Aung, Boyland and Resurrección 2020).

Finally, as a concrete example, we focus on a report by Diane Archer and Charlotte Adelina (2021), from the Stockholm Environmental Institute, in which all of the five approaches to labour we have discussed are represented:

“Waste pickers in Bangkok make significant contributions to the reduction of plastic waste leakages and, therefore, play a key role in advancing a ‘circular economy’ at the urban level. However, most of them are living below minimum wage conditions and face other threats to their livelihoods, such as a lack of access to market information, occupational health hazards, societal discrimination and harassment, and a lack of organisation and social security protections. Even within this group, some workers may be more vulnerable than others – such as street waste pickers (as opposed to salengs who buy waste from customers); waste pickers who work and live near landfills or dumpsites; women with physical safety concerns when they access public spaces and with lower asset ownership; the elderly, children, and migrant workers”.

We consider this inclusiveness as a good starting point for defining an area of intersection between CE and JT: one that aims at dignified and decent work for all, where workers can decide the direction of their labour and participate in the design of the tools of production, in a way that tackles gender and racial inequalities.

19.6 Conclusions

Our definition of labour, combining five different approaches, allowed us to identify which dimensions of labour are already present in the studies on CE – as well as those which are completely absent. Quantitative approaches are very often used, qualitative approaches a little less. The approaches focused on workers' decision-making power and agency, gender inequalities and racism in the labour market, are very rare. Our research confirms the claim (Kirchherr, 2021) that only very few works on CE focus on the social justice and equality.

Under these conditions, transition to CE not only risks maintaining social, gender and racial inequalities, but also accentuating them. A transition is likely to privilege white men with average skills over women and other sections of the population. We observed a nearly complete lack of consideration of racial issues. The very small number of global and international CE models - most are national or regional - does not allow to measure North-South inequalities. There is generally a lack of reflection on labour conditions - particularly in terms of contracts - which leaves out informal, often racialized, workers in the North.

We acknowledge that the main limitation of our research has been its reliance on secondary sources: for example, workers' actual voices are not directly represented in this chapter. Paradoxically, this bias particularly affects informal workers (most of them women and racialized workers) who are directly involved with hands-on waste and recycling work, while being unrepresented by trade unions, public institutions and/or third-sector organisations. Yet, we maintain that our effort can foster a JT-based conceptualisation of CE literature by opening up a workers-friendly space for scientific reflection.

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Chapter 20. Circular Economy (CE) in African countries

Cephas Mandizvidza and Raymond Makhanda

Abstract

This article shall highlight the state of CE practices in African countries and more specifically their Technology Readiness Levels (TRL). The challenges of rapid economic growth due to advancements in innovation, has seen the emergence surging of CE as a prominent concept in sustainable science. The World Business Council for Sustainable Development (WBSD) in 2020 argues that, despite the increasing awareness of a need for a more CE, our world is only 8.6% circular; with this number notably below 9.1% in 2018. In Africa circularity is still very low and most of the times CE practices are responding to the developments of CE models in the Northern world because in most situations waste (mostly toxic) is dumped in the GS (GS) from the GN (GN) as second-hand goods sold at a cheaper price. These are dumped after a short period of time, and resulting into waste management challenges: for example used cars in Africa from Europe and Asia. CE practices in Africa need to be known by the world together with their TRLs for a holistic just transition to a CE in the world.

Keywords: Circular economy, Sustainability, Environmental justice, Greenwashing

CE practices in most African countries are not known to the world. Despite the strong move towards circularity in some countries, the legacy of environmental injustice is still prevalent in and around CE practices, especially in Africa.

20.1 INTRODUCTION

Africa is a continent that is rich in natural resources, yet it remains one of the poorest continent in the world (Agouza & Abu Zaid, 2021). This is largely due to a linear economy that focuses on the extraction, production, consumption, and disposal of goods and services. The linear economy has led to environmental degradation, resource depletion, and social inequality. According to Didenko et al., 2018, the Circular Economy (CE) is an alternative economic model that can help Africa transition to a more sustainable future. The concept of CE is gaining traction globally as a sustainable model for development that seeks to minimize the use of natural resources and reduce waste (resources efficiency). CE has the potential to create a sustainable and prosperous future for both developed and developing economies (Ghufran et al., 2022; Ogunmakinde et al., 2022).

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CE aims to keep materials in use for as long as possible, minimize waste, and reduce environmental impact. In recent years, many countries have started adopting CE initiatives, and Africa is no exception. In Africa, CE presents

a unique opportunity to promote economic growth and create jobs while addressing environmental and social challenges (Wait, 2022). CE principles may also potentially play a strategic role in advancing the African agenda of food security and industrialisation and improving standards of living (Ghufran et al., 2022). However, the implementation of CE practices in Africa face several challenges (Andriamahefazafy & Failler, 2022). This section will provide a comprehensive overview of CE in Africa; including the examination of the current state of CE in Africa, the challenges and opportunities, potential benefits, and the role of stakeholders in promoting its adoption. The inception of CE initiatives in Africa, focusing on the drivers, challenges, and opportunities that exist within the continent will also be explored. Some successful case studies of CE projects in Africa will be highlighted as well as recommendations for the future implementation of CE practices in the region.

20.2 BACKGROUND OF CE IN AFRICA

CE is gaining traction worldwide as a promising approach to sustainable development. The concept of CE is based on designing waste out of the system, keeping materials and resources in use, and regenerating natural systems. In Africa, CE initiatives are emerging as a way to address the region's challenges of poverty, inequality, and environmental degradation.

Africa faces significant environmental challenges due to rapid urbanization, industrialization, and population growth. According to the World Bank (2020), only 34% of waste generated in sub-Saharan Africa is collected, and less than 10% is recycled. This situation poses serious health hazards for people living in poverty, who often live in close proximity to waste dumps and landfills. Additionally, Africa has rich natural resources that are underutilized and often wasted because of inefficiencies in the manufacturing processes, leading to economic losses and environmental degradation.

To address these challenges, African countries are increasingly adopting CE approaches. For example, South Africa launched a National Waste Management Strategy (NWMS) in 2014, which aims to promote a CE by reducing waste generation, increasing recycling, and promoting responsible consumption and production (Department of Environment, Forestry and Fisheries, 2019). Ghana has also developed a national policy framework on CE principles, which seeks to promote resource efficiency, innovation, and job creation (UNEP, 2020). In addition, various private sector actors in Africa are implementing CE initiatives. For instance, Ecobank in 2021, a pan-African bank - launched a Green Small and Medium-sized Enterprises (SME) Financing Scheme, which provides financing and technical assistance to SMEs engaged in green projects, including those that promote the CE. Similarly, Coca-Cola Beverages Africa (2021) has committed to collecting and recycling 100% of its packaging by 2030 through its "World without Waste" initiative.

CE initiatives in Africa have the potential to create numerous benefits, including job creation, increased resource efficiency, reduced pollution, and improved health outcomes. However, significant challenges remain, including inadequate infrastructure, limited access to financing, and a lack of awareness and understanding of CE principles. CE initiatives are gaining momentum in Africa as a promising approach to address the region's environmental and economic challenges. While progress has been made, much work remains to be done to scale up CE initiatives and

realize their full potential. With concerted efforts from governments, private sector actors, and civil society organizations (CSOs), CE initiatives can become a key driver of sustainable development in Africa.

Africa has had observations of sustainable economic activities that can be classified as CE and most of them were mainly driven by economic constraints (Dunmade, 2018). The CE activities were encapsulated within the topics of climate change adaptation or sustainable development (Rademaekers et al., 2020). For a while, Africa operated without absolute policies for CE, it was only when the most CE active nations, Nigeria, Rwanda and South Africa in 2017 pushed for a clear agenda on CE that led to the formation of African Circular Economy Alliance – ACEA (Dunmade, 2018 and Rademaekers et al., 2020). ACEA was financially supported by those three nations as well as the World Economic Forum (WEF) and the Global Environment Facility (GEF). The mandate for ACEA at the time was to foster a commitment to retain resources in circulation for as long as practicable. ACEA was an effort to convert concepts into accomplishments with the co-operations among governments, businesses and organizations taking the centre stage to accelerate the circular economy agenda in Africa (Bukhari et al., 2018).

Several organizations have however emerged to promote CE practices in Africa. The African Circular Economy Network (ACEN), for example, was established in 2015 to support the development of CE in Africa through research, advocacy, and collaboration (<http://africancirculareconomy.org/about/>). The Ellen MacArthur Foundation (EMF) has also launched initiatives in Africa, such as the CE in Cities program, which aims to develop circular economies in cities around the world, including Nairobi, Kenya (Ellen Macarthur Foundation -EMF, 2021). The formation of ACEA (that focuses on development of national and local government policies) and the ACEN (that promotes strategic application in business) is expected to increase CE activities in Africa (Desmond & Asamba, 2019). The key step towards CE for Africa was during the 17th African Ministerial Conference on the Environment (AMCEN) in 2019 that advocated for a CE action plan. An evaluation showed that by 2020, the 52 African countries have developed intentional policies that address CE components. A database by Chatham house in 2021 showed 191 CE policies for 52 African countries grouped under five broad categories as shown in **Table 20.1** and **Figure 20.1** (EMF, 2021).

Table 20.4: Description of CE related policy categories in African countries

Policy category	Description of policy and number of African countries implementing the policy
1.	National CE policies include any national CE policies already in place as well as national green growth or sustainable development strategies that integrate CE principles – 7 countries.
2.	Product policies are any policies that support circular practices relating to the design, manufacture, distribution or import of specific products and materials (mostly bans on plastics use or levies) – 32 countries.
3.	EPR policies place the responsibility for the environmental impacts of products throughout the product life cycle on producers and is often applied to the collection, processing and reuse of waste – 15 countries.
4.	Waste management and recycling policies encourage circular practices relating to the management of waste covering generation, segregation, transfer, sorting, treatment, recovery and disposal – 48 countries.

5	Fiscal policies include government tax and spending policies that incentivize circular practices – 12 countries.
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Source :Ellen Macarthur Foundation, 2021

The world over, almost every country at least has a CE related policy as shown on the online world map (<https://circulareconomy.earth>) by the Chatham House Royal Institute of International Affairs, 2020 as referenced by the Ellen Macarthur Foundation (2021). On the African continent, the number of countries implementing policies under a certain category shows the importance of the category for African countries. According to Figure 1, the

focus on waste management and recycling policies by African nations reflects a common challenge in waste management amongst the African Nations. Product policies also present a common issue on the locally produced goods as well as imported goods, which later cause waste management challenges in terms of waste especially their packaging.

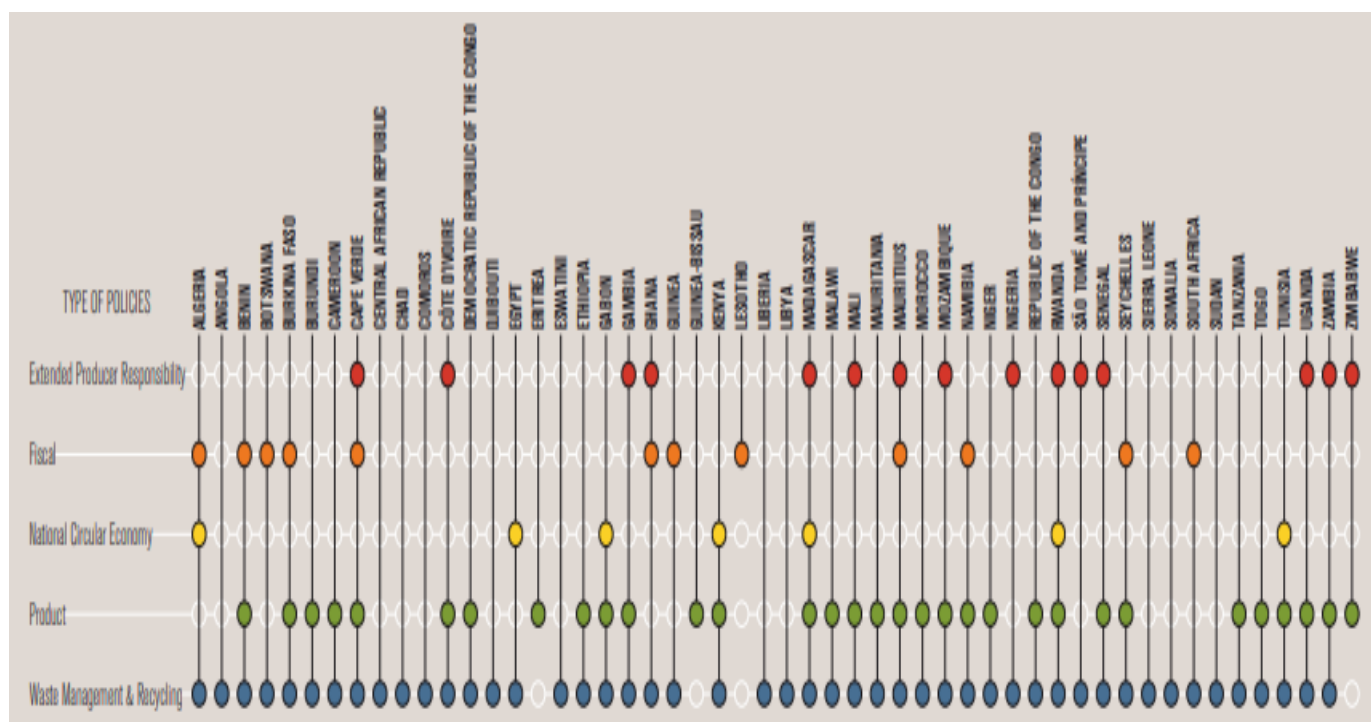


Figure 20. 1 Types of existing CE policies in Africa per country by 2021. Source: GRID-Arendal, ACEN, Footprints Africa and ICLEI, 2021.

In Africa, CE initiatives have been gaining traction in recent years, with several countries implementing policies and programs aimed at transitioning towards a more CE. Historically, many African communities have practiced CE principles for centuries. For example, in rural areas, people often make use of natural resources in a circular manner by reusing waste materials and recycling products. However, as urbanization has increased in Africa, so has the consumption of resources and waste production, leading to a need for more formalized CE initiatives.

The CE has emerged as a crucial strategy for sustainable development in Africa. While many African communities already practice circular principles, there is a growing need for more formalized policies and programs to promote circular practices on a broader scale. As initiatives such as the ACEN and EMF continue to promote the CE in Africa, it is likely that further growth of circular initiatives on the continent in the coming years will be realised.

20.2.1 CE categories, strategies and initiatives in Africa

The journey of CE in Africa though in its infancy, is built on the same principles that direct the categorisation of CE activities, which revolve around “Optimal use, Value recovery, and Circular design models” (Dunmade, 2018; Achterberg et al., 2021). Based on the European system there are 14 categories of CE of which Africa in its various efforts to achieve Sustainable Development Goals (SDGs) is implementing, listed hereafter (Hirsch and Schempp, 2020) – Table 2.

Table 20.2: CE models adopted in Africa

Type of CE model	Leverage of the model(s)
Circular design and production models	<ol style="list-style-type: none"> 1. Focus is on the designing and production of goods that facilitate CE strategies, such as the use of recyclable or compostable materials 2. Generation and installation of process technologies that enable CE approaches 3. Development and sustainable production of novel materials (together with bio-based resources) that are reusable, recyclable, or biodegradable 4. Significantly decreasing or replacing substances of apprehension in materials and products to facilitate circularity strategies 5. A changeover from virgin resources to secondary raw materials and by-products
Circular use models	<ol style="list-style-type: none"> 6. Approaches that promote the 9Rs of waste management for end-of-life or obsolete products and their components preventing their dumping 7. The refurbishment and repurposing of end-of design life or terminated fixed structures that includes buildings/infrastructure/facilities. 8. Ideas that are hinged on service provision , reuse, and sharing models centred on hiring pay as you go, subscription or deposit return arrangements, that allow CE approaches. 9. The rehabilitation and remediation of degraded or abandoned or underutilised brownfield sites to functional state or in preparation for revamping
Circular value recovery models	<ol style="list-style-type: none"> 10. Waste separation and collection, and arrangements that allow for circularity of redundant products, parts and materials 11. Aim is to recover materials from waste in an attempt to retain circular value with the exclusion of biomass related materials 12. The retrieval and valorisation of biomass waste and residues, and conversion to food, feed, nutrients, bio- fertilisers, and other bio based materials or chemical feedstock 13. Wastewater reuse or recycling
Circular support	<ol style="list-style-type: none"> 14. Creation of a platform that fosters the development/deployment of tools, applications, and services of CE strategies

Source : Hirsch and Schempp, 2020

In recent years, African governments and organizations have started to implement policies and programs aimed at promoting CE practices. The inception of CE initiatives in Africa can be traced back to the early 2000s when some African countries began to promote and implement green economic policies. Since then, several CE initiatives have emerged across the continent. Several case studies illustrate successful CE initiatives in Africa and some of them are shown in Table 3 as documented by Patterson et al., 2021 in a publication called “Circular Economy on the African Continent : Perspectives and potential”.

Table 20.3 Selected CE initiatives in some African countries

Country	Initiative(s) and descriptions
Cameroon	The Eco bricks project involves filling plastic bottles with non-biodegradable waste to create building materials (UNEP, 2020).
Egypt	Responding to the impact of the COVID-19 pandemic, the European Bank for Reconstruction and Development (EBRD), the European Union and the Green Climate Fund are working with local partner banks to offer \$264 million to businesses for green investments in energy, water and resource efficient solutions. These initiatives are aligned with existing policies, for example, the National Action Plan for Sustainable Consumption and Production, supporting Egypt's development efforts in circularity and sustainability in multiple sectors including energy, agriculture, water and waste (Patterson et al., 2021).
Ethiopia	The Shoe Project involves the collection of discarded shoes and refurbishes them for resale, reducing waste and creating jobs.
Ghana	An e-waste recycling company called Blue Ocean Investments (https://www.blueoceaninvestmentgh.com/) is working to reduce the impact of e-waste on the environment while creating jobs and generating income. The company processes electronic waste into usable materials such as copper, aluminium, and plastics.
Kenya	The country has implemented policies aimed at reducing waste, such as a ban on plastic bags in 2017 (Standard Digital, 2017).
Nigeria	Lagos State Waste Management Authority (LAWMA) set up a program to collect and recycle electronic waste. The "Waste to Wealth" project promotes waste recovery and recycling by creating jobs and reducing the volume of waste sent to landfills (Ellen Macarthur Foundation (EMF), 2021)
Republic of South Africa	The National Waste Management Strategy (NWMS) by Republic of South Africa includes a goal of achieving zero waste to landfill by 2022. The country also established a textile recycling facility to recycle used clothes and textiles into new products.
	The "Green Cape" program supports small and medium-sized enterprises (SMEs) in adopting CE practices through technical assistance, training, and networking opportunities (Green Cape, 2020).
Rwanda	Rwandan policies such as the Organic Law on Environmental Protection, Conservation & Management No. 04/2005, the National Environment and Climate Change Policy of 2019 and the Law No. 17/2019 explicitly promote CE to: advance sustainable consumption and production patterns, establish the correct procedures for disposal of solid, liquid, hazardous, toxic and electronic waste, prohibit the manufacturing, importation, use and sale of plastic carry bags and single-use plastic in the country. The government has implemented an ambitious CE strategy that includes banning single-use plastics, promoting composting, and building a green industrial park. The strategy has helped to reduce plastic pollution, create new jobs, and support sustainable economic growth (Patterson et al., 2021).
	A company called BBOX (https://www.bbox.com/) has developed a solar-powered battery system that allows rural residents to access electricity without relying on fossil fuels. The

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Country	Initiative(s) and descriptions
	company also offers a pay-as-you-go model that makes it easier for low-income families to afford the technology.
Senegal	Via the Plastics Prohibition Law No. 2020-04 (EPR on plastics producers) and the Environment Code 2001 Law No. 2001-01 (ensuring the appropriate recycling and disposal of all types of waste), and Article R30 (conditions for reuse of water), the country has implemented a diverse and large number of CE initiatives particularly in agriculture and waste management (<i>Patterson et al., 2021</i>).
Zambia	<p>LUSAKA, 3rd December 2018 – ISSUANCE OF STATUTORY INSTRUMENT NO. 65 ON EXTENDED PRODUCER RESPONSIBILITY (EPR) REGULATIONS</p> <ul style="list-style-type: none"> • The Government of the Republic of Zambia through the Zambia Environmental Management Agency (ZEMA) under the Ministry of Water Development Sanitation and Environmental Protection wishes to inform the nation and the general public that the Environmental Management (EPR) Regulations, Statutory Instrument No. 65 of 2018 (EPR Regulations) came into force on 3rd August, 2018. • The Ministry wishes to inform all stakeholders that in accordance with Section 58 of the Environmental Management Act No. 12 of 2011, the EPR Regulations extends the responsibility of the producer of a product or class of products to the post-consumer stage of the product or class of products. • EPR Regulations is one of the tools that the Government will rely on to manage, in an environmentally sound manner, packaging materials such as plastics and their resultant waste. The EPR Regulations will also regulate non-returnable glass and plastic bottles, cartons, beverage cans, waste oils, pesticides or chemical containers, used tyres, electrical and electronic equipment and their resultant waste. <p>(Forms et al., 2019)</p>
Zimbabwe	<p>Petrecozim (Pvt) Limited is an initiative that was started by major companies within the beverage and allied industries to address environmental pollution related to Post-Consumer Poly-Ethylene Terephthalate (PCPET) bottles. This was in line with concerns that were flagged by the Environmental Management Agency (EMA) in Zimbabwe. The disposal of PCPET bottles had become a huge problem in the country due to lack of any visible recovery and recycling effort. Various environmental stakeholders including EMA, prompted beverage companies to take the initiative at their expense to address the problem in a visible and significant way, therefore raised serious concerns. These companies use Poly-Ethylene Terephthalate (PET) packaging in their operations in one way or another as converters, bottlers or brand owners and therefore felt a compelling need to participate to fulfil their Extended Producer Responsibility (EPR) obligations.</p> <p>A case of industrial Symbiosis (IS) has been witnessed from a by-product of phosphatic fertilizers manufacturing. Zimphos is the country's sole producer of phosphate fertilizers, aluminium sulphate for municipal water treatment, sulphuric acid and other industrial chemicals. Gypsum is the main by-product of the manufacturing processes. The by-product, which is a waste, has been found to be useful in various productive sectors of the world. A company has been formed and capitalising on the use of gypsum to make ceiling boards, plastering materials,</p>

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Country	Initiative(s) and descriptions
	paints, grout and ceiling designers. The case is one of eco-innovation that works by fostering IS; a form of brokering to bring companies together in innovative collaborations, finding ways to use the waste from one as raw material for another. Many other cement-manufacturing companies in Zimbabwe have realised the value of gypsum in their manufacturing processes and these have added on to the symbiosis.

A review of whether the policies, strategies and initiatives are really making an impact is very vital, hence the need for sustainability assessments. **Figure 20.2** and **20.3** show a summary of other CE initiatives in Africa. The publications are trying to make CE initiatives visible to the world and what is shown in **Figures 20.2** and **20.3** just indicates that at least something is happening in every African country as far as CE is concerned. If funding can be provided to come up with an Atlas of CE practices in Africa, more initiatives can be recorded and added on to the previously recorded ones by organisations like ACEN.

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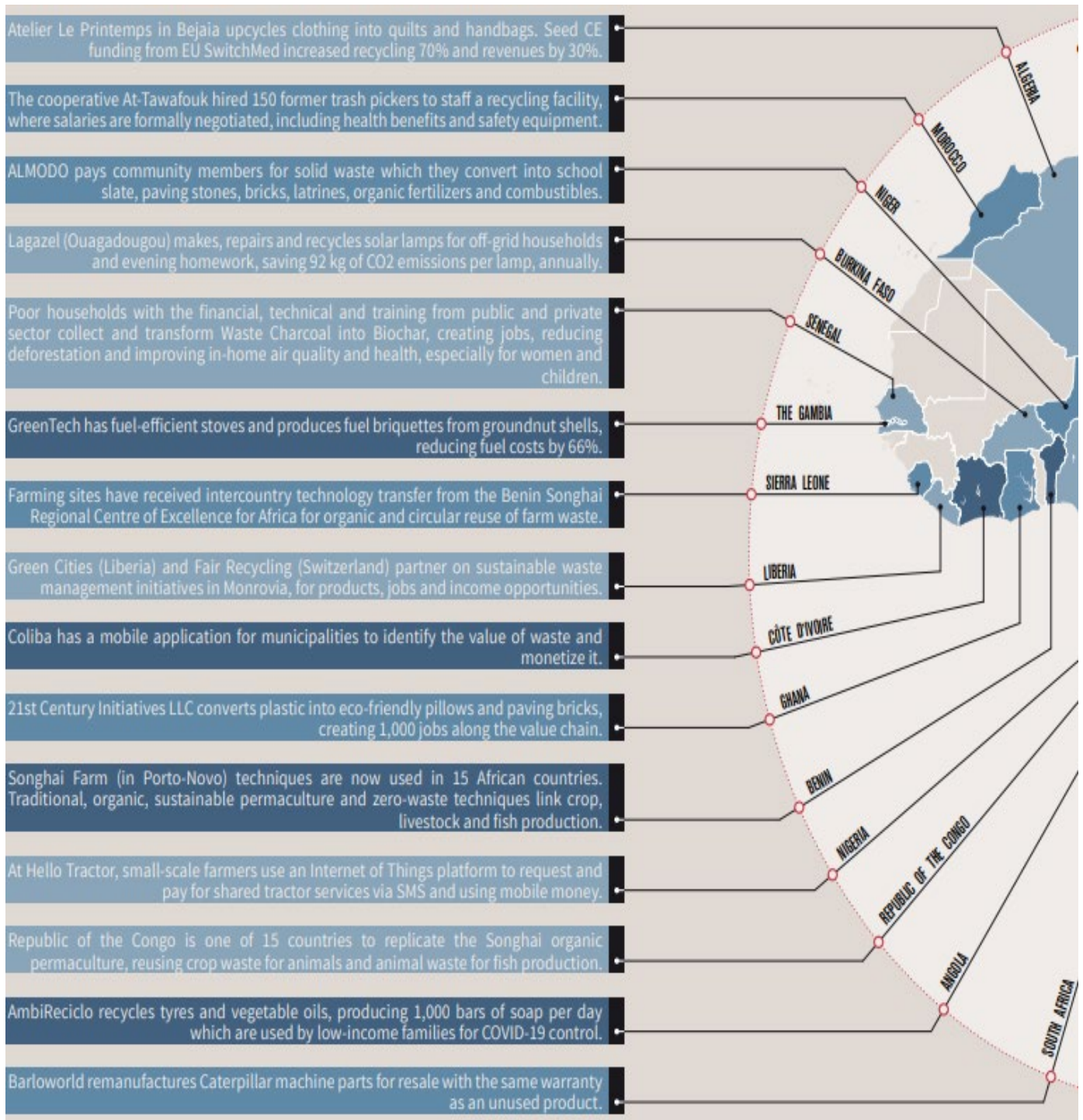


Figure 20.2 CE initiatives in Africa. Source: Patterson et al., 2021

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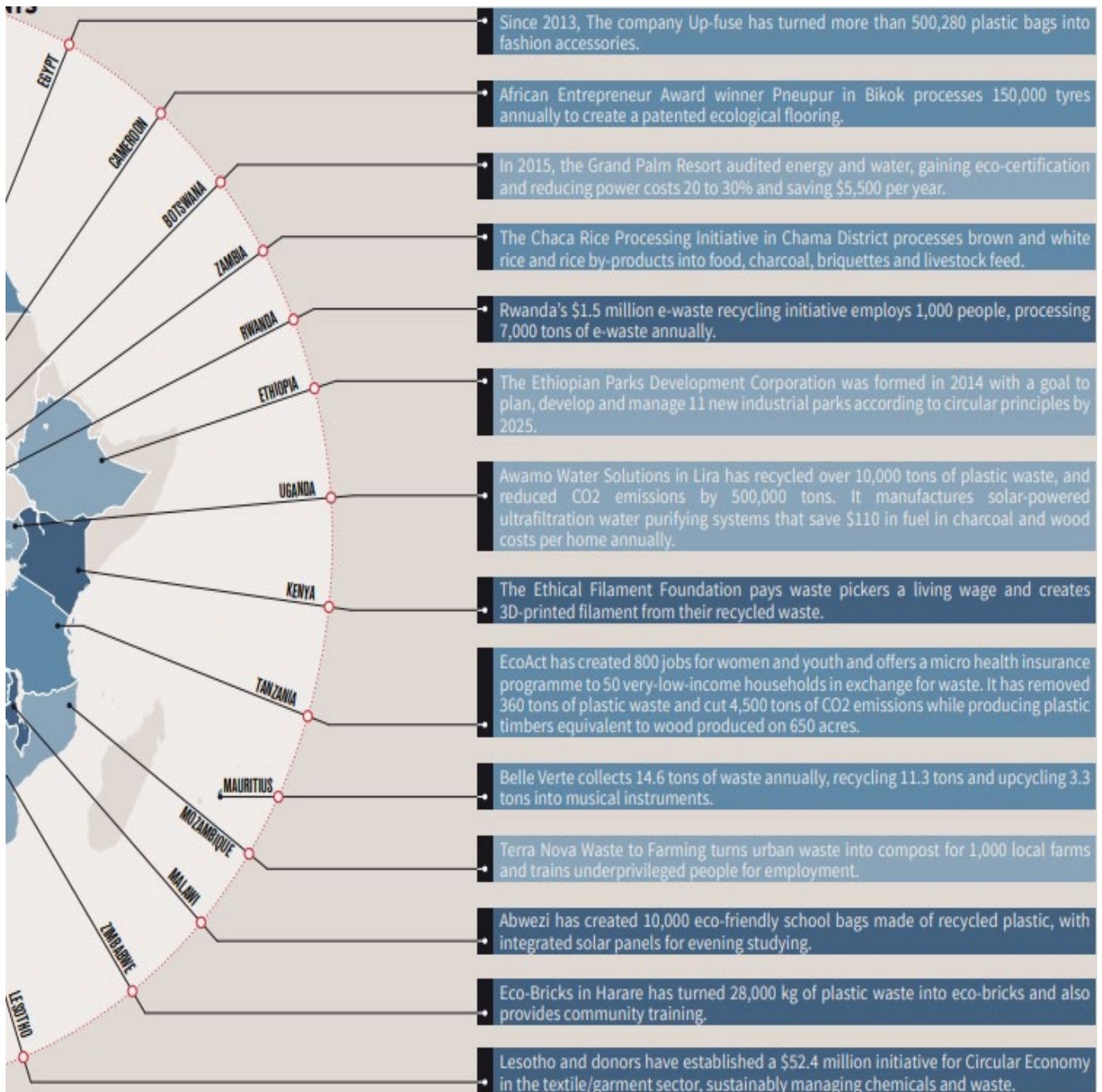


Figure 20.3 CE initiatives in Africa. Source: Patterson et al., 2021.

Some of the CE activities are at very low Technology Readiness Levels (TRL) and not recognised but are very significant in CE value chains, for example plastics bottles picking and sorting. According to Amorim de Oliveira, 2021, waste pickers and informal workers are already integral part of many existing circular systems. They recover and create value from waste – but their contributions are not valued by society. Waste pickers deal with many issues ranging from poor working conditions, poor health, poverty and social stigma. Despite their contributions waste pickers are often considered a social problem. Especially in low-income countries, the number of waste pickers is very high, mostly driven by the lack of better economic opportunities and low human development levels.

20.3 Enablers of CE IN AFRICA

20.3.1 CE enablers and policies in Africa

Several factors are driving the adoption of CE principles in Africa. One of the main drivers is the need to address environmental challenges such as climate change, pollution, and resource depletion. Africa is particularly vulnerable to these challenges due to its reliance on natural resources for economic growth and development. Therefore, adopting CE practices can help to reduce resource consumption, lower emissions, and minimize waste. Another driver of CE initiatives in Africa is the need for sustainable economic development. Many African countries face significant socio-economic challenges such as poverty, inequality, and unemployment. Implementing CE practices can create new business opportunities, create employment, and promote inclusive growth while minimizing negative environmental impacts.

Furthermore, there is growing awareness among African policymakers, businesses, and civil society organizations about the benefits of circular economy practices. Several international organizations, including the United Nations (UN), the EU, and the EMF, have also been promoting CE initiatives in Africa through funding, technical assistance, and capacity building (UNEP, 2018; EMF, 2013). A number of African countries have policies that speak to waste management and recycling and products (Rademaekers et al., 2020). This provides for a platform for CE to develop from, and thus expand to other sectors of interest such as food systems.

20.3.2 Anticipated and realised benefits of CE in Africa

CE provides a viable solution towards sustainable development by focusing on reducing waste and optimizing resource use. According to Christine Mwangi et al., 2023, the universal benefits of the CE are vast, as it represents a triple-win in many cases where environmental, economic, and social advantages are available through policies and measures that are capable of seizing on synergies. The benefits of CE initiatives can be summarised as follows: Environmental Benefits: Africa's natural resources are under significant threat due to unsustainable exploitation, pollution, and degradation. Adopting CE initiatives will reduce the pressure on these resources and promote their conservation. For instance, recycling programs that encourage the collection and processing of waste materials such as plastic, paper, and metals will reduce the amount of waste that ends up in landfills and pollutes the environment. Furthermore, implementing renewable energy solutions such as wind, solar, and hydroelectric power will reduce reliance on fossil fuels and thus mitigate greenhouse gas emissions.

Economic Benefits: CE initiatives in Africa have enormous potential to create jobs and enhance economic growth. The circular economy model promotes the reuse of products and services, which can lead to the creation of new industries and markets. For instance, recycling plants can provide employment opportunities for many people who will be involved in the sorting, processing, and manufacturing processes. Additionally, using renewable energy sources can reduce the cost of electricity production, which in turn can lower the cost of goods and services.

Social Benefits: CE initiatives can also have significant social benefits by improving the livelihoods of communities and promoting social equity. For example, waste collection and recycling programs can provide income-generating

activities for marginalized communities. Additionally, sustainable agriculture practices such as crop rotation and agroforestry can improve soil fertility and enhance food security, particularly in rural areas.

CE presents a viable solution towards sustainable development in Africa. The adoption of CE initiatives can lead to significant environmental, economic, and social benefits. Therefore, policymakers should prioritize the implementation of CE strategies to ensure a more sustainable future for the continent.

20.4 Issues of CE in Africa - Challenges and opportunities

20.4.1 Challenges of CE in Africa

According to Kirchherr et al., 2017, CE barriers are cultural, market, technological and regulatory related. Studies done in the GN countries have shown that barriers that affect CE advancement are poor communication, lack of support from top management, insufficient technical knowledge, no data integration, no recycling infrastructure, lack of sustainable product design and poor to no customer interest. There are also risks (operational, financial and environmental) that discourage investment in CE. The lack of customer interest, non-existent Environmental Management Systems (EMS), and no product standardisation in the market also act as a barrier to CE success (Gift et al., 2023). The African Development Bank Group 2020 (as cited by Christine Mwangi et al., 2023) postulated that, recently more than 50 per cent of Africa's economic growth has been driven by only five countries – Algeria, Egypt, Morocco, Nigeria and South Africa. Therefore, significant cultural and economic differences exist among African countries that influence their development, economic strategies, and readiness and capacity to adopt circular policies and technologies. However, in the African context, the barriers of transitioning to a CE, as observed from several case studies and literature can be summarised as follows;

- Historically the GN has relied on the cheap and available labour and land of the GS; therefore, economically this is still a viable and profitable arrangement, though environmentally unsustainable as was highlighted by Ahmed Shamira,(2022); Desmond & Asamba, (2019). African countries encounter barriers in implementing CE policies and business models because of power relations and vested interests embedded in global values chains. These value chains tend to create power imbalances and economic inequality in African countries that provide cheap raw materials as inputs for higher value products (Desmond & Asamba, 2019; GRID-Arendal, 2021 as cited in Christine Mwangi et al., 2023).
- The quality of recycled resource materials is currently inferior and costly to use in the production cycle, compared to using new material (World Economic Forum, 2021).
- A number of African countries still have structures that support linear practices through taxes, subsidies and government support which is similar to the findings of the Association of Southeast Asian Nations (ASEAN) (Melati et al., 2021).
- There is still technological disparity between the GN and the GS, whereby African countries are reliant on inefficient technologies to recycle or produce new goods.
- CE in many African countries in this study is largely waste management and recycling which is mainly an informal sector inundated with many social injustices.
- The largest corporates whose transition may have a CE impact are controlled by multinationals in the GN, thus African countries do not have control of the design impact or agenda (Dunmade, 2018). In Ghana the

lack of an enabling environment, including financial and other incentives, is a major constraint for the creation of CE, particularly for entrepreneurs to set up informal repair businesses. The power exercised

through EU Extended Producer Responsibility (EPR) legislation by Northern manufacturers in the value chain will become a greater force for change and localised EPR legislation will be less important (Desmond and Asamba, 2019).

- Some of the technologies brought onto the market are relatively new and their effectiveness to a certain extent is unknown, which sort of serves as a deterrent for their adoption in some African countries (Mhlanga et al., 2022).
- SMEs comprise a large portion of the African countries economy, but these are generally lacking in technical expertise and infrastructural technology as they do not have the investment capital (Melati et al., 2021).

The adoption of CE practices in Africa faces several challenges. However, by addressing these barriers, it is possible to promote sustainable economic growth and resource utilization in Africa.

20.4.2 Greenwashing, social and environmental justice issues around CE in Africa

According to Greenpeace (www.stopgreenwash.org) – “greenwashing is the act of misleading consumers regarding the environmental practices of a company or the environmental benefits of a product or service. It involves use of deceptive and manipulative sustainable claims by companies to portray a superficial eco-friendly image than it actually is, by investing more resources on marketing its products as ‘green’ rather than actually minimizing its adverse impact on the environment (Aggarwal & Kadyan, 2011). Companies portray themselves as environmentally friendly without actually making any substantive changes to their operations. In Africa, this practice is prevalent as companies seek to capitalize on the growing interest in sustainability among consumers and investors. Such companies engage in superficial efforts, such as recycling programs or purchasing carbon offsets, while continuing to operate in ways that harm the environment. These companies have faced criticism for failing to address the root causes of environmental degradation, such as reducing carbon emissions or minimizing waste production.

Another issue associated with CE initiatives in Africa is social justice concerns. While promoting sustainability and reducing waste is critical, it is equally important to ensure that these activities do not exacerbate existing inequalities. According to Schroeder & Barrie, 2022, inclusiveness and social justice are key issues that need to be addressed for a successful CE transition to achieve positive social-ecological outcomes. Without addressing the human and social dimensions of the transition, the CE will not deliver on important social goals such as improved health, decent working conditions, or reduced inequality. It might even prevent a transition from taking place, since unjust and unequal societies are unlikely to be stable in political terms. The good news is that the need to address social issues in circular economy transitions, alongside environmental concerns and building the circular business case, is receiving more attention in the mainstream approaches.

