
Article:
Genovese, A. orcid.org/0000-0002-5652-4634 and Pansera, M. (2021) The circular economy at a crossroads : technocratic eco-modernism or convivial technology for social revolution? Capitalism Nature Socialism, 32 (2). pp. 95-113. ISSN 1045-5752

https://doi.org/10.1080/10455752.2020.1763414

The Circular Economy at a crossroad: Technocratic Eco-Modernism or Convivial Technology for Social Revolution?

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Abstract

In the last decade, the concept of 'Circular Economy' (CE) has gained prominence in the political and corporate discourse around the world. According to its proponents, CE represents a new paradigm that will push the frontiers of environmental sustainability by transforming the relationships between ecological systems and economic activities. In this paper we discuss how this idea is problematic for a number of reasons, claiming that the biggest shortcoming of the CE discourse is represented by its apolitical and technocratic framing; in addition, we propose a countervailing discourse of CE based on the idea of convivial technology.

1. Introduction

In the last decade, the 'Circular Economy' (CE) concept has surged as a prominent concept in the political and corporate discourse. Thanks to its immediacy, this notion can be easily communicated, and represents the most probable candidate to replace the outdated 'sustainable development' buzzword. Although CE origins can be located in a specific academic tradition (i.e. Industrial Ecology), it has become an 'umbrella term' - i.e. an empty *signifier* that can shelter different meanings (Rip and Voß 2013) - whose flexibility is a potential battle ground for competing ideological agendas (Korhonen et al. 2018).

In the views of its promoters, the CE paradigm will push the frontiers of environmental sustainability by transforming the relationships between ecological systems and economic activities (Ghisellini et al. 2016). This is supposed to happen through a shift in the design of socioeconomic metabolisms from a linear model based on 'extraction-production-consumption' towards a circular one in which waste, by-products and end-of-life products are ideally totally reused, recycled or remanufactured (Genovese et al. 2017). CE proponents are not just concerned with the reduction of the use of the environment as a sink for residuals, but rather with a thorough rethinking of production methods, which involves a reduction of resource use and the implementation of advanced planning approaches (Genovese et al. 2017).

In this paper, as postulated by Korhonen et al. (2018), we argue that, although presented in a neutral fashion, the CE discourse underlies a highly contested political project. We recognise that, in its currently hegemonic formulation, CE is very much aligned to a technocratic, eco-modernist agenda. The dominant discourse of CE essentially draws on a refurbished version of market-oriented capitalism, which looks at industrial waste and environmental degradation not as 'system failures' but as opportunities to relaunch a new season of - possibly 'green' - economic growth (European Commission 2017). We discuss how this idea is problematic for a number of physical, economic and political reasons and then focus on what in our view is the biggest shortcoming of the CE discourse: its apolitical framing. We call for opening up a debate to deconstruct the hegemonic CE discourse based on a technocratic approach, and reconstruct it by embedding normative and political dimensions. Finally, we propose a countervailing discourse of CE, based on the idea of convivial technology (Illich 1973). Such a framing would not only enable the shift towards environmentally sustainable modes of production, but also a social transformation towards a more just and classless society.

The paper is organised as follows: first, we present the origins of the CE concept, and its dominant framing. Then, according to a Marxian perspective, we discuss the intrinsic contradictions of market capitalism and their implications in terms of resources consumption and waste creation; we link such contradictions to the emergence of the CE paradigm. In the following of the paper, however, we then suggest that CE presents all the features of an 'eco-modernist', technocratic and apolitical project. We then have a look at the alternative CE framings and conclude with a call to re-politicise the concept.

2. The Circular Economy concept: some generalities

The theoretical foundation of the CE concept is rooted in a wide array of academic disciplines and fields; the absence of clear boundaries has hampered the development of a well-defined CE

identity (Merli et al. 2018). Thus, CE can be conceptualised as an 'umbrella' concept (Homrich et al. 2018). As Korhonen et al. (2018) point out, the CE agenda has been led and promoted mainly by practitioners (Ellen MacArthur Foundation 2015; WRAP 2015) and governing bodies (McDowall et al. 2017). Nevertheless, the most influential field to the formulation of CE paradigm is the one of *industrial ecology* which established the concept of *industrial metabolism* (Blomsma and Brennan 2017).

Starting from different theoretical premises, Boulding (1966) pointed out the transition towards closed-loop systems as a precondition for preserving human life. Nevertheless, in terms of contemporary applications of CE to industrial systems, the starting point of such a narrative can be traced back to Frosch and Gallopoulos (1989), who redefined industrial operations by introducing circular material flows, where by-products of one industrial process are used as an input for another in order to achieve higher environmental performance. The term 'Circular Economy' was first introduced by Pearce and Turner (1989), who designed a materials balance model in which the environment is defined in terms of three economic functions (resource supply, waste assimilation, source of utility). This model can be linked to the theory of *Thermoeconomics*, which reconceptualised economics through the principles of thermodynamic laws (Lieder and Rashid 2016). Interpreting the first law of thermodynamics (FLT) in the context of an isolated system where raw materials are extracted, turned into final products and eventually discarded, the quantity of waste generated across a sufficiently long period should be equal to the quantity of raw materials extracted in the same period. However, according to Georgescu-Roegen's (1971) interpretation of the second law of thermodynamics, complete recycling might be impossible since economic processes employ 'low entropy' raw materials and discard 'high entropy' waste materials. The use of thermodynamic concepts, particularly entropy, has been fiercely criticised due to fact that it ignores the potential to harness solar energy (Schwartzman 2008).

