DOI: 10.1111/jiec.13450

JOURNAL OF INDUSTRIAL ECOLOGY WILEY

FORUM

The circular economy growth machine

A critical perspective on "post-growth" and "pro-growth" circularity approaches

Felix Carl Schultz | **Ingo Pies**

Department of Economic Ethics, Martin-Luther-University Halle-Wittenberg, Halle (Saale), Germany

Correspondence
Felix Carl Schultz, Department of Economic Ethics, Martin-Luther-University Halle-Wittenberg, Halle (Saale), Germany.
Email: Felix.Schultz@wiwi.uni-halle.de

Editor Managing Review: Xin Tong

Abstract

This forum article contributes to the prospering debate in the circular economy (CE) community discussing whether—and to what extent—the CE is reconcilable with economic growth. Within this discourse about a functional CE, there exist two contesting perspectives. One argues in favor of pro-growth circularity, the other in favor of post-growth circularity. The aim of this article is to develop a line of argumentation that helps in reconciliating the two seemingly antagonistic perspectives. Toward that end, this article applies the method of "practical syllogism" that is well known in moral philosophy, since it can enlighten how normative and positive arguments can be structured to enable the formulation of well-justified moral conclusions. With the help of this interdisciplinary impulse, the article aims at detecting logical errors in current reasoning and fostering discursive learning processes. The ensuing arguments provide vital implications on the macro level by highlighting four critical elements to facilitate a CE transition, namely an intensive growth trajectory, an internalization of negative externalities through creating (missing) markets, an institutional encouragement of spreading positive externalities, and a diffusion of rents from innovation to society by taking the profit motive into service for enabling sustainability goals. Complementarily, the article provides implications on the micro level by highlighting the necessity to develop supplementary management competencies, namely governance competence to realize argumentative clarification and governance competence to (re-)configurate institutional structures. This article may serve as an incubator to ease new ways of thinking into academia and practice.

KEYWORDS
circular economy, degrowth, economic growth, green growth, industrial ecology, post growth

1 | INTRODUCTION

Situated in the industrial ecology research field (see Bruel et al., 2019), the circular economy (CE) concept has recently been revitalized by scholars, legislators, and practitioners. Many of them expect that a functional and successful CE transition can pave the way for "green growth"—that is, decoupling economic production from environmental impact (Kjaer et al., 2019). However, scholars have found that increases in the gross domestic

product (GDP) have historically been coupled with an expansion of material footprints, thus causing severe ecological impacts (Hickel & Kallis, 2019). As a result of this obvious discrepancy between the "expectations of green growth" and the inadequate "real-world development" of the CE—since the world is only 8.6% circular to date (Circle Economy, 2022)—there has emerged a debate among scholars questioning whether—and to what extent—the CE paradigm is after all compatible with economic growth (Bauwens, 2021; Hobson & Lynch, 2016; Kirchherr, 2022; Schultz, 2022; Zink & Geyer, 2017).[1] Two contesting perspectives have dominated this prospering debate. While one favors post-growth circularity the other favors pro-growth circularity approaches.

