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Using Macroeconomic Indicators to Enact an Ambitious Circular Economy

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Abstract

The circular economy has the potential to promote systemic change towards a sustainable future. However, the dominance of technical and market-oriented considerations has placed the circular economy as part of an eco-modernist agenda, which retains growth in gross domestic product as the overarching priority. In this context, we analyse 12 existing macroeconomic indicators, developed and implemented by governments and international organisations, and determine if they could enact alternative notions of circularity. Specifically, we focus on the performative role that indicators can play in both defining and surmounting such reductionist views, thus helping us to address the world we want to create. We find that many of these indicators are agents of the status quo, but that some could disrupt the omnipotence of GDP thereby getting the macroeconomic conditions right for a more ambitious understanding of the circular economy.

Keywords Circularity metrics · Environmental sustainability · Macroeconomic indicators · Resource efficiency · Well-being

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Introduction

Developed as an umbrella concept built on a heterogeneous collection of different schools of thought and research fields such as *industrial ecology*, *biomimicry*, *cradle-to-cradle design* and *cleaner production* [1], the Circular Economy (CE) has emerged as an essentially contested concept, with undefined theoretical boundaries that lack a common and shared definition [2, 3]. Consequently, as some scholars have pointed out, the CE has predominantly been characterised in apolitical and technocratic terms that suggest a transition to circularity will primarily be led by businesses, practitioners and policymakers [4]. Indeed, the dominance of technical and market-oriented considerations has placed CE as a salient part of the eco-modernist agenda, retaining economic growth as its overarching priority, simultaneously underplaying the aim to displace primary production [5]. Furthermore, CE implementation strategies show scant consideration for social dimensions of sustainability and have a strong focus on 'classic' economic and environmental impacts, both in the academic literature and industrial practice [6].

The CE is being adopted in a context characterised by the dependency of global competitive markets on continuous economic expansion, where economic growth represents the panacea of social, environmental and other non-economic issues [7]. Therefore, the CE is expected to enable 'green growth', understood as a sustained increase in the monetary value of production that does not lead to negative environmental impacts [8]. However, many scholars have challenged this claim and pointed out that it is impossible to decouple economic growth and resource consumption in *absolute terms* at a global scale [9]. Moreover, in the face of the urgent ecological and social damages caused by the current production and consumption system, the limited transformational potential of this *reductionist* view of the CE has led to a call for a far more ambitious interpretation of the concept [10], [11], [12], [13].

Polanyi's [14] *substantive* understanding of human economic activity (as distinct from a more limited definition that equates 'economy' with 'market economy') is useful when grounding such an ambitious approach. In this framework, the current situation in which the global economy is shaped and dominated by market logic and ethics [11, 15] is understood as a particular and historically located institutional arrangement of the social and ecological relations by which humans interact among themselves and with their physical surroundings to satisfy their needs. This means that both the institutions and social relations of production they sustain are susceptible to change if they cease to conform to the requirements of human livelihood [14]. Therefore, the shift towards the CE in response to the present global ecological and social crisis can be regarded not only as a technical reconfiguration of the production processes, but also as a complete systemic transformation of the institutions that regulate humans' material interaction with each other and with nature. Inherent within this, the prevailing economic logic that prioritises the increase in the market value of social outputs also needs to evolve, in order to reflect a new set of social values associated with the reconfiguration of the economic system [12].

Consistent with this interpretation, approaches such as the post-growth paradigm exemplified by Kallis [16], Klitgaard and Krall [17] and Hanaček et al. [18] challenge the market-centred vision of the economy and prioritise more ambitious goals such as human welfare and ecological sustainability [19, 20]. These goals better reflect the aims underlying the original systemic notion of the CE, whereby 'the essential measure of the success (…) is not production and consumption at all, but the nature, extent, quality, and complexity of the total capital stock, including in this the state of the human bodies and minds included in the system' [21]. How, though, do we disrupt the status quo (and reductionistic visions of the CE), and move towards such ambitious circular futures that are more in line with Polanyi's [14] substantive understanding of human economic activity?

In this paper, we assert a *performative* approach to answer this question, and we focus on the role of macroeconomic welfare indicators. Specifically, we suggest that such welfare indicators have the potential to influence the way we enact the economy and thus shape the nature of the economic realities that we can envisage and achieve. In this context, the status quo welfare indicator is currently gross domestic product (GDP) and with it the notion of economic growth. However, as Hale et al. [22] (p.49) put it, 'the economy is not GDP – it is enacted in situated practices more heterogenous than something like GDP depicts', but nonetheless, [GDP] has 'come to substitute for individual, household, community and national wellbeing' (it has become *ontic*) despite its well-studied limitations in these areas and calls for alternative welfare indicators (e.g. [19, 20, 23, 24]). Indeed, leading proponents of the CE including the EU [13, 25, 26], China [13] and the Ellen MacArthur Foundation [8], still rely on GDP as a principal indicator of reference when formulating their CE strategies. Therefore, as per Gibson-Graham [27], we need to be asking what kind of world we want to create, and in response, advancing more ambitious macroeconomic indicators to achieve this.

While there have been important studies that have envisaged futures beyond GDP (e.g. [28]) and a variety of circular futures (e.g. [29, 30]), the performative impact of existing macroeconomic indicators and how they could provide propitious conditions for a transition to an ambitious CE is not something that has been studied to date. Much of the discussion of macroeconomic indicators for a CE focuses exclusively on China [31] and the measurement of circularity itself rather than overarching welfare indicators that could supplement or replace GDP in the public consciousness. For example, Zhijun and Nailing [32] have discussed implementing CE in China and the CE indices and indicators needed to affect this, and Geng et al. [33] provide a critical analysis of China's existing nationally focused CE indicators. Wang et al. [34] have recently proposed new approaches to measuring circularity in China. Outside of China, De Pascale et al. [35] and Saidani et al. [31] have analysed a wide range of potential indicators in the context of the CE, including at the macro-level. However, again, the focus has been on circularity indicators. Similarly, Jacobi et al. [36] and Mayer et al. [37] have proposed economy-wide biophysical frameworks for the assessment and monitoring of a CE, while Schroeder et al. [38] have discussed the relevance of the CE to the Sustainable Development Goals.

In this context, this study's primary aim is *to analyse how alternative macroeconomic indicators could enable us to envision, create and enact ambitious conceptions of the CE.* To achieve this, we review a set of indicators according to a simple conceptualisation that understands the economy as being comprised of three pillars: the economic dimension, the environmental dimension and the social dimension [39, 40]. We do not aim to formulate an ideal approach or system of indicators, or to stray into discussions of modelling the CE that have been effectively addressed elsewhere (e.g. [41]). On the contrary, this paper aims to provide an exploratory overview of how innovative *existing* macroeconomic indicators can enable new visions of the CE. It is, if you like, a practical 'stock take' of what indicators are available now and how these might be augmented further in the future to provide a more hospitable context within which an ambitious CE might be furthered. Indeed, we have pursued this end out of an understanding that specific CE practices can be more or less determined by the way in which we frame, measure and envision the broader macroeconomy.