Given the diverse disciplinary and conceptual underpinnings as well as the absence of well-defined theoretical boundaries, there is a lack of consensus on a specific definition of CE (Kirchherr et al. 2017). The most prominent definition of CE appears to be the one provided by Ellen MacArthur Foundation (2015) according to which *'a circular economy is an industrial system that is restorative or regenerative by intention and design'*. According to the foundation, whose role has been pivotal in promoting CE in the EU, such a system corresponds to an idealistic state where waste virtually ceases to exist, as materials are re-used and recycled indefinitely through closed loops (Ellen MacArthur Foundation 2015). This can be achieved through minimising the material and energy leakages by slowing, narrowing and closing resource loops by following the '3R' value retention options of *reducing*, *reusing* and *recycling* (Geissdoerfer et al. 2017).

Similar visions have been embraced by European institutions. The European Union (EU) has initiated a number of initiatives aimed at delivering *smart, sustainable and inclusive growth*. One of these is the Resource Efficient Europe flagship initiative, based on a CE paradigm and aimed at identifying and tackling the trade-offs between economic development and environmental protection. In 2015, the European Commission adopted the Circular Economy Action Plan (CEAP) a legislative package to boost the EU's transition towards a CE (European Commission 2015). The CEAP proposes solutions for reframing the production cycle according to a circular paradigm, including: cleaner production, sustainable consumption markets for secondary raw materials; targets and timelines for waste management are introduced (European Commission

2020). The CEAP has been clearly influenced by the lobbying activity of a number of European think tanks, such as the above-mentioned Ellen MacArthur Foundation that in 2015 (the same year of the CEAP publication) published the report 'Growth from Within: A Circular Economy Vision for a Competitive Europe'. The report preaches the competitive advantages that a transition to CE would potentially deliver to the EU, providing the foundations for an era of green economic growth (Ellen Macarthur Foundation, 2015). During the same period, financial mechanisms have been put in place in order to foster and support initiatives aimed at the implementation of CE practices in several sectors. This timidly suggest that policy interventions are also required alongside innovative business models currently adopted by companies; bottom-up initiatives at a supply chain level might need to be incentivised through some form of top-down governmental support (for instance, by rewarding positive externalities).

In the remainder of the article we propose a critique of the above-mentioned CE framing, which is hegemonic within European institutions. This critique is based on three aspects. First, we show how the hegemonic discourse of CE directly stems from the intrinsic need of capitalism of expanding and exploring new ways of increasing exchange value; CE, in this view represents a new frontier of capital accumulation. The second critique is directed to the practical and social feasibility of CE and, above all, to the apparent apolitical framing of CE that in reality underpins specific political agendas. Finally, we discuss alternative ways of framing CE that have the potential to escape the logic of capitalist accumulation.

3. The inevitability of waste in a capitalist system

> "The simple circulation of commodities - selling in order to buy - is a means of carrying out a purpose unconnected with circulation, namely, the appropriation of use-values, the satisfaction of wants. The circulation of money as capital is, on the contrary, an end in itself, for the expansion of value takes place only within this constantly renewed movement. The circulation of capital has therefore no limits".
>
> (Karl Marx 1867, 253)

The fundamental contribution of Karl Marx to the economic thought is the understanding of some key functioning of the capitalist economic systems, along with the theorisation of the increasing contradiction of the capitalist mode of production. In the following subsections, we are going to illustrate the key Marxian intuitions, which are significant to the formulation of our critique to the current Circular Economy discourse; such intuitions can be summarised as: the M-C-M' cycle; the tendency of the profit rate to fall; the emergence of a metabolic rift. The following subsections are describing each of these concepts in detail.

3.1 The M-C-M' circulation cycle

One of the first theorisations of Marx is the notion of the circulation of capital. Marx argues that the simplest form of the circulation of commodities is the transformation of commodities into money, and the change of the money back again into commodities. This specific cycle is described by Marx as C-M-C, and identifies economies driven by primary consumption needs: "Once a commodity has arrived at a situation in which it can serve as a use-value, it falls out of the sphere of exchange into that of consumption". In this cycle, for Marx, money acts as the means for

transferring or circulating commodities in a process of exchange; in Marx's own words: "Consumption, the satisfaction of needs, in short use-value, is therefore its final goal" (Marx 1867).

With trade extending beyond the limits of a small, enclosed, society (e.g., rural), commodities must be transformed into money. Since the circulation of commodities is no longer a 'direct exchange of products', money allows for a geographic expansion of trade, overcoming physical, temporal, spatial and personal limitations. The direct exchange of products is indeed split into dialectic transactions, which lead to chains of commodity exchanges, which constitute "whole networks of social connections […] entirely beyond the control of the human agents" (Marx 1867, 76). Global markets emerge, along with a mutual interdependence of agents which might never physically meet.

As such, the cycle M-C-M' emerges, with a circular transformation of money into commodities, and the change of commodities back again into money ("buying in order to sell"). Money that circulates in this manner is thereby transformed into capital and it is already potentially a form of capital. As a result, if a capitalist has money, she will want to use it to buy more commodities and begin the 'constant and monotonous repetition of the same process' of commodity/money circulation (Marx 1867, 210–11). Money, rather than commodities, is the point of exchange. As a machine requiring constant fuel, capitalism requires the "hurried nature of society's metabolic process, the quick disappearance of commodities from the sphere of circulation, and their equally quick replacement by fresh commodities" (Marx 1867, 217), for serving "the unceasing movement of profit-making". According to Marx (1867, 217), within this process, "the velocity of circulation of money is merely a reflection of the rapidity with which commodities change their forms".