In Africa, many CE initiatives often target informal waste pickers, who are typically vulnerable and economically marginalized. These people often rely on waste collection for their livelihoods but are excluded from formal waste management systems. Furthermore, CE initiatives can displace communities that rely on waste collection, leaving

them without a source of income. This displacement can also lead to conflicts between waste pickers and formal waste management services, as seen in countries like Ghana, Kenya, and Nigeria.

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Applying an environmental justice perspective or framework is an important first step to fill the social gap in the circular economy. The direct impacts of waste dumping and pollution on communities have been documented for decades in the United States, including cases of structural environmental racism. Similarly, in Europe the available data dating back to the 1980s provide consistent indications that waste facilities are disproportionately located in areas with more deprived residents, or from ethnical minorities. The observed inequalities in exposure to waste and toxins, and the health impacts thereof, represent a case of environmental injustice (Martuzzi et al., 2010).

In Africa, environmental injustice is observed most of the times when E-waste from the GN is dumped as second-hand goods that will only work for very short periods and then require disposal. These are not usually disposed of properly yet they contain toxic materials that usually find themselves into the environment causing a health hazard especially to vulnerable groups that rely on surface waters.

While CE initiatives present an opportunity for Africa to promote sustainability and economic development, they must be implemented with caution. Companies must avoid greenwashing and prioritize substantive changes that reduce environmental harm. Similarly, social and environmental justice concerns need to be taken into account to ensure that marginalized communities are not further excluded from the benefits of sustainable development.

20.5 CE POTENTIAL IN AFRICA

20.5.1 Opportunity areas for CE in Africa

According to the International Resource Panel (2017) as cited in Desmond and Asamba, 2019, the current and projected increase of resource consumption in a globalised linear economy exceeds planetary boundaries. Raworth (2017) also added that the redistribution of wealth from North to South continues to be essential for the 300 million people who live in poverty in countries still classified as low-income, mainly in sub-Saharan Africa. In face of these situations, CE has the potential of producing cost savings and reducing exposure to market price fluctuations, increasing renewable energy and releasing valuable materials and energy in existing products (Ellen MacArthur Foundation, 2013b as cited in Desmond and Asamba, 2019).

CE strategies in the North risk concentrating power and wealth amongst a few actors in global supply chains to the detriment of poor nations. For example, the European Commission's Circular Economy Action Plan (European Commission, 2017) identifies setting eco-design standards for electronic and electrical equipment, addressing hazardous chemicals in material cycles, and improving circularity of plastics, as priorities for Europe's transition to CE. Much of this plan focuses upon the benefits to Europe through greater resource efficiency. However, a more circular economy in Europe can also deliver benefits for people in low-income countries if their needs are better considered when creating inclusive CE policies (Desmond and Asamba, 2019).

As postulated by Desmond and Asamba, 2019, CE may be a means by which greater value can be created in the South such as the remanufacturing of end of life products for re-export to customers in the North e.g. Barloworld's refurbishment of Caterpillar parts in South Africa. In the past many Global Value Chains (GVCs) have relied upon Africa to provide virgin resources for the manufacture of products in the North (e.g. rare earths and minerals from DRC for production of smartphones in China).

There are numerous and significant prospects for amplified circularity in Africa under the themes of food systems, packaging, the built environment, electronics, and fashion and textiles (World Economic Forum, 2021). This is

majorly because Africa has a young and growing population, which will need food and agriculture being the continent's biggest employer (Wachira Rhoda, 2022). The continent still serves as an electronics dumping ground for the GN (Desmond and Asamba, 2019; Wachira Rhoda, 2022). Plastic packaging is the favoured form of packaging making the packaging industry an area of concern and business opportunity for CE in Africa. CE also provides an employment creation opportunity for the growing African population (Mhlanga et al., 2022), but the Green Alliance (Morgan and Mitchell, 2015) has argued that there is no strong evidence that this will be the case in Africa. As a result, the inequality that exists between the very poor without employment and those with permanent jobs may well continue in the CE.

20.5.2 Funding and technical support

African Agriculture and Trade Investment Fund (AATIF) has made use of concessional capital, guarantees, risk insurance, technical assistance funds, and design-stage grants as forms of funding. These arrangements attract investments from private sector and public funds. UN Environment (UNE) and Global Environmental Facility (GEF) is supporting activities that are inclined towards public sector financing, technical assistance, and advisory programmes and initiatives as was for the Republic of South Africa, Lesotho and Madagascar.

The African Circular Economy Alliance's (ACEA) main intervention pillars include policy advisory, leadership & advocacy, as well as projects and business scale-up. As the transition to a fully CE, the Alliance aims to harness immediate opportunities in Africa for increased circularity in sectors that will support the economy, jobs, and the environment on the continent in the long-term. Outside the signatory countries, its partners include the African Development Bank (AfDB), Global Environment Facility (GEF), World Economic Forum (WEF), African Circular Economy Network (ACEN), United Nations Environment (UNE), KAS Foundation, Platform for Accelerating the Circular Economy (PACE), and the Government of Finland and its affiliate innovation Sitra.

The African Circular Economy Fund (ACEF) is a multi-donor grants trust fund housed by the Climate Change and Green Growth Department of the AfDB. Its objective is mainstreaming the CE as an inclusive green growth strategy to help African nations to meet the goals of the Paris Agreement, SDGs and the African Union's (AU) Agenda 2063. Strategic Partners include WEF, EU, World Bank, Nordic Development fund, UNDP, the Circular Economy Innovation Partnership (CEIP), and ACEN (Ellen Macarthur Foundation {EMF}, 2021).

20.5.3 Policy support

According to a publication by Wetterberg et al., 2022; programmes such as the SWITCH2CE project is working with European and Moroccan stakeholders to pilot Morocco's first Poly-Ethylene (PET) bottle-to bottle recycling process. The professionalization and empowerment of informal waste pickers will be key to ensuring consistent high-quality collection of PET. The pilot will seek to address social justice issues facing informal workers including

- Lack of formal legal recognition, which results in stigmatization and limits their ability to collect waste directly from householders;
- Lack of access to land to legally conduct collection and sorting operations;
- Unequal power relationships with waste traders;
- Exposure to the volatility of the recycled PET market;

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- Lack of worker safety and training; and
- Limited supply chain traceability and transparency.

Other SWITCH programmes, such as SWITCH Africa Green, which is funded by the EU and implemented by the UNEP in partnership with the African Roundtable on Sustainable Consumption and Production (ARSCP), are supporting CE activity in Burkina Faso, Ethiopia, Ghana, Kenya, Mauritius, South Africa and Uganda. Lessons sharing, improvement of regional harmonization of policies, and increasing national level impact in biogas, e-waste management, organic agriculture (which can include reuse of organic materials), green manufacturing, eco-industrial parks and standards in labelling has been the major outcomes. The programme enhances access to green financing and innovative solutions as well as enables the development of policies and standards. It also contributes to awareness raising and facilitates networking.

Some countries are uniting to develop regional policies to advance CE. For instance, in 2015, the East African Community (EAC) announced a ban on imported second-hand clothes from 2019 onwards. The low-priced imports hinder local markets and regional development. However, after complaints from international exporters, who argued that this decision would harm international trade agreements, the proposal is now only for an indirect ban. This compromise includes increasing tariffs, which are intended to disincentivize imports of second-hand clothing, while incentivizing locally produced products and industries. CE policy challenges include untangling policy signals and instruments that may overlap and even contradict one another.

20.6 Conclusions and recommendations

The adoption of CE principles can help African countries address environmental challenges, promote sustainable economic development, and create new business opportunities. While several challenges exist in implementing circular economy practices in Africa, there are significant opportunities for growth and innovation in the sector. By implementing supportive policies, strengthening infrastructure, and increasing financing options, Africa can become a leader in the transition to a more circular economy.

According to Desmond & Asamba, 2019, government policy in Africa has a major role to play at both national and local level. There is little CE specific legislation and so regulations and policies in operation and policies are generally focussed on climate change mitigation, the Green Economy (GE), and waste management. Proposals are often presented but are still awaiting promulgation into government policy and legislation. There are few systematic studies of CE policies in Africa and so identification of policies currently relies on informal research approaches. Further research is required to identify the extent and impact of sustainability legislation and policies such as waste management, recycling, extended producer responsibility, repair and renewable energy.

Networks such as the African Circular Economy Alliance (development of national and local government policy) and the Africa Circular Economy Network (strategic application in business) working in collaboration will be able to facilitate this transition process. For Africa to transition from a linear to a circular economy, barriers need to be overcome through extensive collaboration between the various actors who each have a specific role to play (Desmond and Asamba, 2019).

The power of hubs for CE is being recognized globally. CE hubs and their activities that can be summarised by network governance can be found all over the world in different socio-cultural and political environments. Efforts

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are also underway in Africa. Multi-stakeholder CE platforms exist already e.g. in Nigeria (Circular Lagos), Rwanda and South Africa. Having (a) hub(s) in a country is an advantage as it allows them to harness local circular potentials unique for each country or region. Setting up a CE hub can be flexible and should be tailored to local conditions and stakeholders, including public, private, or public-private partnerships (Vesna et al., 2022).

In their publication of the side event on Boosting Circular Economy in Africa through Hubs Learnings from the WCEF 2022, in Kigali – Rwanda, Vesna et al., 2022 identified and documented several activities that hubs could carry out in African countries. They also documented several options on how to establish a CE hub in African countries and who should be the stakeholders. As a final thought Vesna et al., 2022, postulated some of the following selected points

- Africa is having an enormous opportunity to foster truly sustainable development through circular economic proliferation.
- Europe can assist Africa in fostering the CE through close cooperation and sharing best practices. Engaging in fair and inclusive trade with African countries can substantially support their CE - based sustainable development.
- National and regional African hubs would play a crucial role in preserving and upscaling the existing CE practices. For an inclusive transition to a CE, hubs should be a meeting point for all the stakeholders - government, business, knowledge institutes as well as citizens.
- Respecting the socio-economic situation in Africa, a special focus of the hubs should be given to the informal sector and youth. Hubs could support all the actors in addressing social needs through the lens of a CE.

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Chapter 21. Circular Economy Transitions in Africa: a policy perspective

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Abstract

To effectively implement the circular economy in Africa, it is crucial to tailor its principles to address Africa's unique developmental challenges. This requires a citizen-focused approach that prioritizes social equity, quality of life,

access, and improved service delivery. Engaging with the aspirations of Africa's growing middle class is of utmost importance. African cities, as they urbanize, offer ideal opportunities to implement holistic circular economy models that can inspire new and sustainable urban living. This paper acknowledges the diverse voices and perspectives in Africa, and presents an overview and does not claim to represent the only viewpoint. Merely adopting a technocratic approach to implementing the circular economy in African cities is inadequate. Proponents of the concept must prioritize people and equity as indispensable elements in achieving a circular economy. Many instances and examples already demonstrate the implementation of circular economy principles in African contexts. The question arises: Can policies further support and retain these approaches, or are alternative strategies required to avoid simply following the development path of Europe and other more advanced economies?

Keywords: circular economy, Africa, regenerative, policy, informal sector

This contribution addresses the unique developmental challenges in African cities through the lens of circular economy principles, while prioritizing social equity and citizen engagement.

21.1 Introduction: The Circular Economy in the African context

In the GN, particularly Europe, the circular economy (CE) narrative has primarily focused on waste management, recycling, and cost savings, with product redesign and remanufacturing emerging as recent developments (Desmond and Asamba, 2019). Multinational organizations such as Philips, Desso, Interface, and Renault have

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implemented CE principles in their business models, incorporating concepts like "Pay Per Lux", "carpet tile renting", and remanufacturing (Ellen MacArthur Foundation, 2013a).

In contrast, Africa's development path has primarily emphasized conventional industrialization, neglecting high-value activities and advanced processing methods (United Nations Economic Commission for Africa, 2016). This has resulted in a heavy reliance on imported high-value products and weak linkages with the knowledge economy, research and development, and advanced technology (ibid).

To address this issue, several African countries are now shifting towards developing "greener" economies by focusing on local product design, promoting reuse and repair practices, and reducing negative environmental impacts and ecological scarcities. While discussions on the benefits of a CE approach are still emerging in Africa, many argue that Africa has been naturally practicing CE principles for decades through repair and reuse practices, sustainable farming, and material beneficiation.

The CE is increasingly recognized as a policy framework that maximizes the value of resources for economic development and job creation, rather than solely focusing on waste management and environmental outcomes. As few CE related policies have been developed on the continent (e.g., Extended Producer Responsibility) and Africa needs to find its own CE narrative the question arises: Can policies further support and retain these approaches, or are alternative strategies required to avoid simply following the development path of Europe and other more advanced economies?

Global trade plays a significant role in shaping Africa's engagement with the CE. Africa, as a continent rich in natural resources, has historically been positioned as a supplier of raw materials to the global market. This reliance on exporting raw materials perpetuates a linear economic model with limited value addition and insufficient linkages to local industries and economies.

However, there is growing recognition of the potential benefits of the CE in Africa's trade dynamics. Adopting CE principles can enable African countries to maximize the value of their resources, promote local manufacturing and processing, and reduce dependency on imports of high-value products. By transitioning towards a more circular approach, Africa can strengthen its position in global trade by adding value to its own resources and retaining economic benefits within the continent. There is recognition that the transition to renewable energy will need large supplies of critical metals such as cobalt, lithium, and nickel, and mineral extraction is set to increase by about 500% (The World Economic Forum, 2022). At the World CE Forum 2023, discussions have been initiated in earnest around investigating alternative business models linked to materials extraction and using blockchain to retain ownership and value so that the economic benefits of beneficiating these mineral resources are not lost to the African economies from which they are extracted. This is a developing area.

Moreover, the CE can contribute to addressing Africa's trade imbalances by promoting intra-African trade and regional integration. By developing local CE ecosystems, African countries can enhance economic cooperation, exchange circular products and services, and establish sustainable supply chains within the continent. This can foster economic diversification, work opportunities, and improved resilience to global market fluctuations.

International collaboration and partnerships are also crucial in advancing the CE in Africa's global trade. Knowledge sharing, technology transfer, and investment support between both industrialised and emerging economies can facilitate the adoption of circular practices and promote sustainable trade networks. This collaboration can enable

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Africa to leverage as well as share its resources, talents, and innovative solutions to become a key player in the global CE movement.

The African Continental Free Trade Area (AfCFTA) (African Continental Free Trade Area, 2023) is an initiative under Agenda 2063³⁷. It is a comprehensive trade agreement encompassing various sectors, including digital trade and investment protection and remove trade barriers within Africa.

The AfCFTA includes 55 African Union member countries and eight Regional Economic Communities with the aim to boost intra-African trade, particularly in value-added production, enhance Africa's competitiveness, and economic integration by promoting trade and investment across the continent.

The AfCFTA officially came into effect on May 30, 2019, following the deposit of Instruments of Ratification by 24 member states. It was launched during the 12th Extraordinary Session of the AU Assembly of Heads of State and Government in Niger in July 2019. Trading under the AfCFTA commenced on January 1, 2021, marking an important milestone in Africa's journey towards economic integration and regional cooperation.

Seemingly missing from the AfCFTA is the inclusion of the CE or any reference to sustainable development. Van der Ven and Signé (2021) authored a Policy Brief proposing that it is not too late for the AfCFTA to be an instrument for advancing green growth into the agreements and the ongoing market access negotiations under Phase I (tariff concessions and services schedules). Whilst the term of "green growth" was stated by Van der Ven and Signé, perhaps the CE principles should be included instead?

21.2 Africa's circular economy policy landscape

Unlike the European Union, Africa currently lacks continent-wide specific CE policies. However, there are opportunities within the African Union and national policy frameworks to promote the CE, and there is growing political will to support its implementation.

Agenda 2063, officially adopted by the African Union Assembly in 2015, serves as a collective vision and roadmap for a prosperous and united Africa. While the CE is not explicitly mentioned in Agenda 2063, certain actions within the agenda, such as transforming economies through value addition and addressing climate change and the environment, can pave the way for CE initiatives.

Following this, there is a rising political will to implement the CE in Africa, evident through its inclusion in various international and pan-African initiatives. The African Circular Economy Alliance (ACEA), formed by South Africa, Rwanda, and Nigeria, aims to advance CE practices through policy frameworks and regulations. Supported by organizations like the World Economic Forum, the Global Environment Facility, and the African Development Bank (AfDB), the ACEA plays a crucial role in promoting CE principles.

In November 2019, the African Ministerial Conference on Environment (AMCEN) endorsed the Durban Declaration, the first continent-wide policy explicitly incorporating the CE. Supported by the ACEA, the Durban Declaration

³⁷ Agenda 2063 – The Africa we want - is the continent's strategic framework that aims to deliver on its goal for inclusive and sustainable development and is a manifestation of the pan-African drive for unity, self-determination, freedom, progress and collective prosperity pursued under Pan-Africanism and African Renaissance. The development of Agenda 2063 was inspired by previous work undertaken The Organisation of African Unity (OAU), the precursor of the African Union; to prioritise inclusive social and economic development, continental and regional integration, democratic governance and peace and security amongst other issues aimed at repositioning Africa to becoming a dominant player in the global arena. Source: African Union. Agenda 2063: Africa we want. [Online]. Available at: <https://au.int/agenda2063/overview> [12 Nov 2023]

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acknowledges the value of the CE in driving economic development, job creation, and environmental sustainability. It calls for increased awareness, policy development, capacity building, and private sector investments to accelerate the transition to a CE in alignment with Agenda 2063.

Research undertaken in 2020 for ACEA by Dalberg identified five sectors in Africa with immediate opportunities for increased circularity, jobs creation, and environmental protection. These were published in a report referred to as the "Five Big Bets for the Circular Economy" (African Development Bank Group, 2021) and includes:

- **Food systems:** This bet focuses on reshaping the food production and consumption cycle to reduce waste, improve resource efficiency, and promote sustainable agricultural practices. It involves initiatives such as reducing food loss and waste, promoting regenerative farming, and adopting circular approaches in the entire food value chain.
- **Packaging:** The packaging sector aims to transition from a linear model of single-use packaging to a circular model that emphasizes reuse, recycling, and sustainable packaging materials. This includes promoting packaging design that enables easy recycling, implementing effective waste management systems, and encouraging the use of recycled materials.
- **Built environment:** This bet revolves around creating a circular approach to construction and infrastructure development. It involves adopting sustainable building practices, utilizing renewable and recycled materials, promoting energy efficiency, and encouraging the reuse and recycling of construction waste.
- **Electronics:** The electronics sector focuses on improving resource efficiency, reducing electronic waste, and promoting the sustainable management of electronic products throughout their lifecycle. This includes initiatives such as designing products for durability and repairability, promoting responsible e-waste management and recycling, and encouraging the adoption of circular business models in the electronics industry.

- **Fashion and textiles:** This bet aims to transform the fashion and textile industry by promoting sustainable and circular practices. It involves promoting responsible sourcing of materials, reducing textile waste through recycling and upcycling, adopting circular business models such as clothing rental and repair services, and raising awareness about sustainable fashion choices.

Currently, there is limited specific legislation targeting the CE in Africa. Existing regulations and policies primarily focus on climate change mitigation, the green economy, and waste management. The UN 2030 Agenda for Sustainable Development and the UNFCCC COP 21 Paris Agreement serve as foundational global agreements guiding relevant policy and legislation development. However, many proposed CE initiatives are still awaiting incorporation into government policies and legislation.

An initiative that has gained some traction within Africa is the "green economy". "A green economy is defined as low carbon, resource efficient and socially inclusive. In a green economy, growth in employment and income are driven by public and private investment into such economic activities, infrastructure and assets that allow reduced carbon emissions and pollution, enhanced energy and resource efficiency, and prevention of the loss of biodiversity and ecosystem services" (UNEP, no date). African countries are at different stages of implementing the green economy, with some integrating certain aspects, while others, like Ethiopia, Kenya, and Rwanda, have established green economy strategies. However, the legal and regulatory framework to foster the green economy is still

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underdeveloped in many African countries, and mechanisms for facilitating the transition are not yet fully in place. The most promising markets for the green economy often revolve around agriculture, bio-trade, sustainable tourism, and renewable energy. This can be attributed to the social and economic challenges in Sub-Saharan Africa, where rapid adoption of new concepts may conflict with development and growth objectives (Klein and Reiher, 2016). The green economy provides a good segway to the CE, so countries that have good green economy strategies in place, will find it easier to move to circular practices.

There are few systematic studies of CE policies in Africa and so the identification of policies currently relies on informal research approaches. **Figure 21.1** summarises some of the CE-related policies that are in existence for a selection of African countries, however, is two years old (GRID-Arendal, 2021 as sourced from Chatham House 2021).

- National CE policies include any national CE policies already in place as well as national green growth or sustainable development strategies which integrate CE principles.
- Product policies are any policies that support circular practices relating to the design, manufacture, distribution or import of specific products and materials (mostly plastic bans or levies).
- Extended producer responsibility policies place the responsibility for the environmental impacts of products throughout the product life cycle on producers and is often applied to the collection, processing and reuse of waste.
- Waste management and recycling policies encourage circular practices relating to the management of waste covering generation, segregation, transfer, sorting, treatment, recovery and disposal.
- Fiscal policies include government tax and spending policies that incentivize circular practices.

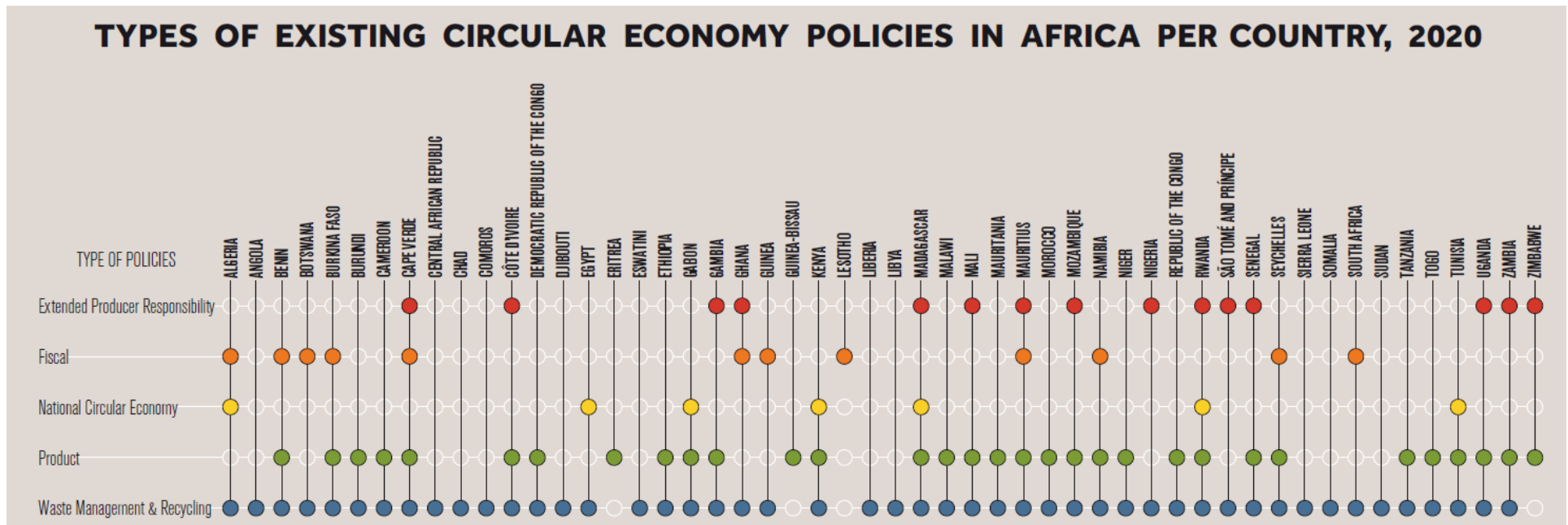


Figure 21.1 CE-related policies, regulations and initiatives in a selection of African countries (Source: GRID-Arendal, ACEN, Footprints Africa and ICLEI, 2021)

21.3 Current status of the circular economy

Although large businesses like Unilever, Nestle, Veolia, and Caterpillar are engaged in CE activities in Africa, the transition to a CE is primarily driven by private business and practitioners on the ground, including NGOs, consultancies, entrepreneurs, and small and medium enterprises (SMEs). These local innovators and SMEs have developed some of the continent's most notable CE innovations and technologies, designed with the local context in mind, emphasizing decentralization, labor-intensive processes, and cost-effectiveness.

The private sector, particularly SMEs, play a leading role in driving the CE transition in Africa. Industrial symbiosis, facilitated by programs like the Switch Africa Green Programme and the British High Commission Prosperity Fund Project, is one of the fastest-growing CE activities on the continent. The African Circular Economy Network (ACEN) is a key organization that brings together CE practitioners from across Africa to share knowledge and build an evidence base. With representation from 42 countries, ACEN plays a significant role in promoting the existing CE case studies from Africa as well as assisting to drive further transition.

The transition to a CE is seemingly driven by changes influenced by trade with global markets and the shifts required by EU Directives and not necessarily changes in policy on African soil.

Organisations that have influence on Africa's transition and promoting the CE include the ACEA, the European Union, the governments of Nigeria, South Africa, Rwanda, Ghana, and Morocco, the District of Abidjan in Ivory Coast, the World Economic Forum and its PACE platform, ICLEI Africa, and UNEP Africa. By embracing a CE strategy, Africa has the opportunity to leapfrog and avoid the linear lock-in (Sopjani, et al, 2020) of resource-intensive practices associated with the linear economy, which has historically driven growth in the GN (Desmond and Asamba, 2019). Chatham House developed "circular economy.earth" (Chatham House, 2021) to allow users to explore the policy and trade dynamics associated with transitioning from linear to circular economic models as well as provide analyses of the opportunities and trade-offs associated with such transitions. Chatham House has initiated a process to develop a global CE roadmap with the specific focus to be **(Figure 21.2)**:

- Developing a shared vision for an inclusive CE
- Identifying and acting on essential areas for mutual collaboration and coordination.
- Raising global ambition.

Why do we need a global circular economy roadmap process?

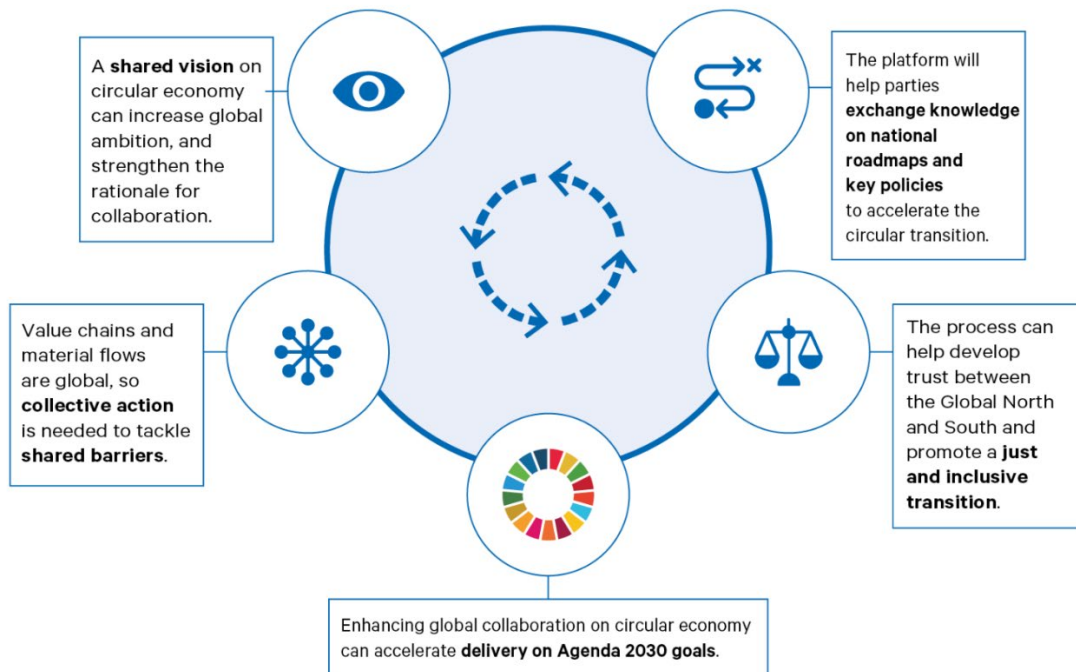


Figure 21.2 Global inclusive CE roadmap process (Source: Chatham House, 2021)

In addition to trade and the effect and impact that trade has on the growth and development of African economies, urbanisation plays a vital role in terms of how cities develop. Urbanization is a significant global trend shaping the 21st century, with the urban population projected to reach 66% by 2050, primarily driven by Africa and Asia. Africa, the second-largest continent, consisting of 54 countries, is expected to have an estimated population of 1.5 billion by 2025 and nearly 2.5 billion by 2050, with approximately 55% living in urban areas. This represents a substantial increase compared to less than 10% in 1950 (United Nations, 2018). However, Africa's urbanization varies across countries and income levels, and the urban-rural welfare gap does not necessarily narrow with urbanization (**Figure 21.3**).

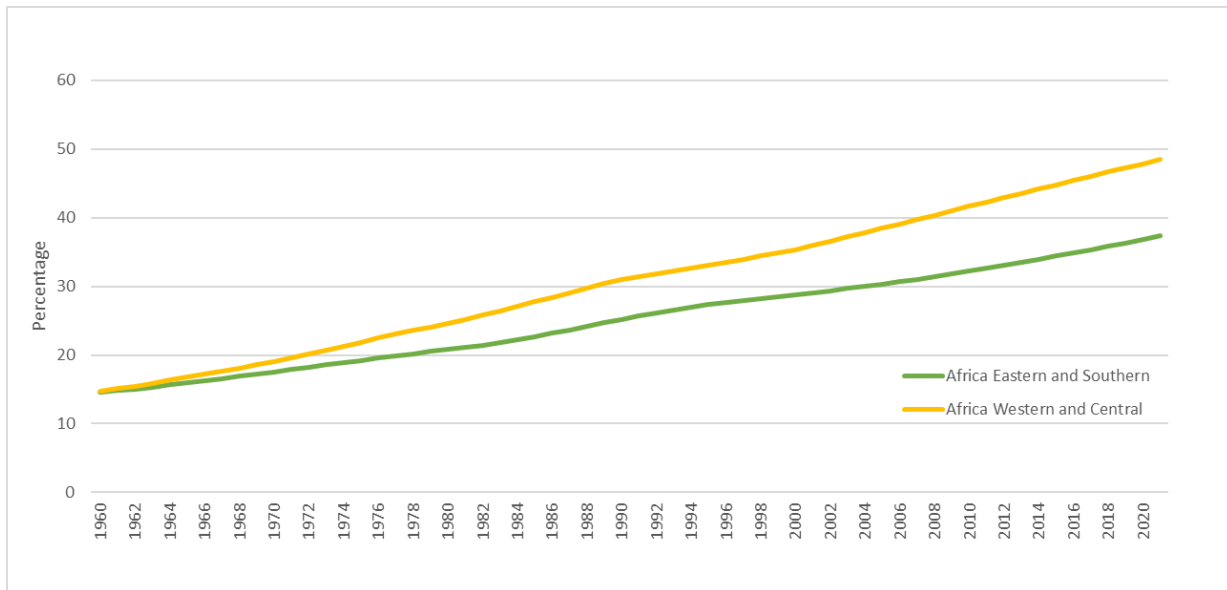


Figure 21.3 Urban population (% of total population), 1960-2020 (World Bank, 2021)

The rapid and unplanned nature of urbanization in Africa poses numerous challenges, as many municipal authorities lack the capacity to accommodate growing urban populations and provide basic services (World Economic Forum, 2017). Poor governance, inadequate infrastructure, historical institutional arrangements, and political instability contribute to the deficiencies in urban services and the proliferation of slums and sprawling residential areas (Güneralp, et al., 2017). These complexities present both challenges and opportunities for implementing CE principles in African cities.

Proper urban planning and development (including adequate infrastructure and taking distance into account) with a focus on circular material flows can mitigate the negative environmental impacts of urbanization while maximizing its potential benefits, such as reduced travel distances and preserved land. However, African cities are characterized by a dominant informal economy, with a significant proportion of non-agricultural workers engaged in informal employment, particularly women in self-employment.

Overall, the urbanization trend in Africa necessitates comprehensive planning based on CE principles for infrastructure development to ensure inclusive and environmentally conscious urban growth.

21.4 Considerations for a Just transition to a circular economy in Africa

Several critical enablers are required to facilitate the transition to a CE in Africa, including:

- **Political will and leadership:** Strong political commitment and leadership are essential to drive the CE transition. Governments and policymakers need to prioritize and support the development of CE policies, strategies, and initiatives. This has been demonstrated by the African Circular Economy Alliance.
- **Stakeholder collaboration and engagement:** Collaboration among various stakeholders is crucial for a successful transition. This includes cooperation between governments, businesses, civil society organizations, academia, and local communities. Engaging all relevant stakeholders in the decision-making process ensures a comprehensive and inclusive approach. Many initiatives are underway in South

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- Africa, Rwanda, Ghana and others, however additional integration would be encouraged. The African Circular Economy Network is attempting to bridge the gaps.
- Policy and regulatory frameworks: Developing and implementing supportive policy and regulatory frameworks is vital, from a continental, regional to a local scale and international agreements. This involves creating an enabling environment that incentivizes CE practices, such as through tax incentives, subsidies, and extended producer responsibility programs. Clear and consistent regulations are necessary to address barriers, facilitate investment, and encourage innovation. Along with this though is the requirement for consistent enforcement, which is not always the case in many African countries.
- Access to finance and investments: Adequate financing mechanisms and investments are needed to support CE initiatives. This includes access to affordable capital, funding for research and development, and support for small and medium-sized enterprises (SMEs) and startups working on CE solutions (existing or proposed). Finance and investments can be in various forms, for example, the European Green Deal. While it offers opportunities for Africa in terms of sustainable investments and technology transfers, there are also concerns about potential negative impacts on African economies. It is crucial for African countries to engage actively with the European Green Deal, ensuring that their interests are protected and that they can benefit. Collaboration between Europe and Africa is essential to address climate change and achieve sustainable development goals (Usman et al, 2021).
- Capacity building and education: Building the necessary skills, knowledge, and capacities is crucial for the successful implementation of a CE. This includes training programs, educational curricula, vocational training, and awareness campaigns to promote understanding and adoption (and in some cases the continuation) of circular practices among individuals, businesses, and communities.
- Infrastructure development and technology transfer: Developing and upgrading infrastructure, including material management facilities, recycling centers, and renewable energy systems, is essential. Technology transfer and knowledge sharing, both domestically and internationally, can accelerate the adoption of appropriate and sustainable technologies for circular practices.
- Research and innovation: Encouraging research, development, and innovation is vital for advancing CE solutions tailored to the African context. Research institutions, universities, and innovation hubs play a crucial role in generating knowledge, developing new technologies, and fostering entrepreneurship in the CE sector.
- Access to markets and value chains: Facilitating access to markets and integrating African businesses into regional and global value chains is essential. This requires strengthening trade networks, promoting market linkages, and creating platforms for collaboration and knowledge sharing among businesses operating in CE sectors.

By addressing these critical enablers, Africa can foster a conducive policy and fiscal environment for the CE to thrive, unlocking economic opportunities, promoting sustainable development, and addressing environmental challenges.

21.5 Concluding remarks

In summary, the risks posed by deglobalization and geopolitical conflict highlight the importance of targeted coordination and collaboration at the global level for a globally inclusive CE. Collaborative efforts in areas such as circular finance, supply chain transparency, standards, trade policy, and knowledge exchange can overcome challenges and create opportunities.

Clear and consistent policies at national, regional, continental and international levels are crucial for creating an enabling environment for CE practices. The African Circular Economy Alliance is a positive step to harmonise and focus the transition to circularity for the continent. The current policies related to the CE in Africa tend to focus on the environment and waste management and implementation across the continent varies.

Africa is a resource rich continent with countries dependent on the extraction of materials traded globally. Often changes in the economy is linked to change in trade policy or renegotiated trade relations. Specific changes in policy alone is not likely to transition to circularity. Greater collaboration and consensus-building among the global community is therefore necessary. These include fair and equitable trade policy, supply chain transparency and traceability, circular finance, and harmonised standards and definitions. Facilitating knowledge exchange on circular roadmaps and policies would also be highly beneficial in promoting best practices and shared learning.

Despite the clear benefits of enhanced coordination and collaboration, there is currently no single multilateral process or organization specifically dedicated to fostering a more harmonized and coordinated global transition to a CE. Establishing such mechanisms would help facilitate international cooperation and provide a platform for addressing common challenges and pursuing collective action.

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Chapter 22. Circular economy transition in European Union countries

Chiara Vassillo

Abstract

The Circular Economy (CE) stands out as a focal point within the developmental agenda of the European Union (EU) and constitutes an integral component of the EU's overarching industrial strategy. Positioned as an indispensable element, the transition towards a more circular economy represents a crucial contribution to the EU's endeavours in fostering a sustainable, low-carbon, resource-efficient, and competitive economic landscape. The concept of CE gained considerable prominence in Europe following its incorporation into EU policy and strategy in 2014, underscored by the introduction of Circular Economy Action Plans by the European Commission in 2015 and 2020.

In the past decade, the Circular Economy has garnered heightened attention, propelled by the challenges outlined in the Circular Economy Action Plans. Member States have undertaken substantial efforts to recalibrate their social and economic activities towards embracing circularity, resulting in transformative shifts characterized by the emergence of novel business models and opportunities. This comprehensive analysis delves into the initiatives, policies, and programs related to the CE across all European countries. Particular emphasis is placed on scrutinizing national recovery plans and various initiatives within the purview of the Just Transition framework. By exploring these facets, the study aims to offer a nuanced understanding of the diverse approaches and strategies adopted by EU member states in navigating the landscape of CE, shedding light on the intricate interplay between policy frameworks, national recovery plans, and the broader framework of just transition.

Keywords: Circular economy, European Union, Just transition, Member States.

This chapter endeavours to elucidate the diverse array of instruments and models utilized across various European countries. A comprehensive analysis of these nations will be conducted, shedding light on significant nuances and distinctions.

22.1 Introduction

The CE is an economic model crafted to eliminate waste by design and optimize resource usage. It encompasses practices such as reducing, reusing, recycling, and recovering materials to establish a closed-loop system. The EU

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has been at the forefront of promoting the CE, implementing strategies and initiatives aimed at fostering sustainability, resource efficiency, and environmental protection.