The paper proceeds as follows. The 'Materials and Methods' section presents the methods that were employed to select and analyse the macroeconomic indicators we address here. The 'Macroeconomic Indicators for an Ambitious CE' section introduces the final 12 indicators selected, as well as the instances where these approaches have been applied in practice. The 'Discussion' section discusses the suitability of the various approaches in helping us to define and perform an ambitious CE. Finally, the 'Conclusion' section concludes and suggests avenues for future research.

Materials and Methods

We selected and classified a range of indicators, frameworks and metrics (henceforth just 'indicators') according to the three pillars that reflect the ambition of a functional CE, namely *efficiency in resource use*, *environmental preservation* and *well-being* [2], [42]. These pillars are also reminiscent of 'sustainability' more generally. However, we rely on the pillars here as an organisational device that captures a broader macroeconomic perspective than a traditional focus on GDP, and because invoking such a framework and broadening the definition of what is important for a CE to measure can itself lead to performative impact that stimulates the development of additional CE indicators.

We specifically focused on macroeconomic indicators (applicable to cities, regions, nations and beyond) that were in existence when this study was conducted (March 2022), and which had been developed or implemented by NGOs, international governmental organisations, partnerships between universities and governments, or governments themselves. We also prioritised indicators with a relevant track record to examine. As a result, the focus here is more empirical in nature, which distinguishes it from a large part of the academic literature described previously. Moreover, we specifically excluded indicators that are concerned with circularity mechanisms themselves, rather choosing to focus on approaches that address the overarching economic system, i.e. we effectively treat the economic system as a 'black box'. The 12 indicators that we settled on were found due to our familiarity, as a five-person research team, with the work in this area and by searching a variety of terms related to *macroeconomic indicators*.[1] As discussed above, the particular focus of this paper—including academic research but focusing on policy applications—has only been studied to a limited extent. As a result, no firm list of keywords or search terms has yet been established in this specific area.

Table 1 and Fig. 1 provide an overview of the indicators that will be covered in this paper. As shown, many of these indicators are applicable to more than one pillar. Indeed, while we classified the indicators to the most relevant pillar based on the issues they address, in some cases, the scope of the indicators also extends to other pillars. Therefore, in Table 1, the connection between indicators and pillars is classified as either 'highly relevant' or 'relevant.' However, in the discussion that follows, indicators are examined in the section to which they are considered as 'highly relevant'.

[1] The searches were undertaken independently by each member of the work package to ensure the broadest possible coverage.

Table 1 The 12 indicators covered in the paper (by pillar)

	Created by	Resource efficiency	Environmental sustainability	Well-being
National Circularity Gap	Circle Economy (non-for-profit organisation)	✓✓	✓	
EU Resource Efficiency Scoreboard	EU	✓✓		
OECD Green Growth Indicators	OECD	✓✓	✓	
Sustainable Development Indicators	UN	✓	✓✓	✓
Natural Capital Index	Stanford University		✓✓	
Ecological Footprint	Global Footprint Network (non-profit organisation)		✓✓	
Environmental Performance Index	Collaboration between Yale University, Columbia University, and the World Economic Forum		✓✓	
Gross National Happiness Index	Government of Bhutan		✓	✓✓
Canadian Index of Wellbeing	Atkinson Charitable Foundation (before 2011) and University of Waterloo (after 2011)		✓	✓✓
Genuine Progress Indicator	Non-profit organisations and universities across the USA (cases in Vermont, Maryland, Colorado, Ohio, and Utah)		✓	✓✓
European Social Progress Index	EU		✓	✓✓
Size of the Informal Economy (% of GDP)	International Conference of Labour Statisticians			✓✓

Note: ✓✓= highly relevant; ✓=relevant. *EU*, European Union; *OECD*, Organisation for Economic Cooperation and Development; *UN*, United Nations

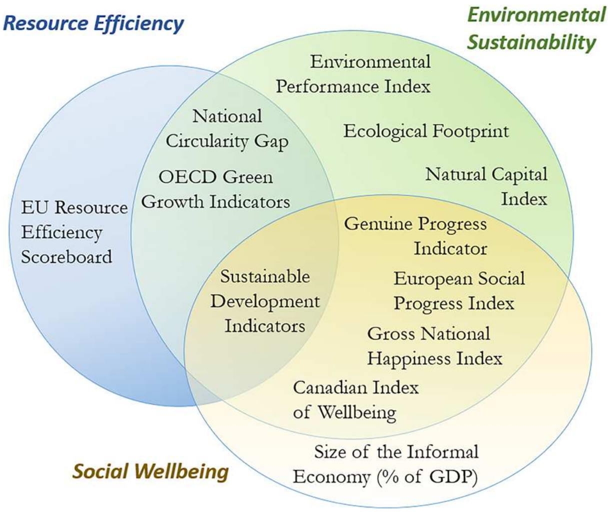

Fig. 1 The 12 macroeconomic indicators and their relationship to the three pillars

Macroeconomic Indicators for an Ambitious CE

The 12 macroeconomic indicators that were selected for analysis here, and the instances where these have been applied to date, are introduced in the following sub-sections starting with resource efficiency indicators, environmental sustainability indicators, and finally, well-being indicators.

Macro-Level Approaches to Resource Efficiency

National Circularity Gap

The notion of the existence of a ‘circularity gap’ in a territory is derived from the economy-wide material flow accounting (MFA) approach. MFA is a methodological framework that quantifies the exchanges of materials and energy in the economy in physical terms [43]. This involves all the material and energy inputs,[2] which can either be incorporated into the physical stocks and end up as outputs of the economic process (exports, emissions and waste) or be recovered/recycled as secondary inputs. The ‘circularity gap’ is then measured as the ratio between the recovered materials and the total amount of resources extracted and used. The most widespread measure of the circularity gap is performed by the non-for-profit organisation Circle Economy, responsible for the Circularity Gap Report initiative (CGRi). The circularity gap is calculated by CGRi mainly at the worldwide level, but it has also been applied at the national level in Austria, the Netherlands and Norway, as well as the province of Quebec in Canada [44].

[2] The MFA does not include water and air (Eurostat, 2018a).

There are a few other examples that showcase similar calculations to measure the level of circularity for economies and territories. One of the approaches that is close to the Circularity Gap discussed above is the methodology followed by Eurostat to develop the 'circular material use rate'. This metric was incorporated into the EU circular economy monitoring framework as a 'single summary indicator about the circularity of [EU] economies at macro economical level' [45]. Although it is based on the same premise as the circularity gap (amount of recycled waste as a proportion of total material use/extraction), some considerable methodological differences exist. For example, Eurostat's approach controversially considers that exports (imports) of recyclable materials contribute to increase (reduce) the circular material use ratio of a country. This basic assumption, contrasting the one made in the CGRi methodology, causes Eurostat's circular material use rate to favour recyclable waste collection over actual waste processing/recycling [46].