3.2 The Tendency of the Rate of Profit to Fall

One of the most compelling contradiction of the circulation cycle is the fact that, whereas capitalists aspire to increasing returns, the average rate of profit has a trend to fall (Marx, 1894). Marx explained this process through the tendency of the "organic composition of capital" (the ratio of the value of constant – i.e., raw materials and equipment - and variable – i.e., labour - capital embodied in the production of a commodity) to rise. In other words, the more and longer capital is used to produce a given set and volume of commodities, the less the profit that can be obtained. This *diminishing returns* law, which was illustrated by Marx (1894) can be explained, in contemporary terms, by at least three mechanisms, as also posited by Harvey (2013, 2014). First, returns can diminish because of the tensions between labour and capital. Workers organised in trade unions can request and obtain better salaries and conditions at expenses of profits. Under certain conditions, increasing purchasing power is beneficial for capitalism because it fuels demand; however, more money in the pockets of the working class equals less profits for the capitalists. Second, returns are bounded to decline as access to technology (e.g. through diffusion of innovation) by competitors lowers the barriers to entry in a specific market and causes the appearance on the market of new processes and products by competitors. Third, there are intrinsic limits to consumption. Markets saturate and demand declines. For instance, a consumer can buy a car for commuting to work; she might need a second car for social purposes; after that, the marginal satisfaction she can get from such products sharply declines. The decline in profit rates also causes the inability of firms to replace equipment at the same pace as before. Companies, as a result, might lose market shares to their competitors; as such, this also causes deterioration of production means, which can in turn cause further decline in production (Gorz 1980). In this

situation, capital cannot reproduce itself at the desired rate; its productivity sharply decreases, with obsolete and not properly maintained machines which need to be decommissioned, inventories to be alienated, plants downsized, and workers laid off. Such a crisis generates enormous amounts of waste, both in physical (raw materials, stocks, and machineries which need to be disposed of) and metaphorical (unutilised capacities) senses.

In order to avoid such vicious circle, and the associated waste, capitalists need to fight a day-to-day battle against the tendency of the rate of profit to fall. This can be done in a number of ways. They can increase production volumes or increase the exchange value (and, consequently, the price) of their products (Gorz 1980). They can move production in countries where labour protection is looser or fight back trade unions. Both strategies have been successfully implemented in most of industrialised countries in the last three decades as documented by Piketty (2014). As a result, the income of capital has been constantly rising from the 1980s, whereas labour income has stagnated, along with aggregated demand. That basically means that returns decline has been merely postponed.

Another way of avoiding diminishing returns is through innovation. As Schumpeter (1934) has shown in the 1930s, innovation is the very engine of capitalist economies and is able to constantly transform production functions by increasing productivity and maintaining acceptable profits. Further research was carried out by Arrow (1962) and Lucas (1988), in order to explain how technical change is able to counterbalance the law of '*diminishing returns*'. This faith in the salvific effects of innovation, however, is being increasingly questioned from many fronts (Strand et al. 2018). The fields of political ecology and ecological economics have shown that innovation can stretch the limits of the law of diminishing return, but only until a certain point; profits increases remain limited by energy availability (Bonaiuti 2018), raw material access (Hickel and Kallis 2019), social unrest (Hirsch 1977), environmental degradation (Kallis et al. 2010).

The presence of social and physical limits to the expansion of capitalism does not prevent capital to explore new ways of overcoming the problem of diminishing returns and keeping the expansive nature of the capital circulation cycle. One of the most effective strategies including technological, marketing and political mechanisms is the so-called *planned obsolescence*; firms increase sales by making products less durable, thus forcing people to change them more often. At the same time, these products can be made more complicated and expensive (through innovation). We could dare to say that this mechanism has become the basis of contemporary production. It is a mechanism that does not attempt to satisfy the specific needs of the people, but rather to keep profits at required levels, while keeping users' dissatisfaction constant. In order to do so, increasing amounts of energy, labour, raw materials, natural resources and of capital are 'consumed' without any positive impact on social welfare. In order to escape from the fall in the average rate of profit, and its associated wastes, the system needs to generate more waste.

3.3 The emergence of a metabolic rift

Due to the expansive nature of the capitalist mode of production - enabled by the M-C-M' cycle, general purpose money and fed by the need to overcome diminishing returns - Marx introduced the notion of a metabolic rift, providing an interpretation of the tendency of capitalism to provoke ecological crisis (Foster 1999).

As pointed out by Foster (1999), Marx and Engels had engaged with the seminal work of the German scientist Liebig (1840), who understood the intrinsically circular nature of pre-capitalist agriculture. Following up on Liebig's work, Marx (1847, 162–63) affirmed that the application of capitalist methods to agriculture were breaking this *circular* dynamic: "Every moment the modern application of chemistry is changing the nature of the soil, and geological knowledge is just now, in our days, beginning to revolutionize all the old estimates of relative fertility […] Fertility is not so natural a quality as might be thought; it is closely bound up with the social relations of the time". As pointed out by Foster (1999) and Foster and Clark (2018), Marx's placed a lot of emphasis on the effect of capitalist agriculture, its productivity improvements and the long-term effects in terms of soil degradation, citing this as a prominent example of exploitation of the natural resources and failure to sustain the conditions of their reproduction.

The profound implications of the capitalist mode of production on natural environments were also pointed out by Engels (1964, 208–10), who observed that: "To make earth an object of huckstering — the earth which is our one and all, the first condition of our existence — was the last step toward making oneself an object of huckstering". Marx (1867) went on to theorise the emergence of a *rift* in the metabolic interaction between humanity and the rest of nature caused by the capitalist mode of production and the growing industrialisation. In Marx's (1867, 637-8) own words:

> "Capitalist production collects the population together in great centres and causes the urban population to achieve an ever-growing preponderance. This has two results. On the one hand it concentrates the historical motive force of society; on the other hand, it disturbs the metabolic interaction between man and the earth, i.e. it prevents the return to the soil of its constituent elements consumed by man in the form of food and clothing; hence it hinders the operation of the eternal natural condition for the lasting fertility of the soil. All progress in capitalist agriculture is a progress in the art, not only of robbing the worker, but of robbing the soil; all progress in increasing the fertility of the soil for a given time is a progress toward ruining the more long-lasting sources of that fertility".