The literature, as well as the EU directive and recommendations, consistently highlight that most of the challenges related to the transition to a Circular Economy (CE) revolve around waste, including its production, reuse, and disposal. The European Commission (2019a) considers waste management a strategic issue for all 28 EU Member States in their transition from a linear to a circular economy. Liu et al. (2017) emphasized the importance of sustainable waste management within the framework of the CE, focusing on the "Reduce, Reuse, and Recycle" (3R) principles. They underscored the necessity of establishing an appropriate legal framework and investing in technologies for efficient resource recycling and waste management infrastructure. Furthermore, Iacovidou et al. (2017b) introduced an innovative approach called "Complex Value Optimization for Resource" (CVORR), aimed at assessing how complex value is generated, lost, and distributed in resource recovery from waste systems. Specifically, municipal waste, even though it represents a relatively small portion (7-10% by weight) of the total waste generated in the EU, is one of the most challenging types to manage due to its mixed and dispersed nature (Malinauskaite et al., 2017). Within municipal waste, food waste emerges as a substantial untapped recyclable component, accounting for nearly 88 million tons generated annually. This wastage not only results in the loss of valuable and often scarce resources such as water, soil, and energy but also contributes to climate change. Only a small fraction (6.3%) of food waste worldwide is diverted from landfills and incineration for composting, making up 22% of discarded municipal waste (European Parliament, 2017b). Additionally, in alignment with the Waste Framework Directive (European Parliament, 2018), builds upon the preceding Waste Framework Directive, which was originally Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain directives, there is a target set for EU Member States to recycle and prepare for reuse 50% of municipal waste by 2020.

Material recycling, composting, and digestion are identified as strategic drivers and strengths of the CE policy in Europe by the Directive. Minelgaitė and Liobikienė (2019) emphasized the significance of reducing, reusing, and recycling behaviours as effective tools for addressing the waste issue in the EU. They also stressed that countries aiming to minimize waste generation should focus on promoting efficient consumption and production patterns. However, these actions, while crucial, do not guarantee a complete transition to circularity. Winkler (2011) identified two structural barriers to improving circularity in terms of product reuse. The first barrier involves a significant accumulation of used materials as in-use stocks, while the second concerns the substantial number of unrecycled materials sent to landfills.

Reusing used materials as secondary raw materials is another crucial aspect, as it can enhance the efficiency and resource sustainability of production processes, contributing to market competitiveness. The 3Rs strategy is not only an environmental but also a market-driven manufacturing strategy (Brissaud and Zwolinski, 2017). According to the European Commission's Circular Economy package (European Commission, 2015b), increasing the use of secondary raw materials can open new markets, reduce production costs, boost business competitiveness, drive innovation, create jobs, and stimulate economic growth. To assess the progress toward a circular economy, quantitative indicators are useful but should be integrated into comprehensive sets that consider their combined effects and the intricacies of system dynamics (EASAC, 2016; Geng et al., 2012).

The concept of a "Just Transition" in the context of the Circular Economy in the EU entails a comprehensive and equitable shift from linear economic models to circular ones, ensuring fairness for all stakeholders involved. This concept is often associated with environmental and social justice considerations. The principles of a Just Transition highlight the necessity for an inclusive and fair process that takes into account the impacts on workers,

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communities, and regions affected by the transition to a circular economy. This involves addressing social inequalities, supporting workers in high-polluting industries, and ensuring that the transition towards sustainability leaves no one behind.

This chapter adopts a macro-level approach, focusing on a country-level perspective. Consequently, it is oriented towards observing the activities of policy actors and examining the associated outcomes.

22.2 Material and Methods

For this chapter, a total of 35 official reports have been analysed, including documents from the European Commission (2015a, 2015b, 2016a, 2016b, 2016c, 2016d, 2017a, 2017b, 2017c, 2018a, 2018b, 2018c, 2018d, 2019a, 2019b, 2019c, 2019d), the European Parliament (2017a, 2017b, 2018, 2019), the European Environment Agency (2013, 2018), Eurostat (2017a, 2017b, 2019a, 2019b, 2019c), the European Investment Bank (2017), the European Circular Economy Stakeholder Platform (2018, 2019), the European Economic Area (2019), OECD (2016, 2017), and the United Nations Environment (2019). Moreover, an extensive literature review has been conducted to delve into the subject matter, aiming to furnish a comprehensive overview of the current state and advancements in CE and the concept of a Just Transition to Circular Economy (JUST2CE) within the EU. The scrutiny involved the analysis of approximately 70 scholarly articles. It is worth noting that not all articles have been explicitly cited in this context, as some solely focused on specific facets of certain countries, and, on occasion, did not provide pertinent information for the scope of this review.

In addition to scholarly articles, a meticulous examination of official documentation has been undertaken. Every national website pertaining to the subject has been scrutinized, contributing to a holistic understanding of the initiatives, policies, and strategies adopted by each EU member state in the realms of CE and the Just Transition. This multifaceted approach ensures a nuanced and well-rounded exploration of the landscape, taking into account both academic perspectives and the practical implementations and commitments of individual nations within the EU.

22.3 European Circular Economy

To assess the awareness of the CE in the European context, it is imperative to gain insights into how countries are currently implementing and should further enhance their efforts to drive the transition towards the CE. All these reports share a common objective: to expedite the transition of European nations toward the Circular Economy. I have collated and analysed this information to develop a comprehensive framework that both summarizes the progress achieved thus far and identifies potential avenues for enhancement.

In the context of the European Union's policies within the just transition framework, there is a strong emphasis on respecting social aspects, integrated in the just transition European framework. The Just Transition Framework aims to ensure that the transition to a greener and more sustainable economy is fair and inclusive, considering the social dimensions of change. The alignment of social aspects and their adherence to the principles of the Just Transition Framework is a crucial consideration within the context of this discussion. Several key policies and principles contribute to achieving this goal by means of the following:

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- **Social Dialogue:** Encouraging and facilitating social dialogue is crucial. This involves engaging with workers, employers, and other stakeholders to ensure that the transition is well-managed, and the concerns and needs of all parties are taken into consideration.
- **Skills Development:** Investing in education and skills development is essential to equip the workforce with the capabilities needed in the evolving economic landscape. This helps workers adapt to new technologies and industries, reducing the risk of job displacement.
- **Labor Market Policies:** Implementing supportive labour market policies, such as active employment measures and social protection programs, helps mitigate the negative impacts of the transition on vulnerable groups. This includes measures like reskilling programs and unemployment benefits.
- **Regional Development:** Focusing on regional development ensures that the benefits of the transition are distributed evenly. This involves targeted investments in regions heavily dependent on industries undergoing significant changes, fostering economic diversification and job creation.
- **Gender Equality:** Promoting gender equality is integral to a just transition. Policies should address potential gender disparities in the workforce and create equal opportunities for men and women in emerging sectors.
- **Inclusive Decision-Making:** Ensuring that decision-making processes are inclusive and transparent is key. All relevant stakeholders, including local communities, should have a voice in shaping policies related to the transition.
- **Social Impact Assessments:** Conducting thorough social impact assessments before implementing major changes helps identify potential challenges and allows for the development of tailored solutions to address them.

The transition to CE in EU countries is a multifaceted process involving various initiatives, policies, and collaborative efforts. Listed below are the main programs and initiatives in the European framework:

- **EU Circular Economy Action Plan:** The European Commission has been a driving force behind the circular economy transition in the EU. The EU Circular Economy Action Plan, introduced in 2020, outlines key initiatives and strategies to advance the circular economy, including sustainable product policies, waste reduction targets, and measures to promote circularity in key sectors.
- **Legislation and Regulations:** EU member states have been incorporating circular economy principles into their legislation and policies. This includes measures to address single-use plastics, promote recycling, and encourage sustainable product design. Extended Producer Responsibility (EPR) schemes, which make producers responsible for the entire life cycle of their products, have been implemented to incentivize circular practices.
- **Waste Management and Recycling:** EU countries have set ambitious targets for waste reduction and recycling. The Circular Economy Package includes specific targets for municipal waste recycling, landfill diversion, and reduction of marine litter. Countries are investing in improved waste management infrastructure and practices to achieve these goals.
- **Circular Design and Innovation:** The EU supports research and innovation in circular design and sustainable technologies. Funding programs, such as Horizon 2020 and its successor Horizon Europe,

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provide financial support for projects that contribute to the circular economy, including innovations in materials, manufacturing, and waste management.

- **Collaboration and Partnerships:** The circular economy transition requires collaboration among governments, businesses, academia, and civil society. EU countries participate in collaborative initiatives and partnerships to share best practices, exchange knowledge, and jointly address challenges related to circularity.
- **Consumer Awareness and Education:** Raising awareness among consumers about the principles of the circular economy is a key aspect. EU countries are involved in educational initiatives and campaigns to inform the public about sustainable consumption, reuse, and recycling.
- **Circular Economy Hubs:** Some EU countries have established circular economy hubs or platforms to facilitate networking and knowledge exchange. These hubs bring together stakeholders from various sectors to promote circular practices and innovation. By incorporating these policies and principles into the just transition framework, the EU aims to create an inclusive and socially responsible pathway toward a sustainable and low-carbon economy.

Furthermore, after the Covid-19 crisis, the European Council reached an agreement on July 21st regarding the recovery plan, known as Next Generation EU, in conjunction with the Multiannual Financial Framework (MFF) for 2021-2027. The historic agreement, finalized on December 11th, encompasses a financial package totalling €1.8 trillion. This includes approximately €1.07 trillion allocated to the multiannual financial framework and an additional €750 billion designated for the Next Generation EU (NGEU) recovery instrument. Notably, the NGEU introduces the principle of debt mutualisation, where the European Commission borrows funds on capital markets to finance the recovery instrument.

The agreement places a strong emphasis on environmental sustainability, with a commitment to allocate 30% of MFF and NGEU funds for climate investment. While specific CE objectives are not explicitly outlined, the agreement includes provisions such as a levy on non-recycled plastic packaging waste as a means of generating new own resources. The Recovery and Resilience Facility (RRF) will play a key role, with member states required to present national plans for approval. These plans, evaluated by the European Commission, must align with growth potential, job creation, economic resilience, and the green and digital transition, including a minimum 30% allocation to climate action.

The 'green' transition within these plans encompasses climate and environmental perspectives, necessitating contributions toward achieving 2030 climate and energy targets and the 2050 climate neutrality objective. CE goals are embedded within environmental objectives, urging member states to demonstrate how their plans contribute to sustainable water use, waste prevention, recycling, pollution control, and the greening of urban areas.

Investments will need to adhere to EU Taxonomy Regulation criteria, and to the "do no significant harm principle" must underpin all actions.

The assessment of these plans involves a quantitative approach, specifying the degree of impact on climate and environmental objectives. Member states are expected to provide additional assessments of the direct and indirect impacts of proposed reforms or investments. The methodology draws inspiration from the Rio Markers system developed by the OECD. While the European Commission's application of the OECD system has faced criticism, particularly regarding the EU budget, these evaluation methods will influence the distribution of funds under the recovery measures package.

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In addition to Next Generation EU, the Multiannual Financial Framework includes InvestEU, designed to allocate funds to specific programmes and measures, emphasizing sustainable investments. The EIB's role in redirecting private investment toward sustainability could significantly contribute to promoting circular economy solutions. Furthermore, initiatives like ReactEU and the extension of the Just Transition Fund will follow established regulations. Next follows a brief overview that will explain all the 27 countries and their contribution to CE transition in their policies and programs.

Austria

Austria boasts a robust CE profile, with a primary focus on environmental innovation, often referred to as "Green Tech" or "Clean Tech." The nation has been making considerable efforts to enhance municipal waste recycling and has shown a commitment to initiatives that facilitate this transition, such as RepaNet. However, for Austria's Circular Economy Strategy to be truly effective, it should incorporate specific objectives aimed at reducing both raw material consumption and waste production. This is especially crucial because Austria ranks among the top waste producers in the region. While the country's National CE plan emphasizes environmental concerns, it tends to overlook the substantial economic opportunities that the CE can provide. Supporting small and medium-sized enterprises (SMEs) and capitalizing on the fact that the service sector contributes significantly to the national GDP, accounting for 63%, could be further strategic actions to be considered in this endeavour. The Austrian government aims to transform the country's economy and society into a sustainable circular economy by 2050, aligning with ecological goals such as achieving climate neutrality by 2040. The circular economy strategy, outlined in the federal program, focuses on interdisciplinary approaches, involving various sectors, regions, and citizens. Given the dynamic and complex nature of the transformation, the strategy emphasizes adaptability and a flexible approach rather than detailed long-term plans. Despite initial successes, Austria acknowledges the need for comprehensive changes in technology, economics, and societal attitudes for the transition to a climate-neutral circular economy. The strategy provides guiding principles, goals, and intervention areas to facilitate concrete measures and activities. The goal is for Austria to become a leading country in this field, and industry participation is crucial for success.

Belgium

Belgium has crafted a comprehensive framework to bolster the CE within the country. Here, numerous initiatives have been set in motion to facilitate a smoother transition. The government has offered subsidies to reduce landfill usage, imposed incineration taxes targeting the reduction of household and small-to-medium enterprise waste, and made substantial investments in robust infrastructure for separate waste collection. These actions underscore the concerted efforts of the government to promote the CE. However, despite these significant steps, Belgium continues to grapple with challenges, including the high operational costs associated with selective waste collection and the need for higher environmental taxation. On March 25, 2016, the Government of Flanders approved Vision 2050, a comprehensive long-term strategy for the region. This strategy envisions Flanders as an open, social, resilient, and international region that combines prosperity and well-being through smart, innovative, and sustainable approaches, ensuring inclusivity. To implement Vision 2050, Circular Flanders (Vlaanderen Circulair) was established in 2017 as a hub and source of inspiration for the CE. Operating as a partnership between

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the government, private sector, civil organizations, and knowledge institutions, Circular Flanders aims to make Flanders a European circular economy trendsetter by 2030. The government has committed to decoupling the material footprint of Flemish consumption from economic growth and reducing it by 30% by 2030. In 2021, Circular Flanders revamped its governance structure to enhance coordination between the Ministers of Environment and the Economy and Innovation. A Steering Group, comprising 20 core partners representing government, private industry, civil society, knowledge institutes, and the financial world, was established. The Circular Construction Strategic Agenda, led by the Confederation of the Construction Industry and OVAM, outlines six ambitions for 2061 through a co-creation process. The choice of 2061 reflects the typical lifespan of contemporary buildings, lasting for 40 years. To address challenges, stakeholders have identified 10 working paths translated into concrete actions. Some of these actions are already in progress, while others are still being developed.

Bulgaria

Bulgaria currently lags in its adoption of the CE. While the country boasts a low per capita waste production rate, it faces substantial challenges in reducing waste generated by SMEs. Moreover, there is a notable scarcity of available funding for enterprises operating in Bulgaria. To enhance the CE's prospects, it is imperative to concentrate on reducing raw material usage and waste production while also implementing tax incentives to encourage new CE investments. The European Commission has advocated for the promotion of 3Rs practices across all economic activities and the implementation of waste prevention measures. Bulgaria has crafted a draft Strategy and Action Plan for transitioning to a circular economy, set for formal adoption in autumn 2022. The cross-sectoral document leverages measures from various strategies and programs related to the economy, environmental protection, and regional development. The primary aim is to boost resource efficiency by implementing the waste management hierarchy, emphasizing waste prevention, promoting material reuse through recycling, minimizing landfill use, and reducing the environmental and health impact of waste. The draft strategy focuses on three key objectives: fostering a green and competitive economy, reducing waste and optimizing resource use, and creating a consumer-benefiting economy. To achieve these goals, specific measures are outlined in the Strategy and translated into actionable activities in the Action Plan. Implementation of the Plan will address imbalances and overcome obstacles to align with the circular economy strategy. The National Development Programme BULGARIA 2030 is a top-tier strategic framework among national programming documents. It establishes the vision and general goals for development policies across government sectors, including territorial dimensions. The document outlines three strategic goals, grouping government intentions into five development areas and setting 13 national priorities. A first three-year Action Plan for implementing the Programme is currently in preparation.

Croatia

Croatia demonstrates a low per capita waste production, yet faces challenges in recycling municipal waste, risking not meeting European recycling targets. The national Circular Economy plan primarily emphasizes waste management and sustainable tourism. To improve, Croatia should prioritize promoting awareness of Circular Economy transition policies and implementing tax incentives. The European Commission strongly advises both

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the private and public sectors to incorporate 3Rs practices in their operations and prioritize waste management prevention for enhanced recycling, incineration, and landfill use.

Cyprus

Cyprus, while having below-average per capita waste production, ranks among the top waste producers among the 28 EU Member States. Its national Circular Economy plan predominantly centres around renewable energy sources such as wind and solar power. The country has made substantial investments in resource usage efficiency and energy network infrastructures under the latest framework program (2014-2020). However, its unique geographical location limits multinational corporations' innovative investments, hindering technological advancement. To advance its transition towards a Circular Economy, Cyprus should implement 3R policies aimed at reducing raw material use, municipal waste, and plastics production. Furthermore, investing in research and innovation is crucial to stimulate progress. In 2021, Cyprus adopted its National Action Plan for the Circular Economy 2021-2027. The plan targets key materials and sectors, encompassing the primary, industrial, and service sectors, with waste policy serving as a fundamental and cross-cutting component. It outlines policy measures to facilitate the shift towards a circular economy, aiming to cultivate a circular mindset among industries, businesses, and consumers. The plan also incentivizes businesses to invest in the circular economy, improve circularity, enhance resource efficiency, foster synergies, and create favourable market conditions for circular products and services, ensuring sustainable production and consumption. Specifically, the Action Plan includes programs highlighting business opportunities in the circular economy, financing the development of new circular products and services, boosting investment in circular practices for businesses and the tourism sector, establishing online material sharing platforms, and promoting the development of standards and certifications for systems, products, and services contributing to a circular economy. Additionally, several measures focus on managing waste as a resource, emphasizing increased separate collection of municipal waste to enhance recycling quality.

Czech Republic

The Czech Republic has actively pursued the transition to a Circular Economy and boasts a strong profile in recycling packaging waste compared to the EU28 member states. The country has also received significant EU funding, primarily dedicated to enhancing environmentally friendly innovative technologies and running awareness campaigns aimed at reducing plastic usage. Efforts are underway to address packaging waste issues through the enactment of appropriate legislation. Several initiatives, including the national Waste Management Plan 2015-2024 with a long-term focus on the Circular Economy (Circular Czechia 2040), have been introduced. The country does face challenges in municipal waste management due to the presence of numerous landfills. Additionally, the implementation of EU waste management and plastics regulations has been relatively slow. To further support this transition, it is essential to provide tax incentives for Circular Economy activities, particularly for SMEs. The European Commission strongly recommends both the public and private sectors enhance their 3R actions and incorporate waste prevention practices in their operations. In December 2021, the Czech Republic adopted Circular Czechia 2040, a dedicated national CE strategy. The vision for 2040 is for the circular economy to bring significant environmental, economic, and social benefits to the country, systematically supporting it as a model for improving

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environmental protection, strengthening competitiveness and technological sophistication, creating jobs, enhancing raw material security, and developing citizens' competencies. The main goal is "Less waste and more value for the Czech Republic," with 10 strategic objectives. These objectives include improving the state of the environment, reducing waste production, enhancing waste management, strengthening competitiveness, creating new jobs, increasing raw material security, improving technological sophistication and innovation, supporting innovative forms of consumption, acquiring new competencies, knowledge, and skills, creating a non-toxic environment, and expanding the circular economy at regional and municipal levels. Circular Czechia 2040 identifies 10 priority areas for the circular economy in the Czech Republic, defining individual goals and measures within each priority. These areas encompass products and design, industry, raw materials, construction, energy, bioeconomics and food, consumption and consumers, waste management, water, research, development and innovation, education and knowledge, economic instruments, and circular cities and infrastructure.

Denmark

Denmark has been a proactive advocate for the transition to a CE from the very beginning. The country holds a leading position in household waste management and has made significant strides in reducing landfills. However, it should be noted that Denmark ranks among the highest per capita producers of municipal waste and has yet to effectively curtail waste production by Small and Medium-sized Enterprises. Denmark has undertaken several initiatives, including the Danish Strategy for Circular Economy, which focuses on providing economic support to activities that aim to recycle materials, reduce waste, and foster environmental innovation. To facilitate this transition, it is essential to improve the coordination of actions at both the national and local levels to ensure consistency and alignment with the EU's waste hierarchy. This can help avoid discrepancies at the municipal level that may not penalize private companies failing to adhere to the established waste management principles. Additionally, the transition can be further accelerated by introducing tax incentives that promote repair services, the circulation of goods, and transactions with clearly defined social objectives. The Action Plan for Circular Economy (July 2021) serves as Denmark's dedicated national strategy and roadmap for the Circular Economy (CE). It also acts as the national plan for waste prevention and management from 2020 to 2032. The plan outlines Danish targets, indicators, policies, and initiatives across the entire circular value chain, spanning from design and consumption to waste, where natural resources are recycled into new products and materials. While addressing various initiatives along the value chain, the Action Plan particularly focuses on three areas with significant environmental and climate impact: biomass, construction, and plastics. It encompasses 129 national initiatives, many of which are currently in implementation. Most of these initiatives are also part of the broader Strategy for Circular Economy (2018), the Action Plan on Plastics (2018), the Climate Plan for a Green Waste Sector and a Circular Economy (2020), the Strategy for Green Public Procurement (2020), and the National Strategy for a Sustainable Built Environment (2021).

Estonia

Estonia is a country with a strong inclination towards the transition to a Circular Economy. The nation has a notably low per capita waste production and has initiated numerous measures to encourage material reuse. It has successfully implemented a deposit-refund system for beverage packaging, leading to the efficient collection of

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almost the entire quantity of such waste. Estonia's commitment to the CE is exemplified by its establishment of the Institute of Circular Economy and Technology, the first of its kind in the country. This institute, located at TKK University, is dedicated to imparting specific skills essential for supporting the CE transition. Moreover, Estonia has been successful in creating effective national networks that bring together both private and public stakeholders involved in the CE system. These networks facilitate information sharing and constructive dialogues aimed at formulating a national CE strategy. Key players in this endeavour include the Circular Economy Forum, the Estonian Association for Environmental Management, and the Ministry of Environmental Affairs. However, Estonia faces several challenges in its transition policy, such as low resource efficiency, limited engagement of national SMEs in waste reduction practices, and an inefficient system for municipal waste and packaging recycling. Estonia is currently in the process of developing a dedicated circular economy strategy, with plans to release a CE white paper in September 2022, followed by an action catalogue by the end of the same year. The draft of the white paper outlines Estonia's vision for a functioning circular system of production and consumption, positioning the country as a smart leader in the transition to a circular economy by 2030. The goal is to establish a circular and competitive business model through sustainable production, smart technologies, and digital solutions. To realize this vision, Estonia emphasizes the importance of creating a favourable social-economic environment and applying guiding principles, including environmental awareness, cooperation, smart solutions, a systemic approach, and an up-to-date legal environment. The draft document outlines key principles for stakeholders, such as needs-based production and consumption, circular design, employing the best available approaches and technologies, following the materials' hierarchy, and promoting sustainable choices among consumers.

Finland

Finland stands out as one of the European leaders in the transition to a Circular Economy. The country has strategically planned a robust national financing system to drive innovation in the CE through initiatives like the Finnish Innovation Fund Sitra. It has also established programs such as RAKI for the recycling of nutrients and has undertaken various projects focused on plastic reduction and CE, including notable efforts like CIRCWASTE. Finland hosted the World Circular Economy Forum conference, which played a pivotal role in promoting the adoption of best practices and setting essential transition guidelines. The CE transition in Finland has been further catalysed by the widespread awareness within the national community about the opportunities that a CE can offer to both traditional and emerging businesses. Additionally, the government has introduced incentive taxes to encourage recycling and reuse activities. To further strengthen the country's eco-innovation efforts, a particular focus should be placed on harmonizing its legislative framework with the criteria for sustainable forestry outlined by the European Parliament, as well as safeguarding the biological cycle. Finland has two primary Circular Economy strategies: "The Critical Move – Finland's Roadmap to the Circular Economy 2.0" (an updated version of the 2016 roadmap) and the more recent "Strategic Programme to Promote a Circular Economy". The Strategic Programme aims to transform the economy into a circular one based on its principles by 2035. It seeks to strengthen Finland's leadership in the circular economy and contribute to the government's goal of carbon neutrality by 2035. The vision for the CE Programme in 2035 is a carbon-neutral circular society, where sustainable products and services form the economic foundation, the sharing economy is ingrained in daily life, choices bolster a fair welfare society, natural resource use is sustainable, and materials circulate longer and more securely. The breakthrough in circular economy adoption relies on innovation, digital solutions, smart regulation, and responsible

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involvement from investors, businesses, and consumers. Finland envisions being a global leader and sustainable solutions provider on the international market through the circular economy. To realize this vision, the CE Programme sets objectives, including a decrease in the consumption of non-renewable natural resources, with sustainable use of renewable resources limited to ensure total consumption of primary raw materials in Finland by 2035 does not exceed 2015 levels (excluding resources used for export products).

France

The CE transition in France has led to notable improvements in waste reduction and increased recycling. The country unveiled a national CE roadmap in 2018, featuring effective objectives designed to support this transition. This success can be attributed to the collaborative efforts of the Ministry for an Ecological and Inclusive Transition, the Ministry for the Economy and Finance, and the Institut National de l'Économie Circulaire (INEC). Furthermore, France has implemented a robust legal framework to promote 3R (Reduce, Reuse, Recycle) activities. It has imposed legal sanctions for non-compliance with rules related to collection, recycling, and packaging, especially in the context of plastics. The country has also raised taxes on waste disposal in landfills while reducing taxes on recycling operations. Additionally, social enterprises involved in the collection and sale of used goods receive incentives, including VAT exemptions. Nevertheless, small and medium-sized enterprises would benefit from additional support. Implementing a national program to encourage circular design training could help reduce raw material usage, minimize waste production, and promote practices like reuse, repair, and sharing. In 2018, France adopted a Circular Economy Roadmap, comprising 50 measures categorized into four main priorities: improving consumption, production, waste management, and mobilizing stakeholders. Key objectives include a 30% reduction in natural resource use relative to GDP by 2030, a 50% reduction in non-hazardous waste landfilled by 2025, and aiming for 100% plastic recycling by 2025. The goal is to avoid 8 million tonnes of carbon dioxide emissions annually through plastic recycling and create up to 300,000 additional jobs. In 2020, the Law Against Waste and for the Circular Economy was enacted to implement these measures, along with additional ones. Measures already in force include the establishment of new extended producer responsibility (EPR) schemes, a reparability index for electronic products, a ban on destroying unsold products, mandatory circular public procurement objectives, restrictions on plastic packaging, and requirements for informing consumers about the environmental characteristics of products. Other measures involve banning single-use plastic products by public authorities, providing information on the carbon footprint of data consumption, and setting minimum availability periods for spare parts for certain products.

Germany

Germany stands at the forefront of the transition towards the Circular Economy and excels in efficiently managing its municipal waste recycling system. The country has implemented a series of well-coordinated CE initiatives, showcasing a strong national-level coordination to enhance resource efficiency and achieve recycling targets. One of Germany's key strengths in the CE realm lies in its promotion of incentives for reuse and design for recycling. This includes measures such as fiscal incentives and a favourable legislative framework. To further encourage recycling practices, Germany introduced a new Packaging Act, complete with a National Packaging Registry. The German CE plan benefits from a robust national policy framework and a population that is highly aware and

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receptive to sustainability issues. However, the country faces a significant challenge due to its high per capita waste production, which remains a pressing concern in this context. While not initially designed as a Circular Economy (CE) strategy, the second update of the German Resource Efficiency Programme (ProgRes III), released in June 2020, can be considered as such. The primary objective of ProgRes III is to enhance the sustainability of natural resource extraction and usage, ensuring the long-term preservation of vital natural foundations for future generations. The program outlines measures across the value chain, from raw material extraction to product design, production, consumption, and waste management, focusing on resource efficiency. ProgRes III, with nearly 120 measures and overarching strategies, aligns with all 10 R-strategies of a Circular Economy. Notably, the program concentrates on the material use of abiotic and biotic raw materials, excluding other resources like water, land, soil, and ecosystem services, which are addressed by specific policies and strategies. Similarly, the utilization of fossil and biotic resources for energy generation is covered in various strategies related to Germany's energy transition. ProgRes III aims to close material cycles and underscores the crucial role of product design in achieving these goals.

Greece

The country's performance in both the private and public sectors is notably deficient. The main weaknesses in 3R actions stem from the challenges posed by the linear economy, resulting in a slow response to the proposals put forth by the EU Commission. Despite some efforts to introduce new legislation and allocate funds for educational and organizational purposes, the goals of these measures have been twofold. They seek to enhance knowledge about the Circular Economy while simultaneously improving governance structures through the establishment of a dedicated operational organization aimed at facilitating the transition. It's worth mentioning that these recent efforts align with recommendations from the European Commission. However, they are clearly insufficient to drive a transition from a linear to a circular economy. The European Commission has strongly urged both the private and public sectors to actively promote 3R actions in their activities, enforce waste management prevention practices, implement the National Action Plan on Circular Economy, advocate for transparency laws and regulations, simplify administrative procedures, and embrace Circular Procurement. The Greek Governmental Economic Policy Council approved the National Circular Economy Strategy in December 2018, accompanied by a two-year action plan. The strategy aims to stimulate growth towards a circular economy in alignment with the country's development strategy, focusing on sustainable resource management, support for circular entrepreneurship, and circular consumption. However, due to a lack of tangible results from the initial two-year action plan and considering recent EU developments, including the European Green Deal and the 2020 EU Circular Economy Action Plan, the Hellenic Ministry of Environment and Energy has drafted a new National Circular Economy Action Plan (National CEAP) for the 2021-2025 period. This plan, officially adopted by the Minister's Council Act No 12 on April 29, 2022, aligns with revised national legislation implementing the 2018 EU Circular Economy legislative package. It ensures strong synergies with the 2030 National Waste Management Plan (NWMP) and the recently adopted 2030 National Waste Prevention Programme (NWPP).

Hungary

The shift from a linear to a circular economy in this Member State has been characterized by a sluggish and intermittent progress. Various barriers hinder this transition, notably the absence of widespread resource-efficient and strategic thinking that could facilitate the process. These challenges are pervasive in both the public and private sectors. Within the private sector, both SMEs and large corporations remain firmly entrenched in the linear economy paradigm. In the agricultural and public sectors, no effective plans or actions have been set in motion to support the transition. The European Commission has underscored the significance of taking specific actions to address these challenges. This includes implementing a Hungarian Circular Economy Roadmap, reducing the consumption of raw materials and waste production, increasing activities related to reuse, repair, and sharing (often referred to as 3Rs), safeguarding the environment, and promoting domestic economic growth. In October 2019, the Energy Efficiency Operational Programmes of the Ministry for Innovation and Technology successfully secured EUR 500,000 in funding from the European Commission for the "Introducing Circular Economy and Addressing Waste Management Challenges" project under the Structural Reform Support Programme. Hungary, in collaboration with the Organisation for Economic Co-operation and Development (OECD) as the lead contractor and relevant policy and economic actors, is currently developing a national Circular Economy strategy with a vision statement for 2040. The project, expected to be completed by the end of 2022, focuses on three priority areas with the highest circular potential for Hungary: food/biomass, construction, and plastics. The envisioned statement and objectives are as follows: By 2040, Hungary aims to become a more competitive and sustainable economy, embracing a comprehensive approach to the CE transition that extends beyond waste management to include the industrial, agricultural, and service sectors. All stakeholders will collaborate to achieve the following targets by 2040, compared to 2019 levels: reduce material consumption, close the loop of materials used in the economy, and generate economic value in material-related activities.

Ireland

The Member State has established a robust network for re-use and repair, complemented by various government support programs.

Ireland's CAP Strategic Plan for 2023-2027 is designed to benefit consumers, farm families, and rural communities by supporting the production of safe, sustainable food and contributing to climate and environmental goals.

The CAP is divided into two pillars. Pillar 1 includes direct support through agri-environment schemes and market measures to provide income support and stabilize markets in the face of challenges. This pillar ensures farmers receive support for their land management efforts, maintains farming activities adapted to local conditions, and aligns production with consumer demands. Pillar 2 focuses on rural development, co-financed by EU member states, to modernize farms, enhance competitiveness, protect the environment, and support rural communities. Measures include promoting technology uptake, addressing climate change, encouraging generational renewal in farming, and boosting rural areas through investments. Ireland, as a member state, works closely with the European Commission and the EU Court of Auditors to implement its CAP Strategic Plan, aiming to protect farm incomes, recognize the efforts of farm families, and contribute meaningfully to climate goals. The plan emphasizes sustainable agriculture, viability, and the vitality of rural communities. Nevertheless, the impact of these initiatives

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has been more pronounced within the public sector, with less substantial results observed in the private sector. Notably, small, and medium-sized enterprises and large corporations have struggled to enhance the efficiency of the 3R strategy. The European Commission emphasizes the significance of executing a Green Deal Circular Procurement and the advancement of an Irish Circular Economy Roadmap. Ireland has undergone significant policy and legislative initiatives to transition to a circular economy, as highlighted in the OECD's 2022 report on The Circular Economy in Ireland. The country is deemed to be at a crucial turning point in this transition. Several key developments include the publication of a new waste policy, "A Waste Action Plan for a Circular Economy," in September 2020. In December 2021, Ireland introduced its first national Whole of Government Circular Economy Strategy. Subsequently, the Circular Economy and Miscellaneous Provisions Act 2022, known as the Circular Economy Act 2022, was published in July 2022. The National Waste Prevention Programme has been transformed into a national Circular Economy Programme, published in December 2021, and the new National Waste Management Plan is being drafted with a focus on a Circular Economy. The National Hazardous Waste Management Plan 2021–2027 has also been realigned to support and deliver a circular economy. The Waste Action Plan for a Circular Economy shifts the focus from waste disposal to preserving resources through circular economic practices, outlining aims, targets, and corresponding measures for the State. The Whole of Government Circular Economy Strategy 2022–2023 is Ireland's inaugural national strategy for the circular economy, emphasizing an overarching policy vision and approach.

Italy has undertaken a comprehensive approach to embrace a CE, positioning it as a cornerstone in its strategic development. The National CE Strategy serves as a guiding framework, steering the country's shift from a linear to a circular economic model. This overarching strategy encompasses measures designed to enhance resource efficiency, reduce waste, and promote sustainable production and consumption practices. In parallel, Italy has enacted legislative measures and policies geared towards propelling the circular economy forward. A pivotal aspect of Italy's CE endeavours is its concerted focus on waste management. The nation has implemented initiatives to revamp waste collection systems, elevate recycling infrastructure, and champion waste-to-energy projects. The overarching goal is to minimize reliance on landfills and facilitate the recovery of materials from waste streams. In tandem with these efforts, Italy is channelling investments into research and innovation, funding is directed towards projects exploring sustainable technologies, circular design principles, and innovations in waste management methodologies. Businesses in key sectors, such as fashion and manufacturing, are actively embracing circular economy principles in Italy. Initiatives within these sectors focus on waste reduction, material reuse, and the implementation of sustainable production methods. The Ministry of Ecological Transition adopted the National Circular Economy Strategy in June 2022 as part of Italy's Recovery and Resilience Plan. The strategy, under Mission 2, Component 1, focuses on key milestones tied to loan payments, including a new digital waste traceability system, tax incentives for recycling and secondary raw material use, revised environmental taxation on waste, the right to reuse and repair, and reforms to extended producer responsibility (EPR) and Consortia systems. It also supports existing regulatory tools like end-of-waste legislation, minimum environmental criteria for green public procurement (GPP) in construction, textiles, plastics, and waste electrical and electronic equipment (WEEE), along with backing industrial symbiosis projects. The overarching targets for 2035 include developing secondary markets for raw materials, reforming EPR and Consortia systems, creating a favourable fiscal system for a circular economy, strengthening upstream circularity strategies like eco-design and product lifespan extension, adopting methodologies to quantify environmental impacts, and integrating circular economy issues into school curricula and professional training.

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Latvia

Latvia's progress in the CE field has been rather unsatisfactory, primarily due to issues in waste management. The main challenges relate to the inadequate collection and sorting of materials, as well as the limited economic value generated from recycling efforts. Furthermore, there is a noticeable lack of awareness among stakeholders regarding the necessity of transitioning to a circular economy. Recommendations from the European Commission revolve around the 3R strategy, which encompasses waste reduction, material reuse, and recycling. Specifically, these suggestions emphasize the utilization of EU funding to enhance waste management infrastructure while promoting consistent regulations at both national and local levels. Additionally, they propose the adoption of the Green Deal for Circular Procurement, targeting both the public and private sectors, along with the inclusion of a free training program. Latvia introduced a CE strategy, the Action Plan for the transition to a circular economy 2020–2027, in 2020. The plan aims to establish a policy framework fostering Latvia's transition to a CE while aligning with the European Green Deal and UN Sustainable Development Goals. The Action Plan focuses on prudent implementation of the CE in Latvia, promoting thoughtful resource planning, utilization, and sustainable production and consumption across sectors.

Lithuania

Lithuania has made significant progress within the private sector, where both SMEs and larger companies have undertaken strategic initiatives aimed at aligning with the circular economy's principles. Their actions are geared towards meeting market demands and addressing environmental concerns, thereby facilitating the transition. However, the situation is quite distinct within the public sector. Here, there is a pressing need for more substantial efforts, marked by the absence of effective policy measures promoting the transition and limited government engagement at both the national and local levels. These challenges continue to impede CE advancements. The European Commission has put forth several recommendations to address these issues. These suggestions encompass the following actions: redirecting investment cash flows from incineration towards more sustainable options, implementing taxes on landfill usage, and enforcing EU regulations on waste management and plastics within the next two years. Furthermore, the EU Commission has advised pursuing additional EU funding to establish a national support program for promoting economic growth within the public sector. This program should focus on targeted activities designed to foster the creation of a CE hub. Lithuania is increasingly prioritizing the transition to a CE to achieve climate neutrality and sustainable development goals while ensuring economic growth and environmental safety. A working group has been established to formulate the National Action Plan for the Circular Economy covering 2023–2035, with the draft set for completion in October 2022. This plan will address circularity in various sectors, including industry, bioeconomy, transport, construction, consumption, and new business models. The shift to a CE necessitates a new approach to raw material use and product consumption, emphasizing the widespread adoption of eco-design to create high-quality, easily repairable, and recyclable products. Despite these efforts, Lithuania's circular material use rate is currently low at around 4.4%, significantly below the EU average of nearly 13%. Lithuania's key objectives for the waste sector include expanding the separate collection of biowaste, textile waste, and furniture waste, providing financial support for innovation and recycling, implementing recycling taxologies, and increasing the use of secondary raw materials to align with the EU average.

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The completed roadmap for Lithuania's industrial transition to a circular economy will serve as the foundation for the upcoming National Action Plan.