Some scholars critiqued the National Circularity Gap. Aguilar-Hernandez et al. [47] argue that most circularity gap studies fail to discriminate between the materials that are emitted, added to in-use stocks or disposed of previous stocks. Including these in the material analysis leads to misleading results because they are not actually available for recovery [47]. Another key limitation of the circularity gap is its extreme dependence on how system boundaries are defined. In this regard, it has been reported that the circularity gaps of the richest countries tend to increase significantly when their material recovery rate is put in relation not only to their domestic extraction and direct imports, but with their total global material footprint (which includes all the materials extracted to produce their imports -*indirect imports*-) [48]. Finally, Martínez-Alier [49] provides a holistic critique of the notion of circularity itself, as it represents an expansion of the resource extraction and waste disposal frontiers of capitalism that does not solve the sustainability challenges of capitalism. Therefore, the circularity gap may not contribute to reducing the environmental impact of the production system but it widens and deepens the resource extraction frontiers to enable further economic growth [49].

EU Resource Efficiency Scoreboard

The Resource Efficiency Scoreboard is a composite indicator that was designed by the European Commission (EC) to support the political actions and goals set by the Roadmap to a Resource Efficient Europe, aimed at improving the use of natural resources among the EU members [50]. The main purpose behind developing such a framework was to monitor the trend for increasing resource productivity and decoupling economic growth from resource use and the related environmental impacts. Its 32 indicators followed a hierarchical structure, with resource efficiency representing the main leading indicator, followed by metrics related to the environmental impacts of resource use and thematic indicators that monitor the transformation of the economy, natural capital and key sectors (European Commission [51]) (Fig. 2). This scoreboard supports a vision of the economy that maximises the use of existing resources, which is in line with some of the principles of the CE, especially with the idea to maintain materials within the economy. The lead indicator, resource efficiency, is calculated by dividing GDP by domestic

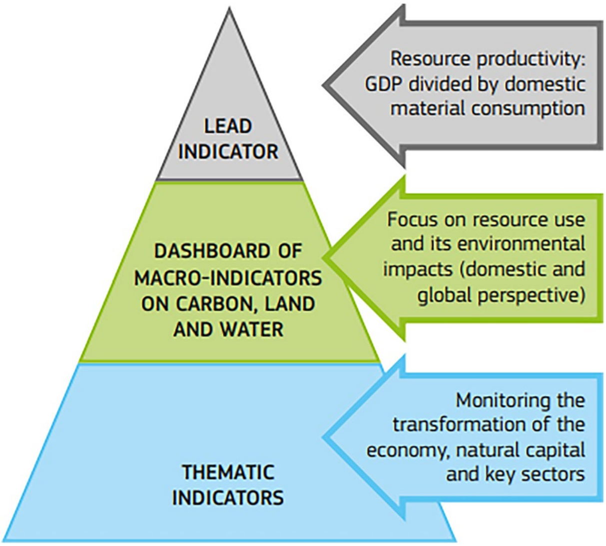

Fig. 2 Tiered structure of the EU Resource Efficiency Scorecard (source: reprinted with permission from European Commission [52])

material consumption (DMC), indicating the amount of economic value that can be obtained per physical unit of materials.

Many drawbacks have been pointed out in the literature about this approach. The main issue is the fact that this indicator still relies on GDP and does not detach itself from the monetary valuation derived from the market sphere [53, 54]. As a consequence, a rise in prices and/or changes of the economic structure of a country towards activities with higher monetary value added may lead to spurious conclusions about an apparent dematerialisation of the economy. For example, during the international financial crisis in 2008, some European countries registered a remarkable increase in material productivity, simply due to the sharp contraction in the construction sector resulting from the sudden burst of a real estate bubble. Moreover, the indicator may reflect the occurrence of relative decoupling while absolute material use may be still increasing [53, 54]. Finally, the issue of system boundaries also applies to this indicator, as apparent efficiency gains may be obtained through displacement of the material burden to other territories [2].

OECD Green Growth Indicators

The notion of 'green growth' emerged in the last decade as an institutional[3] response to the overwhelming evidence regarding the ecological deterioration caused by human economic activity. It is based on the premise that continued GDP growth could be achieved within the ecological limits of the planet and thus continues the line of previous conceptualisations on sustainable development, such as ecological modernisation and the environmental Kuznets curve hypothesis[4] [9, 55]. Smulders et al. [56] propose a conceptual distinction between the

[3] The concept of 'green growth' has been promoted to a great extent by international institutions such as the OECD and the UNEP [56].

[4] The Kuznets curve hypothesis states the existence of an inverted-U relation between economic growth and environmental damage (Cole, Rayner and Bates, 1997), thus prescribing that economic convergence among countries will lead to an overall reduction of the ecological impacts.

'strong green growth' approach and the 'weak green growth' approach. The former is promoted by UNEP, who focus on making growth compatible with environmental preservation, and the latter is advocated by the OECD, whose approach is based on the assumption that it is possible to decouple economic growth and its implicit environmental impact [56, 57]. The vision of green growth of the OECD can use the CE as an enabler of green growth in a similar fashion to the notion of a circularity gap, as the CE can expand the limits of resource extraction and intensify resource use to further enable economic growth [49].

The OECD Green Growth Indicators framework comprises 26 different indicators, categorised into four groups: (1) environmental and resource productivity, (2) natural asset base, (3) environmental dimension of quality of life and (4) economic opportunities and policy responses [58]. These indicators correlate with the growth of GDP and measure on how countries improve their green-growth related performance [58, 59]. This can happen by development of green technology that paves the way for the creation and use of clean energy and a relative decoupling of environmental impact [59]. In this sense, the OECD Green Growth indicators maintains close similarities with the EU Resource Efficiency Scoreboard, as both frameworks are promoted to guide economic policy internationally, and both aim to promote GDP growth while reducing environmental impact. However, the main critique of these indicators is the shared assumption that economic performance is based on enabling economic growth. The growth model has the limitation of being highly dependent on the availability and consumption of resources [59]. It also assumes and encourages the pursuit of decoupling strategies to improve environmental performance, which opens up a new debate. While many experts defend the possibility of decoupling economic growth from resource use and environmental impact [60],UNEP [61, 62], others challenge the feasibility of absolute decoupling occurring at a rate fast enough to prevent global warming over 1.5 °C or 2 °C [9]. In this sense, some scholars call for the decoupling of material use from variables other than GDP, such as those depicted in the Human Development Index (HDI) [9], [63].

Macro-Level Approaches to Environmental Sustainability

Sustainable Development Indicators

The UN 2030 agenda for Sustainable Development aims to enable peace and prosperity for people and the planet through the adoption of 17 Sustainable Development Goals (SDGs) and 169 targets [64]. These goals represent a new strategy to coordinate international governance by providing a set of common global objectives towards sustainability [65]. To measure the global advancements in achieving these goals, the UN published a set of indicators linked to the SDG targets to show how close or far each country is to meeting each goal [66].