This observation can be easily extended to the productive processes characterising modern globalised capitalist production that continuously needs to renovate the cycle of production/consumption, and the waste associated, merely to survive, hindering the intrinsic *circularity* of natural systems which Marx had pointed out. As such, as also stated by many prominent ecologists with firm roots in the Marxist tradition (see, for instance, Gorz [1980]) *waste* is an intrinsically built-in and inevitable feature of capitalist economies, and a much-needed fuel to keep profit at the required level at the individual firm level.

4. The apolitical framing of the current "Circular Economy"

Based on a Marxian perspective, it can be said that, in order to expand, capitalism requires an increasing (or at least a steady) production of waste and natural resources exploitation. However, it became evident that the production of waste has unbearable environmental and human implications. As such, the emerging field of CE is an attempt to address *from within* the capitalist discourse, we argue, the consequences of an economic system based on the irrational creation of waste. But is this form of CE viable in practice?

Although diverse and heterogeneous (as presented in Section 1), the present constellation of definitions of CE share most of the features (and ideology) of the so-called ecomodernism, with a strong emphasis on the role of technology and economic growth in meeting societal challenges (Caradonna et al. 2015). Ecomodernists oppose the idea that market capitalism must be called into question to avoid economic and ecological collapse and instead argue for a reliance on technologies (from nuclear power to carbon capture and storage) that allow for a decoupling of human development from environmental impacts. Although multiple and contested, this CE framing, which is mainly tech-driven or techno-optimistic, is highly problematic for a number of reasons (Korhonen et al. 2018) that we can classify in three main categories.

The first set of criticisms has a physical basis. If we assume an economic system totally based on solar energy – an abundant source of low entropy energy - completely circular material flows, and thus an indefinite reutilisation of material resources, are in theory possible (Ayres 2007). This is how nature has functioned for millions of years; however, in the present industrial society this is in practice virtually impossible. Even considering unlimited availability of solar energy, the dissipation of minerals in distributed sinks all over the planet in high entropy state (minuscule concentration) makes their recuperation extremely expensive and virtually impossible (Kerschner 2010). Similarly, the recuperation of tons of micro-plastics in the ocean, even in the presence of revolutionary solar cleaning technology is a highly improbable task. Secondly, whether or not the material structures necessary to harvest solar energy can be maintained over the long run just by the energy produced by themselves remains to be demonstrated. In a nutshell, there is an increasing evidence that questions the practical possibility of a total and perpetual recycling of all material resources in any type of economic system, regardless of the amount of energy to be assigned to the recycling activities (Burkett 2006; Washida 1998). Another physical limitation is the vulnerability of CE to rebound effects e.g. the fact that it has been empirically observed that increased efficiency eventually lead a faster and greater use of natural resources (Korhonen et al. 2018; Polimeni et al. 2008).

The second line of criticisms is based on the economic feasibility of CE in the present system of market capitalism, which the dominant economic model in the EU. In the 1980s Schnaiberg (1980) famously introduced the 'treadmill of production theory' that hypothesised that class relations within Capitalism continually undermine any effort towards sustainability. Both capitalists and the workers reproduce the illusion that technology will make production greener, but this actually never happens. The only thing that makes the system functioning is increasing production and disposal of waste elsewhere. It is not hard to see that such a system is bound to collapse eventually. This would, at least in part, explain why, regardless of its evident environmental benefits, the economic viability of the CE paradigm is questioned by market dynamics and regulatory inefficiencies which potentially can lead to higher production costs (Genovese et al. 2017). While environmental benefits may be obvious, the implementation of circular production systems and supply chains is often challenging in the current economic systems, as market dynamics and lack of incentives may lead to higher cost of production. Some scholars have argued that in the European context, mainly dominated by free-market ideologies, companies are already capturing most of the economically attractive opportunities to recycle, remanufacture and reuse (de Man and Freige 2016). Companies rely on the need to maintain economic profitability of their activities and investments while market mechanisms (e.g. increase of prices of by-products provided by a company to another) may strongly discourage the adoption of CE strategies. This suggests that

reaching higher levels of circularity may involve an economic cost that European economies cannot cope with, especially as companies are already struggling with high resource prices. Indeed, benefits from recycling of materials tend to decrease until a cut-off point is reached where recycling could be economically too expensive to provide a net benefit. Such a situation has recently become apparent also to the public opinion, due to the ban imposed on imported waste by Chinese public authorities, which has revealed the unpreparedness of recycling networks and CE-related infrastructures in the EU that have been relying extensively on export of waste rather than investing in CE-related infrastructures (Cole 2017). It is evident thus that the applicability of CE in economic systems characterised by free-market and growth-oriented policies is problematic.

Finally, a third argument is political and is related to the self-perpetuation of capitalism itself. It's been observed that capitalism escapes regulation and tends to expand by removing state regulations or by moving to new unregulated virgin territories. In other words, capitalism survival depends on its capacity to expand through new ways of commodification and appropriation. If this is true, a transition towards an ideal CE paradigm, in which economic transactions are necessarily bounded by the circularity of the system, would seriously undermine a further expansion of capitalism (and economic growth itself). On the other hand, a technocratic authoritarian version of CE, in which resource access are denied to the vast majority of humanity, could be totally compatible with a 'capitalism without growth', in which elites maintain privileges through the impoverishment and exploitation of subaltern classes (Kallis 2017). The transition to a CE could indeed lead to further concentration of capital, in which larger and more technologically advanced firms can take advantage of the exit from the market of competitors which are not able to upgrade their means of production as required by more stringent legislation. As a consequence, oligopolistic structures could emerge, and control entire value chains.