Luxemburg

Luxembourg adopted a national Circular Economy (CE) strategy in February 2021, and it has been made available on the CE portal. This strategy serves as a practical guide for public authorities to implement circular practices within specific sectors falling under their jurisdiction, including construction, education and training, finance, food and biomaterials, industry, and retail. The strategy outlines general tools for public authorities to activate and align within their respective sectors, encompassing regulation and standards, financial aspects, and knowledge creation and management. A co-creation approach is employed, encouraging collaboration with relevant public and private stakeholders. To ensure tangible impacts, roadmaps will be developed for each sector, setting meaningful objectives and indicators. The strategy's key goals involve aligning national initiatives and establishing an information and coordination platform. This platform involves collaboration among five national ministries: energy and spatial planning, economy, environment, climate and sustainable development, finance, and labour, employment, and the social and solidarity economy. The implementation of concrete projects is delegated to various national agencies, working in partnership with industry or municipalities.

Malta

Malta has experienced an exceptionally sluggish pace of progress, primarily attributable to a range of natural barriers. These obstacles include a heavy reliance on external energy sources, limited access to natural resources, and delays in the innovation process within the private sector. To address these challenges, the European Commission has offered a series of systemic actions as recommendations. These proposed actions encompass the implementation of EU regulations concerning waste management and plastics within the next two years. Additionally, the Commission suggests initiating a Green Deal focused on Circular Procurement, which is intended to encompass both the public and private sectors. Complementing these measures is the introduction of a free training program aimed at facilitating the transition towards a circular economy. Malta has introduced a Circular Economy Strategic Vision, titled "Towards a Circular Economy 2020–2030." This vision aligns with the government's commitment to constructing the nation's inaugural waste-to-energy facility and its ongoing initiatives to diminish landfill use. The goal is to cultivate an environment conducive to a sustainable, low-carbon, resource-efficient, and competitive economy, aligning with the EU Commission's Circular Economy Strategy. The initial emphasis has been on implementing Action 3, with plans for commencement soon. The overarching regulatory framework is primarily governed by S.L. 549.134 Beverage Containers Recycling Regulations. These regulations aim to boost the circular economy by establishing a beverage-container refund scheme, enhancing the collection and recycling of beverage containers, increasing national recycling endeavours, and reducing litter. It's noteworthy that these regulations do not exempt producers placing beverages in containers on the market from their obligations under S.L. 549.43 Waste Management (Packaging and Packaging Waste) Regulations for any beverages, beverage containers, or other packaging not covered by these specific regulations.

The Netherlands

This Member State stands out as a pioneering force in Europe's transition towards a CE. The systemic actions and initiatives the country has undertaken have solidified its position as a leader in driving this transition. The Netherlands has introduced an array of comprehensive roadmaps, strategies, and programs involving both the private and public sectors. This approach has engaged all relevant stakeholders in a collective effort to promote the transition. Despite its impressive progress, the European Commission has recommended further measures to support the CE's continued growth within the country. These recommendations include establishing a long-term budget dedicated to sustaining the Circular Economy, primarily funded by domestic resources. The Commission also encourages fostering cross-sectoral collaboration and nurturing the development of new circular value chains. The primary objectives encompass achieving a 50% reduction in raw material consumption by 2030 and establishing a circular economy in the Netherlands by 2050. The comprehensive government program, "A Circular Economy in the Netherlands by 2050," was introduced to the House of Representatives on September 14, 2016. This program outlines the necessary steps to utilize raw materials, products, and services more efficiently and intelligently, aiming to realize the circular ambition by 2050. By 2030, the consumption of primary abiotic raw materials should be halved, and the Dutch government has articulated three key goals to expedite the circular transition of the economy: Enhancing the efficiency of production processes to reduce the need for raw materials. Utilizing sustainably produced renewable raw materials, such as biomass, to diminish dependence on fossil fuels and benefit the environment. Developing new production methods and designing products with circularity in mind. These national goals align with international commitments, including EU circular economy policy, the UN 2030 Sustainable Development Goals (SDGs), and the Paris Agreement on climate. The Dutch government's circular economy webpage includes a timeline for the transition towards 2050 and relevant policy documents published until the end of 2021. Implemented initiatives include the 2017 Raw Materials Agreement, involving over 400 parties from government and industry, outlining steps for the Dutch economy to run on renewable resources. In 2018, five transition agendas were formulated for sectors like plastics, consumer goods, manufacturing, construction, and biomass and food, focusing on achieving circularity by 2050. The webpage "Accelerating the transition to a circular economy" describes these transition agendas.

In 2019, the Dutch government presented the Circular Economy Implementation Programme, translating the five transition agendas into concrete actions and projects to be implemented between 2019 and 2023.

Poland

Poland is a Member State that currently has a relatively low focus on the CE. Several factors contribute to this situation, primarily stemming from the public sector's limited responsiveness to the transition. Additionally, the agricultural and manufacturing sectors face significant technological gaps in their adoption of circular practices. Considering these challenges, the European Commission has proposed a set of recommendations designed to propel Poland's CE efforts forward. These suggestions include implementing the Polish CE roadmap, reducing raw material consumption, curbing waste production through the principles of the 3Rs (reduce, reuse, recycle), optimizing resource utilization, and ultimately achieving full circularity within the next decade. These actions are aimed at promoting and accelerating the country's transition to a CE. In 2019, the Council of Ministers approved the Circular Economy Roadmap developed by the Ministry of Economic Development and Technology. The

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roadmap focuses on various tools, not limited to legislation, to facilitate the transition to a circular economic model in Poland. It encompasses activities related to sustainable industrial production, consumption, bioeconomy, new business models, and the implementation and monitoring of the circular economy. The roadmap, spanning until 2023, involves over 40 tasks assigned to specific ministries. The Ministry of Economic Development and Technology, for instance, is engaged in activities such as conducting a feasibility study on a platform for secondary raw materials, developing a government information platform on circular economy, conceptualizing a support ecosystem for enterprises based on circular economy business models, establishing the National Smart Specialisation for the circular economy, and implementing the This-is-CE (oto-GOZ) project, which aims to assess the progress and impact of the circular economy in Poland. The roadmap serves the overall development of the circular economy, with tangible benefits reported by the responsible ministries.

Portugal

Portugal has demonstrated a commendable commitment to a CE agenda within the public sector. This focus is evident in efforts aimed at reducing and reusing materials to enhance service delivery. Notably, these principles have been extended to include immaterial resources, such as the reuse of software within public administrations. However, while the public sector exhibits strength in these areas, the private sector presents a different picture. Within the private sector, both small and large companies have made progress in improving their CE performance. Nevertheless, numerous challenges persist. Local waste recycling and material reuse practices within the private sector remain notably inefficient, and the 3R strategy's implementation is rather weak. Recognizing these challenges, the European Commission has provided specific short-term recommendations. These recommendations emphasize the need for intensified measures to protect the environment and the establishment of a legislative framework to ensure compliance. These actions are strategically aimed at supporting the economic growth of local companies and facilitating the transition from a linear to a circular economy. The Portuguese National Action Plan for the Circular Economy (PAEC), adopted in December 2017 and implemented from 2018 to 2020, is currently undergoing revision to address new circular economy challenges. The PAEC aims to propel Portugal towards its 2050 ambition, focusing on carbon neutrality, resource efficiency, knowledge advancement, inclusive economic prosperity, and a flourishing society. The plan operates at national, sectoral, and regional levels, aligning with EU Circular Economy Action Plan pillars and targeting specific areas such as design, market, education, food waste, and research and innovation. Sectoral focus includes resource-intensive industries like construction, textiles, tourism, and consumer goods. Regional agendas for the circular economy have been developed to adapt national objectives to regional contexts, fostering collaboration and coordination.

Romania

Romania faces considerable challenges in its pursuit of improved CE performance. The country lags other Member States in both the private and public sectors at both the national and local levels. This delay is evident at all levels and is exacerbated by the fragmented and uncoordinated nature of the measures taken thus far. To drive improvements, a shift towards a 3R approach is essential. This approach should involve the development of new products crafted from reused or recycled materials, as well as the promotion of reusable products. In this context, the European Commission has put forth specific recommendations for both the private and public sectors. These

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recommendations are focused on actions that address environmental concerns and the establishment of a comprehensive legislative framework to guide and support CE initiatives. Romania recently approved the National Strategy for the CE through Government Decision no. 1172/21 September 2022. Developed in collaboration with key ministries, this strategy aims to guide the transition from a linear to a circular economic model. It focuses on 14 economic sectors, highlighting seven with the highest circularity potential: agriculture, automotive, construction, consumer goods (food and beverages, packaging, textiles), and electrical and electronic equipment. The primary objective is to establish a framework for circular economy transition through an Action Plan. The success metric is the decoupling of economic development from natural resource use and environmental degradation. Aligned with UN Sustainable Development Goals, global climate objectives, and the EU Circular Economy Action Plan, this strategy integrates with Romania's National Strategy for Sustainable Development 2030 and the National Recovery and Resilience Plan. A joint inter-ministerial coordination process, led by the Head of the Chancellery of the Prime Minister, will adapt the strategy to national specifics and global trends. This collaborative approach involves key stakeholders for effective implementation. The timeline foresees the adoption of the Circular Economy Strategy and Action Plan by 2023, with an Action Plan in place by the third quarter of 2023, ensuring Romania's transition by 2030.

Slovakia

Despite increased efforts, Slovakia has made minimal progress in its transition towards a CE. Inefficient municipal waste management practices, coupled with delays in implementing CE principles, have contributed to these limited results. To expedite the CE transition, the European Commission has recommended several key actions. First, the launch of a Green Deal Circular Procurement initiative is crucial for both the public and private sectors. Additionally, the initiation of free training programs can help build necessary skills and knowledge. Ensuring compliance with EU regulations on waste management and plastics within the next two years is also imperative. One strategic objective to achieve is a reduction in per capita municipal waste production in both the public and private sectors. These measures are essential for supporting the transition from a linear to a circular economy. Slovakia has undertaken a project aligned with the Organisation for Economic Co-operation and Development (OECD) and the European Commission Roadmap for Circular Economy in the Slovak Republic. The roadmap concentrates on three primary focus areas: promoting sustainable consumption and production, particularly through economic instruments; exploring circular economy potential within the construction sector; and working towards circularity in the food and bio-waste value chain. The policy measures identified in these areas aim to boost the utilization of secondary raw materials, encourage eco-design and eco-innovation, promote circular consumption patterns, and enhance waste management, reuse, and recycling.

Slovenia

Slovenia has undertaken numerous initiatives with the aim of achieving circularity, but many of them have not been successful. This is primarily due to the lack of improvements in waste management and a production system that remains rooted in the linear economy. In response to these challenges, the European Commission has provided critical recommendations. They emphasize the strategic importance of implementing a Green Deal on Circular Procurement for both the public and private sectors, accompanied by the establishment of a free training program.

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Furthermore, the EU Commission advises reducing the use of raw materials and minimizing waste production. To address these recommendations effectively, Slovenia must put in more effort to promote the use of secondary raw materials and establish a suitable materials accounting system. These actions are essential for achieving circularity objectives within ten years, in compliance with EU recommendations. In 2018, the Slovenian government introduced the Roadmap toward a Circular Economy as an ongoing process rather than a conclusive document. This strategic initiative aims to provide guidelines for Slovenia, ensuring a systematic and controlled transition to a CE. While primarily directed at the Slovenian government, the roadmap also extends its focus to all stakeholders who have played crucial roles in its development. These stakeholders, as co-creators, bring valuable insights and examples of good practices that may otherwise go unnoticed or unsupported. The roadmap seeks to achieve several goals: Outline the potential for Slovenia to lead the transition to a CE in Central and Eastern Europe. Engage stakeholders in identifying and connecting circular practices. Provide recommendations to the government to facilitate a more efficient transition. Identify circular opportunities that enhance Slovenia's international economic competitiveness and improve the quality of life for its citizens.

Recognized priority areas within the roadmap include the food system, forest-based value chains, manufacturing industry, and mobility.

Spain

Spain is making significant strides in the transition to a CE in both the private and public sectors. Notably, the private sector, encompassing SMEs and large corporations, is demonstrating substantial progress in promoting employment development and resource efficiency through the advancement of the reuse process. However, there are still areas that require attention, such as increasing the recycling of municipal waste and fostering greater stakeholder engagement. In response to these challenges and opportunities, the European Commission has put forth essential recommendations. These recommendations include the swift implementation of the new EU regulations concerning waste management and plastics within the next two years. Furthermore, Spain should enhance its Circular Economy Roadmap and focus on reducing raw materials use and waste production to further bolster its CE initiatives.

In June 2020, Spain approved the Circular Economy Strategy (España Circular 2030), aiming to establish a new production and consumption model. This strategy focuses on maintaining the value of products, materials, and resources within the economy for as long as possible, minimizing waste, and maximizing reuse. España Circular 2030 aligns with EU Circular Economy Action Plans, the European Green Deal, and the UN 2030 Agenda for Sustainable Development. The strategy outlines goals for 2030, including reducing material consumption, waste, and greenhouse gas emissions, promoting reuse, and improving water use efficiency. The Circular Economy Action Plan I, adopted in 2021, allocates a budget of EUR 1,529.47 million for 116 measures. These measures, grouped into five axes and three action lines, address production, consumption, waste management, secondary raw materials, and water purification and reuse. Specific initiatives include promoting eco-design, enhancing product labeling, improving waste hierarchy practices, supporting water purification and reuse, and fostering research, innovation, and competitiveness. The Action Plan aims to achieve the outlined objectives by 2030, with mid-term assessments underway for the 116 measures.

Sweden

Sweden has showcased an impressive commitment to implementing a CE. The country has deployed numerous strategies to effectively realize CE objectives. Particularly within the private sector, both SMEs and large corporations have adopted proactive behaviours to swiftly achieve the goals outlined by the national government and the European Union. It is noteworthy, however, that this proactive attitude in the private sector is not mirrored in the public sector. While specific objectives have been achieved in the public sector, both at the local and central levels, a systemic transformation in public administration has yet to materialize. A few examples of commendable practices within the private sector include the application of a reduced VAT rate and income tax reductions for certain repair services. Following the recommendations of the European Commission, these actions have the potential to cultivate a collective ambition to shift from a linear economy to a circular one. Sweden adopted a National Strategy for CE in July 2020, followed by a CE action plan and an Action Plan for Plastics. Aligned with environmental, climate, and Sustainable Development Goals, the vision is an efficient, non-toxic circular flow of resources. Four focus areas include better product design, sustainable consumption, non-toxic material cycles, and incentives for circular transition. Six prioritized material streams are plastic, textiles, food, renewable materials, construction, and critical metals. The Action Plan, linked to the CE strategy, comprises over 100 measures targeting production, consumption, hazardous substances, and innovation. Notable actions include establishing a national platform for sustainable fashion, coordinating efforts for sustainable plastic use, enhancing non-toxic product design, and funding research for circular business models. A separate Action Plan for Plastics has been published. National Waste Management Plan and Waste Prevention Programme are also in place. Sweden's Action Plan for Sustainable Regional Development (2022–2024) focuses on smart specialization and fostering a competitive, circular, and bio-based economy. It emphasizes regional cooperation, knowledge sharing, and supporting small and medium-sized enterprises in their circular transformation.

22.4 Discussion

EU countries share several similarities in their approaches to circular economy initiatives. While individual countries may have unique strategies, there are common themes and practices that reflect the collaborative and integrated nature of EU policies. Here are some key similarities/commonalities:

- **EU Circular Economy Action Plan:** EU countries align with the EU Circular Economy Action Plan, which provides a comprehensive framework for promoting a circular economy. The plan includes initiatives to improve resource efficiency, reduce waste, and foster sustainable production and consumption practices.
- **Waste Management and Recycling Targets:** EU member states adhere to common waste management and recycling targets set by the EU. These targets aim to reduce landfilling, increase recycling rates, and promote the sustainable management of waste streams.
- **Product Design and Extended Producer Responsibility:** Countries in the EU focus on promoting eco-design principles to enhance the recyclability and durability of products. Many countries also implement Extended Producer Responsibility schemes, holding manufacturers accountable for the entire life cycle of their products.

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- **Plastic Waste Reduction:** There is a shared commitment to reducing plastic waste. EU countries are working towards the implementation of measures such as single-use plastic bags, promoting alternatives, and increasing recycling of plastic materials.
- **Circular Procurement:** EU countries emphasize circular procurement practices to encourage the purchase of goods and services with a lower environmental impact. This involves considering the life cycle of products in public procurement decisions.
- **Innovation and Research:** A common focus on research and innovation to support the CE is evident. Countries collaborate on projects and share best practices to accelerate the development and adoption of innovative technologies and processes.
- **Awareness and Education:** EU countries recognize the importance of raising public awareness and promoting education about the principles of the CE. Initiatives include campaigns to inform citizens about waste reduction, recycling, and sustainable consumption.
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- **Collaboration and Knowledge Exchange:** Collaboration and knowledge exchange between EU countries play a crucial role. Platforms, networks, and forums facilitate the sharing of experiences, challenges, and successful strategies in implementing circular economy initiatives.
- **Legislation and Policy Alignment:** The regulatory frameworks of EU countries are often aligned to comply with overarching EU legislation related to the circular economy. This ensures a consistent and harmonized approach across member states.
- **Circular Economy Stakeholder Engagement:** Governments, businesses, NGOs, and other stakeholders actively engage in dialogues and partnerships to promote the circular economy. This collaborative approach helps address challenges and create synergies for sustainable development.

While each EU country tailors its CE initiatives to its specific context, these commonalities reflect the shared commitment to advancing a CE agenda across the European Union. Considering the prevailing social and economic conditions in EU countries and the state of our natural environment, the transition to a Circular Economy appears not only essential but imperative. With a growing global population, the availability of raw materials worldwide is becoming increasingly limited, emphasizing the urgency of shifting our focus towards recycling and proactively preventing waste generation. The European Union holds a pivotal role in propagating the CE concept. It has released numerous CE-related documents and mandated its member states to engage in the processes necessary for transitioning their economies toward a CE model. Essential for the successful implementation of CE are the measurement and evaluation of the actions taken. This includes monitoring the progress of the transformation towards a CE, as well as assessing the effectiveness of CE objectives at multiple levels, such as macro, meso, and micro levels.

The varying levels of progress among individual countries in their transition to the CE can be attributed to several factors. These include the adoption of different development strategies aimed at shifting their economies toward a circular model, as recommended by EU ministers at the Environment Council in June 2016. Furthermore, disparities in social and economic development, notably between the EU-15 and the EU-13 countries, play a significant role. Regrettably, the outcomes achieved thus far suggest that only a limited number of these development strategies can be deemed effective in aligning with the circular economy standards set by the European Union and in some countries.

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In summary, the European Union's progress towards adopting a circular economy has been remarkably sluggish. From 2015 to 2021, the collective circularity rate of all 27 EU member countries only increased by a meagre 0.4 percentage points. Disconcertingly, seven countries, namely Lithuania, Sweden, Romania, Denmark, Luxembourg, Finland, and Poland, regressed during this period. Consequently, auditors have cast doubt on the EU's ambition to double its proportion of recycled materials integrated back into the economy by 2030, deeming it a formidable challenge.

A circular economy aims to maximize the value of products, materials, and resources by minimizing waste. To facilitate this transition, the European Commission introduced two Circular Economy Action Plans. The initial plan, launched in 2015, included 54 specific actions, while the second plan, released in 2020, added 35 new actions and set the target of doubling the "circularity rate" by 2030 – the proportion of materials recycled and reintegrated into the EU economy. These plans are not legally binding but were designed to assist member states in boosting circular economy initiatives in recent years. By June 2022, nearly all EU countries had either adopted a national circular economy strategy or were in the process of developing one. To support the transition, the EU allocated over €10 billion between 2016 and 2020 for green innovation and aiding businesses in embracing the circular economy concept. However, member states predominantly spent this funding on waste management rather than preventing waste through circular design, a strategy that likely would have had a more substantial impact. While the latter strategy could potentially yield a more significant impact, it is not the primary emphasis within the framework of the just transition in the CE. While the EU action plans did incorporate several initiatives aimed at promoting innovation and investment, there is still a substantial distance to cover in this regard.

22.5 Conclusions

The CE model represents a departure from the prevalent linear economic model, characterized by the "take, make, consume, dispose" approach. It advocates for closing the loop, replacing the "dispose" stage with "reuse." The principles of the CE are applicable throughout a product's lifecycle, spanning design, production, consumption, and waste management. Various legislative acts, guidelines, and financing programs support the implementation of CE principles. The transition to a CE can occur at macro, meso, and micro levels, necessitating considerable time and investment. The European Union plays a pivotal role in promoting CE principles, as evident in documents from the European Commission mandating member states to undergo processes for transforming their economies. These documents emphasize monitoring CE progress through a designated framework, enabling comparisons between member states and facilitating the sharing of best practices. The analysis reveals that older EU member states (EU-14), particularly Germany, Belgium, the Netherlands, Spain, France, Italy, are more advanced in CE. Conversely, Malta, Cyprus, Croatia, Latvia, Ireland, and Greece exhibit lower CE advancement. Belgium and the Netherlands show significant upward trends in encouraging CE. Germany emerged as the most advanced in CE transformation, while the least advanced included Cyprus, Czechia, Malta, Lithuania, Latvia, Hungary, Ireland, Slovakia, Romania, Estonia, Croatia, and Bulgaria.

The varied CE progress across countries stems from differences in adopted development strategies, socio-economic disparities between EU-14 and EU-13 countries, and the effectiveness of implemented strategies. The study acknowledges certain limitations, including the existence of websites in multiple languages and variations in the articles found concerning advancements in the field of the circular economy. These factors contribute to the complexity of the analysis and may introduce nuances in the interpretation of the progress observed. As already

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said, the European Union plays a pivotal role in disseminating the CE concept, publishing numerous CE-related documents and obliging its member states to undergo processes associated with transitioning their economies to a circular model. Effectively measuring and assessing activities undertaken to implement CE is crucial for its proper execution. Monitoring should extend to the progress of transformation towards CE and the efficiency of achieving CE goals at various levels, including macro, meso, and micro levels. The European Commission, in its commitment to advancing the Circular Economy, has devised a monitoring framework that undergoes continuous refinement. European countries, in a broader context, assume a pivotal role in this sector's development. However, it is imperative to acknowledge that there is still progress to be made, particularly concerning aspects related to the concept of a just transition. Achieving a more comprehensive and inclusive circular economy requires further steps, with an emphasis on addressing social and economic justice considerations within the overarching framework of sustainable development.

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Chapter 23. Circular Economy transition in China and India

Antonio Thomas

Abstract

China and India are the world's two most populous countries, characterized by various similarities, such as an export-driven economy. Nevertheless, they seem to have approached the topic of circular economy and sustainability more broadly somewhat differently.

The investigations conducted by Chinese and Indian researchers show a different approach toward the topic of circular economy. For China, government action appears to be very incisive, maybe in the attempt to maintain world leadership as the leading exporting country. For India, on the other hand, the country's difficulty in countering the rapid population growth that has occurred in the last decades and the corresponding growth in waste, as well as tackling the environmental and social impacts, emerges. Some remarks can be derived from this comparison, which in some way is still conditioned by the presence of a different amount of resources to be invested in this direction.

Keywords: circular economy, sustainability, municipal solid waste, 3R principles, eco-industrial parks.

The paper aims to underline how two large countries with many similarities demonstrate different attention toward circular economy and sustainability in general. A significant issue by virtue of their high impact on the environmental sustainability of the entire planet.

A bit odd phrasing, and definitely too vague

23.1 Introduction

The circular economy is gradually changing how we manage and use the resources and materials needed to carry out human and industrial activities. The most significant change is probably, at the cultural level related to an increasingly pervasive diffusion, in the international community, of the logic underlying sustainable development. Pivotal to this approach is the need to re-use, repair or remanufacture products that are commonly used in production processes, with a potential 48 percent reduction in greenhouse emissions by 2030 (EllenMacArthurFoundation, 2015). More and more countries and companies, therefore, have decided to change

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production methods to adopt circular economy practices; starting with the use of materials and production processes that can facilitate the recovery of used materials.

Not by chance, the concept of circular economy (hereafter CE) has recently gained momentum in the political, scientific, and economic debate. As a result, organizations and scholars have established different sets of principles for its adoption, also widening the perspectives linked to the implementation of CE pillars to those technical, geopolitical and social factors able to assure a transition to the CE that also becomes responsible, inclusive and socially fair for people living in heterogeneous contexts characterized by specific different features. The attention paid by the European Union (EU) in this regard is certainly to be judged as a pathfinder. In 2020, as part of the *European Green deal*, the European Commission adopted a set of proposals to make the EU's climate, energy, transport, and taxation policies fit for reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990. This target includes specific regulations, such as new rules on packaging, the abolition of planned obsolescence of products, and the 'right to repair, to extend the life cycle of products, minimizing waste, and recycling materials to make them participate in other production cycles. The latter goals aspire to combine sustainability with an increase in the competitiveness of EU countries and employment dynamics.

Of course, the EU is not the only significant area of the world that is quickly heads toward the CE path. International objectives for achieving a global CE are enclosed in the United Nations' *Sustainable Development Goals* (SDGs) signed by all 191 UN Member States. Specifically, Global Goal 12 aspires to ensure sustainable consumption and production patterns. It includes targets that intend to achieve more efficient use of resources (target 12.2) and reduce waste generation through prevention, reduction, recycling, and re-use (target 12.5).

Less known could be the directions in which other areas of the world are moving. In this regard, this chapter aims to provide an overview of the state of the art of EC-related practices adopted in China and India. The aim is to show and discuss the main policies that these two great nations have implemented in the direction of sustainable development.

The salient characteristic of China and India is that their fast-growing economies are expected to dominate the global economy by 2050. Geographically, these two countries cover a combined area of 12,857,460 km², about 8.7% of the world's land surface, with an estimated total population of about 2,86 billion, 35.6% of the global population. Economically, they are members of the G20, with a combined total GDP of around US\$ 20,648 trillion (21.9% of global GDP), and a GDP pro-capita of US\$ (PPA) 21,358 and 8,358, respectively (FMI database).

The next two sections describe the development and the key features of CE in China and India. The last section offers some conclusive remarks.

23.2 The development of circular economy in China

23.2.1 The framework

People's Republic of China has a long and established tradition of policies related to the CE, as in this country, CE is not simply regarded as an incrementally improved environment management policy, but it has been introduced as a binding paradigm supporting the transition of the country's economic system toward a more sustainable economic structure. Consistently, the CE embodies a broad series of environmental efficiency-oriented initiatives concerning the whole material flow at all production, distribution, and consumption (Su et al., 2013). In doing so,

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the CE traditionally covers more areas, aside from resources and waste problems, concerning renewable energy systems and energy saving, land management and soil protection, and water resource management (Geng and Doberstein, 2008). Consistently with these assumptions, in this country, CE is usually meant as "a generic term for the reducing, re-using and recycling activities conducted in the process of production, circulation, and consumption", reflecting the linkage with the "3R framework" (reduce, re-use, recycle) (Liu et al., 2017).³⁸

Not surprisingly, policies regarding a comprehensive resource utilization were first introduced in the 1950s, hoping to obtain more products from the same resource (Zhu et al., 2010). In the 1970s, the attention to sustainability issues significantly increased because of the effects of growing pollution and the enormous demand for resources caused by the rapid industrialization processes involving the country. Until the 1990s, however, the main reason that prompted the interest in the EC principles was the lack of resources that could feed an economy with an average growth of 10.6% per annum during the last 30 years. The search for more efficient methods of using resources or for their re-use has, therefore, become a fundamental goal for the largest worldly exporter and energy user (21.3% of the total in the world).

The rapid growth of the economy has also caused extremely serious problems in the country, such as air pollution, deforestation, water depletion, desertification, land degradation, loss of biodiversity. Consequently, China's politicians have been encouraged to consider the EC as a pathway to follow in order to reduce the exponential increase of greenhouse emissions and environmental degradation, ensure human health, and to contrast the other social problems due to the huge population, such as pollution by urban and industrial waste.

However, only from 2002, the concept of CE formally found its introduction in China, when the Government accepted the idea of a new development strategy entrusted to an entity named *State Environmental Protection Administration*. In that year central authorities also enacted the *Cleaner Production Promotion Act*.

In the meantime, in 2004, China became the world's largest waste generator overtaking the USA. This immense amount of industrial solid waste produced by the Country represents one-quarter of the world total (Geng and Doberstein, 2008). Moreover, China also consumes approximately 2.5 kilograms of raw material to produce \$1 GDP, while OECD countries only require 0.54 kilograms on average (Mathews and Tan, 2016). Due to this gap, in the same year the *Chinese State Council National* appointed the *National Development and Reform Commission* instead of the mentioned *State Environmental Protection Administration* to take over the duty for promoting and implementing the CE in the country. Since then, Chinese policy makers proposed a Five-Year Plan specifically aimed at enforcing and promoting the CE. The activities carried out under this new framework can be addressed into three levels (called *circles*) simultaneously covering the areas of production, consumption, and waste management.

³⁸ The Chinese approach toward CE is wider than that proposed both by the *EllenMacArthurFoundation*, and the EU. The first considers the CE an alternative form of economic model that aims at decoupling global economic development from finite resource consumption (2015: 20): "one that is restorative and regenerative by design and aims to keep products, components, and materials at their highest utility and value at all times, distinguishing between technical and biological cycles". The EU concept of CE focuses on the value of products and resources, and aims at promoting the minimization of their use and waste: "the value of products and materials is maintained for as long as possible; waste and resource use are minimized, and resources are kept within the economy when a product has reached the end of its life, to be used again and again to create further value" (EC, 2015). So, while the EU's approach focuses more narrowly on waste and resources and opportunities for business, the Chinese concept of CE also incorporates pollution and other issues, as it is framed as a response to the environmental challenges created by rapid growth and industrialization (McDowall et al., 2017).

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The first circle refers to the corporate or micro level. It chiefly involves the design of manufacturing plants, concerning issues such as cleaner production, *environmental management systems*, and product recycling schemes. To date, the most significant and successful activity at the micro-level of the CE has been cleaner production. Demonstration projects have been implemented in twenty-four Chinese provinces, involving a diverse range of industrial sectors, including chemical, construction materials, petrochemicals, pharmaceuticals, machine manufacturing, mining, textiles, power plants, metallurgical industry, light industry, transportation, and electronic industry (Geng and Doberstein, 2008).

The second circle is the inter-firm or meso level. It was created with the purpose to capitalise on the trading of industrial by products such as heat energy, wastewater, and manufacturing wastes, and is based on the promotion of eco-agricultural systems, waste trade markets, and especially *eco-industrial parks* (EIP), where companies valorise the economies of agglomeration between plants that interchange products and materials, reducing waste.³⁹ A typical Chinese EIP consists of an industrial production area, a scientific research area, a residential area, and a business and service area, where they all share the benefits of the CE, since they are connected with one another. Thus, the Chinese method of planning EIPs, which includes production and residential areas, emphasizes the establishment of integrated material, water, and energy management systems. This integrated approach encourages the creation and maintenance of eco-industrial networks among companies placed in these areas (Bleischwitz et al., 2022).⁴⁰

In the third circle, also identified the macro-level or social level, the CE stimulates both sustainable production, and consumption activities through the development of eco-cities and eco-provinces that attempt to create a recycling-oriented and pollution prevention society (Geng et al., 2011). The CE cities and provinces are involved along four directions: i) the industrial system, ii) the infrastructure, iii) the cultural setting, and iv) social consumption. Chinese institutions selected the Guiyang City and Liaoning Province as China's first pilot experimentation of macro-level CE.

Within this framework, in January 2009 Chinese Government implemented the *Circular Economy Promotion Law*, indicating the involvement of the fundamental CE pillars in its economic development plans. This law was the world's first national regulation supporting CE at all levels of society. This law claimed that economic growth must pursue sustainable ways at every level of state policies. Following this law, new industrial policies created by the Government must meet the criteria for promoting a circular economy based on the three mentioned "R" principles: reduction, re-use, and recycling of activities in the production, circulation, and consumption of products (Li and Lin, 2016). Simultaneously, other regulations stimulate companies to implement management systems reducing resource usage and waste generation while improving resource recovery and recycling (Mathews and Tan, 2011). The key industries individuate for applying the principles of the EC concern high environmental impact sectors,

³⁹ All the companies belong to an EIP share common infrastructure and services and trade industrial by-products, such as heat, energy, wastewater, and manufacturing wastes for the reduction of use of new raw materials. To form an interdependent ecological industrial system, wastes or by-products of one level of production tend to become raw material or inputs for other productive cycles by the process of waste exchange, clean production, and other measures to achieve the closed-circuit circulation of materials and the multi-level use of energy (Su et al., 2013). As a result, an EIP is expected to maximize use of materials and energy and minimize release of wastes.

⁴⁰ EIPs are usually categorized as: i) *integrated* (i.e., with entities/operations from several industrial sectors); (ii) *sectoral* (i.e., with a dominant industrial sector); and (iii) *venous* (i.e., the dominant industrial sector is waste reuse and recycle) (Lyu et al., 2022).

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such as steel, nonferrous metals, coal, electricity, chemicals, building materials, light industry, papermaking, textile, machinery manufacturing, agriculture (forestry), processing and utilization base of renewable resources.

At the societal level, a rapid increase in the number of pilot projects concerning the CE and their scope is in progress. To date, the *National Development and Reform Commission* has initiated two batches of national pilot projects, including participation by 109 enterprises, 33 industrial parks, seven provinces, and nineteen cities. Even large towns such as Shanghai, Yangzhou, Guiyang, and Hangzhou have plans for establishing an eco-city. Eco-cities and eco-provinces aspire to make the whole inherent area a CE; that is zones where recycled renewable energy produces close to zero carbon waste power for each existing activity.

23.2.2 Toward the future

The *Circular Economy Development Strategies Action Plan* created in 2013 has further embedded the idea of CE into Chinese legislation with clearly defined goals, such as the re-using 72% of industrial solid waste, a modern system for recovering at least 70% of waste products, raising energy productivity by 18.5%, increasing water productivity by 43%, and re-using 70% of some minerals that are heavy pollutants (Mathews and Tan, 2016). The 13th five-year plan (2016-2020) has also introduced specific measures devoted in recovering polluted areas. Moreover, it has favoured the creation of various institutions to support micro-level CE initiatives and the creation of 20 EIPs (Mathews et al., 2018).

The most recent 14th five-year plan, covering the timeframe 2021-25, aspires to develop the CE focusing on initiatives such as promoting recycling, remanufacturing, green product design, and renewable resources. This plan should impact all manufacturers doing business in China, but especially those using resources for production and creating waste (Bleischwitz et al., 2022).

The targets fixed by 2025 include (Yuan et al., 2020):

- improving resource productivity by 20%, and energy and water consumption per unit of GDP lower by 13.5% and 16%, respectively, compared to 2020 levels,
- reaching a utilization rate of 60% for bulk solid waste and 60% for construction waste,
- re-utilizing sixty million tons of wastepaper and 320 million tons of scrap steel,
- producing twenty million tons of recycled nonferrous metals,
- increasing the output value of the resource recycling industry to US\$773 billion.

Additionally, this last five-year plan sets further interventions China should undertake to achieve higher compliance with the CE principles. The new guidelines include (Bleischwitz et al., 2022):

- promoting the green design of products,
- strengthening clean production by accelerating innovations and upgrading,
- enforcing the R&D concerning the utilization of wastes and reusable materials in industries such as ecological restoration, green building materials, and transportation engineering,
- promoting the co-processing of urban waste,
- improving the recycling network of waste materials,
- increasing the level of processing and utilization of renewable resources,
- encouraging the recycling and utilization of agricultural and forestry waste.

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The final purpose of these interventions is to reach neutrality in greenhouse gas emissions in 2060. The goal is not easy to pursue, considering that China emitted 27% of the world's greenhouse gases in 2021 and has more installed coal capacity than the rest of the world combined.

Regardless of the real ability to reach these targets, it may be said that the era of relying on large amounts of resource consumption to drive economic growth is going to end as, currently, environmental protection and improvement are listed among the highest priorities on China's development agenda. This situation, unprecedented in Chinese history, represent an epochal change in the economic history of this country (Pesce et al., 2020; Bleischwitz et al., 2022).

Likewise, other Western countries, such as the USA and Germany, the Chinese Government tend to support these initiatives through preferential industrial recruitment and financial policies, such as land subsidies and tax incentives. Even the most adopted tool to measure CE performances – the *Material Flow Analysis* - ⁴¹ derives from western countries, recalling the EU's index (Geng et al., 2011). Anyway, the most imitated example of environmental and sustainability policies was the Japanese law for *Effective Utilization of Recyclables* implementing CE since 1991 (Qi et al., 2016). That is as, since 2000, Japan has showed the ambition to establish CE in the whole country, in order to join production, consumption, and waste management into a unique "recycle-oriented society".

As explained, *National Development and Reform Commission* is the leading institution for the policies concerning the EC. It is responsible for organizing and coordinating the academia, central government departments, industrial associations, and local governments during the study and design of the Chinese CE indicator system. Furthermore, the *Commission* regularly evaluates the performances of lower-level governments respect on the fixed targets, assuring that the policies planned by higher-level institutions are rightly implemented at the local level.

23.2.3 Perspectives and limits

Many scholars (e.g., Qi et al., 2016; McDowall et al., 2017) believe that the implementation of CE in China is gaining various benefits, in terms of economic, environmental, and social welfare. In addition to a contributing to unemployment problems, these benefits concern the quality of life for citizens, proper use of resources, and the environment, stimulating social justice at a higher level, preventing environmental poverty, and narrowing the income gap between population. The most important transformation, however, is related to the image of the country as a whole and of Chinese companies. In fact, citizens and consumers of Western countries have recently starting to modify their minds on the quality of the products that come from China and on the consequences for the environment of the productions made in that country. Until now, the image of low-quality productions with a high environmental impact has prevailed.

⁴¹ As known, the *Material Flow Analysis* is a quantitative method of measuring the flow of natural resources and material through various scales of economy, which can range from whole cities to single rivers. It consists of methodically organized indices, where it then uses mass balancing to analyse the relationships between human activities, material flows and environmental degradation. This method can be altered to examine anything from all the energy flowing through an economy to single chemical element, such as carbon. The indicator system is particularly valid in identifying the inefficient use of energy, natural resources and materials, as well as how material flow shifts affect the countries' economy and environment.

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Nevertheless, China still has a long way to go to improve its credibility and reputation. The lack of specific and unanimously accepted indicators does not allow a precise calculation of the results obtained by China and its companies in terms of CE to be shown to Western countries more attentive to these issues.