From an ecological perspective, some of the SDGs are compatible with the main principles and goals of circularity; therefore, the indicators designed for of some of the SDGs are also relevant to analyse the transition to the CE. For instance, reducing waste generation through prevention, reduction, recycling and reuse is currently among the targets of SDG 12 (responsible consumption and production), and the SDG 13 (climate action). Also, the improvement of agricultural productivity by the reduction, recycling and reuse of waste is contemplated in SDG 2 (Zero Hunger) [67]. Extended use of renewable energy sources, one of the pivotal enablers for constructing the CE [2], is contemplated in SDG 13 (Climate Action). Also, other SDGs have both direct and indirect links with the environmental aspect of the CE agenda, such as SDG 6 (clean water and sanitation), SDG 7 (affordable and clean energy), SDG 11 (sustainable cities and communities), SDG 14 (life below water) and SDG 15 (life on land).

Despite their apparent suitability, the SDG goals are built as a set of indicators instead of a holistic indicator, leading to trade-offs as certain issues can be prioritised over others. For example, poverty-related goals might be prioritised at the expense of other SDGs related to environmental performance [68]. Another factor is the attainment of different goals, such as economic growth, climate action and responsible consumption and production, which do not correlate or negatively correlate with each other, leading to an increase between the trade-offs and contradictions within the SDG and their indicators with the attainment of a sustainable development [69]. A third criticism of the SDG indicators is the challenge of gathering all the necessary data to calculate them at a global scale [70].

Natural Capital Index

The notion of natural capital is used to describe components of the natural environment that provide valuable goods or services that are critical for society including minerals, fuels, animals, plants or ecosystems [71–73]. The need to monitor the state and trends of natural capital has motivated the creation of the Natural Capital Index (NCI). The NCI provides a structured and comprehensive approach to measure natural capital and allow decision-makers to take into account national natural capital and ecosystem services when they make decisions about economic development [74], [75].

NCI has been used in several studies to assess the status of the amount and value of the natural capital in certain locations. For example, the NCI has been used in combination with the ecological integrity hierarchy framework (EIHF) to estimate the natural capital of Mexico [75]. Also, Scotland has developed its own methodology, the Natural Capital Asset Index (NCAI), to account for its natural capital stock [76]. In addition, Stebbings et al. [77] used their own version of NCI, based on the ecosystems service dependencies of an economy, to assess the benefits of natural capital of the marine environment in the UK.

The use of NCI allows policymakers to track their action and their progress in preserving or improving their natural capital, which includes preserving the biodiversity within their countries, preserving their natural resources and progressing towards a more sustainable development [71], [73]. The use of this framework encourages a transition away from production-based indicators towards the consideration of ecological assets, which can be aligned with some of the elements that compose the CE. The NCI also encourages policymakers to understand the causes of biodiversity loss and allows them to take specific measures to prevent further deterioration.

A disadvantage of the NCI framework is that it adopts an environmental output perspective to address the societal performance of the economy. Although this perspective aims to weight the value of nature and its preservation, it does not distinguish if the presence of natural capital is caused by an actual shift towards more sustainable practices or by simple geographical luck. Such a perspective provides a limited view of the performance of the economy, as it disconnects the environmental impact of the economy from its ability to satisfy societal needs. Another source of criticism is the commodification of nature implicit in the use of NCI, as environmental values cannot be measured with units as money [78], or the incompatibility of the monetised nature with market mechanisms [79]. Another weakness of NCI is the diversity of methods and approaches to calculate it. Approaches such as that of the World Bank, the index applied to Hungary by Czúcz et al. [80], or the framework presented by Fairbrass et al. [74], each deploy their own methodologies to measure NCI, thus leading to a lack of coherence and the difficulty of comparing results. Furthermore, there appear to be very limited applications of NCI, although the World Bank is attempting to be ambitious with its index and intends to measure many countries on a regular basis [81].

Ecological Footprint

The concept of the Ecological Footprint (EF) of a population was first introduced by Wackernagel and Rees [82], who defined it as 'the area of ecologically productive land (and water) in various classes — cropland, pasture, forests, etc. — that would be required on a continuous basis to (a) provide all the energy/material resources consumed, and (b) absorb all the wastes discharged by that population with prevailing technology, wherever on Earth that land is located' [83]. Many scholars used the EF to measure the environmental impact of a country [84], [85], [86]. The EF aligns with the idea that the CE can reduce the environmental impact of the economy. Hence, a strong adoption of CE practices should be translated to a decreased EF in a country.

The most widely disseminated EF measurement is currently developed by the Global Footprint Network (GFN) [87]. In practice, the EF is calculated by adding up all the demands for biologically productive space measured in global hectares and is then contrasted with the total available biocapacity [88]. This offers an estimate of the 'ecological deficit' incurred by the populations that use resources in excess of their own biocapacity, which is compensated through the consumption of the 'ecological reserve' or 'credit' belonging to the inhabitants of other territories [89]. The Environmental Footprint is an indicator that better reflects the impact of the human activity in comparison to the NCI, as it takes into account the demands for resources. This indicator thus allows the estimation not only of the resources that a country has, but also how much each country contributes to environmental degradation. This element in especially relevant in a context of a globalised economy where most of resources are not sourced locally, because it allows us to identify how wealthy countries account for global environmental degradation despite having a well-preserved local environment.

Another EF-derived metric used to reflect the unequal environmental pressure that some populations exert on others is the estimate of the number of 'planets Earth' that would be required if the entire world population shared their consumption pattern (in terms of per capita EF).[5] Although hypothetical, this exercise yields compelling results: according to the latest data available (2017), if all countries had

[5] Data available at https://data.footprintnetwork.org/#/

the same per capita EF as Qatar (the largest per capita EF), humanity would need the equivalent of 9 'Earths' to subsist; 8 in the case of Luxembourg; 5 for Canada and the USA; more than 4 for Australia, Belgium and Denmark; between 3 and 4 for South Korea, Austria, Sweden and the UAE; around 3 for the Netherlands and Germany.

The methodology employed by the EF relies on several assumptions that may to a large extent be determinant for the results obtained. Perhaps the most significant of these are the calculation of the total available biodiversity: the share of available land for cultivation and infrastructure is estimated to be equivalent to the amount of land actually used for these purposes. As a consequence, the methodology does not allow for unused reserves of cropland and buildable land or distinguish between different cultivation techniques and/or ownership regimes, thus reflecting land productivity rather than land management sustainability [87]. Another implication of the GFN methodology is that most of the estimated EF corresponds to the biodiversity required to absorb the direct and indirect CO_2 emissions linked to consumption. This has been criticised by some authors, who argue that the EF ends up being a CO2-centred static measurement that does not consider potential shifts in the global energy matrix towards options with less ecological impact [90]. Detractors also point out that the methodology penalises territorially small and commercially open rich countries, regardless of their potential to develop and use renewable energy and exploit their biodiversity more intensively and efficiently. Consequently, they propose that the calculation of EF should be based on models depicting different scenarios to reflect the particular environmental policies of each territory, instead of relying on environmental accounting [90].

While some of the methodological objections have been addressed in subsequent developments of the EF and its variants, the idea of abandoning accounting in favour of modelling has been largely dismissed. This is mainly because the purpose of the EF is precisely to account for the global negative environmental impact that supports the higher levels of welfare, efficiency and sustainability of the richest countries. Moreover, EF calculations aim to reflect the situation corresponding to the current global production and consumption patterns and energy matrices, and not to speculate on unjustifiably optimistic future scenarios of change [91]. In this sense, accounting for the indirect resource requirements and emissions embodied in the goods imported by the different countries, far from being seen as a drawback, is generally considered the main strength of the methodology.