Nevertheless, despite the above-mentioned issues, what is worrying about the dominant CE discourse is its apolitical essence. According to EU institutions, the transition to a CE is supposed to happen automatically in Western market economies. The role of people, class relations and power asymmetries, indigenous people, women, plants and animals are generally overlooked (Schröder et al. 2019). The details about how such a Copernican revolution in the way we produce and consume would happen are, probably intentionally, vague. Who, where and how is going to decide where and how to implement closed-loop production and consumption systems? Hobson (2016) claims that CE advocates consider the role of citizens as passive actors that can only accept or reject practices that have been formulated on their behalf by designers, engineers, economists and policymakers. This trend is clearly visible in the discourse of the EU or of the various think-tanks that lobby for CE. The report "The political Economy of Circular Economy" published by the ClimateWorks Foundation gives a lot of emphasis on the need to minimise opposition to CE projects whilst less attention is dedicated to reframing - or simply reflecting on - the decision-making processes underpinning the transition to CE (Becque et al. 2016).

Similarly, Hobson and Lynch (2016) have noticed that citizens are framed in the CE discourse essentially as consumers of 'sustainable products/services'. In other words, the EU announcements about CE hypothesise a depoliticised citizen that is inseparable from the consumer, whose passive role is limited to market choices driven by pricing or eco-labelling. Empirical work on the implementation of CE practices seem to confirm this depoliticising process. Savini (2019) has shown how most of CE practices are not concerned with reducing waste through

progressive anti-consumerist policies; they rather reinforce the idea of a never-ending growth of material well-being enabled by 'valorisation of waste'. In this sense, as Stegemann and Ossewaarde (2018; 26) argue, the myth of 'a growth from within' seems "highly effective in masking contradictions and in unifying diverse and conflicting interests (including the conflicting interests of various industries and member states) within the historical bloc, to the point that resistance and consent is managed concerning economy and ecology". The result of these dynamics is that class structures, power relations – it seems the whole debate about CE totally overlooks this aspect – and the societal implications (e.g. the levels of freedom and democracy) of such a transition to the new paradigm are rarely questioned. Social, cultural, political and paradoxically even environmental aspects are subordinated to competitiveness and growth. Above all, a systematic analysis of policy implications and of implementation outcomes (which industrial sectors will benefit the most? Which stakeholder groups can be classified as winners and which one as losers) is absent in the hegemonic discourse of CE of the EU (Korhonen et al. 2018; Murray et al. 2017). Moreover, the global implications of a CE transition are not discussed enough in the European context. Given the planetary outreach of global supply chains, how CE proponents expect to restructure colonial and postcolonial links between rich and poor countries is a totally neglected topic. Is CE applicable to global supply chains that base their viability and profitability of the immense disparity of labour and environmental regulations across the Global North and South? What about traditional agro-ecological practices that are already sustainable and support the majority of people living in the Global South? Are they going to be replaced in the name of eco-efficiency and circularity?

5. Alternatives: Circular Economy for social revolution

> "Today a lack of realism no longer consists in advocating greater well-being through the inversion of growth and the subversion of the prevailing way of life. Lack of realism consists in imagining that economic growth can still bring about increased human welfare, and indeed that it is still physically possible."

André Gorz (1980, 14)

The depoliticisation of CE is not yet irreversible. We think that there is the opportunity (even the imperative) to reshape the debate about the transition – thanks to the power of the imaginary mobilised by the CE concept - towards a new economic paradigm that takes into account environmental and social limits to growth. The technocratic project that the ecomodernist vision of the CE underlies – a 'weak formulation' of CE we might argue - is questionable from a scientific perspective, but it is also undesirable for other non-technical reasons (Crist 2016). We don't oppose the core ideas of industrial ecology on which CE draws, but we think they are insufficient to promote a radical transition towards a society that is not only environmentally sustainable but also just and egalitarian (Ede 2016).

For these reasons we put forward two critical reflections that, in our view, should be the base for reframing the present debate and theorise a '*strong formulation*' of CE, which could be embraced by the labour movement as a social transformation programme. Instead of rejecting the CE concept (and creating a new, possibly marginal, discourse with uncertain effectiveness) we think that it would be more effective to 'contaminate' it with countervailing thinking. According to a Gramscian view, we argue that a *direct confrontation* with the dominant CE view will not threaten the dominant groups which have crafted this discourse, as their authority is firmly rooted in civil

society, thanks to their current solid cultural hegemony (Gramsci 2007, 168). We, however, envisage a Gramscian "war of position" in the CE battlefield; a process in which the social foundations of a new CE formulation should be built, leveraging on alternative intellectual resources.

The first point which should be considered in such process consists in questioning the ownership of production units. The CE agenda takes for granted that the basic production unit is localised either in private or state-owned enterprises. Democracy in the decision-making about what processes, what products and how profits are distributed is a topic which is totally absent in CE literature. We believe that a genuine transformative transition towards a CE cannot occur without questioning hierarchies in workplaces, production management and planning. Such a reasoning also includes all the possible forms of 'alternative organizations' (self-managed enterprises; reclaimed factories; co-operatives) that function outside the logic of market economy (Parker et al. 2014). This could be then implemented in the planning of circular chains of 'liberated' units of production. Policies and incentives that can possibly lead to the creation of value-chains based not only on circularity but also on the two previous principles should be designed. It is important to say, however, that reverting the ownerships of production means does not necessarily address the fundamental issues of capital's expansive circularity and its metabolic rift.