However, an undoubtable aspect is that, with a framework of 280 measures related to sustainability, China has a long history of resource-oriented policies and implemented production-oriented policies. Hence, although the policies have quickly expanded only after the year 2000, the country can be considered a pioneer in the CE (Zhu et al., 2018). Moreover, the CE as interpreted in China differs from the concept in the EU through a broader environmental approach, e.g., by addressing air pollution and water and emphasizing less waste hierarchy⁴². Subsequently, China's policies toward the CE became more comprehensive over time, with a broad engagement of government agencies, an extensive and progressive coverage of recycling opportunities, production initiatives across multiple scales, and use of different policy instruments. Besides the initiative-taking efforts by the state actors, policymakers have largely benefited from knowledge from international experiences with a process of adoption and assimilation (Mohajan, 2021). They learned to innovative ideas and practices internationally, and integrated them into policies in a manner consistent with the local features, even if the internal context of China is too large to be considered as homogeneous (Geng and Doberstein, 2008).

This study also reminds that China's policymaking efforts toward the CE have been an enduring, incremental one, leading to a comprehensive set of related policies and state actors. The progress benefited from a top-down approach and integration of international and academic knowledge (Geng and Doberstein, 2008; Mathews and Tan, 2016). The objectives of the CE do not directly conflict with the country's ambitions to pursue a high level of economic development and industrialization. Conversely, CE addresses key issues China has been facing in its rapid growth, such as resource scarcity, low productivity, and air and water pollution. This positive picture of great dynamism nevertheless contains limits and barriers that slow down the path toward the full application of the CE principles and hinder the achievement of the targets set by the programs.

A first relevant limitation is that the current policy framework is too stressed on the means toward the CE and not enough on the ends and prospects of the CE itself. Most of the policies concern increasing available resource flows and resource productivity without attending to the ends of a sustainable scale of stocks of product and service provision for consumption and final needs. That is, little attention is paid to identifying an optimal level of consumption that can be judged sustainable over time. The related risk is to assume that production volumes can expand infinitely (Zhu et al., 2019; Pesce et al., 2020).

A second barrier is that the most of incentive-based measures is not market-based but company-based. In doing so, companies tend to internalize externalities increasing their competitiveness but without transferring the benefit an upper efficiency to the market. This situation also encourages companies to obtain policy incentives through lobbying that affects the policymaking process regarding the design of incentives themselves (Liu and Côté, 2017; Zhu et al., 2019). Thus, it would be appropriate for companies to be more focused to consumer and market demands, instead of directing their attention to the search for incentives, as incentives do not necessarily correspond to the most appropriate market requests.

⁴² *Waste hierarchy* is a tool for the evaluation of processes protecting the environment alongside resource and energy consumption, from most favourable to least favourable actions according a priority based on sustainability.

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A third limitation regards the Chinese legal system, that currently is quite fragmented and lacks a unified platform for promoting the CE. For example, some of China's current tax regulations discourage businesses and the public from re-using or recycling resources, while the extremely low resource taxation system disincentivizes material recycling (Mohajan, 2021; Bleischwitz et al., 2022). So, to fill the gap that does not allow a unitary view of the whole policies and strategies to reach the target, the legislation should also be improved.

A fourth trouble emerging in this country is the weak applying of the regulations assuring the respect of the rules. The linkage between noncompliance with a regulation and the punishment for noncompliance that can be judged as inadequate. That is, because injured parties are not adequately compensated, and some environmental crimes receive administrative instead of criminal punishment (Su et al., 2013).

A further barrier to the diffusion of CE in China concerns the low presence of state-of-the-art environmental technologies, due to the inadequateness of technical capabilities and financial resources (Mathews and Tan, 2011). Systematic efforts by institutions to try to close these gaps are still lacking.

23.3 The complex transition of India toward of circular economy

23.3.1 Background

India is a nation known to have many contradictions. Having recently become the most populated country in the world, it is also characterized by wide inequalities and types of production carried out mainly by a myriad of small and very small enterprises with methods that are not up to date on the technological side and without much respect for the preservation of resources or the environment in general. These circumstances result in heavy repercussions on the endogenous context, both on the environmental and social side, but also from the exogenous side, penalising the image and reputation of Indian companies and of the country as whole (Ghosh, 2020; Ardra and Barua, 2022). It is clear, therefore, that the adoption of CE criteria holds considerable importance for its economy and the world economy. At present, however, although multiple directives have been issued in this regard, there is a lack of a comprehensive framework that compels or incentivizes companies to pursue sustainability principles (Utkarsh and Ahluwalia, 2018. Ghosh et al., 2021).

23.3.2 The municipal solid waste

The reasons concerning the previous brief description are many and they will be explained shortly. First, it should be mentioned that, according to local scholars (Rehman et al., 2016; Sharma et al., 2021; Lahane and Kant, 2022), India's main problem concerns *municipal solid waste* (henceforth MSW)⁴³ India currently produces 62 million tons of solid waste per day. Based on changing consumption patterns and rapid economic growth, this volume will reach 165 million tons by 2030 and 436 million tons by 2050.

⁴³ MSW is here considered according to the definition of *The World Bank* (World Development Indicators, 2012) as: "non-hazardous waste generated in households, commercial and business establishments, institutions, and non-hazardous industrial process wastes, agricultural wastes and sewage sludge".

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The generation of 62 million tons is further divided into hazardous waste, including biomedical waste (about 4.5 million tons), plastic waste (about 3 million tons), and electronic waste (3.2 million tons). Of 62 million tons of solid waste, only 20% is recycled. The most significant recycling component concerns electronic waste. About 50 percent of it is processed to extract valuable metals such as gold, silver, platinum, and other expensive ones that are then resold (Goyal et al., 2018; Kumar and Agrawal, 2020). As in other developing economies, the most common method of disposing of the remaining 80 percent of MSW involves storing it in open landfills, in most cases illegally, thus, spilling pollutants into soil and water. As an alternative to landfill, wastes are incinerated, releasing toxic gases and pollutants into the atmosphere. Both prevailing methods, therefore, severely affect human health and sustainability. Waste proliferation is believed to be connected to increasing levels of debilitating diseases, neurological disorders, respiratory problems, and birth deformities among Indian citizens (Mutz, 2015).

Although this sector is regulated by various legislations enacted by the *Ministry of Environment, Forestry, and Climate Change*, in cooperation with the *Central Pollution Control Commission*, state governments, and municipalities, waste management continues to be carried out primarily as a fragmented and unorganized activity, employing 39 million workers. This number represents nearly 3 percent of the population. People working in this sector usually lack adequate training, safety measures, and awareness of the risks they face. Not surprisingly, they have a life expectancy of 45 years and spend 30 percent of their income on medicine (Fiksel et al., 2021).

The remaining 80% of MSW is not recycled mainly due to insufficient municipal services. In most cities, the dustbins installed for waste collection are not cleaned regularly, resulting in people dumping household waste along roadsides, street corners, and in vacant lots, thus creating unauthorized, unhygienic, and unsustainable local landfills (Kumar and Agrawal, 2020).

In rural areas, including about 377 million people, agricultural wastes, including crop and animal residues, are often burnt in the field, or used as traditional household fuels. These practices have resulted in severe air, soil and water pollution, creating health problems for workers and nearby households. Currently, recycling and composting programs are unable to keep pace with the growth of waste, although, from few years, some startup companies and NGOs are introducing new solutions ranging from high-tech waste processing to improve training and support for waste picker communities.

In addition to the constant rise in population, the fast increase in municipal waste in India is primarily due to the diffusion of consumerism. In turn, consumerism has been fostered by the quick improvement of inhabitants' average income and to the growth of middle class, as well as from the higher number of workers with purchasing power, from the interest of foreign retailers to collect market share, and relevant change in consumers' aspirations to enlarge the set tangible products they possess (Utkarsh and Ahluwalia, 2018; Ardra and Barua, 2022). However, while companies firstly aim to capitalize their profit avoiding investments in sustainability that do not ensure an improvement in the economic-financial balance, the need for waste management practices is left to the low effectiveness measures of Government, local entities, and citizens.

To tackle the consequences of waste produced by consumerism, since 1991 the Indian Government has launched the so-called "launched the eco-labeling 'Ecomark' scheme, to increase consumer awareness, for easy identification of environment-friendly products" (Yaduvanshi et al., 2017: 5). This, many companies have included green activities in their business and products. Adopting green consumerism is a promising approach to reducing environmental impacts (Yaduvanshi et al., 2017; Lahane and Kant, 2022). In general, however, a significant proportion of the population still has a high level of poverty and is unwilling to pay any additional costs to have

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more sustainable goods/services (value for money), especially in the emerging rural markets (Singhal et al., 2019; Nudurupati et al., 2022).

A second well-founded reason for the steep increase in MSW is the heavy urbanization, as the percentage of people living in urban areas has grown to 37.7% in 2015, as compared to 17.29% in 1950. Anyway, big cities are able to “collect around 70 to 90% of MSW generated, in comparison to smaller cities and towns that gather less than 50% of waste generated” (Yaduvanshi et al., 2017: 3).

A third motive concerns citizens' lack of awareness of environmental and sustainability issues which does not solicitate companies to adequate their productive systems. Not by chance, researchers (Fiksel et al., 2021; Nudurupati et al., 2022) observe that the adoption of EC in Indian companies still is an infancy phase, despite various government-sponsored initiatives and adherence to international targets. Even so, the investigations show a moderate awareness of CE, but which does not correspond to actual consumption choices. For instance, the *Green Living Survey* conducted in 2014 found that most Indian consumers are familiar with green products, have confidence that green products are better for the environment, and feel that bio-based ingredient enhance the desirability of a product. But this awareness does not translate into purchasing decisions. That is because although citizens perceive environmental degradation and realize that different choices need to be made, too many of them are still struggling to meet daily needs. Thus, sustainability issues take a back seat (Kamble et al., 2020). In addition, people's level of confidence in buying green products is very low because they are unsure of their eco-friendly nature. This approach based on consumers, therefore, cannot be the only solution to solve the country's MSW problems (Kumar and Agrawal, 2020).

23.3.3 The perspectives

A report drafted by the Ellen MacArthur Foundation (2016) believes that there would be relevant environmental and economic benefits if India adopts the principles of sustainability on a large scale, and also companies would obtain increasing in competitiveness. The path to achieving these expected benefits, however, still appears long.

That is although the Indian Governments' interest in sustainability issues is somewhat dated. In 1986, the *Environment Protection Act* was established, followed by a series of other regulations to support sustainable waste management to protect the quality of the environment and reduce pollution from all potential sources. Unfortunately, these regulations have not been very successful. Therefore, in 2016 a series of more stringent rules were issued for MSW management, including specific requirements for plastic wastes, electronic wastes, construction and demolition debris, biomedical wastes, and hazardous wastes. Despite these regulatory efforts, the Indian economy is expected to generate unrecycled growing waste streams due to increases in population, urbanization, crops, and livestock, resulting in significant human health and environmental impacts even in the following years. The growth of international trade will also contribute to increasing MSW. On the one hand, India exports finished products to Western countries, on the other hand it tends to import end-of-life products to be reused or dismantled to recover valuable components.

More recently, however, pilot projects related to various technologies for the effective utilization of waste have been put into practice, such as waste-to-energy, transfer-storage-disposal, composting, bio-methanation, co-treatment, and some other processes. These waste management initiatives have been able to convert waste streams into business models, introducing integrated management facilities that support the treatment of multiple wastes in a single facility, with low time and cost. At the regulatory level, the main initiatives supporting EC

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implementation are the Swachh Bharat Mission launched in 2014, the establishment of a series of waste management rules documents, the renewable energy targets, the publication of the drafts *Nations Resource Efficiency* (2019) and *Battery Waste Management Rules* (2020), and the incorporation of zero-waste policy in SMEs management which constitute the main typology of Indian firm (Nudurupati et al., 2022; Sohal et al., 2022).

However, the low effectiveness of the regulations can be also traced back to the weak attention paid by Government to people engaged in this sector with formal recognition of the waste management industry. This weak attention explains why the industry does not systematically adopt new techniques and technologies for waste collection and sorting (Fiksel et al., 2021).

Another direction being pursued relates to energy production. Given the high incidence of energy poverty, a major challenge for the country is to ensure universal access to clean electricity for the population by 2030 (Sawhney et al., 2016; Gosh et al., 2021). In 2018, the Indian Government announced a renewable capacity target of 227 GW to be achieved by 2022 and 275 GW to be achieved by 2027. However, electricity generated by the plants is only 66.4 MW per day. Operation and maintenance problems hinder the 100% utilization of existing capacity.

Even wastewater is a major challenge. They are about 38,000 million litres per day, but the treatment capacity is lower than 12,000 million litres per day (CPCB, 2009).

Regardless of these efforts, an underlying problem for disseminating EC principles in India concerns a cultural aspect, as the concept of CE is still new, as it is for other developing countries. With the increasing tonnage of waste per year, a pressing need to introduce an innovative cyclic model which implies the use and re-use of waste and to consider "waste as a resource" emerges (Kamble et al., 2020). In this view, consumer acceptance of remanufactured or recycled products is an essential first step to the success of the closed-loop supply chain and to achieving the goal of CE. However, as mentioned above, researchers have verified that consumers are reluctant to purchase remanufactured products. Some investigations (Nudurupaqi et al., 2022; Sohal et al., 2022) show that, nowadays, environmental awareness has a non-significant impact on Indian citizens' consumption choices. But the CE can only be realized if consumers' attitudes are positively modelled toward recycled and remanufactured products. To this end, it would be important to improve communication with citizens through the dissemination of comprehensive product information (Singhal et al., 2019). Therefore, it is necessary to introduce programs to raise people's awareness and affect their purchasing behaviours regarding MSW, train staff to handle safe disposal of MSW, especially e-waste, and produce eco-friendly products (Sharma et al., 2121).

In better detail, about citizens features, it was also noted (Kamble et al., 2020) that the female population shows less awareness compared to the male population, as well as people under 30 years of age. Qualification and high level of education support a higher awareness as well as, in terms of hierarchical levels, employees show an awareness lower compared to that of managers and supervisors. Therefore, progress in the education level could improve the sensitiveness toward CE.

Another type of intervention concerns the *Green manufacturing*, here considered in a generic manner as manufacturing practices that do not harm the environment during any productive phases. Green manufacturing involves the green design of products, use of eco-friendly construction materials and packing, and re-use after the product's end of life. In doing so, it has been demonstrated that the depletion of natural resources and production of trash tend to be reduced (Rehman et al., 2016). By emphasizing rationalizing materials and re-using components, green manufacturing encompasses many manufacturing principles, including 6Rs i.e. reduce, re-use, recycle, recover, redesign, and remanufacture. Thus, *Green manufacturing* contributes to waste management, environmental protection, regulatory compliance, pollution control, and other allied requirements (Sohal et al.,

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2022). To improve the effectiveness of this approach, however, it is necessary to involve firstly the myriad small and medium enterprises (SMEs) that comprise the core of India's industrial system. In a large developing country such as India where much of the SME sector is not yet fully organized and often receives limited support by government improvement programs, the journey to become integrated into the CE is very difficult (Nudurupati et al., 2022; Pereira et al.; 2022).

Summarizing, to capture around half a trillion dollars' worth of economic value to be generated through the CE in India by 2030, as forecasted by the *Ellen MacArthur Foundation* (2016), it is important to understand specific challenges that prohibit achievement of the full potential of CE. Some of these challenges regard the supply side. They concern measures such as filling the gaps concerning suitable infrastructure to support "6R" for large quantities of wastes, improving the logistic sector (reverse logistic, circular supply chain...) aimed to support the collection, separation of used materials and extraction of raw materials, and the practices for the diffusion of education/capabilities among companies to undertake the "6R" activities in a safe and environmental-friendly way (Goyal et al., 2018; Sohal et al., 2022). Other measures regard the demand side and are linked to citizens' cultural pattern toward the indispensable sustainability pathways (Mutz, 2015; Sharma et al., 2021). Thus, they include initiatives to change mindset of the "throwaway" society for acceptance of CE related products. Anyway, all the measures presuppose a stronger governmental support through incentives and penalties, with large-scale controls of the performances obtained in the different directions of intervention (Rehman et al., 2016; Kamble et al., 2020). Until now this aspect has been often missing in the Indian legislative context.

23.4. Conclusions

This brief review of the path to the circular economy (CE) followed by these two big countries that are united by an impetuous economic growth exhibits clear differences. On the one hand, China, led by a top-down government approach, shows an early understanding of the need to transition towards CE and is more stringently pointing the way forward for companies and citizens. A choice driven presumably by the goal of consolidating its position as the world's leader exporter with respect to those foreign markets whose consumers are more sensitive to the sustainable development and to the necessity to implement CE pillars. On the other hand, India, in addition to begin its pathway slightly later, has accumulated a further clear gap. That is, although its being the world's largest democracy makes it easier to establish partnerships with Western countries, the social and environmental consequences of the weak attention to sustainability issues are perhaps even more pronounced than in China. However, we must remember that China currently has a higher level of resources to invest in sustainability than India.

A silver lining joining both countries is the growing awareness of the unpostponable need to accelerate the adoption of CE principles. This awareness is certainly positive for the pathway toward the sustainable development of the whole world since these two countries account for nearly 36% of the global population and 22% of GDP. The discussed landscape also let emerge at least three considerations confirming the prevalent literature orientation. A first observation regards the predisposition toward the adoption of CE principles that seems directly related to the level of well-being of communities. When populations are focused on the most pressing problems related to finding resources to survive, sustainability issues take a back seat. Thus, local authorities of less developed

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countries, while perceiving the existence of an environmental and social issue, believe that the problem should be addressed first and foremost by more affluent countries.

A second consideration concerns the fact that it seems equally unrealistic to believe that markets and firms can autonomously lead toward a widespread context of sustainability. If the CE is destined to become the future mantra of economic development, as more and more situations and events are confirming, actions led by institutional bodies at the national as well as international level are indispensable. The adoption of SDGs is certainly, to date, the most striking virtuous example. No less important, at the corporate level, is the growing practice of adopting reporting systems that in some way attest to the ability of companies to achieve economic performance consistent with, if not functional in, the other dimensions of development related to the environment and sociality. Environmental reports or social and sustainability balances, as well as the more advanced integrated reports, certainly represent an important step in this direction.

A third thought concerns the close relationship between safeguarding environmental conditions and social conditions. It is becoming increasingly clear that these two spheres cannot be separated. Where there is social degradation, there also emerges environmental degradation, and conversely. National and international institutions and bodies, therefore, must act with these interrelated dynamics in mind. Similarly, these bodies must consider that without investment in training and technical and technological innovations, it is difficult to pursue a true path to sustainable development.

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Chapter 24: Visioning four different circular futures: what could 2050 look like?

Martin Calisto Friant and Walter V. J. Vermeulen

Abstract: There are many competing visions regarding what a circular future entails and how it would transform our social, economic, and political systems. This chapter sheds light on these different circular discourses by asking the following research questions: what kind of society would different visions of a circular future seek to create by 2050? To answer this question, this chapter unpacks the four circular discourses developed by Calisto Friant et al. (2020). Results examine how these four discourses would organise and operationalise circular transport, energy, agriculture, and industrial systems in 2050. Results also explore the political systems and governance processes they would establish and the type of society, culture, and daily life they would create. Our chapter concludes that there is a real danger in following growth-based circular discourses and scenarios because their visions cannot be implemented within the boundaries of the Earth. Indeed, over 50 years of academic research has demonstrated that decoupling economic growth from environmental degradation fast enough to prevent climate breakdown and biodiversity collapse is impossible. Degrowth-oriented circular society approaches, on the other hand, might shed light on socially innovative transformations that can allow all humans to meet their needs within the ecological boundaries of the Earth.

Keywords: circular economy; circular society; futuring; sustainability; degrowth.

This chapter asks: what kind of society would different visions of a circular future seek to create by 2050? To answer this question, we explore what competing circularity futures propose for our transport, energy, agriculture, industry, political institutions, culture, and everyday life.

24.1 Introduction

In the past decade, the circular economy (CE) rose from a niche concept in the sustainable production and consumption literature to become a major component of any business, government, or civil society discourse on sustainability. A Google search for “circular economy” in 2012 would lead to around 80 thousand results, the same search now leads to over 80 million. However, the CE is nothing new, the metaphor of a circle to represent a sustainable economy has existed at least since the 1970s with Barry Commoner’s magnum opus, “The Closing Circle” (Commoner 1971). The idea of a society that works in harmony with the natural cycles of the Earth can be traced even further back to the ancestral worldviews and ways of life of indigenous peoples throughout the globe

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(Kothari et al. 2019). The current definition and forms of implementation of CE are very diverse and still very much contested, with many different actors proposing different visions and discourses of CE, depending on their socio-economic perspectives and interests (Korhonen et al. 2018).

This chapter seeks to shed light on these different circular futures and scenarios by asking the following research questions: what kind of society would different visions of a circular future seek to create by 2050? To answer this question, this chapter unpacks the 4 circular discourses developed by Calisto Friant et al. (2020) to explore how these different approaches to circularity imagine the future. It does so by working with an artist to illustrate 4 images that represent the futures that each of the 4 discourse types would envision by 2050.

This chapter is thus the result of a “futuring” thought experiment, where we unpack and draw out four circular discourses into the near future and critically engage with their sustainability implications. By collaborating with an artist to visualise each of these futures, we hope this chapter can help academics and practitioners better understand the different visions of circularity that currently compete in the discursive debate and to better grasp their key implications for human planetary well-being.

After explaining the methods (section 2), the article explores the four possible futures that each of these discourse types would envision by 2050 (section 3). Section 4 investigates which of these visions currently dominates the discursive debate on CE and discusses the sustainability implications of each of these futures. We conclude with final reflections and avenues for further research.

24.2 Methods and theoretical framework

The typology of circularity discourses developed by Calisto Friant et al. (2020) was chosen as the theoretical framework for this article as it is a typology that has been widely used by other academics for discourse and policy analysis on the topic (e.g. Arai, Calisto Friant, and Vermeulen 2023; Melles 2021; Ortega Alvarado et al. 2021; Palm et al. 2021). The framework is based on a comprehensive literature review on CE and all its related concepts, including both ideas from the GN and South. It is thus a broad and plural typology that embraces many different approaches to the topic in a holistic manner. It is particularly useful to this chapter’s research aims, as the typology can help us envision the complexity and diversity of futures that different CE proposals entail in a coherent and systematic manner.

The 2x2 typology differentiates CE discourses based on 2 criteria. First, whether discourses are *optimist* or *sceptical* regarding the possibility that economic growth can be decoupled from environmental degradation fast enough to prevent a socio-ecological collapse (eco-economic decoupling). Second, whether discourses are *holistic* by including social justice and political empowerment considerations or *segmented* by focusing on resource efficiency alone. This differentiation leads to 4 broad circularity discourse types: *Technocentric Circular Economy* (*optimist* and *segmented*), *Reformist Circular Society* (*optimist* and *holistic*), *Transformational Circular Society* (*sceptical* and *holistic*), and *Fortress Circular Economy* (*sceptical* and *segmented*) (see **Figure 24.1**).

		Approach to social, economic, environmental, and political considerations	
		Holistic	Segmented
Technological innovation and ecological collapse	Optimist	<p>Reformist Circular Society</p> <ul style="list-style-type: none"> - Assumptions: reformed form of capitalism is compatible with sustainability and socio-technical innovations can enable eco-economic decoupling to prevent ecological collapse. - Goal: human prosperity and well-being within the biophysical boundaries of the earth. - Means: technological breakthroughs and social policies that benefit humanity and natural ecosystems. - Example concepts: natural capitalism, cradle to cradle, the performance economy, the natural step, the blue economy, regenerative design, sound material-cycle society, doughnut economics. - Proponents: various international organizations, academics, large foundations, and some governments. 	<p>Technocentric Circular Economy</p> <ul style="list-style-type: none"> - Assumptions: capitalism is compatible with sustainability and technological innovation can enable eco-economic decoupling to prevent ecological collapse. - Goal: economic prosperity and development without negative environmental externalities. - Means: economic innovations, new business models, and unprecedented breakthroughs in CE technologies- - Example concepts: industrial ecology, reverse logistics, biomimicry, industrial symbiosis, extended producer responsibility, cleaner production, bioeconomy. - Proponents: some academics, many corporations, various national and city governments, and international organizations.
	Sceptical	<p>Transformational Circular Society</p> <ul style="list-style-type: none"> - Assumptions: capitalism is incompatible with sustainability, and socio-technical innovations cannot bring absolute eco-economic decoupling to prevent ecological collapse. - Goals: a world of conviviality and frugal abundance for all, while fairly distributing the biophysical resources of the earth. - Means: complete reconfiguration of the current socio-political system and a shift away from productivist and anthropocentric worldviews. - Example concepts: conviviality, steady-state economics, permacircular economy, degrowth, eco-anarchism, Buddhist economics, buen vivir, ubuntu. - Proponents: many academics, social movements, bottom-up circular initiatives, and indigenous peoples. 	<p>Fortress Circular Economy</p> <ul style="list-style-type: none"> - Assumptions: there is no alternative to capitalism and socio-technical innovation cannot bring absolute eco-economic decoupling to prevent ecological collapse. - Goal: maintain geostrategic resource security in global conditions where widespread resource scarcity and human overpopulation cannot provide for all. - Means: innovative technologies and business models combined with rationalized resource use and migration and population controls. - Example concepts: the tragedy of the commons, the population bomb, overshoot, disaster capitalism, capitalist catastrophism. - Proponents: survivalists, a few academics, some geostrategic think tanks, and state policies.

Figure 24.1: Circularity Discourse Typology (adapted from Calisto Friant, Vermeulen, and Salomone 2020)

To develop a visual representation of the 4 discourse types and their proposed futures we worked with an artist and designer, Anke Muijsers. Through a series of collaborative sketching exercises, we developed an illustration of each of these futures (see **Figure 24.2**)⁴⁴. These figures detail the type of future and socio-economic system that each circularity discourse would imagine for 2050, with the mix of agricultural, industrial, housing, energy, consumption, and transport systems they would engender. We sought to create visual representations that are

⁴⁴ These artistic representations (figures 2, 3, 4, 5 and 6) were illustrated by Anke Muijsers from <https://visual-research.studio/>

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both complete and comprehensive but also simple and easy to understand so they could be used as education and workshop materials with citizens, researchers, practitioners, students, and other actors.

24.3 Four different visions of a circular future

24.3.1 The Technocentric Circular Economy Future

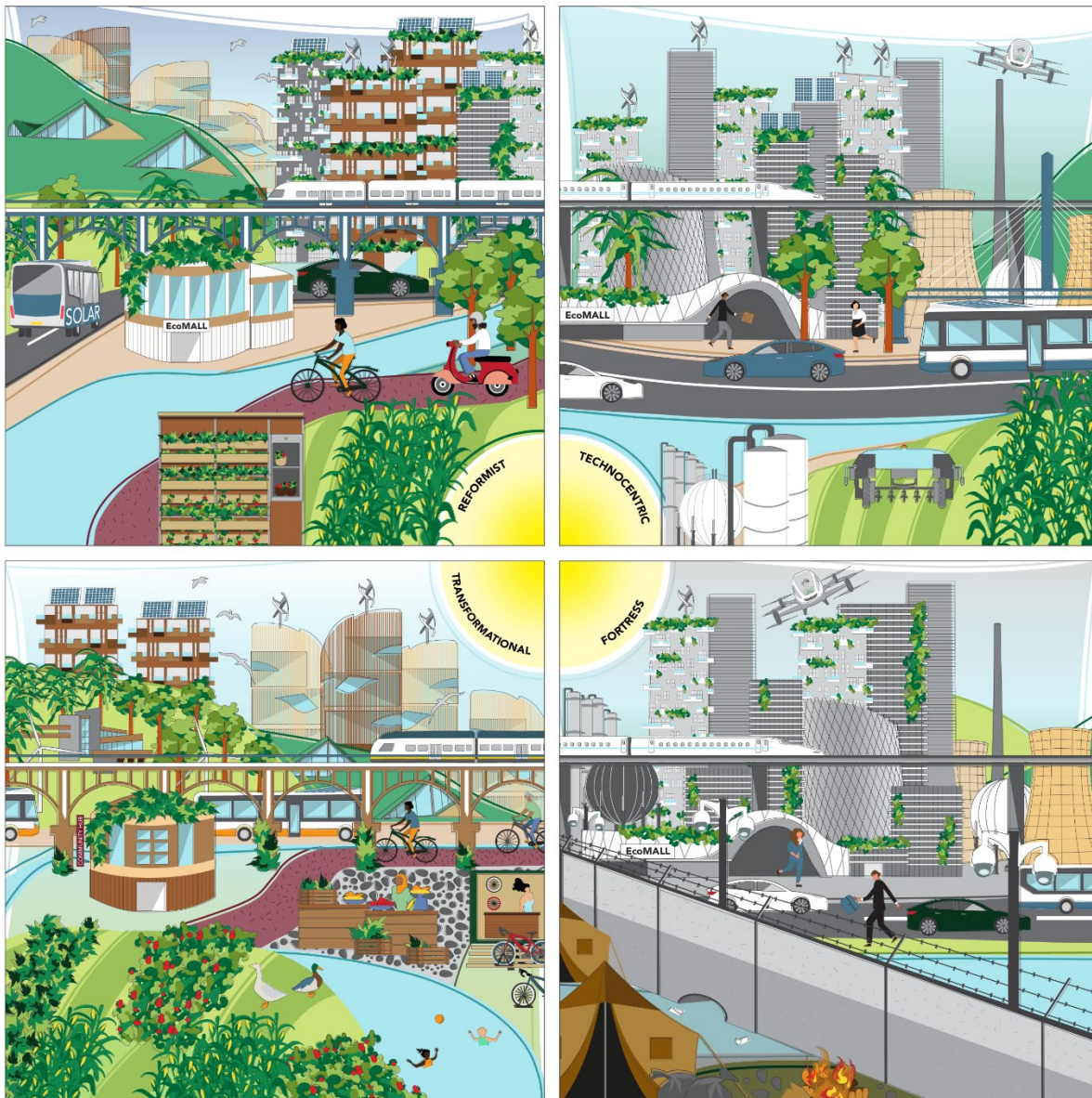


Figure 24.2 Visual representation of the circularity discourse typology (Calisto Friant 2022)¹

Technocentric Circular Economy (TCE) discourses are *optimist* about the capacity of technology to prevent socio-ecological collapse as well as *segmented* as they don't include social justice and political empowerment considerations (see **Figures 24.1** and **24.3**). These discourses seek to reconcile economic development with

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ecological sustainability through innovative business models and technological breakthroughs, especially in resource recovery, biotechnology, and renewable energy.

In a TCE future, industrial output and energy demand continue to grow by using many different sources of energy, including solar panels, wind turbines, hydrogen, biofuels, nuclear, and even fossil fuels such as gas and oil with carbon-capture and storage technology to prevent greenhouse gas emissions. Agriculture is highly efficient and automatised and uses artificial intelligence (AI), robotisation, biotech and genetically modified organisms (GMOs) to increase resilience and productivity and reduce losses. This industrial agriculture system thereby supplies food for human consumption and industrial feedstock to produce biofuels and advanced biomaterials (such as bioplastics), all while recuperating organic wastes from urban areas through bio-digestion and waste-water recycling. Transport systems include high-tech innovations such as autonomous vehicles, high-speed rail, and passenger drones, as well as green aircraft powered by biofuels, hydrogen, or electric batteries. Buildings are made from recovered or innovative sustainable materials and are packed with smart technologies, which allow energy-efficient insulated housing, malls, and offices to rise surrounded by green walls, wind turbines and solar panels. New recovery technologies and businesses flourish in this society, with myriad innovations to recycle all types of waste and repair, remanufacture or refurbish disused products.

Many industries switch from selling specific goods like cars, smartphones, and washing machines to providing services like transportation, cleaning, lighting, or computing (so-called product-service systems). Industries also start producing closer to consumption markets with innovative robotisation and machine learning technologies. This also allows for a strong symbiosis between and within urban and industrial clusters, which efficiently and continuously re-use and recuperate wastes to manufacture new products.

TCE visions do not address social considerations, so current social relations and working practices remain broadly unchanged and thereby replicate present racial, class, gender, property, health, and ethnic disparities. Overall, a TCE vision seeks to create a highly productive and efficient society with an abundance of technical solutions that allow for high material standards of living and the continued reproduction of capitalist socio-economic relations.

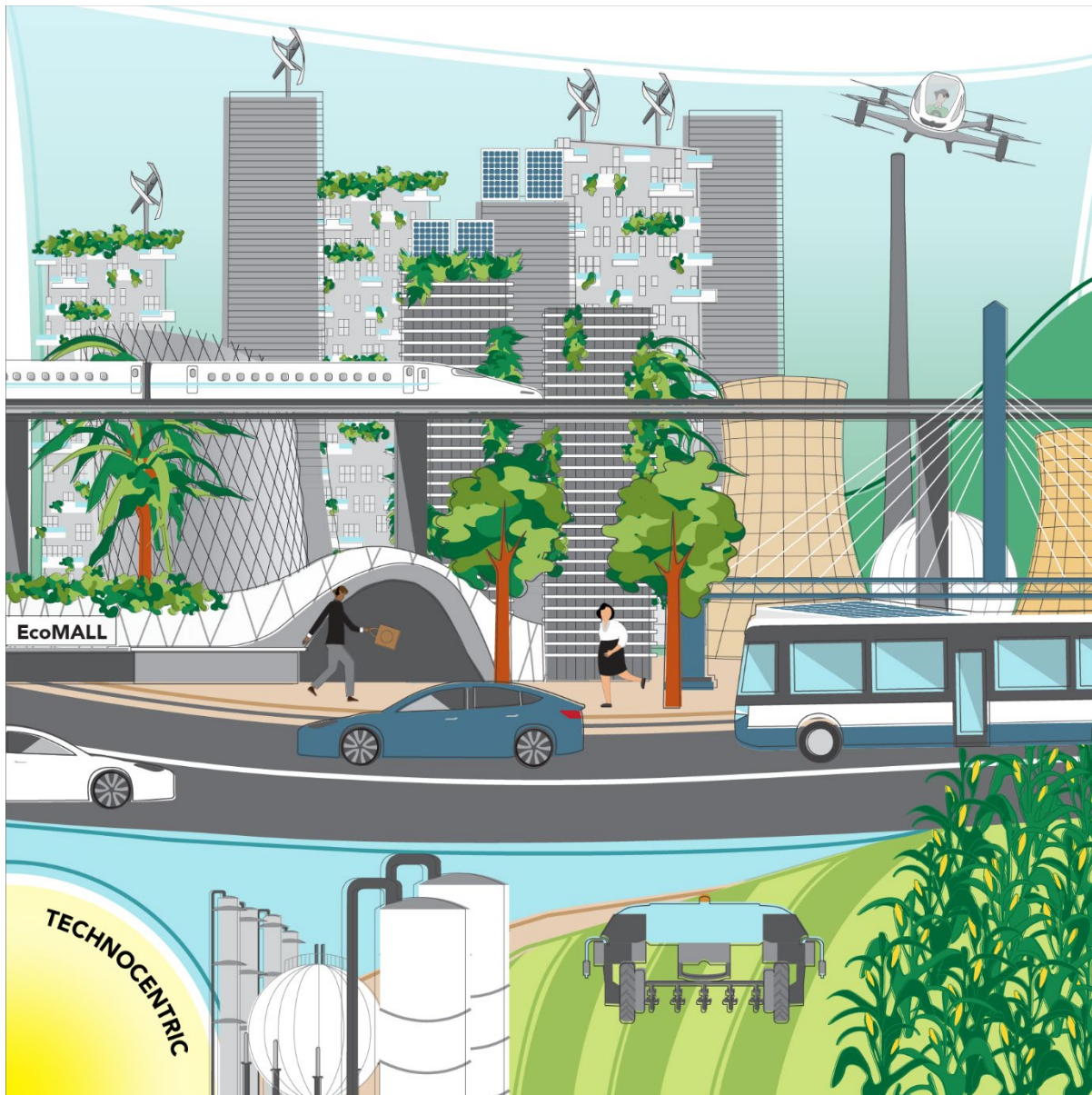


Figure 24.3 Visual representation of a Technocentric Circular Economy future (Calisto Friant 2022)¹

24.3.2 The Reformist Circular Society Future

Reformist Circular Society (RCS) discourses are *optimist* about the capacity of technology to prevent socio-ecological collapse and *holistic* as they integrate many social justice and political empowerment considerations (see **Figures 24.1** and **24.4**). These discourses seek to create a sustainable circular future through a combination of innovative business models, social policies, and technological breakthroughs. RCS visions thus add a social justice lens to the many technical and business innovations of TCE visions.

An RCS society combines high-tech innovations and industrial processes with greater care for workers' well-being and respect for human rights. It is a society where technology has brought nature closer to humans with a myriad of nature-based solutions like green walls and parks that mitigate heat waves and floods. It is a future where industrial processes operate like natural ecosystems, sharing resources between localised manufacturing hubs and cities to continuously re-use wastes to produce new goods. Innovative technologies like robotisation, 3D

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printing, chemical recycling, big data, and artificial intelligence enable the re-localisation of industrial processes and the mining of urban areas for secondary materials. This is all powered by abundant renewable energy from large-scale solar and wind farms, hydroelectric dams, and geothermal plants. This smart energy grid also provides power for an electrified transport system combining high-speed rail, autonomous vehicles, and passenger drones, with electric scooters, buses, bikes, and aeroplanes.

Buildings are constructed with recovered resources and sustainable bio-sourced materials. Urban spaces are optimised, renovated, insulated, and greened as much as possible. The need for offices and housing is reduced thanks to co-working and house-sharing platforms. A myriad of sharing economy activities emerge thanks to new information technology platforms enabling people to rent, lend, and share tools, knowledge, work, cars, bikes, resources, and much more. In this networked economy, people become less inclined to own products and rather seek access to their transportation, cleaning, computing and other needs. Companies thereby switch from selling products to providing services through product-services systems like leasing phones and washing machines instead of selling them.

Agriculture systems are also transformed by combining organic agricultural practices with high-tech innovations like vertical farming, aquaponics, hydroponics, autonomous tractors, and genetic engineering. This enables the provision of diverse diets of fresh produce for humans, the production of biofuels for energy use, the supply of biomaterials for industrial applications (such as bioplastics). Bio-digestors and wastewater recovery systems also enable the efficient re-utilisation of urban organic waste as fertilisers.

The nation state remains the dominant model of governance, but some local participatory mechanisms are encouraged (such as participatory budgeting) and transparent, open, and accountable representative institutions are reinforced. The welfare state is also strengthened and redistributes excessive inequalities while ensuring the access of basic services for all, such as education, healthcare, and social security. Moreover, international organisations are empowered to address global sustainability challenges in a collaborative manner, such as climate change, poverty reduction, and biodiversity protection.