The post-growth circularity perspective queries whether an economic growth trajectory can lead to a sustainable development of modern society. As a result, authors such as Hobson and Lynch (2016), Zink and Geyer (2017), Parrique et al. (2019), Schröder et al. (2019), Siderius and Poldner (2021), and Bauwens (2021) have called for post-growth circularity (eventually translating into degrowth) and the abandonment of the profit-seeking motive by firms. On the *macro level*, Bauwens (2021, p. 2) diagnoses: "[A]ttempting to create a circular economy while maintaining perpetual growth is likely to pose an insurmountable challenge; instead, a postgrowth approach to circular economy may be required." He reasons: "[A] circular economy will likely remain a mere pipe dream as long as the growth imperative drives the economy." This post-growth circularity approach is meant to establish a new "era … in which macroeconomic goals are reoriented towards equitable downscaling of production and consumption and wellbeing enhancement" (Bauwens, 2021, p. 2). Along similar lines, Zink and Geyer (2017, p. 600) hold the view that "[w]hat is truly required to reduce environmental impact is less production and less consumption." On the *micro level*, this "post-growth circularity era" (which is hoped to eventually translate into degrowth) is expected to require the abandonment of the profit-seeking motive by private firms. Bauwens (2021, p. 2, emphasis added) recommends "a deep reconsideration of the very meaning of doing business, which would have to be recentered around the values of cooperation, care, sharing, community and solidarity *instead of profit making*." Further, Siderius and Poldner (2021, p. 9) argue that "ultimately profit maximizing firm[s] [are] incompatible with CE." In a similar vein, Zink and Geyer (2017, p. 593) have developed CE strategies, but they emphasize that these strategies are "unlikely to be attractive to for-profit firms." Furthermore, they caution "that simply encouraging private firms to find profitable opportunities in the circular economy is likely to cause rebound and lower or eliminate the potential environmental benefits." In order to realize a post-growth era in which profit-seeking must be replaced by other *means*, Bauwens (2021, p. 2) has called for "appropriate policies, which include, but are not restricted to, abandoning the blind pursuit of GDP expansion."

In recent years, there has evolved a dissenting perspective in the literature that pleas for a CE that grows (Kirchherr, 2022; Kjaer et al., 2019; Lieder & Rashid, 2016; Moreau et al., 2017). Consequently, this perspective has queried "if 'post-growth' is truly to be the aim of CE" (Kirchherr, 2022, p. 1). Opposing calls for post-growth circularity, several authors such as Moreau et al. (2017) and Kirchherr (2022) have advocated for pro-growth circularity and the modification of conditions for profit-seeking of private firms to *balance* economic, environmental, and social goals. On the *macro level*, Kirchherr (2022, p. 2) reasons: "'[P]ost-growth' circularity may result in an economy that is smaller and possibly even more circular, but not necessarily more environmentally, socially, and ultimately economically sustainable." Hence, he holds the view that an appropriate approach must "ensure that the economy's GDP, circularity, and sustainability are all growing at the same time—the original promise and ambition of the CE concept" (Kirchherr, 2022, p. 2). In a similar vein, Kjaer et al. (2019, p. 32) argue that "the ultimate aim of CE should be to enable absolute resource decoupling, which goes beyond simply extracting more value from resources." On the *micro level*, some authors argue that such a pro-growth circularity approach requires to "modify the conditions for profitability toward a CE" (Moreau et al., 2017, p. 503). Therefore, this perspective emphasizes "the need for political reform" (Moreau et al., 2017, p. 503) with the aim that firms should *balance* profit-seeking and sustainability activities. In order to realize a pro-growth circularity and a modification of conditions for profit-seeking, Kirchherr (2022, p. 2, emphasis added) has called for "policies which aim at *balancing* environmental, economic, and social goals, and thus sustainability" In this way, this perspective aims at enabling the growth of GDP, the transition to circularity, and thus progress toward the ultimate goal of sustainability.

Against this background, it is important to note that recently Schultz (2022) has reconstructed both perspectives, identifying a tradeoff between antagonistic opinions. In response to the call for further research on this crucial topic by leading CE scholars (Bauwens, 2021; Corvellec et al., 2022; Kirchherr, 2022; Zink & Geyer, 2017), this article adds to and expands on the recently identified tradeoff perspective in order to contribute a detailed examination of viable opportunities to successfully approach a decoupling of economic growth and environmental impact. Since "there is clearly a need for conceptual coherence" in the CE literature (Corvellec et al., 2022, p. 429), this article bridges the gap by outlining how to approach and overcome the intellectual stalemate between the two dominant perspectives in the literature that are seemingly antagonistic. Section 2 reconceptualizes both argumentations on the *macro level* and the *micro level* by applying the "practical syllogism" method. Finally, Section 3 summarizes the insights and draws out relevant implications for fellow researchers, politicians, practitioners, and citizens aiming at facilitating a successful CE transition.