Environmental Performance Index

The Environmental Performance Index (EPI) measures the health of a country's environment and the vitality of a country's ecosystems using 32 measures in 11 categories EPI [92] . The EPI represents a collaboration between Yale University, Columbia University and the World Economic Forum, and has been in operation since 2006, when it replaced the Environmental Sustainability Index [93]. The EPI's breadth is highlighted by its inclusion of biodiversity and habitat, climate change and water quality elements, demonstrating its strength as an environmental indicator [94]. This index can contribute to a more accurate assessment in the context of the CE, as traditional measures such as GDP do not consider environmental externalities [19]. In this sense, the EPI and the EF share a common approach when they relativise the environmental impact of a country in relation with its own available environmental resources, while the NCI is limited to only analyse the available natural resources within each country. The EPI is thus as equally aligned with the CE as the EF is, given that a strong adoption of circular practices should lead to a higher environmental performance.

One of the strengths of the EPI is that it allows comparisons of the environmental performance across countries [95, 96] and also between sectors within the same country, as in the case of Lithuania [97]. In this sense, the use of EPI can be useful from an output perspective, as it can estimate how much the environmental performance has improved after the adoption of the CE. Some authors point out that the EPI framework does not easily translate environmental performance into practice. This is because it combines elements that do not describe important environmental issues but are important for tracking the performance of these elements as they affect society. For example, air and water pollution are calculated in relation to the impact on humans. As a result, the EPI is strongly correlated with the indicators relevant to environmental stress to human health, while it has a very low correlation with the indicators relevant to ecosystem vitality [96].

Also, the EPI does not appear to be inclusive of well-being, as it only monitors environmental-based elements and elements related to human health. EPI measures key environmental outcomes and targets to provide performance evaluation for policymakers to encourage the improvement of environmental performance [94, 98]. Therefore, many scholars combine the use of EPI with other indicators, such as economic growth or the Human Development Index [94], [99].

The EPI has been widely applied, accounting for a total of 163 countries in 2010 [96]. However, some countries are missing from the evaluation due to the lack of quality data and it has been reported to be only relatively reliable in 109 countries [96]. Furthermore, a study by Abdullah [100] highlights that the current methodology to compute EPI fails to address the existing data gaps, therefore proposing that a fuzzy decision making method should be applied instead.

Macro-Level Approaches to Well-being

Gross National Happiness Index

The Gross National Happiness (GNH) index was created with the intention that sustainable development should take a holistic approach towards notions of progress and give equal importance to non-economic aspects of well-being [101, 102]. The GNH index served as a guiding philosophy for Bhutan's governance based on nine domains [102]: psychological well-being, health, education, time use, cultural diversity and resilience, good governance, community vitality, ecological diversity and resilience and living standards. By using these nine domains, the GNH index aims to orient the country towards happiness by assessing the presence of the conditions that generate unhappiness.

The novelty of the GNH index is that instead of measuring aggregate or average happiness, it aims to measure how members of the population (in this case Bhutan) reach a 'sufficient level' of happiness across a set of dimensions. The underlying assumption of the GNH index is that the ability of people to be happy depends on meeting a range of minimum conditions [103]. This approach allows for a stronger focus on well-being and its development, leading to improved environmental preservation [103]. Considering the fact that social aspects are largely overlooked in conventional economic performance measurement, the GNH index bears the potential to address this issue in the context of the CE. Hence, the use of an index such as the GNH aligns with a vision of the economy that does not necessarily seek economic growth, but social satisfaction, which can lead to a strong version of sustainability.

The GNH proposes an approach that measures social progress while disregarding material production. This allows the GNH to overcome the disadvantages of GDP on the economic policy debate and to provide a vision of economic performance that enables a strong vision of sustainability [101, 104–106]. However, the main weakness of using a happiness-based indicator is that happiness is a subjective, contextual and culturally shaped notion that is defined differently across different societies [107]. In addition, GNH is only used in Bhutan, and there is a lack of available data across the world to perform cross-country comparisons [105, 108]. Since 2011, the UN General Assembly has urged other countries to follow Bhutan's example and measure happiness and well-being, although no other nation has followed this call so far. Furthermore, it could be challenging to measure GNH consistently. Although Bhutan does not have an explicit CE policy, and there are no cases where the GNH has been applied as an indicator to measure performance of CE practices, the political impact of GNH index had important implications for the sustainability performance of Bhutan as this indicator encourages a more convivial perspective to develop the economy as it does not demand an increase in economic production [101], [106].

Canadian Index of Wellbeing

The Canadian Index of Wellbeing (CIW) indicator aims at generating a national, broad and balanced instrument to show the public the evolution of well-being, in all of its possible dimensions. The main reason behind the creation of this indicator was the over-reliance on GDP to measure the economic performance of Canada [109, 110]. Its creation is a citizen-led initiative that started at the Atkinson Charitable Foundation (ACF) in 1999, when a group of Canadian experts posed the question: 'What would it take to create a tool that truly measured Canadian well-being?' In 2010, the ACF ceased calculating the CIW, which has been calculated and monitored by the Faculty of Applied Health Sciences at the University of Waterloo since 2011. To calculate CIW, a set of 64 different indicators are extracted from data sources provided by Statistics Canada. These indicators are grouped in 8 different domains: community vitality, democratic engagement, education, environment, healthy populations, leisure and culture, living standards and time use [111], [112].

The CIW has been used in Canada, together with GDP, to provide a different perspective to decision-makers on the main problems and challenges that Canadian society faces [109]. This represents a critical difference between GNH and CIW: GNH has replaced GDP, whereas CIW is used to complement it. Although GDP has not been completely replaced, its use, accompanied by CIW, provides a more nuanced vision on the performance of Canadian society other than how much the country produces. This led to closer political attention to the elements and issues identified by the CIW [88].

However, the use of the CIW index presents a set of challenges, such as the difficulty to have complete stocks of data, the potential redundancy and interconnectedness of the different sets of data, and the cost to calculate this complex indicator [88]. Although policymakers in Canada do not mention the use of the CIW in their CE policies, we can speculate that the use of CIW could align with a vision of the economy that prioritises social welfare instead of growth, which can also lead to a strong version of sustainability in a similar fashion to the GNH.

Genuine Progress Indicator

The creation of the Genuine Progress Indicator (GPI) has been motivated by the lack of comprehensiveness of GDP, and the need to create metrics broader than GDP that put economic, environmental and social elements into a common framework and observe progress in a more comprehensive way [113–115]. Thus, the creation of the GPI was an attempt to provide a more accurate measure of welfare and to gauge whether or not an economy is on a sustainable time path [116–118]. In this context, GPI was built to provide a broader picture than GDP and to support more sustainable and socially inclusive economic policies [116]. This use of the GPI as a complement to GDP is shared by the CIW. The GPI consists of more than twenty aspects of economic lives that are ignored by GDP. The list was based on the data available by Cobb et al. [116]. These aspects are grouped in the following five categories: (1) built capital, (2) financial assets, (3) natural capital, (4) human capital and (5) social capital [118]. The result is an index that attempts to measure our collective welfare in terms of principles of sustainable development drawn from the economic, social and environmental domains.