While privately owned corporations remain the norm, and capitalist power relations subsist, a greater voice is given to unions, workers, and stakeholders in business boards. A triple bottom line of profit, planet, and people thus guide corporations and help create socially responsible and environmentally sustainable business models. An anthropocentric and liberal worldview based on the respect of human rights and an aspiration to pursue sustainable development within capitalist market relations guides socio-cultural practices.



Figure 24.4 Visual representation of a Reformist Circular Society future (Calisto Friant 2022)¹

24.3.3 The Transformational Circular Society Future

Transformational Circular Society (TCS) discourses are *sceptical* about the capacity of technology to prevent socio-ecological collapse and *holistic* as they integrate many social justice and political empowerment considerations (see **Figures 24.1** and **24.5**). These discourses seek to create a fair, democratic, de-colonial, and sustainable post-capitalist future where humanity and nature live in mutual harmony by re-localising and redistributing power, wealth, and knowledge. It is a society where industry belongs to workers, democratic public institutions, and communities rather than private investors and bondholders. Profit motives and endless economic growth imperatives thus no longer dictate economic and political decisions. It is a society where power is equally shared amongst all thanks to a plurality of deliberative democracy innovations such as citizen assemblies of randomly selected citizens, participatory budgeting processes, referendums, and citizen initiatives. It is an economy that redistributes wealth and resources from those that have the most to those that have the least, thanks

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to high taxes on wealth and a diversity of social justice programs like job guarantees, universal healthcare, public childcare, free education, abundant social housing, social security, and universal basic income (UBI) etc.

It is an economy run through social and solidarity economy practices of care, reciprocity, and solidarity. There is hence an abundance of economic and social initiatives that care for humans and non-humans alike, such as repair cafés, community gardening, fab-labs, cooperative firms, support groups, sharing initiatives, convivial biodiversity conservation and ecosystem regeneration projects etc. Working time is reduced to allow people to be involved in all the above community activities or any personal, artistic, spiritual, relational, or family project. Productive work, personal achievement and competition are no longer the foremost goals in life, allowing for slower, more meaningful, and convivial forms of life. Citizens thereby gain a renewed sense of freedom and control over their time and the meaning they wish to give to their lives.

Industrial and manufacturing systems are as low-tech as possible and focus on providing for real human needs rather than endless artificial wants. Products are highly durable and easily repairable and upgradable. Product patents and manuals are open and free to facilitate modularity and innovation. People thus partake in a plurality of repair, repurpose and do-it-yourself activities that give them tangible control over their material resources.

Global energy use is reduced to sustainable levels for the biosphere, and it is shared to ensure enough energy is available for everyone. Moreover, energy is produced in socially and environmentally respectful manners thanks to decentralised energy grids of community-owned renewable sources like wind turbines, geothermal plants, and solar panels.

All agriculture is organic, highly biodiverse, and as local as possible, utilising urban food waste for community composting and urban agriculture. Cooking and food preparation is cherished and slowed down, with deep care and appreciation for diverse, seasonal, healthy, plant-based ingredients that ensure human and planetary well-being.

Transportation needs are reduced as much as possible by planning inclusive walkable cities, with easy access to local goods and services for all thanks to plenty of green spaces, accessible sidewalks, and bike lanes, as well as free and quality public transport systems. This leads to convivial cities and neighbourhoods with access to local markets, parks, communal spaces, gardens, and public services for everyone, regardless of class, gender, ethnicity, sexual orientation, race, (dis)ability or age. Long-distance travel is reduced to a minimum and, when necessary, it happens by train or sailboat and supports community tourism that respects local cultures and ecosystems.

The construction of additional buildings is reduced to a minimum by focusing instead on repurposing unused or under-used buildings and preventing the unfair and unsustainable accumulation of building stock through. When infrastructure construction is necessary to meet social needs, it focuses on using local materials and socio-ecologically responsible building practices. Biodiversity is cherished by protecting ecosystems, prioritising green infrastructure, and replacing unnecessary parking, roads and highways with green belts and roofs.

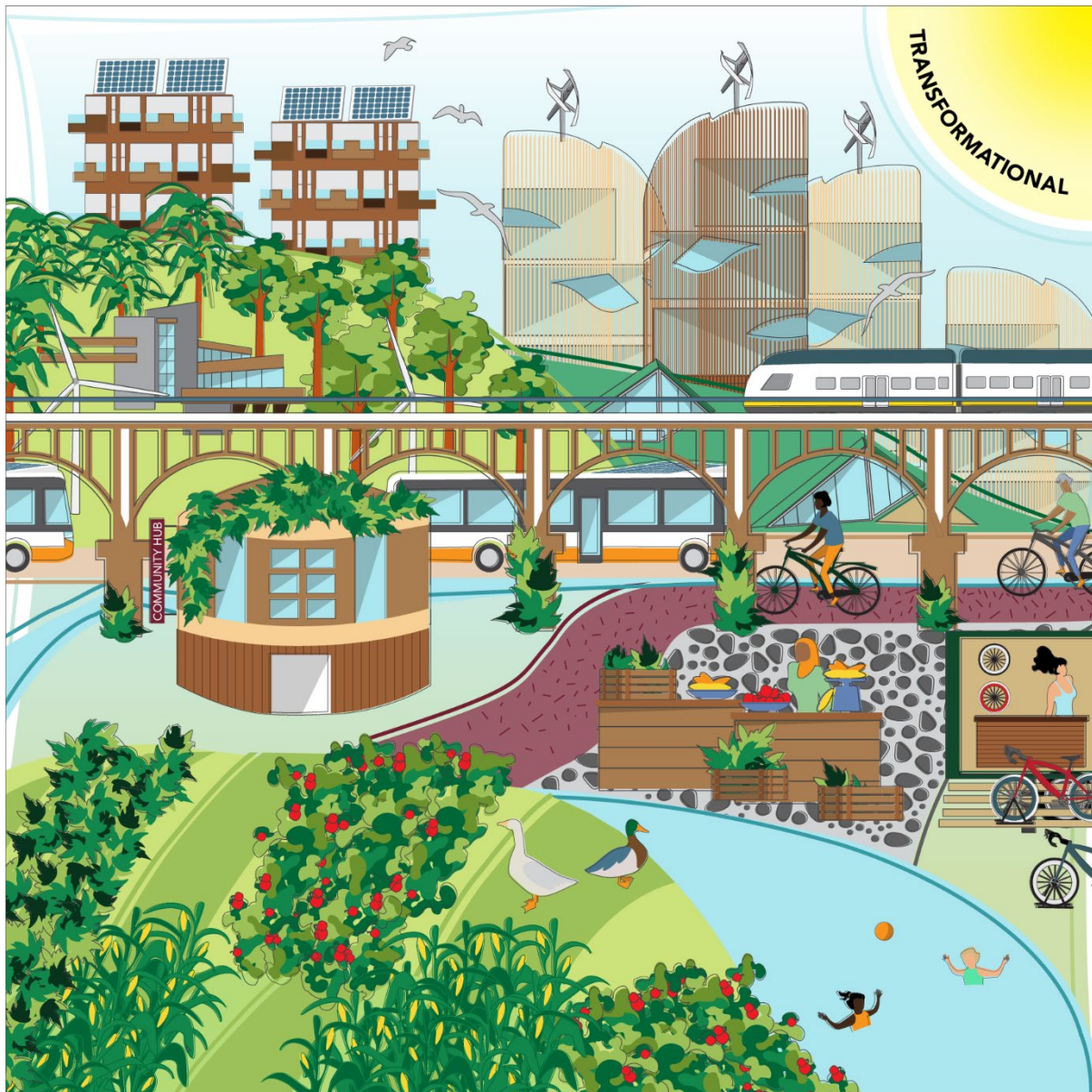


Figure 24.5 Visual representation of a Transformational Circular Society future (Calisto Friant 2022)¹

24.3.4 The Fortress Circular Economy Future

Fortress Circular Economy (FCE) discourses are *sceptical* about the capacity of technology to prevent socio-ecological collapse and *segmented* as they don't include social justice and political empowerment considerations (see **Figures 24.1** and **24.6**). They describe a future in which biophysical stability is severely weakened and geostrategic resource security is sought through technological innovations and top-down controls on people and resources. FCE discourses are concerned about the tangible shortages caused by overpopulation and the overconsumption of natural resources. Yet, instead of envisioning a utopic vision to solve these socio-ecological challenges and prevent planetary overshoot, they see climate breakdown and ecological collapse as inevitable due to the entrenched nature of capitalist power relations and a generally negative vision of human nature. Therefore, rather than attempting to describe the world as it should be, FCE discourses focus on describing the world as it will most likely be if current unsustainable socio-ecological trends continue.

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FCE discourses thus see a world where people seek to protect themselves and maintain access to resources despite the surrounding collapse. Protection from mass climate-induced migration is intensified with heavy security apparatus of walls, surveillance systems and migration controls. Military and economic domination and coercion are used to secure access to key resources and build high-tech industrial societies. Minerals for wind turbines and solar panels, uranium for nuclear power plants, and land for bio-fuels are thus obtained throughout the globe by some societies, despite global shortages that prevent others from accessing these resources. Military and police power also enables some societies to impose the conservation of critical biodiversity hotspots, and to restrict access to fossil fuels. It thereby secures key planetary functions and resources for some humans to enjoy by imposing sufficiency on all others.

Islands of material wealth and abundance are hence created by neo-colonial and imperial practices. This allows some societies to maintain high-speed rail networks, autonomous vehicles, passenger drones and malls filled with electronics, clothing, furniture, and other goods for those that can afford them. Climate engineering, autonomous tractors, AI, GMOs, and biotechnology maintain a limited supply of foods and industrial feedstock for those who can afford them. Water scarcity and pollution are rampant due to constant droughts, floods, and heatwaves, but new water-saving, decontamination and desalination technologies provide water access for those who can pay for it.

In the most powerful cities, buildings and urban systems are highly efficient and interconnected thanks to big data, AI, and the internet-of-things to ensure the effective use of limited resources. Innovative recovery technologies and strong integration between powerful consumption and production centres ensure the efficient recovery, remanufacture, refurbishment, and recycling of waste materials for new products and services. Some nations use high-tech robotisation, automatization, bioengineering, and machine learning technologies to create eco-industrial systems with optimum labour, energy, and material efficiency. However, these industrial tools and resources remain inaccessible to most of the Earth's population. In fact, for most of humanity, informal settlements and refugee camps are the norm, and people undertake multiple informal activities (such as waste picking and scavenging) to make a living due to widespread job scarcity.

An FCE future is a world where socio-ecological crisis has become the new normal. Current social disparities along racial, class, gender, property, health, and ethnic lines are reinforced and exacerbated as those with historical power are able to maintain access to the limited resources that remain. All in all, it is a bleak portrait of the future where a minority of people in a few countries secure a relative material abundance amidst a heavily degraded planetary system with strong resource constraints for most of humanity. It is circularity and sustainability for those that can afford it and imposed sufficiency for all the rest.

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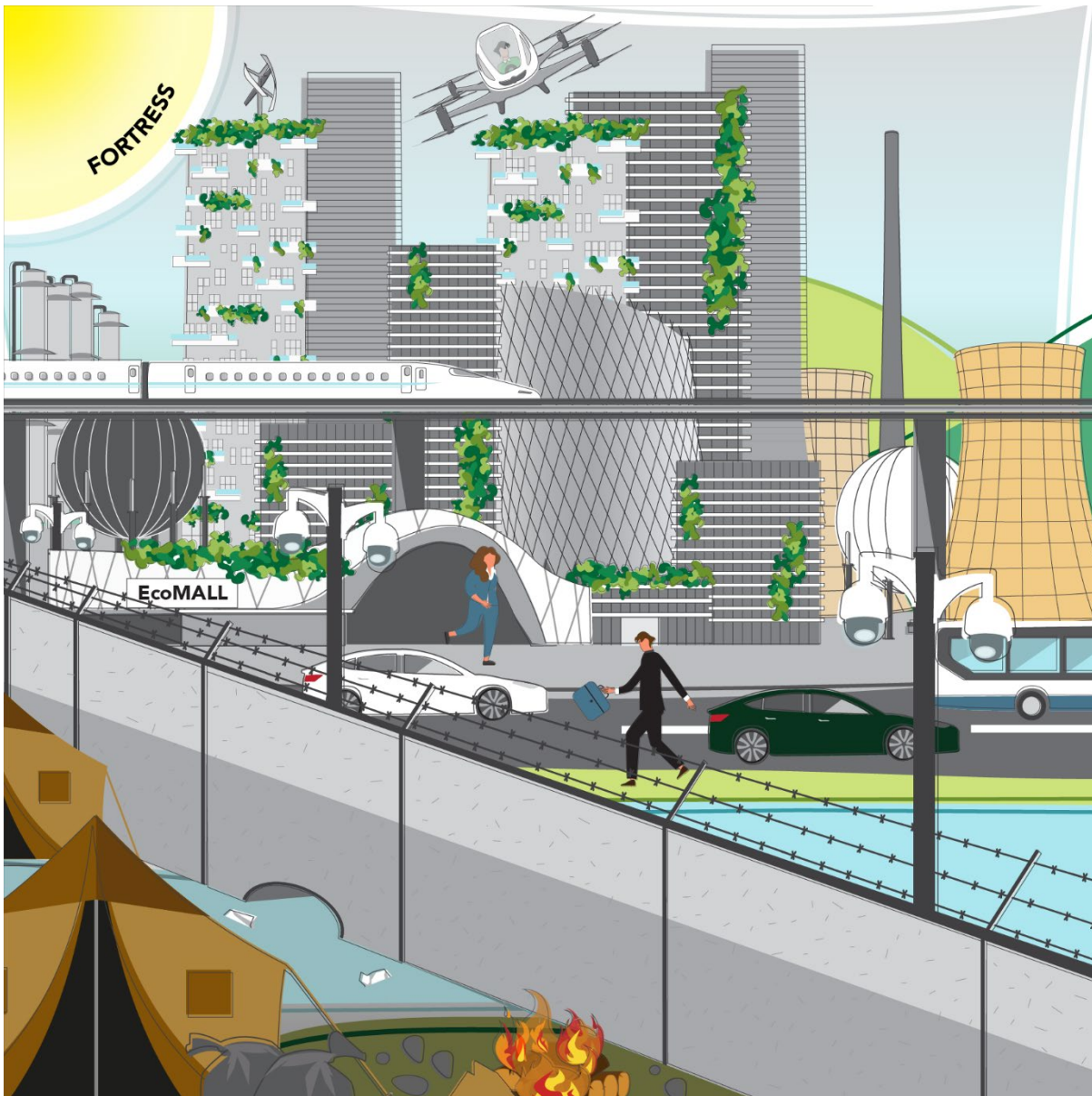


Figure 24.6 Visual representation of a Fortress Circular Economy future (Calisto Friant 2022)¹

Table 24.1: Summary of sectoral transformations envisioned for 2050 by the four circularity discourse types

	Technocentric Circular Economy (<i>optimist and segmented</i>)	Reformist Circular Society (<i>optimist and holistic</i>)	Transformational Circular Society (<i>sceptical and holistic</i>)	Fortress Circular Economy (<i>sceptical and segmented</i>)
Energy	Energy use increases through the expansion of solar, wind, hydrogen, biofuels, nuclear, and fossil-fuels with carbon-capture and storage.	Energy use increases through the expansion of smart grids, large-scale solar and wind farms, hydroelectric dams, and geothermal plants.	Global energy use is reduced to sustainable levels and is produced in socio-ecologically respectful manners through community-owned renewable sources (mostly wind and solar)	Energy use decreases for most of humanity but rises for the wealthy, who can pay for new technologies (e.g. biofuels, hydrogen, solar, nuclear, and carbon-capture and storage).
Agriculture	High-tech and highly automatised industrial agriculture system using AI, robotisation, and GMOs to produce food and industrial feedstock (biofuels and biomaterials) and recuperate urban wastes as fertiliser.	Combining organic agricultural practices with high-tech innovations like vertical farming, AI, bio-digestors, robotisation, and GMOs to produce food and industrial feedstock and recuperate wastes as fertiliser.	Agriculture is organic, highly biodiverse, and locally produced using urban food waste for community composting and urban agriculture. Healthy plant-based diets ensure human and planetary well-being.	High-tech and highly automatised industrial agriculture system using AI, robotisation, and GMOs to produce food and industrial feedstock for those who can afford it.
Industry	Business models focus on servicing and leasing. Re-localisation of production through robotisation, and machine learning as well as advanced recovery technologies that recuperate wastes from consumption centres.	Business models focus on servicing and leasing. Re-localisation of production through robotisation, and machine learning as well as advanced recovery technologies that recuperate wastes from consumption centres.	Industry as low-tech as possible and focuses on providing essential needs rather than endless wants. It is run through social and solidarity economy practices including cooperatives, repair cafés, and sharing initiatives.	Powerful countries have integrated production systems through robotisation, and machine learning as well as advanced recovery technologies that recuperate urban wastes.
Building and infrastructure	Focus on using recovered or innovative sustainable building materials as well as smart technologies and big-data solutions to improve energy efficiency.	Focus on using sustainable building materials, smart technologies, and nature-based solutions to improve eco-efficiency as well as co-working and house-sharing to optimise the use of space.	Construction is reduced to a minimum by focusing on repurposing unused buildings and preventing the unfair and unsustainable accumulation of building stock. Construction is based on socio-ecologically responsible local materials.	Powerful cities use innovative, sustainable building materials as well as smart technologies, AI and big-data solutions to improve energy efficiency. Informal settlements and refugee camps are the norm for the rest of humanity.
Transport	Focus on high-tech private transport through autonomous vehicles, passenger drones combined with high-speed rail and aircraft powered by biofuels, hydrogen, or electric batteries	High-tech electrified transport system combining private and public systems such as passenger drones, scooters, bikes, autonomous vehicles, buses, high-speed rail, and aircraft powered by green fuels.	Transportation needs are reduced by planning walkable cities, with easy access to local services, accessible sidewalks, bike lanes, and free public transport. Long-distance travel is reduced are privileges rail and sail.	High-tech transport is available for the wealthy, including autonomous vehicles, passenger drones, high-speed rail and aircraft powered by biofuels, hydrogen, or electric batteries.
Consumption	Consumption focuses leasing and access rather than ownership.	Focus on leasing and access rather than ownership. Many sharing economy platforms so people can rent, lend, and share tools, work, cars, bikes etc.	Products are durable, repairable, and upgradable. People have greater control over their material resources as parents and manuals are open.	Small percentage of humanity maintains high material wealth, amidst global poverty.
Governance	Social considerations are absent, so they will replicate current social relations and working practices, and reproduce present racial, class,	Nation-states based on accountable representative institutions share power with international organisations to address local and global sustainability challenges.	Deliberative democracy innovations such as citizen assemblies, participatory budgeting, and referendums ensure that power is equally shared by all citizens.	Powerful countries use their economic and military power to secure access to key resources despite global shortages.

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Social welfare	gender, property, health, and ethnic disparities.	Welfare states redistribute excessive inequalities and provide for some basic needs like healthcare and education. Regulated markets provision most other goods and services.	Strong redistributive focus through high taxes on wealth and social justice programmes like job guarantees, universal healthcare and education, social housing, and UBI.	Powerful countries maintain social security for their citizens through strict migration controls and protections.
Work relations		Capitalist private ownership of corporations continues but with a greater voice to unions, workers, and other stakeholders and a focus on a triple bottom line (people, planet, profit).	Companies belong to workers and communities rather than private investors and bondholders. Working time is reduced , and work-relations are equal, fair, and democratic.	Capitalist private ownership of corporations prevails and offers some formal employment in powerful capitals. Most of humanity survives from precarious informal work.
Culture and worldviews		Anthropocentric vision based on liberal vision of human rights and sustainable development within capitalism.	Postcapitalist worldview based on care, solidarity, and reciprocity for human and more than human life and a deep focus on socio-ecological well-being through conviviality, and radical democracy.	Cultural relations remain unchanged , and replicate present racial, class, gender, property, health, and ethnic disparities.
Scientific validity	Lacks scientific validity because it assumes that eco-economic decoupling is possible. Projections for increased energy and resource use are thus incompatible with planetary limits.	Lacks scientific validity because it assumes that eco-economic decoupling is possible. Projections for increased energy and resource use are thus incompatible with planetary limits.	Scientifically valid because it is not based on eco-economic decoupling. It thereby recognises and adapts to planetary boundaries and resource limits.	Scientifically valid because it is not based on eco-economic decoupling. It thereby recognises and adapts to planetary boundaries and resource limits.

24.4 Discussion

First and foremost, it is important to note our description of 4 circular futures is an inevitable simplification of complex visions, and its main objective is to help understand the core differences across most circularity discourses to date. Moreover, the actual future of our planet is unpredictable and will depend on how we address present challenges today. **Table 24.1** resumes the key elements of the four described futures to help us compare and contrast their core ideas.

Each of the above discourses has its strengths and weaknesses. RCS and TCE visions place too much hope on sustainable technological innovations to address resource shortages, climate change, and biodiversity collapse. This is clear now that decades of academic research have evidenced that the absolute decoupling of economic growth from environmental degradation cannot occur on a scale sufficient to prevent climate breakdown and biodiversity collapse (Haberl et al. 2020; Hickel and Kallis 2019; Jackson 2016; Parrique et al. 2019; Wiedenhofer et al. 2020).

The idea of perfectly circular resource cycles is simply biophysically impossible. Indeed, materials inevitably degrade and dissipate each time they are cycled. Moreover, in a growing economy, recovered materials can only provide a fraction of our resource needs. More natural resource extraction and environmental degradation will thus remain necessary as long as economic growth continues, so the TCE and RCS visions of a perfect regenerative economy are impossible in the present growth-dependent capitalist system (Genovese and Pansera 2020; Giampietro and Funtowicz 2020).

On the other hand, TCS discourses are perhaps too optimistic about the possibility of transforming current capitalist ways of life, social structures, and power relations in a fair, democratic, and sustainable manner. Envisioning a post-growth society, and thus, a post-capitalist future, does seem like a far shot, especially in a

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discursive landscape that makes many people believe that “there is no alternative” and think that “it is easier to imagine an end to the world than an end to capitalism” (Fisher 2009). Yet, as Christian Felber puts it, “there are plenty of alternatives” (Felber 2015) thanks to a rich history of social movements and ideas from the GN and South alike that have proposed and enacted radically different ways of living and flourishing (like degrowth, buen vivir, ecological swaraj, steady-state economics, economy for the common good etc.).

On the opposite end of the spectrum, FCE discourses place no hopes neither on technological innovations nor on fair societal transformations. Instead, they rationally, and perhaps cynically, describe the future of humankind and planet Earth if nothing is done to reverse current unsustainable trends. Yet, it is also clear that this is not a world where anyone would like to live, except perhaps some wealthy elites who own crucial technologies and industries and could thus maintain and grow their positions of power.

One thing is certain: we live on a finite and fragile planet with key boundaries and limits, and if we keep overshooting them, the Earth’s climate and ecosystems will inevitably break down and collapse, and critical resources will be exhausted. If we decide to believe in capitalism and the idea that technology can allow us to decouple economic growth from environmental degradation, then we are bound to see crucial planetary functions and ecosystems fail before our eyes. However, if we develop a post-capitalist society that can operate beyond economic growth, then we might have a chance of living in a desirable future that truly leaves no one behind. The real choice is thus not between a TCE, RCS, TCS and FCE society but actually between a TCS and FCE society because those are the only discourses that take the very real material limits of our planet into account.

Thankfully, there are a plurality of circular visions and ideas from the GN and South that have developed a wide range of post-capitalist and post-growth societal visions (and TCS discourses described above are just the tip of the iceberg). They are a breadth of inspiration that can help us overcome the socio-ecological challenges of the 21st century.

Unfortunately, these alternatives are currently not being fully explored as research on CE has found that TCE is currently, by far, the most dominant discourse in public and private institutions (Arai, Calisto Friant, and Vermeulen 2023; Berry et al. 2021; Calisto Friant, Lakerveld, et al. 2022; Calisto Friant et al. 2023; Calisto Friant, Vermeulen, and Salomone 2021; Campbell-Johnston et al. 2020; Melles 2021; Ortega Alvarado et al. 2021; Palm et al. 2021). CE debates and implementation to date have thus not sufficiently addressed the socio-political implications of a circularity transition and the biophysical limits to economic growth. But what would most people prefer when envisioning a circular future?

There is little research on CE perceptions; two recent studies of civil society and citizen perceptions of CE in the EU show that a more holistic and socially inclusive approach to CE is preferred (Lazarevic and Valve 2017; Repo et al. 2018). Three recent surveys also suggest that citizens would prefer TCS discourses. The first survey by the Observatory of Utopic Perspectives in France found that 54.6 % of respondents prefer a sufficiency-oriented and inclusive ecological utopia rather than a growth and technology-oriented neoliberal utopia (15.9%) or a conservative traditionalist utopia (29.5%) (Observatory of Utopic Perspectives 2019). The second survey, by the Global Commons Alliance, found that 74% of people in G20 countries agreed that governments should move beyond focusing on economic growth and profits and instead focus more on human well-being and ecological protection (Gaffney et al. 2021). The third survey found that 60.5 % of people in 34 European countries favour post-growth values such as environmentalism, collectivism and altruism as opposed to neoliberal capitalist values like hierarchy, individualism, and materialism (Paulson and Büchs 2022).

Moreover, a recent survey on CE perceptions around the world by Utrecht University and Revolve Circular found that *holistic* circular society discourses (TCS and RCS) were preferred compared to *segmented* discourses (FCE

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and TCE) (51.6% vs 48.4%) and that respondents placed a high degree of importance to social justice concerns and consumption/production reduction imperatives (Calisto Friant, Vermeulen, et al. 2022).

The abovementioned research suggests that the *TCE* discourse, which dominates the current debate on circularity, does not align with what citizens would prefer when they are asked to think of a circular future. While these surveys have their limitations, many other studies find that when citizens openly and freely deliberate in a well-informed, inclusive, and democratic environment, they tend to make significantly more sustainable decisions than politicians (Cabannes 2018; Calisto Friant 2019; Dryzek et al. 2019; Fishkin 2018). Research even finds that, in a democratic context, citizens choose to forgo personal gains for the benefit of future generations (Hauser et al. 2014).

A deliberative governance process that hands decision-making power to citizens could help co-design and implement fair and sustainable circularity policies that subordinate economic growth to planetary boundaries and social justice imperatives. This democracy is also needed in the workplace by replacing the hierarchical shareholder capitalism of corporations working to generate endless profits for their stockowners, with non-profit cooperatives owned and managed democratically by workers for the benefit of their socio-ecological communities. Indeed, a more diverse, democratic, and inclusive construction of a circular future is needed to better include the plurality of citizens' discourses and perspectives on circularity.

24.5 Conclusions

This chapter explored 4 CE futures and their key sustainability implications. Our insights suggest that the hegemonic and growth-focused TCE discourse is more a "fairy tale" of technological innovation and competitiveness than a feasible circular transition to all humanity. This TCE future will likely provide many benefits for a few leading businesses, industries, countries, and economic actors but will also most certainly be unable to ensure a dignified life for all humanity and prevent the overshoot of planetary boundaries. In fact, such a future might worsen the unsustainable extraction of natural resources from the GS and could end up exacerbating current patterns of neo-colonial discrimination and exploitation along gender, race, class, and ethnic lines. The TCE vision may have become the hegemonic CE discourse precisely because it ignores these social and political implications. It is hence a depoliticised discourse that seeks to create a CE transition that does not challenge the current growth-dependent capitalist system of endless expansion and commodification of life and nature. In this vision, transition "from linear to circular" simply means better recycling and recovery technologies rather than addressing the systemic causes of our current socio-ecological crisis. It is thus unsurprising that such a discourse gained so much traction in the policy and business arena, as it promised the illusion that a circular flow of materials could allow capitalist economies and businesses to continue growing.

Yet, this TCE discourse is in no way the only vision of a circular future. There are many different circular visions that subordinate economic growth and profits to social and ecological imperatives. We explored these in the FCS future, and as mentioned above, various surveys suggest that citizens actually prefer a more transformative and socially inclusive circularity transition. More inclusive and participatory development of circularity policies, where citizens can openly deliberate and decide on the course of the circularity transition in an informed and democratic

manner, would thus likely allow us to overcome current lock-ins and path dependencies. Hence, we must, first and foremost, call for real democracy, one that empowers people through randomly selected citizen councils, non-

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profit cooperatives, and other institutions that can break powerful interests and lead the way to a socially legitimate and ecologically feasible circularity transition.

More research is needed to gain a better picture of what circularity discourses people find most appealing and what circular economy and society policies they would choose in a democratic context. Further research on circular futures and citizen perspectives and preferences on circularity is hence much needed to help better plan and envision a desirable circular transition that actually brings about improvements in human and planetary well-being. In doing so, our chapter and our illustrations of the four different futures can help visualise the full picture and diversity of circularity visions that exist, with their key differences and commonalities. It can also help imagine a plurality of solutions, practices and policies that can be developed within different circularity approaches. Finally, it can help in transdisciplinary research activities and participatory workshops to define democratic agreements and common visions regarding the shape and type of circularity transition that people can aspire to co-design and co-create.

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Chapter 25. Interfaces of Transformative Innovation Policies, Socio-environmental Justice and Circular Economy: a focus on the Brazilian Semiarid Region

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Abstract

Transformative Innovation Policies (TIPs) represent a novel approach that links innovation with societal and environmental challenges during the transition towards low-carbon systems. This framework illuminates the interplay between political dynamics and socio-environmental equity, especially in regions marked by resource scarcity and unequal distribution. A prime example is Brazilian semi-arid area, characterized by resource limitations leading to unhealthy practices like using hazardous firewood for cooking. The Biodigestor Sertanejo Program, a result of collaboration among the Brazilian Government, the UN's International Fund for Agricultural Development (IFAD), and the Global Environment Facility (GEF), has been operational since 2008 to promote sustainable production in this region. This research focuses on this initiative, leveraging TIPs, social/environmental justice, and circular economy literature to analyse policy documents. Through assessing intervention goals and project execution data, the study aims to gauge the efficacy of the program in providing technological innovation access, fostering stakeholder engagement, and ensuring a socially and environmentally equitable transition.

Keywords: Transformative Innovation Policies; Justice; Circular Economy, Sertanejo Biodigestor Program

The Chapter addresses the issue of inadequate access to essential resources in the Brazilian semi-arid region, causing precarious living conditions. TIPs are proposed to connect innovation with social and environmental challenges, aiming for an equitable transition to sustainable low-carbon systems within the framework of CE.

25.1 Introduction

In recent years, the circular economy (CE) concept has gained popularity as an effective way to reduce the harmful impact of linear economic models on the environment (Stahel, 2016, Kirchherr et al., 2017; Geissdoerfer et al., 2017). However, although the CE model is widely considered to be a response to ecological issues, some have pointed out its failure to consider the social consequences of this model (Padilla-Rivera et al., 2021). The social implications of CE models have received insufficient attention, perhaps due to a lack of conceptual clarity (Mies

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and Gold, 2021). This indicates that there is an emphasis on the productive aspects of the economy, which has given rise to many criticisms of the CE model (Kopnina, 2019; Temesgen et al., 2021). The CE has great potential to address environmental concerns, but is sometimes negligent in the social pillar (Blomsma & Brennan, 2017). Thus, it is necessary to develop discussions committed to evaluating the social ramifications of the CE model that addresses social challenges. Against this background, the research is framed within the multidimensional framework proposed by the JUST2CE project, emphasizing the need for a comprehensive evaluation of the CE transition. The framework comprises four key dimensions: framing, vulnerability, distribution, and learning. Framing involves understanding how different actors interpret and shape the CE transition, while vulnerability delves into the social and epistemic injustices present within CE discourse. Distribution examines the geographic and social inequalities associated with CE policies, while learning emphasizes the importance of participatory approaches and reflexivity in knowledge production. These dimensions are interconnected, promoting a holistic understanding of the complexities of the CE transition. The framework encourages a critical examination of power dynamics, marginalized voices, and global inequalities within the context of the CE implementation. Inserted in the CE dynamics is biogas. Biogas production is an excellent approach that helps reduce waste and mitigate greenhouse gas emissions, showing the use of a CE model (Wang et al., 2021). In the Brazilian scenario, CE is seen very positively in contexts of scarce resources, as is the case of the Semiarid Region. It is a region that faces serious socioeconomic difficulties, such as poverty, limited economic diversity and lack of access to safe ways of cooking. These challenges significantly limit income generation and employment prospects for communities in the region (IPEA, 2019). Biogas has been seen as an alternative to face the environmental, social and economic challenges that developing regions are subject to (Diouf & Miezán, 2019). Committed to contributing to this problem, the Sertanejo Biodigestor Program seeks to promote this form of energy as a solution to social issues in the Brazilian semi-arid region. This biogas promotion policy serves as an excellent approach to a CE, since, through the use of biodigester technology, rural organic waste is treated for the production of cooking gas and fertilizers (Silva & Correia, 2020).

This research aims to evaluate the effectiveness of the Sertanejo Biodigestor Program in promoting access to technological innovation, with attention to the dimensions of distribution, participation and recognition of EJ (EJ). Thus, this study seeks answers to the following research question: *How can the Sertanejo Biodigestor Program be evaluated in relation to its strengths and weaknesses considering the dimensions of distribution, participation and recognition of Environmental Justice?* By analysing the connection between energy justice and transformative innovation policies from a case study, this research can help public policies and initiatives committed to ensuring an equitable and sustainable transformation in rural areas. By pointing out the challenges and opportunities of this policy, this study also sheds light on the prospects for promoting social and EJ in the promotion of biogas in a context marked by major environmental, economic and social problems.

25.2 Literature review

25.2.1 EJ and its dimensions

The distribution of natural resources has been widely discussed in recent years, as it relates to the production or intensification of inequalities. The displacement of environmentally harmful activities in GS regions and the

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resulting "ecological debt" has triggered significant environmental distribution conflicts as highlighted by EJ advocates and scholars (Hornborg and Martinez-Alier, 2016; Martinez-Alier, 2021; Scheidel et al., 2018). These disparities necessitate acknowledgment and response within the frameworks of CE underscoring the importance of addressing global structural asymmetries. Apart from the geographical allocation of burdens and benefits, the concept of "justice" entails ensuring equitable access to resources and opportunities to rectify inequalities and vulnerability (Barca, 2020). Committed to discussing these disparities, EJ has increasingly approached complex dimensions of the social sphere (El Amrani, 2021; Lessmann & Steinkraus, 2019). The focus of EJ, in general, is on highlighting the environmental burden and lack of access to decision-making of economically, socially and politically marginalized communities (Pellow, 2021). In view of this, EJ is indicated as a promising approach to investigate aspects related to the development of the CE, with emphasis on the social dimension of these processes (Menton et al., 2020). Sustainable Development (SD) is increasingly linked to EJ (Schlosberg et al., 2019). Social justice, economic well-being and environmental management are interdependent dimensions so the EJ and the SD act from this discussion in the direction of revealing problems and finding solutions for the unequal distribution of natural resources and for the way in which this dynamic generates social marginalization in the context of environmental exploitation (Pellow, 2021). The questions mentioned above arise from the recognition that if not handled fairly, transitions towards sustainability (considering all dimensions) have the potential to impose unwarranted challenges on workers and their communities, potentially resulting in resistance that could impede the successful execution of required actions. From this standpoint, the concept of a "just transition," originating from the labor movement, takes on significant importance. Brian Kohler, a Canadian labor member, encapsulated this concept back in 1966 when he asserted, "*The real choice is not jobs or the environment. It is both or neither.*" This statement succinctly captures the essence of the just transition idea, which remains highly relevant in our current era marked by profound political polarization and the tension between employment and environmental concerns (Eisenberg, 2019).

Schlosberg's EJ theory (2004) contributes to the reflection on this theme, as it identifies three key issues to be observed: *distribution*, *participation*, and *recognition*. *Distribution* refers to the allocation of material goods and rights/duties among the members of society. *Participation* is related to decision-making, referring mainly to understanding how opportunities for participation by communities and individuals are made possible to demand EJ and equity in the distribution of environmental impacts. Finally, *recognition* refers to the inclusion of all subgroups in a society in any attempt at development and the explanation of how the most privileged groups achieved this status and why. Furthermore, it involves valuing cultural diversity and respecting the unique perspectives and experiences of affected communities. Schlosberg's structure (2004) can help answer the main criticisms of CE pointed out by the current literature. By bringing EJ into CE policies, weaker groups, such as precarious workers, would engage in the social and economic policies to be applied and the subgroups of a society, which should be included in any attempt at development. Known as the tripartite EJ framework, this theory provides a holistic and intersectional approach to understanding and addressing issues of EJ. Thus, it is recognized that EJ is not restricted to the distribution of environmental risks and benefits, but also involves complex issues of recognition and participation, essential to ensure equitable and sustainable environmental outcomes for all. By including EJ in CE policies, it is possible for policies to walk in fairer, more equitable and sustainable ways in relation to their impacts on people and communities. Thus, EJ is also increasingly linked to SD principles, as the social dimension is critical to ensure that a society is sustainable in environmental and economic terms.

25.2.2 Transformative Innovation Policies (TIPs) and their interfaces towards EJ and CE

The search for EJ has been one of the main demands of civil society, especially those communities that disproportionately suffer the negative effects of environmental imbalance (Liotta et al., 2020). In this context, it is important to understand how political and economic paradigms relate to the issue of EJ and how innovation policies can contribute to a more inclusive and sustainable approach. The political paradigm of TIPs has proven to be an alternative to deal with the current crises, by connecting innovation with social challenges and transformative changes, opening a new discursive space for discussions and policy advances (Diercks et al., 2019). The emphasis on the interactive nature of innovation allows bringing together different parts of the system for the development of innovation, including companies, cities, communities and organizations that can contribute to sustainable transitions (Geels, 2020). TIPs also aim to address failures in policy coordination and reflexivity that often impede the effectiveness of innovation policies. Failure to coordinate policies refers to the inability to horizontally coordinate policies in different domains, such as environmental policies, fiscal policies, economic, social and employment policies, which can generate inequalities and negative impacts on vulnerable communities (Akon-Yamga et al., 2021). These discussions point out that EJ involves social issues that must be included in the political agendas of innovation and technology. This means ensuring that innovation policies are inclusive and consider the needs of historically marginalized communities and social groups. Furthermore, it is important to consider that technological solutions are not enough to address issues of EJ. As Bullard (2021) points out, EJ requires a holistic and interdisciplinary approach that considers the social, cultural and political dimensions of environmental problems. This implies listening to and involving affected communities in political decisions and the construction of sustainable and inclusive solutions. The emergence of this new political paradigm, focused on connecting innovation with social and environmental challenges, points to the need for new solutions to deal with the current crises and for a more inclusive policy that involves different actors and considers different dimensions. In this context, the TIPs approach seeks to address flaws such as directionality, policy coordination, articulation of reflexivity and geographic dimensions, seeking to promote a transition to more sustainable practices. TIPs propose an innovative approach to deal with social and environmental challenges, through the connection between innovation and transformative changes. TIPs consider innovation as an interactive and social process, involving different stakeholders, including companies, cities, communities and organizations. TIPs thus aim to create an environment conducive to innovation and systemic changes that can lead to sustainable and inclusive transitions (Schot & Kanger, 2018). It is important to remember that this approach argues that an emphasis on the interactive nature of innovation allows the connection between different parts of the system for the development of innovation (Geels, 2020; Diercks et al., 2019). The approach of the TIPs is important for the discussion on EJ, since it considers the inclusion of different actors and the concern with the social and environmental dimensions in the innovation policy.