2 | "POST-GROWTH" AND "PRO-GROWTH" CIRCULARITY: A PROPOSED RECONCEPTUALIZATION BY APPLYING THE "PRACTICAL SYLLOGISM"

In this section, the article analyzes and (re-)conceptualizes the argumentative structure of the two prevalent perspectives on the *macro level* (Section 2.1) and the *micro level* (Section 2.2) by using the "practical syllogism." This analytical tool helps to identify objectionable positive premises with

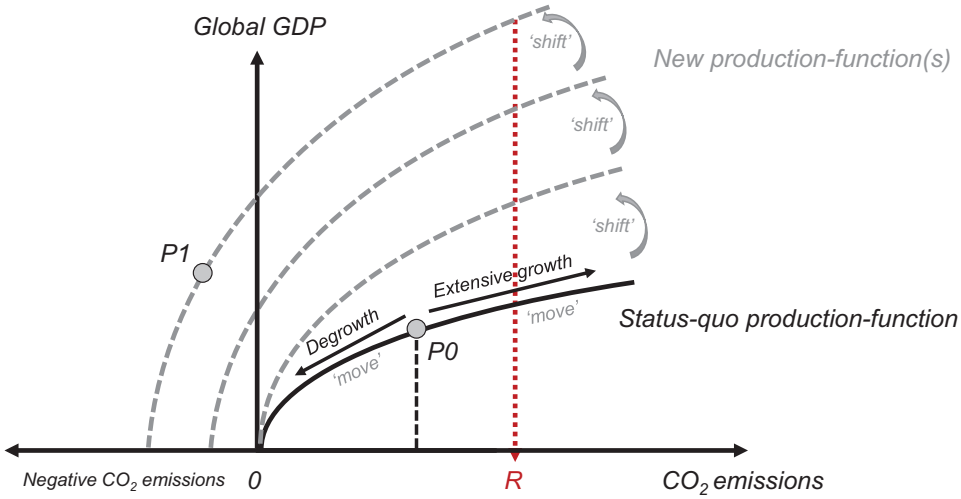

FIGURE 1 Post-growth versus pro-growth: Moving along versus shifting the production function(s) at the macro level.

the aim to check whether moral conclusions are well justified (Homann & Pies, 1994; Mothersill, 1962; Schreck et al., 2013). In particular, it can help to detect errors in reasoning and thus may foster discursive learning processes. The practical syllogism method is well suited for analyzing moral claims in public discussions, policy initiatives, and corporate strategies (Hielscher et al., 2016), and it has already been proven functional in various debates, for example, on corporate social responsibility (Schreck et al., 2013) or genetically modified organisms (Hielscher et al., 2016). Methodologically, the practical syllogism consists of a normative principle about what is desirable ("*ought to be*"). Further, it contains a premise about factual conditions ("*what actually is*"). Finally, it contains a prescription for action ("*action-guidance*") that is derived as a logical conclusion from the two premises (Mothersill, 1962; Schreck et al., 2013).

2.1 | The macro level perspective

First, this article (re-)formulates the normative principle, the empirical premise, and finally the normative conclusion of the *post-growth perspective* for the macro level:

Post-growth circularity argumentation (macro level):

1. **Normative premise**: It is morally desirable to establish a functional CE to mitigate climate change.
2. **Positive premise**: Only de-growth is an effective approach to sufficiently reduce CO_2 emissions.
3. **Conclusion**: We should aim at establishing a post-growth CE.

Although this post-growth argumentation looks logically coherent, it rests on a factual error. In particular, it ignores the fact that "mankind likely needs to achieve negative CO_2 emissions before 2050" (Detz & van der Zwaan, 2019, p. 1) in order to reach the 1.5°C maximum temperature increase target of the Paris Agreement (see also, e.g., Bednar et al., 2021; DeAngelo et al., 2021; Hansen et al., 2017).[2] As illustrated in Figure 1, starting from the status quo (point P_0), degrowth (post-growth) scholars who argue for "less production and less consumption" (Zink & Geyer, 2017, p. 600) literally postulate to *move* along a given production function[3] in south-western direction with the aim to decrease CO_2 emissions by reducing the production output.