One of the main characteristics of GPI is that it considers income distribution, where an increase in the income of the poor carries a higher weight than an increase in income of the wealthy. For example, the difference in income weighting is justified as income inequality and is correlated with several social problems, such as higher rates of drug abuse, incarceration and mistrust and poorer physical and mental health [117]. However, GPI is also criticised for lacking robust valuation techniques and lack of appropriate data to value many of its components that are assumed. For instance, GPI measures the cost of non-monetised elements such as the cost of crime, the cost of noise pollution, the cost of family breakdown or the cost of lost leisure time [119]. There is no consensus about the valuation process and the data used for measuring some of the aforementioned components. Although the GPI is not used in countries with explicit CE policies, the GPI shares a common approach with the CIW. Namely, it aligns with a vision of the economy that prioritises social progress instead of growth, which can also lead to a strong version of sustainability in a similar fashion to the CIW.

European Social Progress Index

The European Social Progress Index (ESPI) indicator was developed to measure social progress as a complement (and not a substitute) to traditional measures of economic progress, such as GDP. It was developed within the framework of the ‘Beyond GDP’ discussion, and there have been only two editions published, in 2016 and 2020 [120]. The ESPI is developed by the EU-SPI Pilot project and funded by the EC to improve policymaking, in particular for those initiatives aimed at enhancing cohesion across the EU [88]. The Index measures social progress using twelve components that are aggregated into three broader dimensions describing basic, intermediate and more subtle aspects of social progress, respectively: (1) basic human needs: nutrition and basic medical care, water and sanitation, shelter, personal security,(2) foundations of well-being: access to basic knowledge, access to information and communication, health and wellness, environmental quality; (3) opportunity: personal rights, personal freedom of choice, tolerance and inclusion, access to advanced education.

The ESPI is intended to complement and not replace GDP. This use and design suggest critical similarities with the CIW and the GPI. However, given the novelty of this indicator and the lack of literature that has analysed it and practices using this indicator, it is challenging to foresee its applicability to EU policymaking. Given its design and intended use, we can expect that the ESPI will have a similar impact to the GPI and CIW. However, a critical difference of ESPI is that it has been developed by the EU institutions and not an external academic organisation or an NGO. This suggests that the ESPI may have more potential than its Canadian and US counterparts in shaping EU policy. The use of this index could enable a stronger version of sustainability in the CE transition, in a similar fashion to the GPI and CIW.

Size of the Informal Economy (as a Percentage of GDP)

The International Conference of Labour Statisticians (ICLS) defined the informal economy as labour that is outside the scope of social protection mechanisms and labour legislation [121]. Some specific examples of the informal economy include child employment, domestic labour and care work. GDP is not inclusive of the informal economy, even though it has been estimated to account for more than 60% of the World's employed population. It is worth mentioning that the informal economy is associated with social vulnerability due to precarious labour conditions and lack of social protection [122].

Several studies have attempted to measure the size of the informal economy. While it is usually expressed as a percentage of GDP, the precise methodology to calculate the size of the informal economy is not unanimous, with studies attempting to use a variety of techniques such as structural equation modelling [124], Multiple Indicator—Multiple Cause (MIMIC) modelling [125] and the Gutmann approach [126]. Taking into account the social dimension associated with the quality of employment is particularly relevant for monitoring the EU's transition to CE, as many of the circular activities linked to recovery, repair and reuse have been reported to rely on low remunerations and high rates of unpaid employment [48].

Table 2 provides a summary of the 12 indicators that were included in the final analysis.

Discussion

In light of the preceding analysis, there seems to be (at least) two ways in which we could address the main goal of this paper, i.e. *to analyse how alternative macroeconomic indicators could enable us to envision, create and enact ambitious conceptions of the CE*. First, we could take a narrow *pragmatic* or *technical* point of view and think

Table 2 Comparison of alternative indicators/frameworks for measuring economic performance

Indicator/framework	Implementation context	Elements measured	Shortcomings
National Circularity Gap	43 countries in different regions	Performance in recovering waste	Focused on waste management. Dependent on the geographical definition of recycling (local waste collection vs. local waste processing) and of total material use (domestic use vs. material footprint)
EU Resource Efficiency Scoreboard	European Union	Multi-factor framework consisting of several indicators focusing mainly on: - Resource efficiency - Land/Water productivity - Carbon footprint - Waste management - Supporting research and innovation - Environmental and energy tax - Biodiversity management	Interpretation for some indicators requires extra accuracy since there are indicators that overshadow each other; no social factor has been taken into consideration
OECD Green Growth Indicators	38 member states of the OECD	Multi-factor framework consisting of several indicators focusing mainly on: - Economic growth - Labour markets - Resource productivity - Biodiversity and ecosystems - Renewable and non-renewable stocks - Environmental dimension of quality of life - Technology and innovation - International financial flows - Environmental taxation	Some of the indicators are still in the phase of development and it is not clear how they are measured; no social factor has been taken into consideration
Sustainable Development Indicators	UN Inter-agency and Expert Group on SDG Indicators (IAEG-SDGs)	- Climate change - Energy - Zero hunger - Life under water - Life on land - Sustainable cities and communities	The flexibility in which precise indicators are chosen by a nation makes it difficult to make a full comparison across countries

Table 2 (continued)

Indicator/framework	Implementation context	Elements measured	Shortcomings
EPI	180 countries (including Denmark, Luxembourg and Switzerland)	- Environmental health - Ecosystem vitality	The methodology to calculate EPI scores has evolved multiple times since its inception. Furthermore, although the score was calculated in 2020 for 180 countries, a few nations are still missing
Ecological Footprint		- Environmental impacts - Energy and material consumption - Waste management	This indicator only focuses on the environmental output of the economy and the natural elements present in a country
NCI	Calculation only in exploratory and academic studies	- Water availability - Biodiversity management - Agricultural fertility - Natural stocks	This indicator only focuses on the environmental output of the economy and the natural elements present in a country
GNH	Government of Bhutan	- Psychological well-being - Health - Education - Time use - Cultural diversity and resilience - Good governance - Community vitality - Ecological diversity and resilience - Living standards	This indicator has been calculated only in Bhutan. It has been developed as an initiative of the monarchy without public involvement
CIW	Canada	- Community vitality - Democratic engagement - Education - Environment - Population health - Leisure and culture - Living standards - Time use	This indicator has only been used by one country (Canada). The data necessary to calculate this indicator is often unavailable or challenging to calculate

Table 2 (continued)

Indicator/framework	Implementation context	Elements measured	Shortcomings
GPI	State of Vermont, State of Maryland, State of Washington, State of Hawaii (USA)	- Built capital - Financial assets - Natural capital - Human capital - Social capital	This indicator has only been used by a few states within the USA. The data necessary to calculate this indicator is often unavailable or challenging to calculate
ESPI	European Union	- Nutrition and medical care - Water and sanitation - Shelter - Personal security - Access to knowledge - Access to information and communication - Health and wellness - Environmental quality - Personal rights - Personal freedom - Tolerance and inclusion - Access to advanced education	This indicator is still under development, and it has not been used yet by the EU
Size of the Informal Economy	South Africa, North Korea, Latin America, Soviet countries, Pakistan, Romania, the Caribbean and Spain	Extent of labour that is outside the scope of social protection and labour legislation	The informal economy has not been calculated on a regular basis for most nations. Furthermore, there are several methodologies adopted for its calculation, which makes it hard to make reliable comparisons across nations

about the extent to which the 12 indicators represent a broader conception of the economy, beyond that offered by GDP, as framed by the three pillars outlined (efficiency in resource use, environmental preservation and well-being). Second, and the main focus of this paper, we could invoke a *performative* approach and think about how each indicator might itself be an agent that helps us move beyond its specific instrumental merits or demerits and enact a still more ambitious vision of a CE.