For these reasons, our second critical reflection is a call to question how science, technology and innovation are governed. CE promoters call for rethinking how we produce but do not question *why we produce what we produce*. Rather than being left to the *invisible hand* of the market or to the paternalistic role of a technocratic state, innovation and production should be aligned to social desirable goals (Owen and Pansera 2019b). This also implies to open the space of decision-making to multiple stakeholders and social classes, alternative voices, minorities (Stilgoe et al. 2013), with the aim of producing technologies that can be embedded in closed-loop supply chains and also enable new and more just ways of living.

We think of the notions of the 'ecology of tools' (Gorz 1980) or 'convivial technologies' as proposed by Illich (1973). We suggest that 'convivial tools' (Gorz 1980; Illich 1973) may be useful in building an alternative framing for CE. 'Convivial Tools' are instruments, technologies & infrastructures for enacting the commons in open, enlivening way; for achieving 'individual freedom realized in personal interdependence'. They foster relations within and beyond the human world and bring about small, slow and beautifully simple energy-efficient solutions. They are accessible to everybody and easy to use. The essential message of conviviality resides in the awareness that there is a point after which technological development becomes anti-economic and anti-human; its damages overcome its benefits. In Illich's (1975) words, "productivity backfires into counter-productivity". Our overcrowded and polluted cities are an example of this phenomenon.

Different forms of technology and different levels of complexity are compatible with conviviality. The point is not the level of sophistication of a given technology, but rather how this is designed and how it shapes people's lives, in terms of interdependence between human beings and with technology. Conviviality literature suggests that there is a need for creativity and autonomy "for and through" the use of convivial tools and technologies. Societal choices are often being imposed upon people under the guise of technical choices. The struggle for different technologies, through the inversion of tools (conviviality), is therefore a fundamental condition for the transformation of society (Gorz 1980). Convivial technology are socio-technical solutions that satisfy 5 core

dimensions: Relatedness, Accessibility, Adaptability, Bio-interaction, Appropriateness (Vetter 2018).

When it comes to relatedness, convivialists assume that human beings are not just capable of relating to others, but dependent on relationships to others. Therefore, developing and using convivial technology implies the activation and expansion of human relationships and capacities. In the context of CE, relatedness in technology refers to technical solutions that create, enhance or improve human relationships opposed to technologies that divide and isolate people.

Accessibility refers to the possibility of laypeople to access the design and knowledge needed to create convivial technologies. This could be a matter of open source licenses, adequate documentation and standards, cultural barriers (such as gender norms or discrimination). Ownership of a technology can matter as well in terms of long-term control, access and use. As regards CE, accessibility implies that all the stakeholders involved in specific production/consumption activities should be able to freely access and use the technology proposed and also be able to manipulate, modify, repair, reuse it.

Adaptability refers to the independence from state-owned or private-owned infrastructures allowing for the use of everyday tools in order to follow independent usage patterns. As regards CE, adaptable technologies imply the possibility to 'disconnect' or to use alternatives whenever one desires. In other words, an adaptable convivial technology does not imply the exclusion from a given community of those individuals who are not willing to accept it.

Bio-interaction refers to the idea that tools should be *useful* to ecological cycles and interact positively with living organisms. In the case of CE, bio-interaction might refer to those technological solutions that, apart from being environmentally friendly, create spaces and opportunities for animals and plants to flourish and prosper in the urban space.

Appropriateness refers to the fact that a convivial technology must take account of the entire context, local circumstances, availability of materials and skills. As such, convivial technologies must be contextual and dependent on local knowledge, values, purposes and worldviews, relying on specific epistemologies (de Sousa Santos 2015).

The construction of a concrete imaginary based on convivial CE practices will require a research programme that could involve expert and practitioners across several disciplines, stimulate innovative policy-making and new forms of labour struggles. This goes far beyond the purpose of this paper. What we want to stress here is the reflection that any form of struggle aimed at defending ecological equilibria sustaining life should underpin a radical critique of the social relations that enable capitalist modes of production. However, we argue that the opposite is also true: any form of struggle to achieve social justice cannot neglect the intimate links between the destruction of the web of life and the causes of social injustice.

6. Conclusions and Further Research

In the last decade, the concept of 'Circular Economy' (CE) has gained prominence in the political and corporate discourse around the world. In this paper, we have discussed how this idea, in the formulation promoted by European institutions and think tanks is problematic for a number of physical, economic and political reasons. We claim that the biggest shortcoming of the current CE discourse is represented by its apolitical framing.

While recognising a vibrant debate about different forms of framing circularity, we call for a deconstruction of the increasingly hegemonic discourse of CE of the EU based on technocratic and productivist approaches and reconstruct it by embedding normative and political dimensions. Given the increasing popularity of the CE slogan and discourse, and its power to mobilise policy-making, we think it's important to try to reshape or 'occupy' the language box built around the notion of circularity instead of rejecting it *tout court*. We argue that, strategically, it is much more important to have a contested and diverse set of CE formulations instead of having a single marginal alternative discourse with a different language and different buzzwords. We propose a countervailing discourse of CE based on the idea of *convivial technology*, which could stimulate researchers and scientists to think about different ways of framing CE that take into account power, normative aspects, cultural diversity. We also think that the re-appropriation, on these bases, of the Circular Economy idea could be a tool for social transformation which could be embraced by the labour movement.

