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Perspective

Is efficiency enough for circular economy?

Meletios Bimpizas-Pinis^a, Emilija Bozhinovska^b, Andrea Genovese^a, Benjamin Lowe^a,
Mario Pansera^{c,*}, Josep Pinyol Alberich^{d,e}, Mohammad Javad Ramezankhani^f^a Sheffield University Management School, Conduit Road, Sheffield S10 1FL, UK^b Erasmus University Rotterdam, International Institute of Social Studies, 2502 LT 's-Gravenhage, the Netherlands^c Universitat Autònoma de Barcelona, 08193 Cerdanyola del Valles, Barcelona, Spain^d ABIS – The Academy of Business in Society, Avenue Louise 231, 1050 Ixelles, Brussels, Belgium^e University of Exeter Business School, Rennes Dr, Exeter EX4 4PU, UK^f University of Kent Business School, Canterbury CT2 7FS, UK

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The calls for a transition towards a Circular Economy (CE) are often accompanied by claims about the intrinsic *efficiency* of circularity. CE is usually portrayed as an efficient new paradigm able to reduce material and energy demand and thus minimise environmental impacts, while increasing economic output. Despite these claims and the relevance of the notion of efficiency for the transition towards a CE, few scholars have addressed the definition and application of economic efficiency within a CE context.

The common definitions concerning economic efficiency draw on the notion of Pareto-optimality and welfare-maximisation. These definitions share two basic principles. First, economic efficiency implies an economic state in which it is impossible to improve the situation of one party without imposing a cost on another (Pareto equilibrium). Second, economic efficiency represents society getting maximum net benefits from an activity or from the allocation of scarce resources, which can be represented in different forms including minimising costs, maximising revenues/profits, or maximising utility. These concepts are rooted in neoclassical equilibrium theory and, although they have been widely used by scholars and practitioners, they may not necessarily be aligned to CE priorities.

Despite its increasing popularity, economists have paid little attention to the CE agenda so far. On one hand, owing to the origins of the CE in industrial ecology, most of the CE literature has not engaged with the neoclassical approach to efficiency, also failing to create its own conceptualisation of economic efficiency. On the other hand, what seems to dominate the field of CE is the notion of eco-efficiency and its variants.

Eco-efficiency refers to the production of goods and services while using fewer resources and creating less waste and pollution. The notion of eco-efficiency might imply economic efficiency, as it is concerned with creating more value, through an increase in resource productivity and a decrease in resource intensity, both of which can present a competitive advantage for businesses. The logic of focusing on eco-efficiency is based on the assumption that this would lead to a reduction in resource consumption whereas preserving the value of products and services and mitigating environmental impact.

Nevertheless, eco-efficiency as a concept does not offer a sufficient response to the challenge of sustainability for several reasons. First, the concept of eco-efficiency does not resolve the Jevons Paradox and does not address rebound effects. Consequently, lower prices due to increased efficiency may result in an immediate increase in consumer demand, thus partially or fully offsetting the benefits of circular practices. Second, indicators of eco-efficiency, such as resource intensity, have failed to incorporate a true account of environmental and social dimensions. In particular, resource intensity does not reveal the qualitative aspects of the environmental impacts associated with the use of resources, such as toxicity or scarcity of materials, but also environmental and geopolitical conflicts related to unequal and asymmetric power relations. Third, using such indicators could lead to misleading results due to methodological weaknesses. For example, improvements in resource intensity might have two completely different reasons. One is a reduction in the amount of materials used and the other is an increase in the economic value of the products. If resources are used to produce products with

* Corresponding author.

E-mail address: Mario.pansera@uab.cat (M. Pansera).<https://doi.org/10.1016/j.resconrec.2021.105399>

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higher values, GDP would grow faster than the resource consumption and resource intensity would decrease even though the absolute resource consumption may increase. In addition, in economic recessions, GDP tends to fall faster than resource consumption. In conclusion, it seems evident that eco-efficiency is better at measuring resource and labour productivity, rather than the progress towards a circular economy.

This reasoning implies that policy-makers and firms cannot merely rely on a formulation of the CE exclusively based on increasing eco-efficiency. This represents a serious challenge to the usual way of delivering industrial policy because improving efficiency (and thus productivity) has traditionally been perceived as the best way to contribute to the common good, as a way to optimise production and potentially minimise its environmental impact (Creutzig et al., 2018). This connection may not be so straightforward in the case of the CE. The objective of CE is also to optimise the use of objects, not just their production. CE might be a counter-intuitive concept for industrial societies as it is about reproduction rather than growth or production and productivity.

Ultimately, the key aim of an *ambitious* CE is to meet societal needs in the context of what is actually needed with reference to material use. CE also draws on care and other non-market dimensions; as such, evaluating it through market-based concepts such as eco-efficiency might be problematic. However, maintaining the economic and resource value of the materials is not yet perceived as a priority by policy-makers and economic researchers focused on efficient production and economic growth because prevention activities slow GDP growth.

The essential fact here is that the notion of economic efficiency itself is a socially constructed concept with its politics and its political implications. Indeed, economic efficiency might be seen as a public goal that may compete, be combined with or balanced against other public priorities, such as social justice, inclusivity, or environmental protection (Krugman and Wells, 2015). Political ecologists and ecological economists have conceptualised new ways to frame economies to include new public priorities other than efficiency, such as the concept of 'doughnut economics', where the economic system should acknowledge environmental boundaries while acknowledging societal needs (Raworth, 2017). Also, the concept of degrowth aims to maintain welfare while reducing consumption and production (Kallis, 2011). Other scholars argue for the critical reconceptualisation of capitalism and post-capitalism, to question the need for economic growth as the ultimate societal good, or to challenge the presumption of the neutrality of market economies and to open up the debate on the possibility that a transition towards a sustainable economy involves a fundamental change of the capitalist system instead of incremental reforms (Genovese and Pansera, 2020). All these contributions show the need to develop new conceptualisations and new frames to review how our understanding of the economic system reflects or ignores certain public priorities and societal needs, such as environmental impact, or social equity. In this sense, the way in which the CE is conceptualised, and its efficiency is measured, reflects this same system of priorities.

In summary, the concept of economic efficiency is a basic notion of how market-based capitalism should be evaluated, and therefore it is essentially political by default. However, it has contributed to the failure to incorporate environmental and social dimensions to the evaluation of the economic system, leading to an unprecedented environmental emergency and economic inequality. The transition towards a CE and the reformulation of how the economy must work is an opportunity to open up the debate on what are the priorities of the CE agenda. This reformulation is highly important, as, if evaluated with the same criteria, the transition towards a CE runs the risk of repeating the same failures of the linear market-based economy and the prioritisation of overproduction instead of creating a sustainable economic system. Also, the definition of CE represents a unique opportunity to include environmental and social criteria to evaluate its performance. We believe that the new criteria to evaluate the transition towards a CE should go beyond the mere evaluation of the production process and include elements such as social equity or planetary stewardship as necessary means to build a circular economy that is truly sustainable.

Authors' statement

The list of authors is in alphabetic order. The co-authors were equal collaborators in the writing of this article.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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