Taking a pragmatic or technical approach and starting with the resource efficiency-based approaches, we can see that despite their attempt to combine economic and physical dimensions, they continue to reflect a productivity-based vision of the economy. In this sense, GDP still plays a major role in the calculation of the embedded indicators, ultimately subjecting the results to monetary-price valuation. Consequently, most of the indicators only account for improvements in terms of *relative* decoupling, which can give rise to the emergence of rebound effects, and therefore may be achieved through absolute increases in resource use [127, 128]. These drawbacks, frequently observed within frameworks that measure efficiency for sustainable development, can play down the importance of focusing on environmental and social issues that the CE claims to address [33], [13], [123].

The case of the National Circularity Gap is different to the other metrics related to resource efficiency. In this case, the National Circularity Gap is built entirely upon physical quantities. It is also focused mainly on materials recovery, in contrast to the EU Resource Efficiency Scoreboard and the Green Growth Indicators, which measure multiple dimensions. The strength of the Circularity Gap is that it provides both a simple and direct measure to keep materials in circulation at the macroeconomic level. However, there are also weaknesses around the lack of accounting for related matters such as the energy consumption of recycling activities and the potential for misleading results: improvements in the form of a reduction in the circularity gap may be obtained by increasing material efficiency and recycling rates but can also be the result of economic downturns due to recessions or crises. Moreover, this approach has proved to be very sensitive to the criteria chosen to determine the total amount of materials used by an economy (with domestic material consumption and global material footprint as the two extreme cases) and to account for the international trade of recyclable residues. Depending on these crucial methodological decisions it may be possible for a country to reduce its circularity gap by simply shifting the burden to other territories.

With regard to the environmental sustainability-based indicators, these refer to a specific aspect of public priority. For example, the Sustainable Development Indicators, which measure the achievement of the UN's Sustainable Development Goals. Whereas these indicators measure elements related to environmental preservation, they also include metrics related to other dimensions that reflect the levels of social welfare and human development. Nevertheless, it is important to highlight the contribution of indicators such as the EF to account for the unevenly distributed global environmental impacts underpinning the higher levels of welfare, efficiency and sustainability of the richest countries [129, 130, 131].

A common problem across the sustainability-based indicators is that there is often not sufficient data available to calculate the indicators for all countries. There is also a notable trade-off between specificity and breadth among the environmental approaches. The SDI are broad and cover many aspects of the environment, whereas EF, EPI and NCI are limited to calculating the environmental output of the economy. These indicators provide an interesting example of how to acknowledge the environmental performance of a country and to avoid the idea of a profit-driven economy but fail to provide a vision of human development.

Concerning the well-being indicators, the definition of well-being can vary across cultures and social contexts. Consequently, all the well-being-based indicators may be aligned with different notions and policy priorities. For instance, the definition of GPI shares common values with the notion of eco-efficiency, whereas the GNH index aligns with the post-growth paradigm given that it was designed to replace GDP. Moreover, each country has developed its own well-being-based indicator given the diversity of ways to define this concept. This represents a challenge because of the implicit social values within each indicator. Also, these indicators differ in the extent to which they are used. While ESPI is an experimental indicator that is not fully established, the other well-being indicators (GNH index, CIW and GPI) are somewhat standard in their respective countries and exert a visible influence on the policy debates where they are implemented. One common observation among all the well-being-based indicators is that they diverge in how to operationalise the notion of well-being, reflecting different conceptions of this concept. For instance, the CIW includes elements such as democracy or leisure time, whereas the ESPI focuses on elements such as unemployment or poverty. Another characteristic from most of the well-being-based indicators, namely GNH, CIW, GPI and ESPI, is that they place some emphasis on the environment, whether through operationalising and including environmental performance, or by considering metrics reflecting the quality of the environment and nature.

In summary, the resource efficiency indicators tend to provide a limited vision of the economy. Focusing on the technical improvement of production and efficiency measured in monetary terms, they dismiss the potential rebound effects, which can jeopardise the environmental ambitions of the CE and increase the absolute ecological impact of the economy. The environmental sustainability indicators, such as EPI, NCI or EF, address this issue but do not consider the requirements of human development and societal needs that the economy is expected to provide. In this sense, only the Sustainable Development Indicators attempt to combine environmental and social dimensions, even if these dimensions are not integrated. In addition, some of the SDGs are contradictory, for example the SDG that fosters economic growth (SDG 8) contradicts the need for climate action (SDG 13). Finally, most of the approaches grouped within the well-being category, namely GNH, CIW, GPI and ESPI, place at least some emphasis on the environment, whether through operationalising and including environmental performance, or by considering metrics of the quality of the environment and nature. Overall, it seems clear that while there are limitations associated with the existing stock of macroeconomic indicators, taken together or in combination, they provide a more comprehensive picture of the economy than GDP, as framed by the three pillars. Namely, these indicators reflect critical elements of the economy, such as the use of materials, the achievement of global goals towards a sustainable development and the preservation of the environment, and they attempt to conceptualise socially relevant ideas, such as social progress, well-being or happiness. From an instrumental point of view, these indicators can provide critical insights for the development of new indicators to overcome the productivist paradigm associated with GDP, and to enable the development of more ambitious notions of the CE.

Taking a performative stance now, it is clear from the preceding analysis that there are (at least) two broad groups of indicators, which cut across pillars, and reflect differences in underlying assumptions. Gasparatos [132] suggest that indicators are effectively *value articulating institutions* [133] that adhere to embedded worldviews about what is important to measure and how to measure it even if this is not always explicit. On the one hand, the EU Resource Efficiency Scoreboard, the OECD Green Growth Indicators and the GPI accord with the concept of eco-efficiency and the broader notion that environmental and social impacts can be monetised and subject to trade-offs, usually via market mechanisms. As a result, these approaches lead us to perform a very specific type of CE and one that is ideologically aligned with neoclassical economic theory. In their recent paper, Bauwens et al. [29] articulated four different plausible circular futures, one of which, *circular modernism* displays a clear faith in technology, markets and consumerism to lead the transition to circularity. It is just such a scenario that is likely to be performed when the focus is on the EU Resource Efficiency Scorecard, the OECD Green Growth Indicators and the GPI (and GDP), a reductionist scenario that is characterised by eco-modernism and the idea of 'green growth'.