In terms of future researches, we recognise that a potential alternative to the discourse of the EU - which we defined as a "weak form" of CE - could be found in the Chinese approach. Compared to the EU version, the Chinese way to CE is characterised by a *planned* approach (Mathews and Tan 2016). An entire section of the 11th Five-Year Plan (for 2006–10) was devoted to CE. The circular economy was upgraded to a national development strategy in subsequent Five-Year Plans (2011–15; 2016-20). Such strategy is based on Eco-Industrial parks and *Industrial Symbiosis* networks bringing together optimally selected companies for achieving economic and environmental gains (minimisation of waste, emissions and environmental externalities, eco-systems preservation) (McDowall et al. 2017). This approach, based on governmental intervention and private sector engagement, seems to address some of the limits of the market-driven CE. Nevertheless, such initiative could still be affected by an eco-modernist spirit. In this sense, further research should be devoted to understand if the Chinese way to CE would be able to overcome the limits shown by the technocratic approach promoted by the EU.

Acknowledgements

This research has received funding from the European Commission's H2020-MSCA-ITN-2018 scheme, Grant Agreement 814247 (ReTraCE project). We are grateful to the anonymous referees and Dr. Marco Veronese Passarella (Leeds University Business School) for the intellectually stimulating comments provided.

References

Arrow, K.J., 1962. "The Economic Implications of Learning by Doing". *Review Economic Studies* 29:155–173.

Ayres, R.U., 2007. "On the practical limits to substitution". *Ecological Economics* 61:115–128.

Becque, R., Roy, N., Hamza-Goodacre, D., 2016. *The Political Economy of the Circular Economy*. Accessed April 2020. https://www.climateworks.org/wp-content/uploads/2016/12/CE-political-economy.pdf

Blomsma, F., Brennan, G., 2017. "The Emergence of Circular Economy: A New Framing Around Prolonging Resource Productivity". *Journal of Industrial Ecoogy* 21:603–614.

Bonaiuti, M., 2018. "Are we entering the age of involuntary degrowth? Promethean technologies and declining returns of innovation". *Journal of Cleaner Production* 197:1800–1809.

Boulding, K.E., 2013. *The economics of the coming spaceship earth, in: Environmental Quality in A Growing Economy: Essays from the Sixth RFF Forum.*

Burkett, P., 2006. *Marxism and ecological economics : toward a red and green political economy*. Leiden and Boston: Brill.

Caradonna, J., Borowy, I., Green, T., Victor, P.A., Cohen, M., Gow, A., Heinberg, R., 2015. *A degrowth response to an ecomodernist manifesto*. Accessed on April 2020. www.Resilience.org.

Cole, C., 2017. "China bans foreign waste – but what will happen to the world's recycling?" *The conversation*, October 21.

Crist, E., 2016. "The Reaches of Freedom: A Response to An Ecomodernist Manifesto". *Environmental Humanities*. 7:245–254.

de Man, R., Friege, H., 2016. "Circular economy: European policy on shaky ground". *Waste Management Research*, 34(2):93-95.

de Sousa Santos, B., 2015. *Epistemologies of the South: Justice against epistemicide*. Routledge, New York.

Ede, S., 2016. *The Real Circular Economy. How Relocalising Production With Not-For Profit Business Models Helps Build Resilient and Prosperous Societies*. Accessed on April 2020. http://postgrowth.org/wp-content/uploads/2016/12/The-Real-Circular-Economy-Sharon-Ede-December-2016.pdf

Ellen Macarthur Foundation, 2015. *Growth within: A circular economy vision for a competitive Europe*. Accessed on April 2020. https://www.ellenmacarthurfoundation.org/assets/downloads/publications/EllenMacArthurFoundation_Growth-Within_July15.pdf

Engels, F., 1844. *Outlines of a Critique of Political Economy, in The Economic and Philosophical Manuscripts of 1844*. New York: International Publishers.

European Commission, 2015. "Closing the loop - An EU action plan for the Circular Economy" Accessed on April 2020. https://www.eea.europa.eu/policy-documents/com-2015-0614-final

European Commission, 2020. "Circular Economy - Implementation of the Circular Economy Action Plan". Accesse on April 2020. https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan.pdf

Foster, J. B., 1999. "Marx's theory of metabolic rift: Classical foundations for environmental sociology". *American journal of sociology*, 105(2):366-405.

Foster, J. B., & Clark, B., 2018. "The robbery of nature." *Monthly Review*, 70(1):1-20.

Frosch, R. A., & Gallopoulos, N. E. (1989). Strategies for manufacturing. *Scientific American*, *261*(3):144-153.

Genovese, A., Acquaye, A.A., Figueroa, A., Koh, S.C.L, 2017. "Sustainable supply chain management and the transition towards a circular economy: Evidence and some applications." *Omega* 66:344-357.

Georgescu-Roegen, N., 1971. *The entropy law and the economic process*. Cambridge, Mass: Harvard University Press.

Geissdoerfer, M., Savaget, P., Bocken, N.M.P., & Hultink, E J. (2017). The circular economy–A new sustainability paradigm? *Journal of Cleaner Production*, 143:757-768.

Ghisellini, P., Cialani, C., Ulgiati, S., 2016. "A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems". *Journal of Cleaner Production* 114:11–32.

Gorz, A., 1980. *Ecology as Politics*. Boston: South End Press.

Gramsci, A., 2007. *Prison Notebooks, Volume 3 (translated by J.A. Buttigieg)*. New York: Columbia University Press.

Harvey, D., 2013. *A Companion to Marx's Capital: Volume 2*. London and New York: Verso Books.

Harvey, D., 2014. *Seventeen contradictions and the end of capitalism*. Oxford: Oxford Press.