However, there are two major problems with such an approach. First, it is questionable how sustainable it is to ask political actors to sacrifice material wealth. Particularly in democracies with competitive elections, this may make it difficult for them to win public support. But even if it were possible to convince politicians to go against the interest of their principals in material well-being, there is still the second problem that willfully reducing production and consumption levels is of only limited value for improving the overall sustainability performance, especially when it comes to mitigating climate change.

Even if granted that this approach might lead to reduced CO_2 emissions and thus may postpone reaching the critical CO_2 emission level (R) (see Figure 1), such a post-growth strategy can never succeed in reaching negative net CO_2 emissions. Figure 1 helps to understand that doing so requires a fundamentally different approach. Instead of *moving* along a given production function, effective protection against climate change requires a pro-growth strategy of radical innovation that *shifts* the production function(s) in the north-western direction until negative net CO_2 emissions can be realized (e.g., point P_1 in Figure 1).

Building on this conceptual clarification, we can now make use of the practical syllogism in order to formulate an argument that excels the plea for post-growth circularity at the macro level. We draw attention to the interesting fact that there is a comparatively superior option for mitigating climate change without sacrificing material well-being. We do so by leaving the (1) normative premise unchanged, by improving the positive premise (Δ2), and thus deriving a new conclusion (Δ3):

Novel pro-growth circularity argument (macro level):

(1) Normative premise: It is morally desirable to establish a functional CE to mitigate climate change.

(Δ2) **Positive premise**: In sharp contrast to de-growth circularity, only pro-growth circularity can incentivize systemic innovation activities that are essential to realize net negative CO_2 emissions.

(Δ3) **Conclusion**: We should aim at a pro-growth approach to circularity for creating innovative opportunities to realize net negative CO_2 emissions.

Thus, our pro-growth argumentation is fully in line with the macro perspective by, for example, Kirchherr (2022, p. 1) who formulates "a plea for a circular economy that grows." In fact, the achievement of net negative CO_2 emissions requires radical innovation dynamics to develop disruptive technologies as well as new governance models. Instead of pursuing "anti-market dreams," we need a system that establishes strong innovation incentives for organizations such that *competitive processes are re-programmed to serve the environment*. Without accelerating innovation dynamics, no CE could ever realize net negative CO_2 emissions, which are urgently needed for effective climate protection.

2.2 | The micro level perspective

We now turn to the micro level, where both prevalent perspectives in the literature are skeptical with regard to the appropriateness of the profit principle for a functional CE. While Bauwens (2021, p. 2), as one representative of the post-growth perspective, advocates for "a deep reconsideration of the very meaning of doing business," Kirchherr (2022, p. 9), as one representative holding a pro-growth perspective, advocates for "balancing environmental, economic and social goals" (Kirchherr, 2022, p.2). Since we have already refuted the macro argument of the post-growth perspective, we can bypass its radical position at the micro level and instead focus on the micro argument of the pro-growth perspective. Again, we make use of the practical syllogism to (re-)formulate their balancing argument by identifying the normative principle, the empirical premise, and finally the normative conclusion of the *pro-growth perspective* for the micro level:

Pro-growth balancing argumentation (micro level):

1. **Normative premise**: It is morally desirable to establish a sustainable CE.
2. **Positive premise**: The traditional profit orientation of firms is not enough for sustainability. It needs to be complemented by social and environmental goals in order to reorient the firms' decision-making processes. The only opportunity for private firms to fulfill the sustainability desiderata of a CE is to switch from one-dimensional profit-seeking toward three-dimensional optimization (i.e., environmental, social, and economic).
3. **Conclusion**: Firms need to pursue economic, environmental, and social goals. We therefore should aim at establishing governmental policies that incentivize firms to switch from pure profit-seeking toward *balancing* the three sustainability dimensions.

At first glance, this argumentation looks logically coherent. But it contains a blind spot regarding the whole spectrum of opportunities for organizations to realize sustainability desiderata. Adding to and expanding on the contemporary debate, this article highlights (once again) the conceptual distinction between *moving along* versus *shifting* a curve. As Figure 2 helps to illustrate, *optimization* means to *move* along a given marginal profit function (MP),[4] while *governance innovation*[5] means to *shift* these negatively sloped curves to the right (from MP_1 to MP_2 to MP_3) (Pies & Schultz, 2023).