In this study, we examine TIPs and their role in disseminating this technology as a strategy to drive and enhance the adoption of biogas technology in Brazil. Therefore, by adopting the perspective of TIPs to analyze this case, we recognize that this initiative goes beyond simple technology promotion but encompasses systemic changes, addressing economic, institutional, and social challenges to drive the adoption and positive impacts of biogas technology in small rural properties in the Brazilian semiarid region.

25.3 Materials and Methods

In this section, the methodological aspects related to the analysis of the Sertanejo Biodigester Program will be presented from the participation, recognition and distribution dimensions of Schlosberg's theory (2004) on EJ.

25.3.1 Case Study

The Biodigester Sertanejo Program is a social initiative that aims to contribute to the sustainable development of the Brazilian semi-arid region (Carvalho & Lago, 2020). Although the first biodigesters of the Program were delivered in 2009, this social technology has reached a larger number of families in recent years, through a biogas production system from rural waste, used as a source of energy to cook food and as a fertilizer that spread throughout Brazil. The Program is part of a larger project known as Dom Helder Câmara. The project is funded by the International Foundation for Agricultural Development (FIDA) and the Brazilian government, the initiative developed actions with around 54,000 families from 913 municipalities that live in the Brazilian semi-arid region by offering technical assistance and social promotion, coordinating and implementing actions that seek to training to improve income and promoting economic, social and organizational autonomy (Barros et al., 2020).

Figure 25.1 show that the low-cost sertanejo biodigester is a simple system that uses the anaerobic decomposition of organic waste to produce biogas. Approximately 2,000 biodigesters have already been constructed, and additional projects are in progress to further disseminate this technology in the region, thousands of people to benefit from it. Installed close to sources of organic waste, such as animal manure and food waste, the technology consists of an excavated pit lined with impermeable materials. It consists of four boxes: inlet box, fermentation box, gas storage tank and outlet box. Organic waste is added through an inlet and undergoes anaerobic fermentation inside the biodigester, resulting in the production of biogas, which is used by households for cooking, while its effluent can be used as organic fertilizer (Mattos & Farias, 2011).



Figure 25.1 Sertanejo biodigester built in the Brazilian semi-arid region. Source: Mattos & Farias (2011)

The socioeconomic vulnerability of the rural population in the northeastern semi-arid region has intensified due to successive increases in the value of cooking gas derived from oil. For these reasons, the population has more frequently used firewood and/or charcoal to cook food, even though this practice involves serious risks to the health and safety of these communities (Gioda, 2019). The Biodigester Sertanejo Program is, therefore, one of the

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social technologies supported by the Dom Helder Câmara Project that contributes to the generation of clean and renewable energy in rural communities in the semi-arid region, reducing dependence on fossil fuels and improving the quality of life of local families (Barros et al., 2020).

The Biodigestor Sertanejo was implemented in several communities in the Brazilian semi-arid region with the aim of contributing to improving people's quality of life and preserving the environment (Calgaro Neto & Souza de Oliveira, 2022). The semi-arid region is characterized by long periods of drought, scarcity of water resources and low soil fertility. These conditions make food production difficult and make the lives of residents of the region quite challenging (Silva et al., 2019). The Brazilian semiarid occupies 12% of the national territory and is home to around 28 million inhabitants divided between urban (62%) and rural (38%) areas (**Figure 25.2**). Therefore, it is one of the most populated semi-arid regions in the world (INSA, 2022). Almost 80% of all rural establishments present in the Brazilian semi-arid region are characterized as family farming, which corresponds to 37.1% of the segment in Brazil (IBGE, 2017). More than half (59.1%) of Brazilians living in extreme poverty live in this region, which also has lower human development indices, which take into account indicators of longevity, education and income (SUDENE, 2021).



Figure 25.2 Brazilian Semiarid Map. Source: SUDENE (2021)

The municipalities that make up the Brazilian semi-arid region have a hot and dry climate and an economy based mainly on family farming (Bezerra et al., 2020). The Sertanejo Biodigestor Program was applied in rural communities in the Brazilian semi-arid region due to the challenges faced by the region. Geographic characteristics and difficulties in accessing clean and renewable energy sources are some of the main problems that rural communities in the semi-arid region have to live with. For this reason, policy makers saw the Sertanejo Biodigestor Project as a viable and sustainable alternative for generating clean and renewable energy, which can be produced from rural waste, resources that are abundant on family farms.

In addition, 75% of rural households in the region do not have an adequate treatment or disposal system for sewage which, in general, is dumped into rudimentary pits, ditches, or directly into the ground, or into streams, rivers or lakes (IBGE, 2017). These problems represent a serious public health and environmental problem, since improperly treated sewage can contaminate the soil, groundwater, rivers and lakes, in addition to increasing the risk of diseases.

25.3.2 Data collection and analysis

In our exploratory study, we used a qualitative data analysis approach through a case study to reach an understanding of the weaknesses and strengths of the initiative characterized by the Sertanejo Biodigestor Program based on the dimensions of Schlosberg's (2004) tripartite approach to EJ. We compiled relevant literature and examined published documents, including scientific articles, reports, theses and dissertations, video content from social networks, and materials produced by the government, civil society organizations, and the media about the Program's work. Data were categorized with specific descriptions and active searches were carried out for strengths and weaknesses, experiences, stakeholders, policy decisions and important events that related to the

Program. This process involved several detailed readings of the texts to identify themes based on Schlosberg's (2004) conceptual framework for EJ.

Based on what the author proposes about approaching the dimensions of recognition, distribution and participation, we seek to understand how politics seeks to intervene in these questions of justice. Using EJ's tripartite structure, we defined categories of analysis based on Schlosberg's (2004) proposal in a systematic and organized way through the elaboration of a matrix (see **Table 25.1**) that relates the criteria to the dimensions of recognition, distribution and participation.

Table 25.1 Analysis dimensions based on Schlosberg's criteria (2004)

Dimension	Aspects analyzed
Participation	<ol style="list-style-type: none"> 1. Involvement and active participation of local residents in the program implementation process. 2. Conducting training and technical assistance actions for local communities. 3. Existence of reports of positive impacts on the quality of life of local residents arising from the implementation of the program.
Recognition	<ol style="list-style-type: none"> 4. Respect and appreciation of local culture and traditions by the Sertanejo Biodigestor Program. 5. Existence of dialogue and negotiation with local communities to identify their needs and demands. 6. Consideration of local residents as partners in the program implementation process.
Distribution	<ol style="list-style-type: none"> 1. Promotion of equitable distribution of benefits generated by the program. 2. Fair and equitable distribution of benefits generated by the program among local communities. 3. Seeks to reduce socioeconomic inequalities and promote sustainable development in the region.

Source: The authors based on Schlosberg (2004)

We chose papers based on their alignment with our research objective. Searches in the databases took place on 04/05/2023. We searched for the terms "Biodigestor Sertanejo and Semiárido" and "Biodigestor Sertanejo and

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Semiárido" (in order to gather texts written both in Portuguese and in English) in the Scopus, Web of Science, Google Scholar and Periódicos Capes databases to raise academic publications that explored dimensions of this policy. In order to access news published by the media and by civil society organizations, a more extensive search was carried out in the Google search engine with the filter "news", from the same term. We also searched for content published on the Government of Brazil website to access policy documents. We also conducted a survey on the YouTube social network, where civil society organizations, government and universities produced videos with content about the Program.

We did not make time restrictions in our searches and we chose to consider documents published since the beginning of the Program's activities. We included 19 documents (9 academic studies and 10 documents from civil society organizations) during the analysis, using the Snowball technique, as recommended by Biernaki and Wandorf (1981), due to the potential that these texts had to support the study.

In the end, we obtained a result of 159 documents, however some exclusions were made, either due to identified repetitions (12) or because the contributions were not useful for our investigation (64). Our content analysis, therefore, was performed from 95 documents. Information on searches is systematized in **Table 25.2**.

Table 25.2 Search mechanisms and number of documents

Document source	Amount	Excluded	Total
Academic studies			
Web of Science	1	0	1
Scopus	0	0	0
Capes periodicals	3	1	0
Google Scholar	40	9	31
Added by the snowball technique	9	0	15
Repeated	-	12	0
News, Reports and Videos			
Google search engine	36	12	28
Videos	15	7	8
Government Website	45	23	22
Added by the snowball technique	10	0	10
Total partial	96	42	54
Total	159	64	95

Source: authors'elaboration

Documentary research based on the analysis matrix that considered Schlosberg's tripartite structure provided important subsidies for the analysis of the Sertanejo Biodigestor Project. The adoption of systematic and organized criteria presented in Table 1 allowed a more rigorous and reliable analysis of the social impacts in which the project intends to intervene.

25.4 Results and discussions

In this section, we present the results and discussions of the documentary analysis carried out on the Sertanejo Biodigestor Program, from the perspective of EJ. By evaluating the dimensions of participation, distribution and recognition, we seek to understand how the program has been implemented and what socio-environmental impacts have been generated for farming families in the Brazilian semi-arid region.

25.4.1 Scientific literature

In this analysis, we evaluate the participation, recognition and distribution of the Program's actions explored in the academic literature published in the searched databases. The literature review pointed out that one of the fundamental criteria for the success of a community program is the participation and active involvement of local residents. Regarding the Sertanejo Biodigestor Program, several articles highlight the involvement of the community in the implementation of actions (De Souza et al., 2021) in which initiatives were identified that enabled a participatory process of building the program. Queiroz (2015) and Barros et al. (2021) explore the mobilization of community leaders and local associations with the implementation of the Program, which contributed to the dissemination of technologies and the training of residents. In addition, another important criterion is the carrying out of training and technical assistance actions for local communities. In this regard, several studies point to the importance of the qualifications and training offered by the Sertanejo Biodigestor Program. For example, the study by Gama et al. (2018) highlights that technical training was fundamental for the autonomy of communities in the management of biodigestors, in addition to generating income and improving the quality of life of residents Silva and Correia, 2020; Barros et al., 2021). Finally, another important criterion is the existence of reports of positive

impacts on the quality of life of local residents resulting from the implementation of the Program. Several articles highlight the benefits generated by the Sertanejo Biodigestor Program, such as reducing environmental impacts, improving public health and generating employment and income (Bezerra et al, 2020; Santos, 2023; Salzer, 2018 and Gama, 2018). The recognition and appreciation of local culture and traditions are fundamental aspects for the success of community programs. Gama (2018) highlighted the importance of considering the local culture. As for the criterion characterized by the existence of dialogue and negotiation with local communities to identify their needs and demands, in the academic studies analyzed, reports of dialogue actions with local communities to understand their needs and demands before the implementation of the Program were not identified, only during the implantation of the biodigester and after. This proves to be a bottleneck for the initiative, as knowledge of the needs of communities in terms of waste treatment and the choice of the most appropriate technologies for each location is important for the effectiveness of the policy. Equitable distribution of benefits generated by the program is an important criterion for ensuring social justice and promoting sustainable development in the region. Several studies highlight the importance of promoting the equitable distribution of benefits generated by the program, as pointed out by Barros et. al (2020) and Calgaro Neto & Souza de Oliveira (2022) when highlighting that the Biodigestor Sertanejo Program contributes to the social inclusion of the community. In addition, these studies indicated that the implementation of the program promoted the reduction of environmental impacts, improvements in public health and in the quality of life of local residents. In general, it is possible to state that the analyzed literature also highlighted that the Sertanejo Biodigestor Program promoted actions in the dimensions of participation, distribution and recognition.

25.4.2 Analysis of news, reports and videos

Based on the analyzes carried out on the news published about the Biodigestor Sertanejo Program, it is possible to verify that the dimension of recognition of the JE has been contemplated in a significant way. The news, in general, highlight the importance of the program for the generation of clean energy and organic fertilizer in rural

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communities in the Brazilian semi-arid region, highlighting the adaptation of technology to local conditions and sertaneja culture (Renova Semiárido, 2020; Aberje, 2018). However, regarding the dimension of participation, the news has some limitations, as had already been observed in the analysis of academic productions. Although the documents highlight that farmers contributed to the construction and operation of biodigesters (IFRN, 2013 FBB, 2015, UFPB, 2022), none mentioned community participation in the decision-making process, nor in defining the best technology or choosing of the criteria that determined who would benefit from the Program. This may indicate a limitation in the engagement of different sectors of the community and compromise the sustainability and effectiveness of the program. Regarding the distribution dimension, the news presents some challenges. Although they all highlight the economic and environmental benefits of technology for rural communities in the Brazilian semi-arid region, no mention was made of the measures adopted to ensure the equitable distribution of environmental and social benefits and burdens among the different social groups involved. This limitation may indicate the need to improve the policy for distributing the benefits generated by the program. Schlosberg (2004) points out that a common problem in many rural communities is the lack of recognition of traditional knowledge and practices in relation to agriculture and environmental management. This was a positive point observed during the content analysis of the documents, there is mention of initiatives related to the Program that seek to value and strengthen these practices, including meetings of farmers that promote the exchange of experiences between different rural communities. Regarding the dimension of participation, another common problem in many rural communities is the lack of effective engagement in decision-making processes related to the management of natural resources and the implementation of public policies. Several analyzed texts mention projects and initiatives that seek to increase the participation of rural communities in these areas such as water management actions carried out, including by women in the region (Governo de Sergipe, 2021).

In addition to news, various actions and dimensions of the Program were explored through content published by the government and civil society organizations, either through reports, opinions or through content published on the YouTube social network. Analysis of these documents provided important information about how the program is being implemented and what its implications are for EJ. The analysis of the Biodigestor Sertanejo videos identified three recurring themes: i) the collaboration between rural producers and the program team, ii) the reduction of poverty and iii) the contribution to sustainable rural development, and the installation and maintenance of biodigestors by rural producers. These documents showed that the collaboration between rural producers and the Biodigestor Sertanejo team is crucial to the success of the program, but that it is not always possible to make this interaction viable (Diaconia, 2016; LATACS TV, 2021).

There are videos that point out that rural producers are encouraged to collaborate with the program, either through the installation of biodigestors or by publicizing the program to other rural producers, a concern that converges with the distributive dimension of JA, which seeks equity in the distribution of environmental benefits and respective risks (Diaconia, 2014; Experimentador do Sertão, 2022). In this sense, the dimensions of the EJ can be seen as useful analytical tools to assess whether a sustainable development project or program is fair or not.

Analyzing these dimensions can help identify whether environmental benefits and costs are equitably distributed across different social groups, whether there is adequate participation and inclusion of affected communities in environmental decisions, and whether cultural identities are valued and recognized. In the case of the Sertanejo Biodigestor Program, the distribution of benefits is highlighted in several analyzed documents. In addition, the documents point out that the savings provided by the use of biodigestors generated extra income for the family, including cases in which families began to receive extra income from the sale of food products provided by the

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ease of access to gas for cooking or commercialization. of organic fertilizers produced by the biodigester on its own properties.

The reduction of cooking gas costs and the production of biofertilizers were pointed out as the greatest benefits of the program (Diaconia, 2016). Although the analyzed documents demonstrate distributional and participation concerns, there is little evidence of concern with the recognition dimension. This can be attributed to the limited nature of these documents, which generally focus on technical and practical aspects. However, the lack of attention to the recognition dimension is problematic because it neglects the cultural and social aspects of the communities involved in the program.

25.4.3 Strengths and Weaknesses of the Sertanejo Biodigester Program in terms of TIPs

The Biodigester Sertanejo Program has contributed to the promotion of sustainable technologies in the Brazilian semi-arid region, with the main objective of producing renewable energy and reducing the environmental impacts caused by the use of fossil fuels. However, like any program or public policy, Biodigester Sertanejo has strengths

and weaknesses that must be considered when assessing its impact on the communities and social groups involved. In the distribution dimension, we observe how the analyzed documents seek to present a positive image of biodigesters, emphasizing their environmental and economic benefits. However, there is no critical reflection on the limitations and challenges of using biodigesters, such as obstacles to the need for technical and financial training of farmers and dependence on transport and logistics infrastructure for the use of biogas. There also does not seem to be an effective concern with cases in which the family stops using the biodigester. The analyzes allow us to perceive a constant movement of ratification of the positive side of the Program and the way in which the initiative can contribute to the reduction of energy and input costs, with emphasis on the potential economic benefits for farmers. However, there is no critical reflection on how the use of biodigesters can reinforce farmers' dependence on institutions or companies that provide technologies for biogas production, for example, or on specialized technical assistance to operate. This dimension of Schlosberg's model is a point of attention, since, even if social technologies are important to ensure that aspects of justice are observed, they can maintain the unequal distribution of power and resources between different social groups. Power is a crucial aspect of EJ, as marginalized communities are often relegated to opportunities to participate in decision-making processes that directly affect their own lives. In the case of the Sertanejo Biodigester Program, it is important to examine in future research whether these power relations are producing or maintaining injustices. The videos and news reviewed often feature technical experts explaining biodigester technology and how it works. While this information is important, it is also important to ensure that the voices of project-affected communities are heard and that they have a say in how the project is implemented. In general, although the full participation of the community in the stages that precede the implementation of the Project has not been identified, the active participation of local residents in the process of implanting the biodigester, carrying out training actions and technical assistance for local communities were identified in reports of positive impacts on the quality of life of farmers and demonstrate the Program's commitment to promoting sustainable development in the region. The analysis of the documents pointed out that the events in which the appreciation of the local culture is mentioned is not enough to guarantee the full approach of the dimension of recognition of the JE. The posture of the government and the organizations involved in relation to the dimension of recognition of the EJ could be more robust, for example, in proposing

broader partnerships with local cultural groups. The continuity of the program should consider maintaining these relationships and promoting the equitable distribution of benefits to local communities, thus ensuring its long-term sustainability. Finally, it is necessary to highlight the importance of cooperation between different actors and institutions involved in the program, including civil society organizations, universities, research institutions and government agencies. Collaboration between these different actors can contribute to identifying innovative solutions and improving the program, in addition to strengthening the articulation and support network for male and female farmers.

25.5 Conclusions

The Biodigestor Sertanejo Program is an important initiative in the search for sustainable solutions for the environmental and social problems of the Brazilian semi-arid region. By providing an alternative for producing clean energy from organic waste, the program promotes EJ by acting directly to reduce the negative environmental

impact and improve the living conditions of rural populations. The Sertanejo Biodigestor Program has made efforts to involve farmers and their families in the process of implementing biodigestors, promoting training and offering technical assistance. However, there are still limitations on how farmers' participation is effectively incorporated into the program, especially in terms of decision-making and priority setting, that is, in the steps that precede technology deployment. It was identified that the program has the potential to contribute to the reduction of socioeconomic inequalities in the region, providing a source of renewable energy and financial savings for family farmers. However, there is a need to assess more broadly how the program is being distributed geographically and across different socioeconomic or gender and racial groups to ensure that inequalities are not perpetuated or even exacerbated. Finally, in the recognition dimension, the program demonstrates a limitation in recognizing and valuing cultural diversity and the identities of the communities involved. A greater effort is needed to ensure that the approaches adopted in the program are sensitive to cultural differences and respect local specificities, so that the program is truly inclusive and sustainable. Thus, it is important that the Sertanejo Biodigestor Program promote more robust actions to strengthen the recognition dimension, through consultation and involvement of local communities in the design and implementation of the program, valuing their traditional practices and knowledge, and promoting gender equity. and social inclusion. Only then will it be possible to ensure that the program is effectively transformative and sustainable in the long term. An important limitation of this study to be mentioned is that the documents may not have been able to provide an in-depth understanding about the Program, due to its scope and complexity. At the same time that this is imposed as a limitation, it also reinforces the recommendation for future research that strives to expand this study, for example, through interviews, so that other points of view are explored in the context of this policy.

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ufpb#:~:text=O%20projeto%20'Ecofossas'%2C%20coordenado,canal%20do%20projeto%20no%20Instagram.

Chapter 26. Participation Beyond Statements: Some Critical Considerations about Inner Cilento, Italy

Serena Kaiser, Chiara Vassillo

Abstract

Italy has adopted several initiatives for the engagement of the different stakeholders, within the framework of Circular Economy oriented policies. Italian inner areas have recently been very much focused by both Italian and European institutions, and many funds and initiatives have been dedicated to these territories. The aim of this chapter is to evaluate two participation initiatives in a specific territory of Campania Region, inner Cilento, to examine whether they are building empowering experiences for local communities or not. The first one is a bottom-up initiative, the MAI (Meeting Area Interne – Inner Areas Meeting); the second one is a top-down initiative organized by a local municipality to create a connection between the interested subjects and European calls for agrivoltaic projects of local energy production. Therefore, the study's main purpose is to provide a reading guide for territorial participation initiatives, in order to define their real empowering potential for local communities and to what extent they can encourage a just transition from linear economy towards a circular model.

Keywords: Participation; Local Communities; Inner Cilento; Territories; Just Transition.

With the aim of providing suggestions for decision makers, this chapter analyses some participation experiments in the inner Cilento territory, Campania Region, comparing the practice to the political intentions included in the strategic documents dedicated to participation

26.1 Introduction

The centrality of participation measures towards Circular Economy has been recognized by a joint initiative of European Commission and the European Economic and Social Committee (EESC) that, in 2017, created the European Circular Economy Stakeholder Platform (ECESP)⁴⁵, in order to guarantee that the actors of civil society play a role in the transition. In Italy, the National Plan on Sustainable Production and Consumption⁴⁶ (foreseen by

⁴⁵ <https://circulareconomy.europa.eu/platform/en>

⁴⁶ It is important to highlight that a draft of this plan has been created in 2008 and revised in 2013. After this, the 2015 law which is mentioned below foresees a definitive plan, but it is still unaccomplished. From the 2008 and 2013 drafts and from the aim of the law's article 21, it is possible to outline what is said here. See also <https://www.mase.gov.it/pagina/la-strategia-europea-consumo-e-produzione->

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the Law 221/2015⁴⁷), only includes people in the operational area called "Consumption and Sustainable Behaviours". This means that they are mainly considered as consumers and that the approach consists in emphasizing individual behaviours and responsibility instead of collective organization. On the other hand, recent initiatives of implementation and revision of the National Strategy for Sustainable Development⁴⁸ include, at least formally, the concept of territorialization, which suggests that the individual/consumption oriented/behavioural dimension should not be the only one to conceive participation. Italy's inner areas have recently been very much focused both by European and national institutions, and many funds and initiatives are dedicated to these territories.

According to Pansera, Genovese and Ripa (2021), however, the so called "ecological transition", together with the transition towards Circular Economy (CE) is often presented as a merely technological issue, thus neglecting social and political aspects which deal with discrimination, participation, social and environmental justice, among the others⁴⁹. Reducing the matter to a simple necessity to create new products which can be considered adequate to be labelled as "circular" may lead to an unchanged neoliberal market where profit is still the rationale but the goal becomes that of selling labelled products. Furthermore, this technocratic option might also produce a rebound effect⁵⁰.

Building upon the above insight, this chapter looks at the initiatives that are promoted within rural contexts, and particularly at two specific cases, to investigate whether they represent techno-oriented policies or an authentic way to widen the participation of local communities.

Many initiatives are detectable in the territory of inner Cilento in the fields of environmental preservation, social promotion, just ecological transition, circular economy and sustainability, especially within the agri-food and tourism sectors. This is true both from the institutional side and the world of local associations. For this reason, it is possible to investigate both top down and bottom-up initiatives⁵¹.

During the period spent on the territory, many circularity experiments have been detected, especially in the agri-food sector. Many of them are driven by young people (under 30) who had been living and working abroad or in other Italian cities, before the COVID pandemic started. Their stories have been collected during a six-month period (and several other brief periods after that) spent through the territories of Laurino, Sacco, Valle dell'Angelo and Roccadaspide. These young people were mainly employed in gastronomy and hospitality-related jobs: this means that all of them had problems when this kind of activities had to be closed due to the several lock downs; some of them also ended up losing their jobs.

Having to choose what to do in that difficult situation, many of them decided to go back to their hometowns for two main reasons: a) the possibility to stay safe from the sanitary point of view (small towns were incomparably safer than big cities during the COVID pandemic, due to their isolated positions and the scarcity of people's movements); b) the loss of their own salary, because of which they were not able to afford urban living.

[sostenibili#:~:text=Piano%20d%E2%80%99azione%20nazionale%20su%20Consumo%20e%20Produzione%20Sostenibili,Strategia%20Nazionale%20per%20il%20Consumo%20e%20Produzione%20Sostenibile](#)

⁴⁷ <https://www.gazzettaufficiale.it/eli/id/2016/1/18/16G00006/sg>

⁴⁸ https://www.mase.gov.it/sites/default/files/archivio/allegati/sviluppo_sostenibile/SNSvS_2022.pdf

⁴⁹ Pansera, M., Genovese, A., & Ripa, M., (2021) Politicising Circular Economy: what can we learn from Responsible Innovation?, *Journal of Responsible Innovation*, 8:3, 471-477, DOI: 10.1080/23299460.2021.1923315, <https://doi.org/10.1080/23299460.2021.1923315>

⁵⁰ Ibid.

⁵¹ Spending time on the territory is always the best option to have information about local initiatives, but some web-sites giving local news can be helpful, like for example <https://www.sentieridelbuonvivere.it/gal/>.

This might appear as a big fracture in a young person's life; however, many of these young people created new job opportunities for themselves and their communities, thus changing the destiny of some family businesses settled in inner Cilento.

In order to create the possibility for this phenomenon to change the trend of depopulation in inner areas, the participation of local communities in local public life – particularly of the youngest component – becomes crucial. Indeed, a recent study developed by the association "Riabitare l'Italia" in collaboration with the University of Torino and several other research entities has revealed that young people from the inner areas of southern Italy have a peculiarity in terms of wishing to stay or to leave, compared to similar sample-groups from central and northern Italy: they are characterized by the pattern "wishing to stay but believing not to be able to stay" (Mazzocchi et al., 2022)⁵². As it is possible to see in the results and discussion section, this observation seems to be confirmed by both the topics engaged by the organizers and the feedback collected among the participants during the MAI-Lab (Laboratorio del Meeting Aree Interne – Inner Areas Meeting Laboratory), performed in Valle dell'Angelo the 1st of July 2023.

26.2 Materials and Methods

As it is possible to read on the dedicated website⁵³, the "Inner Areas National Strategy" ("Strategia Nazionale Aree Interne" – SNAI) is an Italian national plan aimed at developing projects and actions to intervene on the difficult situation of 1077 municipalities, divided into 72 "project areas" (official denomination) and including about 2.072.718 inhabitants. Taken together, these areas represent 60% of the whole national territory and the 52% of Italian municipalities, but only the 22% of the population, due to the well-known phenomenon of depopulation in inner areas, sometimes described as a "demographic bleeding".

A territory is classified as "inner area" when it falls within the boundaries of the "intermediate", "peripheral" or "ultraperipheral" area in terms of distance from the "poles", which are the municipalities where the three main typologies of services – health, education and mobility – are concentrated⁵⁴.

The selection of the territories to be classified as "inner" has started in 2013 and, from the financial point of view, two national laws – the Stability Law of 2014 and the Budget Law of 2018 – comprehensively allocated 281,2 million euros for the implementation of the SNAI. These funds have been destined to services (school, health and mobility) in the selected areas. In addition to these funds, the regional institutions also dedicated economic resources from the co-financed programs of the European Development and Investment Funds 2014 – 2020 (SIE Funds) to support local development projects. Moreover, the National Recovery and Resilience Plan (Piano Nazionale di Ripresa e Resilienza – PNRR) has foreseen 825 million Euros for services, social infrastructures and rural pharmacies to allocate in municipalities with less than 3000 inhabitants and a more specific investment of

⁵² Mazzocchi, G., Barbera, F., Bochicchio, D., Cersosimo, D., Cutello, G., Leone, S., Lucatelli, S., Membretti, A., Orio, A., Scotti, M., Sonzognò, G., Storti, D., Tomnyuk, V., Urso, G., 2022, *Giovani Dentro. Uno sguardo alle prospettive e ai bisogni dei giovani delle aree interne*, Publisher: Riabitare l'Italia.

⁵³ <https://www.agenziacoesione.gov.it/strategia-nazionale-aree-interne/>

⁵⁴ <https://www.istat.it/it/archivio/273176>

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300 million Euros for the improvement of the roads⁵⁵. An additional 310 million Euros for the three-year period 2021-2023 have widened the funds⁵⁶. **Figure 26.1** shows the map of the 72 Italian inner "project areas".

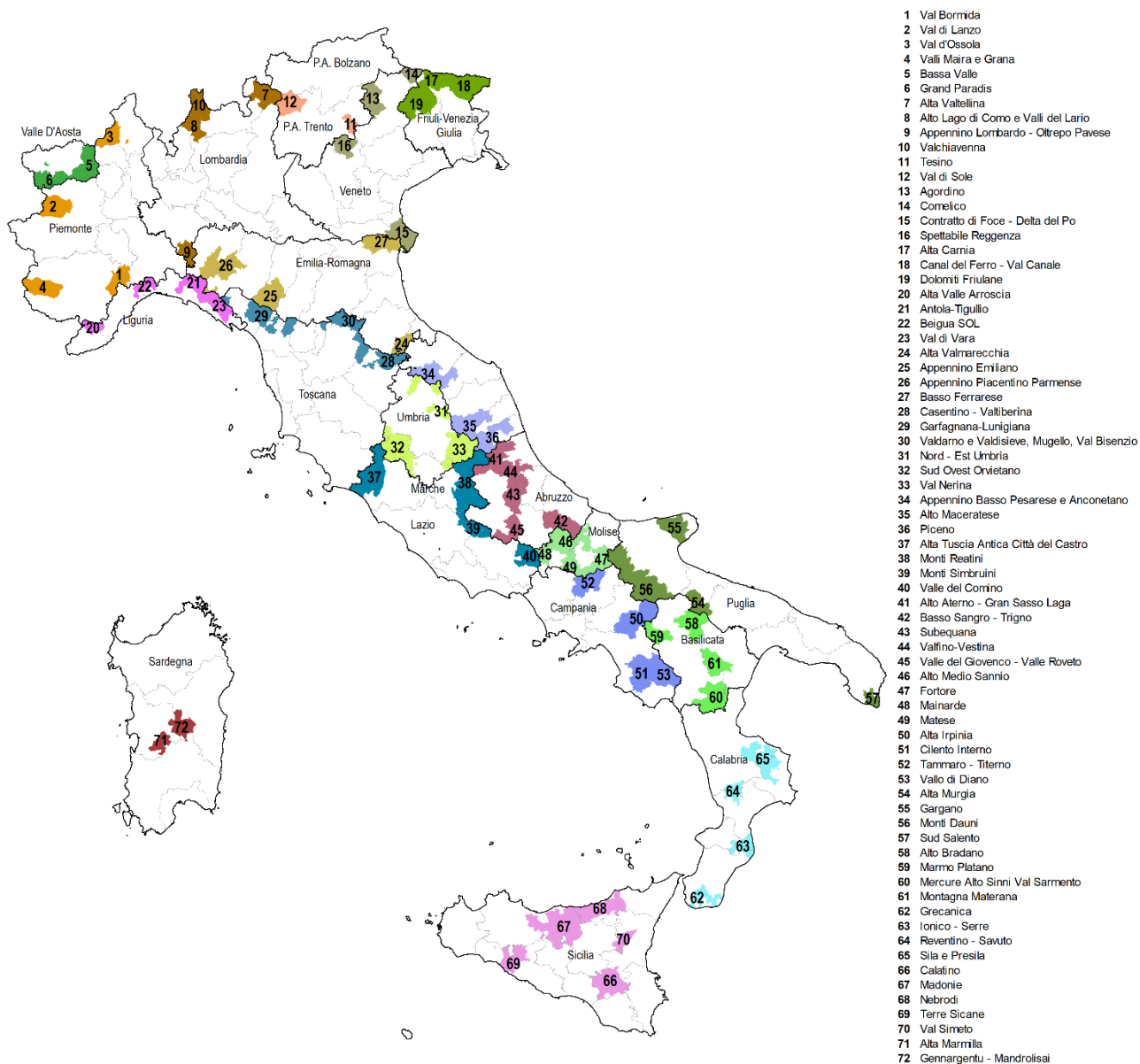


Fig. 26.1 The map of the 72 "project areas". Source: <https://politichecoesione.governo.it/it/strategie-tematiche-e-territoriali/strategie-territoriali/strategia-nazionale-aree-interne-snai/le-aree-interne-2014-2020/>

In addition to these 72 areas, in 2022 the Government decided to include also small islands, because they are considered as having the same problems of inner areas in terms of services and distances. They have been grouped in a 73rd area and include about 240 000 inhabitants, divided into 35 island municipalities⁵⁷.

⁵⁵ Relazione annuale sulla Strategia Nazionale per le aree interne, Presidenza del Consiglio dei Ministri, Dipartimento per le politiche di coesione, anno 2020, https://www.agenziacoesione.gov.it/wp-content/uploads/2021/11/Relazione-CIPRESS-2020_finale.pdf

⁵⁶ Ibid.

⁵⁷ <http://territori.formez.it/content/isole-minori-prima-area-ufficiale-snai-2021-2027>

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Among the inner areas of Italy, it is interesting to focus on specific territories and issues that seem to be representative of the real level of implementation of what is stated in the official documents.

This chapter focuses on the participation processes in the area of inner Cilento ("Cilento interno"), providing two examples of participation, one that can be considered bottom-up and the other top-down, using two tools provided by literature to evaluate whether they are complete or improvable.

The two events are: 1) the MAI-Lab (Laboratorio del Meeting Aree Interne – Inner Areas Meeting Laboratory), performed in Valle dell'Angelo the 1st of July 2023. The laboratory has been built to create a discussion session among young people, other residents, associations, and multiple subjects of the inner areas of Cilento, and has taken place during the MAI (Meeting Aree interne – Inner Areas Meeting) initiative. The host of the event is an agri-food small facility named Àusono; 2) the institutional event organized by the municipality of Roccadaspide about agrivoltaic projects and the dissemination of information about calls for EU funds, that has taken place on the 23rd of September 2023 in Roccadaspide, organized by the coordination office and the areal desk of the Municipality. The two participation examples are not meant to be representative of every initiative taking place in the territory of inner Cilento, but to build two specific cases which may represent a frame of reference of what can be treasured and/or criticized about participation-related experiences.

The chapter also aims at analysing the statements included in political documents and comparing them with the reality that has been investigated by means of several visits, interviews and questionnaires performed during a period spent on the field, within the framework of a P.O.N PhD project.⁵⁸

It is important to specify that, due to the narrative and informational nature of this chapter, data will be presented in the form of a storytelling, with the aim of disseminating information and giving a point of view which can be helpful for the future decision-making processes.

Regarding the investigation on the field, visits, participation in the events and interviews have been performed to collect data. Then, findings have been discussed trying to use the two tools literature, used to criticize the current practices. In addition to this, the previously mentioned "National Strategy Plan" has been considered, as well as the document "Carta della Partecipazione Aree Interne" ("Participation Chart for the Inner Areas")⁵⁹, in order to have a set of national specific documents to compare with the local situation. Finally, another evaluation consists in analysing the programmatic document "Strategia d'Area per il Cilento Interno" ("Inner Cilento Areal Strategy")⁶⁰ and trying to compare it with the national documents and – more importantly – with the real initiatives on the territory. Inner Cilento includes 29 municipalities listed in the footnote⁶¹, 14 of which are considered as peripheral and ultraperipheral⁶². **Figure 26.2** shows the map of inner Cilento, dividing it according to the territorial definitions that have been described above. Translating the caption from Italian, the first four colours stand for: Belt (orange), Intermediate (light green), Peripheral (emerald green), Ultraperipheral (dark green).

⁵⁸ developed by the International PhD Programme/UNESCO Chair "Environment, Resources and Sustainable Development" at the Department of Science and Technology, University of Naples "Parthenope".

⁵⁹ Cittadinanzattiva, with the support of Strategia Aree Interne, *Carta della Partecipazione Aree Interne*, 2020, https://www.cittadinanzattiva.it/multimedia/import/files/Carta_della_Partecipazione_Aree_Interne.pdf

⁶⁰ Strategia d'area del Cilento Interno, 2019, https://www.agenziacoesione.gov.it/wp-content/uploads/2020/07/Strategia_Area_Cilento_interno.pdf

⁶¹ Aquara, Bellosguardo, Campora, Cannalonga, Castelcivita, Castelnuovo Cilento, Castel San Lorenzo, Ceraso, Controne, Corleto Monforte, Felitto, Gioi, Laurino, Magliano Vetere, Moio della Civitella, Monteforte Cilento, Novi Velia, Orria, Ottati, Perito, Piaggine, Roccadaspide, Roscigno, Sacco, Salento, Sant'Angelo a Fasanella, Stio, Valle dell'Angelo and Vallo della Lucania.

⁶² Ibid.