Hickel, J., Kallis, G., 2019. Is Green Growth Possible? New Political Economy, DOI: 10.1080/13563467.2019.1598964.

Hirsch, F., 1977. *Social limits to growth*. London: Routledge

Hobson, K., 2016. "Closing the loop or squaring the circle? Locating generative spaces for the circular economy". *Progress in Human Geography* 40:88–104.

Hobson, K., Lynch, N., 2016. "Diversifying and de-growing the circular economy: Radical social transformation in a resource-scarce world". *Futures* 82:15–25.

Homrich, A.S., Galvão, G., Abadia, L.G., Carvalho, M.M., 2018. "The circular economy umbrella: Trends and gaps on integrating pathways". *Journal of Cleaner Production* 175:525–543.

Illich, I., 1973. *Tools for conviviality*. New York: Harper & Row.

Kallis, G., 2017. "Socialism Without Growth". *Capitalism Nature and Socialism.* 30(2):1–18.

Kallis, G., Schneider, F., Martinez-Alier, J., 2010. "Growth, Recession or Degrowth for Sustainability and Equity?". *Journal of Cleaner Production.* 18:511–606.

Kerschner, C., 2010. "Economic de-growth vs. steady-state economy". *Journal of Cleaner Production* 18:544–551.

Kirchherr, J., Reike, D., & Hekkert, M., 2017. Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, 127:221-232.

Korhonen, J., Nuur, C., Feldmann, A., Birkie, S.E., 2018. "Circular economy as an essentially contested concept". *Journal of Cleaner Production.* 175: 544–552.

Liebig, J. (1840) *Organic Chemistry in its Applications to Agriculture and Physiology*. London: Taylor and Walton.

Lucas, R.E., 1988. "On the mechanics of economic development". *Journal of Monetary Economics* 22:3–42.

Marx, K. (1963) [1847]. *The Poverty of Philosophy*. New York: International.

Marx, K. (1976) [1867]. *Capital, Volume I*. London: Penguin/New Left Review.

Marx, K., (1981) [1894], *Capital, Volume III*. London: Penguin/New Left Review.

Murray, A., Skene, K., Haynes, K., 2017. *The Circular Economy: An Interdisciplinary Exploration of the Concept and Application in a Global Context*. *Journal of Business Ethics*. 140:369–380.

Mathews, J.A. and Tan, H., 2016. Circular economy: lessons from China. *Nature*, *531*(7595):440-442.

McDowall, W., Geng, Y., Huang, B., Barteková, E., Bleischwitz, R., Türkeli, S., Kemp, R. & Doménech, T. (2017). Circular economy policies in China and Europe. *Journal of Industrial Ecology*, *21*(3):651-661.

Merli, R., Preziosi, M., & Acampora, A. (2018). How do scholars approach the circular economy? A systematic literature review. *Journal of Cleaner Production*. 178:703-722.

Owen, R., Pansera, M., 2019a. "Responsible Innovation: Process and Politics", in: Schomberg, R. von (Ed.), *International Handbook on Responsible Innovation*. Cheltenham: Edward Elgar Publishing

Parker, M., Cheney, G., Fournier, V., Land, C. (Eds.), 2014. *The Routledge Companion to Alternative Organization*. Oxon: Routledge.

Piketty, T., 2014. *Capital in the Twenty-first Century*. Cambridge, Mass.: Harvard University Press.

Polimeni, J.M., Mayumi, K., Giampietro, M., Alcott, B., 2008. *The Jevons paradox and the myth of resource efficiency improvements*. London: Earthscan Research Editions.

Rip, A., Voß, J.-P., 2013. "Umbrella Terms as Mediators in the Governance of emerging Science and Technology". *Science, Technology and Innovation Studies*. 9:39–59.

Savini, F., 2019. "The economy that runs on waste: accumulation in the circular city." *Journal of Environmental Policy and Planning* 21:675–691.

Schnaiberg, A., 1980. *The environment, from surplus to scarcity*. Oxford: Oxford University Press.

Schröder, P., Anantharaman, M., Anggraeni, K., Foxon, T.J., 2019. "Conclusion: Pathways to an inclusive circular economy" in: *The Circular Economy and the Global South*. London: Routledge.

Schumpeter, J.A., 1934. *The theory of economic development: an inquiry into profits, capital, credit, interest, and the business cycle*. Cambridge, Mass: Transaction Publishers.

Schwartzman, D., 2008. The limits to entropy: Continuing misuse of thermodynamics in environmental and Marxist theory. *Science & Society*, *72*(1):43-62.

Stegemann, L., Ossewaarde, M., 2018. "A sustainable myth: A neo-Gramscian perspective on the populist and post-truth tendencies of the European green growth discourse". *Energy Resources and Social Science*. 43:25–32.

Stilgoe, J., Owen, R., Macnaghten, P., 2013. "A Framework for Responsible Innovation". *Research Policy* 42:568–1580.

Strand, R., Saltelli, A., Giampietro, M., Rommetveit, K. and Funtowicz, S., 2018. New narratives for innovation. *Journal of Cleaner Production*, 197:849-1853.

Vetter, Andrea. 2018. "The Matrix of Convivial Technology – Assessing Technologies for Degrowth." *Journal of Cleaner Production* 197:1778–86.

Washida, T., 1998. "Material dissipative conditions and the impossibility of complete recycling". *Structural Change and Economic Dynamics*. 9:271–288. https://doi.org/10.1016/S0954-

349X(98)00041-1

WRAP, 2015. *Economic growth potential of more circular economies*. Retrieved April 11, 2018 from http://www.wrap.org.uk/sites/files/wrap/Economic%20growth%20potential%20of_more%20circular%20economies.pdf