On the other hand, indicators such as the Circularity Gap and the GNH do not reflect the same productivist approach. As we have seen, the Circularity Gap measures *physical* quantities and does not attempt to commensurate these using a monistic numeraire. In a philosophical sense, the GNH is similar in that it attempts to measure social progress in a context that is defined by 'sufficient levels' of happiness, which itself depends on *minimum* conditions. What we have, therefore, is indicators that are not as sympathetic to competitive markets and that, as a result, lead us to perform alternative and (some might say) more ambitious versions of the CE. For example, Bauwens et al. [29] define a *bottom-up sufficiency* scenario, which is critical of the eco-efficiency agenda and more attuned to the de-growth literature. Indeed, the primary focus in this scenario is on reducing resource consumption rather than increasing resource productivity. Consequently, higher R strategies—such as refuse, reduce and reuse—are privileged. In such a context, where economic growth in no longer the priority, 'it is conceivable that this scenario is more likely to focus on resilience and ecological integrity rather than cost-based notions of efficiency' [12], p.10). As a result, indicators that observe thresholds and limits may be the most compatible and thus most able to enact such alternate and ambitious visions of the CE.

Reflecting on these underlying assumptions helps us to design indicators in a more thoughtful and impactful way, considering their potential performative impact. Indeed, to really to be able to disrupt the omnipotence of GDP and help us to address what kind of world we want, as Gasparatos [132] says, the selection of indicators 'needs to be consistent with the values of affected stakeholders' (p.1613). Therefore, given the selection of any indicator is contingent on a set of societal values and public objectives, the scrutiny of these potential indicators should be opened to the general public and their design should allow civil society to determine the main priorities based on their own needs. In this sense, the case of the CIW of Canada provides a good example of how to develop an indicator engaging civil society organisations and scholars to provide a new macroeconomic logic. More specifically, most of the indicators analysed are complex and multicriteria indicators, which aim to complement GDP.[6] Examples of this are the CIW, GPI, ESPI and the SDIs. These indicators allow complex and multi-dimensional phenomena to be summarised. However, incorporating diverse criteria into a single measurement needs an approach to balance elements such as resource efficiency and environmental and social factors in a way that is widely accepted in different contexts, and it is in this respect that affected stakeholders also need to be considered.

In addition, though, there is clearly a tension here: such complex indicators take a holistic approach, but their very complexity may mean that the indicator does not become *ontic*

[6] To date, only the GNH index has been used to replace GDP.

in the same way that GDP has done, i.e. it does not end up substituting for the goal it is meant to represent and thus does not impact the anticipated stakeholders. This represents a dilemma for policymakers who may rightly be wary of the tendency to search for one single almighty indicator given that the CE is more inclined towards an understanding of the economy as a system of complex social relations embedded into broader ecological system. Furthermore, this view could be reinforced given the role of power relations in defining the abstractions that indicators come to represent.

Where does that leave us then? Picking up on this idea of power relations, perhaps the real challenge is not replacing or augmenting GDP per se but making sure that the reductive influence of an indicator or indicators does not end up serving the primary interests of the powerful and therefore simply measuring what is acceptable rather than what is necessary to achieve our ambitions [22]. As part of this, we must recognise that the tendency to utilise a pillar-based approach, while intuitive as an organisational device, can reinforce ontological boundaries and exacerbate inequities given that this masks how these silos are 'often overlapping, co-constructed, and experienced differently in local experience' (Ibid, p.49). Moreover, such an approach risks stymying the emergence of new priorities beyond the pillars such as social resilience, cultural preservation or geopolitical safety. Therefore, to obtain performative impact in a *positive* sense, impact that goes far beyond what indicators are meant to represent, we need to ground the development of these indicators by engaging local stakeholders in the scope and definition of that which is important to measure. Asserting an ambitious vision of a CE can itself have performative impact in this direction and encourage such stakeholder engagement.

Conclusion

The CE is an essentially contested concept which has increasingly become associated with eco-modernism and a concomitant focus on GDP growth rather than the displacement of primary production. Consequently, the *ontic* nature of GDP—whereby it 'substitute[s] for individual, household, community and national wellbeing'—goes unchallenged by this dominant and reductionist conception of circularity [22]. This is the starting point for this paper, which aimed to analyse how alternative and more ambitious conceptions of a CE can be more or less determined by the way in which we frame, measure and envision the broader macroeconomy. In other words, we have sort to assert a *performative* approach to macroeconomic indicators and think about how these can help us create the world we want and one that is more attuned to Polanyi's [14] *substantive* understanding of human economic activity.

With this in mind, this paper analysed 12 macroeconomic indicators across three pillars that have been used to define a CE—resource efficiency, environmental sustainability and social well-being—and which together provide a broader conception of macroeconomic logic that includes environmental and social elements. These indicators have all been developed and implemented by international organisations, civil society organisations and public institutions, thus providing a relevant track record and a practical appreciation of the approaches in these three areas that are currently available. As described earlier, this is a practical exercise in taking stock of what indicators are available now and how these might be augmented further in the future to provide a more hospitable context within which an ambitious CE might be furthered.

The 12 indicators were discussed in *instrumental* terms (i.e. the extent to which their merits and demerits allow us to measure the three pillars that we focused on) and in *performative* terms (i.e. how the indicators allow us to transcend a reductionist view of the CE and further alternative CE visions). Overall, we suggested that despite significant limitations, the indicators reflect critical elements of the economy missed when giving pre-eminence to GDP and thus provide guidance for the development of new indicators to overcome the productivist paradigm characteristic of GDP. However, in addition, reflecting on the performative potential of indicators, we suggested that this allows us to design indicators in a more thoughtful and impactful way. Indeed, the potential for performative impact demands that the design of indicators is opened to affected stakeholders, not least to ensure that the reductive power of indicators does not end up going unquestioned and serving the interests of the powerful.

There are several limitations associated with our findings. The main limitation is the scope of the indicators selected: we aimed to observe not only the design of the indicators, but also their use, and this restricted our research to those indicators that have been applied in practice. The second limitation is the analytical framework selected, which only encompassed three elements (resource efficiency, environmental performance and well-being), thus ignoring the possibility of new elements that can emerge in different contexts. Nonetheless, these concluding remarks indicate several new avenues for future research. First, in light of this stock taking exercise, the next step is to develop and determine an ideal set of indicators that support the creation of a new understanding of the economy. Second, the discussion in this paper could also be developed further into a broader conception of economic performance, beyond neoliberal conceptions of efficiency and growth, i.e. how should performance be understood when we think about broader and more ambitious visions of the CE? In furthering these ends, we as social scientists are actors in the current economic system. As such, our work can contribute to new ways of measuring and understanding that system that have performative impact on stakeholders far beyond what these approaches are meant to represent. This is the story of the success of GDP. It is also a story that we can use to assert alternative and ambitious notions of the CE.

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