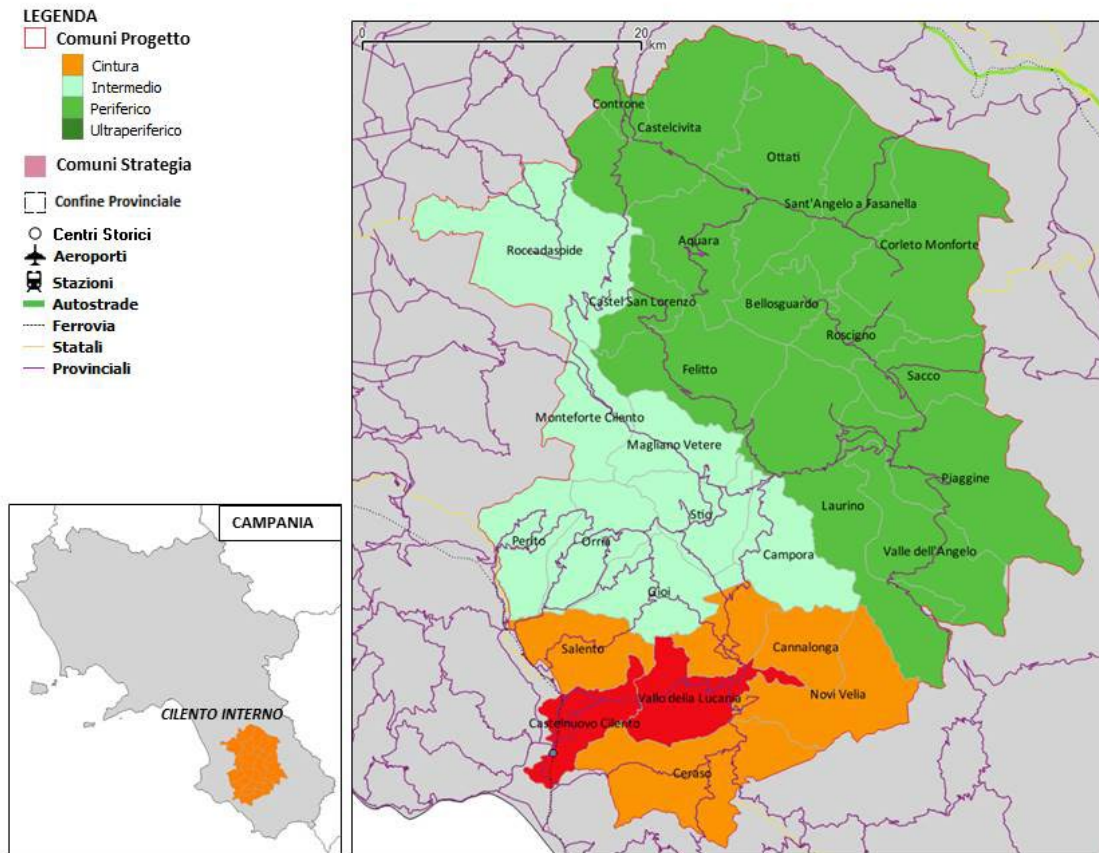


Fig. 26.2 The map of inner Cilento. Source: <https://www.agenziacoesione.gov.it/strategia-nazionale-aree-interne/regione-campania-aree-interne/cilento-interno/>

Data from the event have been directly collected taking part to the initiative and by means of an interview to one of the organizers.

26.2.1 Two main tools for a critical perspective

Starting from the end of the '60s, it is possible to find several studies and theories about the interaction between local communities and institutions. Without any doubt, the most famous work on the topic is the one published by Sherry Arnstein in 1969, creating a linear progressive diagram (the "ladder") of the levels of participation, starting from the absence of citizens' control (namely "manipulation") and culminating in the total control by citizens.⁶³

As it is possible to see from **Figure 26.3**, the linearity of the model suggests that it has been conceived in an historical and cultural context that did not take into account the multitude of plans that real situations show. The model just goes from level one to level eight, considering that the best circumstance for citizens is the top of the ladder. However, this model has capital importance as it introduced the idea that participation is always a matter

⁶³ Arnstein S.R. (1969), A ladder of Citizen Participation, in Journal of the American Institute of Planners, vol. 35, No. 4, July 1969, pp. 216-224.

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of power and that sometimes institutions use the narration of participation to hide the reality of policies that are not participative at all.

Arnstein's reflections were very much concentrated on the exclusion of subjects that she called the "have-nots" and the author is completely aware of some of the limitations of her model. Indeed, in her words:

"The justification for using such simplistic abstractions is that in most cases the have-nots really do perceive the powerful as a monolithic 'system,' and powerholders actually do view the have-nots as a sea of 'those people,' with little comprehension of the class and caste differences among them⁶⁴.

Another about Arnstein's ladder is that participation is conceived as a tool of interaction and sharing between the two categories of institutions and citizens: there is no room for the categories of non-citizen inhabitants. Of course, this can be normal, considering the historical period of Arnstein's reflection. In the present world, maybe one of the most representative groups of "have-nots" would be the one of non-citizen inhabitants, being the citizenship rights one of the strongest tools for the exclusion of the poor minorities.

Despite these issues, the ladder is still used as an inspiration for more recent studies on participation, like for example Frelih-Larsen et al (2023), that uses it to create an assessment method for the level of participation in consultations and deliberative democracy about the use of pesticides in EU⁶⁵. Another example is Teladia & van der Windt (2022): the study includes Arnstein's model within a new framework based on the Socio-Ecological System Framework and assess the level of participation in Dutch energy communities⁶⁶.

Arnstein's ladder – although its declared limitations – seems to be appropriate for the evaluation of one of our cases of interest, which is the institutional event organized by the municipality of Roccadaspide about agrivoltaic projects and the dissemination of information about calls for EU funds. The results of this evaluation are presented in next section.

⁶⁴ Ibid.

⁶⁵ Frelih-Larsen A, Chivers C-A, Herb I, Mills J, Reed M. The role of public consultations in decision-making on future agricultural pesticide use: insights from European Union's farm to fork strategy public consultation. *J Environ Planning Policy Manage.* 2023; 25: 476–92. <https://doi.org/10.1080/1523908X.2023.2212369>.

⁶⁶ Teladia, A., van der Windt, H., A new framework for analysing local participation in community energy initiatives *IOP Conf Ser Earth Environ Sci*, 1085 (2022), Article 012034, [10.1088/1755-1315/1085/1/012034](https://doi.org/10.1088/1755-1315/1085/1/012034)

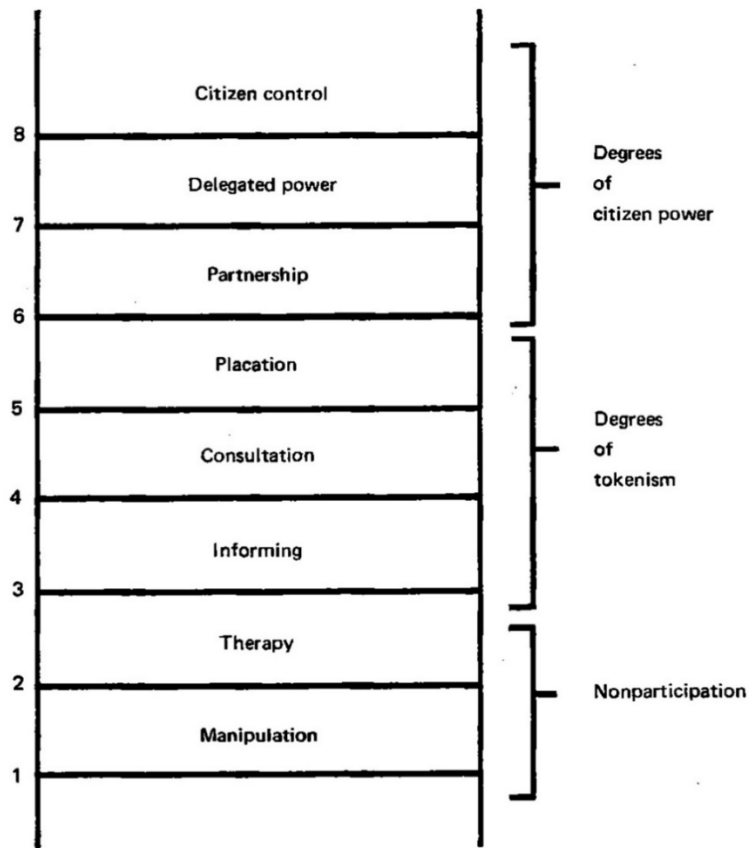


Figure 26.3 The Arnstein's model of the Ladder of Citizen Participation Source: <https://organizingengagement.org/models/ladder-of-citizen-participation/>

The boundaries of participation have been widely explored also by Luigi Pellizzoni in his "Participation Circle"⁶⁷. The "circle" creates a distinction between private and public participation, but also between civil and political participation. It is interesting to notice that, in this model, the common identification of the private dimension with the civil one, as well as the assimilation of public and political issues is dismantled, so that the four dimensions can be matched together in four different combinations.

To make the model simpler, Pellizzoni creates four paradigmatic situations that represent each quadrant, using football as an exemplary topic.

We have reproduced here the circle without the example of football, using examples that fit better in the overall contest of one of our two cases of interest, the MAI event. **Figure 26.4** represents the "Participation Circle" adapted to our work:

⁶⁷ Pellizzoni L., 2005, «Cosa significa partecipare», *Rassegna italiana di sociologia*, 46, 3, pp. 479-514, DOI: <https://dx.doi.org/10.1423/20432>

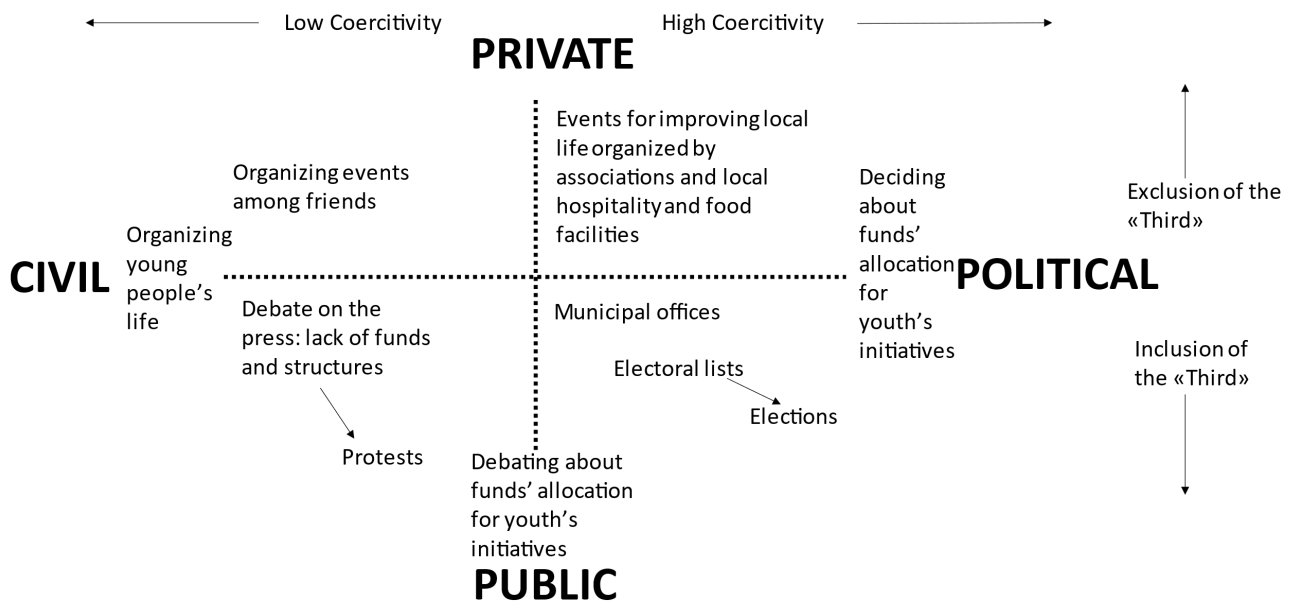


Figure 26.4 The circle of Participation by Pellizzoni adapted to our work

As it is possible to see in the figure above, Pellizzoni's idea is to state that the civil and the private dimensions do not coincide and that there is the possibility for a civil/public dimension, as well as for a political/private one, depending on the inclusion/exclusion of the "third": this is the reason of the presence of the two vertical spheres of "Inclusion of the Third" and "Exclusion of the Third". The notion of the "third" can be controversial, since its identity is not precisely defined: sometimes it consists of a material subject, sometimes it is represented by the ideal asset of a relation among the individuals of a community. The fundamental property that the "third" must have is to represent the principle of accountability. The idea of the "third" – as a turning point for the distinction between the public and the private – derives from the Lockean and Hegelian distinction between the private/familiar domain and the public one, the first being characterized by the absence of the "impartial judge" (the "third") and the second by its presence. But Pellizzoni's scheme also includes the Marxian and Gramscian idea that the element of power is the one determining the difference between the private and the public field⁶⁸: this is the reason why the scheme includes the two horizontal spheres "High Coercitivity" and "Low Coercitivity". In Pellizzoni's diagram, elements from our second case of interest have been put into it instead of the examples that he created for his publication.

⁶⁸ Ibid., p. 11.

26.3 Findings and Discussion

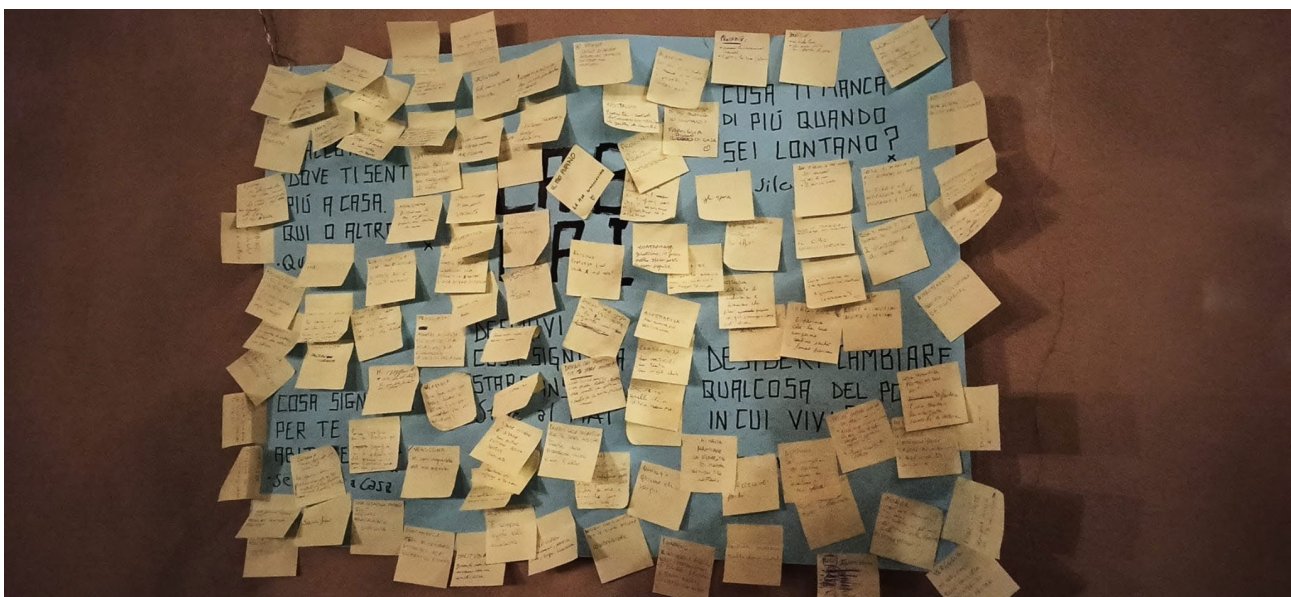
Being the topic of this chapter politically and socially shaped, findings and discussion have been joined in one section, in order to give critical observations together with the outcomes of the research. The first event that has been analysed (following the chronological order) is the MAI (Meeting Aree Interne – Inner Areas Meeting).

The organizers are some local associations: the association “Vojto”, which has also created the festival “VDA Music Potlach” in Valle dell’Angelo; the association Rehub Alburni APS, which is involved in the creation of cultural networks in inner Cilento; the association “Sfavilla” from Villa Littorio; the association “Raccontare Significa Resistere” from Castel San Lorenzo; the association “Dynamicor” from Corleto Monforte; the association “Spazi Attivi” from Trentinara. These associations invited young inhabitants of inner Cilento to participate in the MAI lab and in the MAI event, starting from an initiative of two among them, “Rehub Alburni” and “Vojto”: creating a traveling event which could promote both associations and companies managed by local young people. This intention met the interest of the working group “Presidi Culturali nel Cilento Interno” (“Cultural Hubs in Inner Cilento”), whose intent was to perform research on young generations of inner Cilento.

The event has been analysed as an example of self-organization of local communities about some relevant issues, which can be grouped into the macro-themes of services, environment, economy and culture/social change. The grouping into these macro-themes has been possible only after our participation in the event: indeed, at the beginning, the arguments proposed by the organizers were: “residing, distance, desire, belonging, perspectives, relationships, prejudices and habits”. Then, analysing the questions and the answers that emerged, it is possible to say that the proposed arguments were articulated following the main macro-themes that the research group have listed above.

Figure 26.5 is a picture of a panel that has been built during the laboratory, using all the thoughts and proposals that came out in the course of the discussion. The panel was installed also during the evening event, to present a creative summary of the proposals that had been collected in the afternoon by the participants in the MAI-Lab.

As it is possible to see, the main questions are written in block letters on the blue carton board, while all the little answers are put on them by means of little yellow post-it notes.



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Figure 26.5 The MAI-Lab Panel

The aim of the event has been to formulate proposals and provide realistic data for the policymakers to engage good practices and promote the territory. This is why the ideas on the yellow post-it notes are both about big issues and simple family memories: the attempt was to give value to the problems that young people experience in the inner areas, but also to the cultural heritage that they are still connected to.

Figure 26.6 shows the detail of a single post-it note representing a big problem of the territory: the isolation and the lack of connections among the provincial roads, but also the need for a better cleanup and maintenance of the footpaths on the mountains and country places. Indeed, the note (in Italian) says: "Isolation. Solving the problems of the provincial roads, cleaning up the footpaths and keeping the municipal roads open".

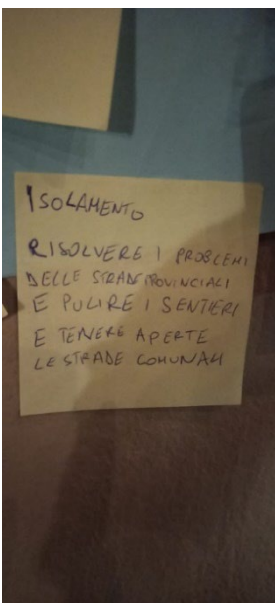


Figure 26.6 Detail of a single post-it note on the MAI-Lab Panel

On the other hand, **Figure 26.7** shows a very "personal" idea put on another post-it note, which confirms the double intention of the laboratory and represents the local cultural values. The note says: "I miss eating mum's *ciambotta* when I'm away" (*ciambotta* is a local traditional dish prepared with vegetables and olive oil).

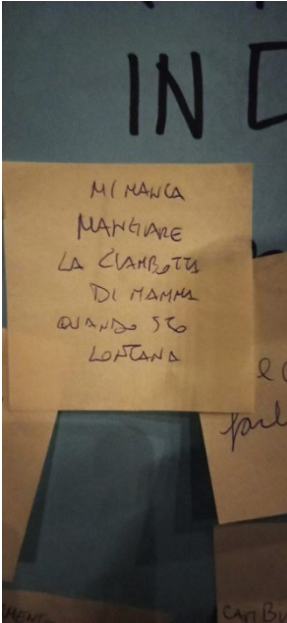


Figure 26.7 Another detail representing a post-it note about family cultural heritage and local food

The methodology that the laboratory has tried to perform is the Action-Research and the approach is declared to be bottom-up. Action-Research is a methodology whose main assumption is the idea that the researcher can understand only the facts that she/he participates to change. This is very different from (but sometimes confused with) the fact that many researchers – especially those belonging to the technical disciplines – also work on the territory, for example in consultancy performances. Action-Research is made of a bi-univocal relationship between the researcher and the territory, which is not the case of consultancy works. Moreover, Action-Research is not even identifiable with participated city/town/regional planning, which consists in a “democratization” process of decision making and in the direct involvement of inhabitants about the planning and projecting of the territories where they live. Action-Research, in conclusion, is a research methodology, which should not be confused with professional practice approaches⁶⁹. Since the organizers of the event have both taken part in the laboratory and collected data for a research study and a document to be created and addressed to local institutions, Action-Research requirements seem to be respected for what concerns their presence in the process.

Following the scheme of Pellizzoni’s “Participation Circle”, we may conclude that the MAI initiative might be interested in becoming a civil/political organization whose final intention aims at performing a public/political action on the territory but is still positioned into the private/political quadrant. This result is evident for two main reasons: 1) ontological: the promoters are not a movement or a political party but a group of local associations and single individuals, together with small local businesses; 2) intentional: the promoters of the initiative are interested in the decisions about the allocations of funds for youth’s policies but they have created an event that has been hosted by a private subject (the agri-food small company), without the creation of an electoral list or program.

⁶⁹ Saija, L., 2016, *La ricerca-azione in pianificazione territoriale e urbanistica*, Publisher: Franco Angeli/Metodi del Territorio.

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Of course, in the next future this situation is likely to be changed, since the goal of the research performed by the organizers is to create a document to be addressed to the local institutions. This means that, as well as in the Pellizzoni's original diagram, there is the possibility to pass from a quadrant to another, thus forming a real "circle". On the other hand, the interview to one of the organizers also outlines the intention to create a branding for MAI in the future: this may divert attention from the public goals and attract energies towards market/profit-oriented horizons, so the challenge is now to understand whether the working group will undertake a collectivistic or an individualistic path.

The other case of interest analysed here is the initiative about agrivoltaic EU funds that has taken place on the 23rd of September 2023 in Roccadaspide, organized by the coordination office and the areal desk of the Municipality. Agrivoltaic projects are realized planting photovoltaic panels in agricultural fields. The important thing to understand is that, from the moment of the installation, the process of agricultural production needs to be changed, according to the presence of these sun-shading panels. For this reason, it is very important that farmers are completely aware of all the consequences of the adoption of these measures.

Using the participation ladder by Arnstein, we may say that the initiative represents a level 3: Information. Indeed, some experts and responsible from the territorial institutions (local and regional) have been invited to give explanations about agrivoltaic projects and some related calls for funding local initiatives. **Figure 26.8** shows the ratio behind the organization of the event and its results, according to the elements that the research group have collected.

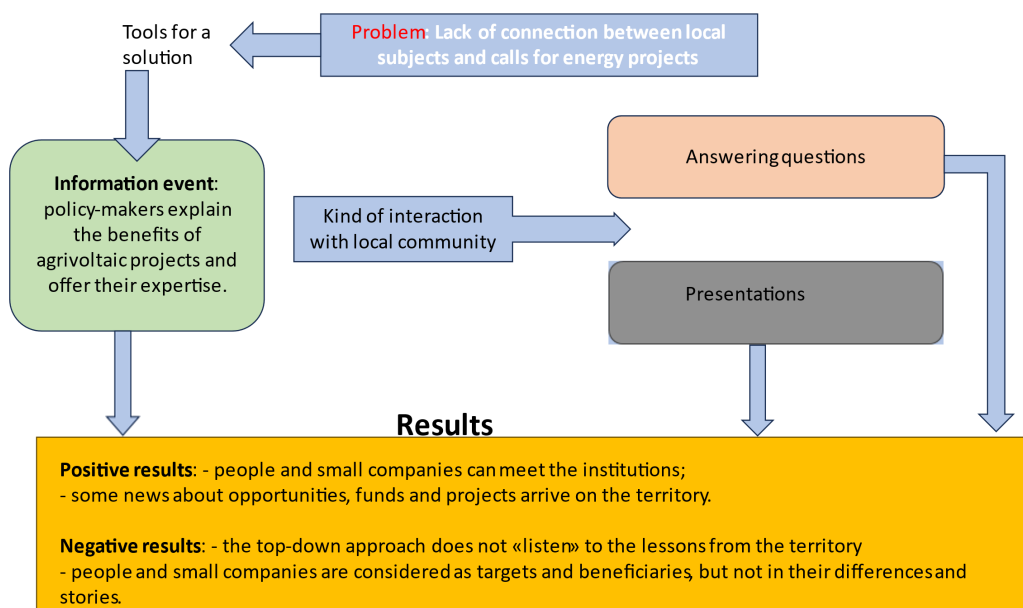


Figure 26.8 Ratio and results of the event about agrivoltaic in Roccadaspide

An important element to be considered is that the deadline for the funding opportunities was very close to the date of the informative event.

Reading the above mentioned "Inner Areas Participation Chart", it is possible to find principles like the one that states that citizens' participation should include all the phases of public policies, starting from the agenda and then going towards the decision, the programming and the implementation. Following this principle, an event that only provides information about funding opportunities in a moment that was very close to the deadline cannot be considered very much participative at all.

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Taking part in the event, some interesting questions and critical speeches from the audience proved that the real needs of the territory are peculiar, that EU projects are often conceived in places that are far from the implementation areas and that people from the territories should be listened more.

It is evident that the level of mere information is not enough, because the local actors are informed about opportunities that are not feasible on that specific territory.

However, it must be said that the areal desk was born only in April 2023 and that its operators, when interviewed, have expressed the interest to widen the range of initiatives to incentivize participation.

Discussing the specificity of the areal desk, it is possible to say that it is managed by a new generation of social facilitators and that they are trying to change trends of participation policies in the territory of inner Cilento. From the interviews, it is evident that they are also trying to involve universities and different actors to create a transformative approach for participation policies. Of course, they will need time to invert the course of policies that did not work in this direction and this can be the reason why the initiative of Roccadaspide was interesting but still followed some old pattern.

Leaving the initiatives to highlight only two last problems detected in the documents, it is possible to focus on the distance between what is declared in the strategic documents and what is really implemented on the field, and the fact that sometimes documents promote the market as a solution. If we read the "Inner Cilento Areal Strategy" mentioned above, we can see that a wide amount of problems are detected about the local health system, the transports and education, but solutions seem to be proposed only creating job opportunities and a market on natural resources and the agri-food dimension. There is even the use of the expression "product/territory" to promote the development of inner areas in a modern declination.

This perspective can create some economic benefits, but it is important to take into account that environmental and social impacts of such an identification of the territory with a product can be significantly negative.

A vision about what is a just way to create job opportunities and well-being should include evaluations on several dimensions that cannot be compressed in the economic one.

Also staying in a merely economic field, it is possible to say that inner territories and the participation processes of local communities can be a pillar in a just transition towards circular economy, because of all the cultural heritage of preservation, reuse, recycle, regeneration, care and life cycle extension that these territories can express. If participation represents only a good word for documents and public speeches, while decisions are taken elsewhere, all this heritage will not even be seen.

26.4 Conclusions

The experience of the MAI teaches that, although the rhetorical elements of participation can be present in many initiatives, their destiny depends on the collectivistic or individualistic purposes that groups from below can chase. More specifically, not all the initiatives that can be defined "from below" are necessarily aimed at achieving collective dimensions or advocacy of political relevance. "From below" we find activists, associations, NGOs, small companies, young entrepreneurs, etc... So, it is important to go beyond the rhetorical aspects about participation in each initiative to understand whether participation is a concrete good practice or just a "spot".

This is true also for what concerns the "top down" initiatives: as the initiative of Roccadaspide can show, there is still need for a real inclusion of the instances and claims of the territories, before organizing such meetings,

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otherwise the risk is that they only represent occasional fake events, created to show to the higher institutions that the local ones are working on the territories.

But the critical perspective is necessary to evaluate the intentions and the actions of all the actors, so we should also focus on the lack of interest about the territorial specificities that sometimes characterizes the higher and centrale institutions, for example EU.

To overcome the problem described above about funds that are available for projects that do not comply with the needs and heritages of some territories, much more needs to be done in the sense of research, consultations, cognitive investigations, etc...

Good policies should take into consideration both the top-down and the bottom-up dimensions to create a more participated life for territories in inner areas and everywhere, but the suggestion that applies to the two dimensions is to overcome the surface and go towards a real knowledge of the local needs. Bottom-up initiatives, as well as top-down ones, may exclude some subjects if the goals are shaped by market-oriented groups or, on the other hand, if solutions are developed by institutions that do not have any knowledge about the local problems.

This can be fundamental in terms of who participates: for example, some municipalities of inner Cilento like Sacco are hosting migrant communities that are not even taken into account in these initiatives, being citizens the main protagonists/target of both the bottom up and the top-down cases.

Hopefully, the current interest for inner areas will create new opportunities to decline projects on the real needs and vocations of such territories.

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CONCLUSIONS

This eBook aims to provide scholars, practitioners and policymakers with an overview and a rigorous and exhaustive analysis of the complexity and criticality of the current state-of-the-art knowledge in the field of CE. These aspects have been analysed in the various chapters (using a variety of methodological, theoretical and empirical methods in different socio-economic contexts). The book provides a broad picture of the problems, criticalities and barriers characterising the current transition towards a just CE. In line with the spirit of this e-book and the project behind it, the contributions of the chapters have directly and indirectly brought out a certain number of indications for transformative policies capable of changing the assumptions underlying the current linear economy model and directing attention towards more comprehensive CE models, based on stakeholder engagement and socially awareness both in terms of research and practice. The salient points of these transformative policies and research implications are summarised below.

Transformative policies

The mainstream neoliberal CE model cannot jointly address social and environmental perspectives and goals. A new socio-economic phase is emerging that calls for models that are more aware of social needs and environmental justice implications. This emerging phase should lead towards Transformative Policies capable of generating more comprehensive and socially inclusive CE models in research and practice.

Integrating diverse groups, cultures, and areas is critical in a globalised world. A transformative CE model must focus on GN and GS relations aiming to highlight (and change) the impacts of GN decisions on GS (both at production and consumption level). It is vital for the GN, as well as for the affluent classes in the GS, to transform their materialist and consumerist lifestyle, as it is at the heart of present injustices and socio-ecological impacts.

A transformative model of society must focus on stakeholder engagement so that citizens are not just consumers but actively contribute to the CE transition, for example, as producers, users, and repairers. The EU should make changes to its CE policies to prevent widening the gap between different areas and increasing social and environmental injustices. A TP should feed these changes towards a more just transition by integrating, on the one hand, the specificities of different geopolitical contexts and, on the other, environmental and social justice with the CE. In particular:

- a. TPs must consider geopolitical differences within the EU and meet long- and short-term needs. In the GN, policies are business-oriented, and citizens have little or no power. In many GS countries, policies are more flexible but limited by the rules of large companies from the GN. TPs should focus on decolonising circularity,

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that is, considering the plurality of forms of understanding and implementing CE and disrupting geopolitical power relations;

- b. TPs should focus on integrating environmental and social justice issues into CE policies, in order to avoid perpetuating the same environmental and social injustices created by the current linear economic model.
- c. Just as an example, gender considerations in the CE perspective should go beyond the SDG approach and lead towards reframing valuation systems so that they can properly incorporate social and reproductive work, which is crucial for socio-ecological sustainability. Gender justice must thus play a key role in both CE research and policy. TPs should focus on the causes of labour inequalities that are being reproduced by the application of CE. More research and analysis are needed to generate and disseminate the appropriate knowledge on the causes of these problems and the cultural/interpretative approaches to be adopted.

Socio-ecological systems should be guided by concepts of common good, public happiness, and quality of life. These principles must be stated as unavoidable requisites for a TP aimed at creating a virtuous circle with institutions, policymakers, citizens and companies. Non-quantitative indicators are needed to map the complexity and the different ways this vision of social and ecological well-being is advanced. Any transformative policy seeking to create desirable sustainable futures must consider the need to grasp and *protect* the variety of relations between human and more-than-human life. To meet this crucial task, any socially desirable CE should conform to the concept and practices of Responsible Research and Innovation (RRI). The latter puts people and the planet at the centre of the debate and helps design transformative policies aiming to achieve both social and ecological well-being.

As a consequence of such a well-being vision (common good, public happiness, life quality), new metrics and new indicators capable of capturing the different dimensions of sustainability constitute an indispensable element for the transition towards a more socially aware CE. The transition to a more sustainable socio-ecological system and CE cannot be pursued in the context of the current growth-based capitalist economies. TPs towards a just transition to socially aware CEs must take into account social variables and related drivers and influencing factors. TPs must consider different geopolitical aspects and socio-ecological models (production and consumption) in the GS and the GN to respect local specificities without imposing production and consumption models that generate economic, social, labour and environmental injustices.

It is well known that Africa is a very differentiated reality from multiple points of view (economic, social, natural, cultural, political). A CE policy for the entire continent is still missing, and CE is not yet part of Agenda 2063; nevertheless, country-specific actions have been adopted. A transformative CE policy for all of Africa should be adopted, which considers country differences and similarities. This is key to react to the power of countries and companies of the GN. In contrast, the EU has one of the best CE regulatory systems, which is recognised worldwide. However, the results of these systems are not equitably shared among countries, and actions high in the EU waste hierarchy (prevention) are poorly supported. Finally, CE policy approaches adopted by China and India highlight different levels of progress in both countries. China seems to be moving beyond waste management and adopting policies that address social goals and the targets of SDGs (Xie et al., 2021).

The diverse scenarios that emerge in different economic and geographical areas highlight the importance of sharing political actions and involving stakeholders and citizens in influencing the affirmation of different CE perspectives. Transformative innovation policies must take into account territory-specific factors in order to

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support local communities in their efforts towards a just transition. Stakeholder engagement, cultural diversity, local experiences and community needs are crucial to transform the CE transition into a just transition and improve socio-ecological well-being. As a consequence, policymakers will have to increase their efforts towards appropriate and unified norms at the global level while ensuring flexibility of their application at local levels. In this regard, it is vital to use qualitative and quantitative indicators to measure progress at appropriate spatial and temporal scales, including environmental and gender dimensions and levels of stakeholder engagement.

Policy implications

A deep consideration of the Chapters in this e-book highlights the importance of critically evaluating the CE paradigm to foster a just transition, particularly concerning unaddressed topics such as environmental and social injustices. As a result, it emerges that appropriate TPs may have a key role in supporting a transition to CE and reducing the current environmental and social injustices, including those based on gender. Most case studies in the literature still provide a reductive vision of the CE, excessively focused on waste management and recycling. Waste recycling is a secondary solution compared to reusing, repairing, and preventing waste production by design, aiming to extend product life and reduce resource consumption. CE is a much wider concept that involves the entire socio-ecological system of a country, from production to consumption. Furthermore, CE is considered by some an umbrella concept (Murray et al., 2017) since it originates from different schools of thought that break with the neoclassical theory and envision socio-ecological change with varying levels of radicality. Chapter 1 points out the importance of environmental services provided for free by Nature. As suggested by Pearce and Turner (1989) and by Odum H.T. and Odum E.P. (2000), disregarding the contribution of environmental services would only end up strengthening the linearity of the economic system. Consequently, chapter 1 has briefly outlined some emerging conceptual solutions for a more socially aware CE, such as the “social & solidarity economy”, the “care-centred economy”, and the “civil economy” paradigms. These are important models to monitor for policy purposes since they appear to overcome the limits of the mainstream CE, which is still based on the neoclassical paradigm where economic decisions are mainly driven by prices and profit and consumption maximization goals and neglect the social impacts and injustices generated in the society.

It should be highlighted that the current focus on mainstream CE gives rise to serious problems, in clear contrast with the just transition approach. For instance, the trade and flow of waste from the North to the South, and the poor working conditions in which waste collection and recycling activities are carried out in the GS (e.g. case studies of waste pickers in Bangkok, in Brazil, in Ghana for example; nevertheless, in the GN the case of Barcelona and Catalonia showed that about 5000 informal waste collectors worked in that region, shedding light that the phenomenon is also present in the EU).

This highlights that implementing a CE, particularly in the sectors of waste management that are regulated and oriented towards the objective of economic efficiency and recycling (e.g. WEEE, municipal solid waste), addresses only some of the environmental and social impacts or externalities of waste management. Therefore, to ensure a just transition to CE, an in-depth analysis of the impacts on the most vulnerable people in the GS.

The studies in the book also show that a transition to CE in the GN has negative effects in other geographical areas, particularly in the GS. More precisely, relevant obstacles to a just transition are the formally regulated waste

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management and recycling systems and their market-based objectives focused on economic efficiency at the expense of environmental and social objectives. As a result, the consideration of alternative and more participative business models as well as economic paradigms beyond neoliberalism is essential to reform the formal systems of waste management and recycling and their functioning.

Research implications

Focusing on the three parts, the topics of interest towards which scholars could address their future research efforts can be summarised as follows.

Part I: Basics of the CE and state of the art

- CE models that are capable of interpreting and representing greater social awareness.
- Identifying barriers and driving factors towards a Just to CE transition and the related determining factors.
- Considering measures of shared responsibility between different actors/countries in technological transition processes, as highlighted in the case of electric vehicle technology.
- Greater attention to initiatives and strategies for stakeholder involvement in the transition to a just CE to incorporate economic, social and environmental issues.
- Evaluate the specific factors of regional models of EC development for a better plurality of theorisations and interpretations capable of supporting the adoption of appropriate political measures for a just transition towards the EC.
- Comparisons of GN and GS case studies are needed to evaluate possible common patterns and best practices.
- Application of a decolonial approach to facilitate the understanding of the costs and benefits of a CE transition for a wider range of peoples and territories.

Part II: Measuring the Circular Economy

- A further and more in-depth exploration of indicators beyond GDP, especially indicators that meet stakeholder expectations and needs regarding the measurement of performances in the CE transition.
- A further and more in-depth exploration of new hybrid research approaches for indicator development as an alternative to the normative approach to support management strategies and policymaking.
- Assessment of the practical application of CE transition frameworks based on the pillars of responsible research and innovation to better understand their practical value and limitations.
- Evaluation of how the CE contributes to achieving sustainable development goals in the GS context and how the research knowledge collected so far is favouring the improvement of well-being in the GS.
- Further exploration of indicators and existing methods (for environmental, social and economic assessment) to understand their strengths and weaknesses and how they could be integrated to measure and promote a CE transition that increases socio-ecological well-being.

Part III: Towards a Just CE: key concepts, national paths, and scenarios

- Analysis of winners and losers in CE transition and identification of appropriate policy measures to mitigate the stakeholders affected negatively by the transition.
- Identification and analysis of environmental and social benefits and costs of measures to improve the labour conditions and life of waste pickers. In particular, more in-depth exploration is needed to facilitate the integration of informal waste pickers in the formal economy and improve their technical and entrepreneurial skills to improve their income.
- Analysis of the gender dimensions in CE transition through case studies, in particular from the GS, since most of the current empirical cases regard the GN.
- Case studies adopting a gender innovation perspective in the research process to better understand the implication of a CE transition on reproductive care work and on women and other vulnerable people.
- Analysis of qualitative aspects related to labour in CE case studies to understand the point of view of labour about the CE transition and its implications. Studies about workers' decision-making power and agency, gender inequalities and racism in the labour market are also very welcome since such aspects are rarely investigated by the current literature. There is also a lack of studies addressing informal workers' labour conditions in the GN, such as the case study of Barcellona waste pickers workers.
- Analysis of policies and regulations supporting the take-up of CE practices in Africa, including: a) green public procurement, infrastructure and technological development, and financial instruments; b) support to entrepreneurial activities, improvement of data collection and management about resources flows and their recirculation in the economy; c) environmental and social assessment of benefits and costs of the adoption of digital and innovative technologies and automation.
- Given the EU's diversified state of the CE transition, case studies of well-performing areas are required to disseminate best practices and help less-performing regions reach a more equitable CE transition.
- Environmental and social assessments of CE development in China and India are also relevant and much needed, especially considering a just transition lens.
- More research is needed to shed light on citizens' preferences for future circular scenarios and what circular economy and society policies they would choose in a democratic context. This analysis would help policymakers and practitioners envision a more desirable circular transition that could bring about human and planetary well-being.

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