Figure 2 shows marginal profit on the ordinate and corporate circularity activities on the abscissa. Starting with the status quo (point A), the first arrow illustrates how a profit-oriented firm optimizes its behavior. As long as marginal profit is positive, the firm moves to the right. It chooses a higher level of circularity activities until the MP_1 curve intersects the abscissa. In point B, marginal profit is zero. Here, the firm realizes its maximum profit. A perspective that calls for "*balancing*" highlights point B as a sub-optimal sustainability performance. It perceives the chosen level of business activities as socially or/and environmentally harming third parties. It postulates that it is desirable that the firm should choose an even higher level of corporate circularity activities to address environmental (and social goals) more effectively, thus moving further to the right of point B in order to reach, for example, point C.

However, there are two major problems with such an approach. First, it is questionable how sustainable it is to ask firms to sacrifice profit. Particularly in competitive markets, this may endanger their very existence. But even if it were possible to convince managers to go against the

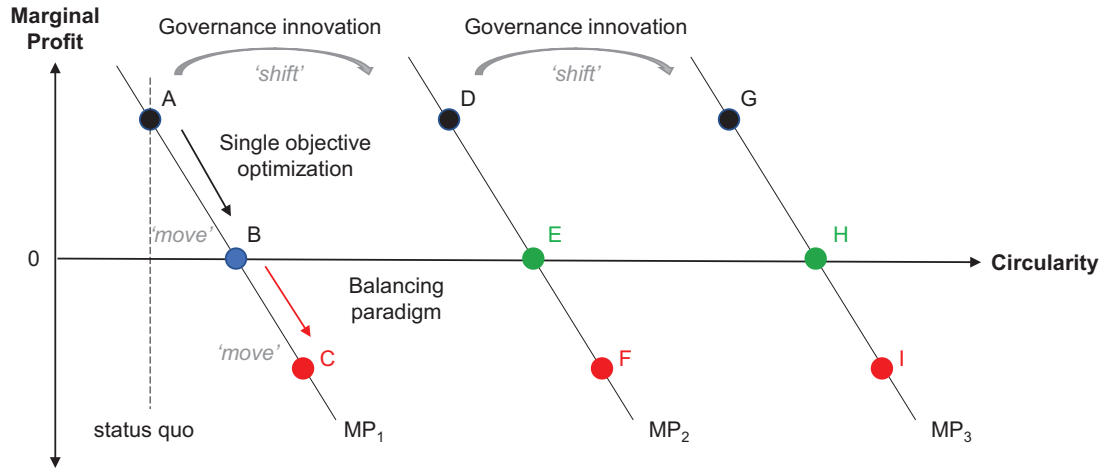

FIGURE 2 Re-balanced optimization versus governance: Moving along versus shifting the marginal profit function(s) at the micro level (inspired by Pies and Schultz, 2023).

profit interest of their principals, there is still the second problem that deviating from the profit maximum is of only limited value for improving the sustainability performance.

Against this background, it is helpful to enlarge the perspective from *optimization* (moving along the curve) to *governance innovation* (shifting the curve). While *optimization* takes the situation and its incentive mechanisms as given, *governance innovation* aims at changing the incentive properties such that new behaviors—and new equilibria—become incentive compatible. Governance innovation changes the institutional framework conditions for optimizing in the sense that social and/or environmental engagement *becomes instrumental* for profit-seeking. It thus creates an enabling environment for improved sustainability performance. Instead of taking small steps from B to C, the firm jumps from B to E. A stream of governance innovations would bring about further shifts of the MPs to the right, from MP_2 to MP_3 (and thus a jump from E to H). The points D and G represent the initial situations after a governance innovation took place, respectively. The points F and I would represent a possible relapse into balancing (i.e., "non-optimization") behavior after a governance innovation already moved the MP curves, respectively.

As Figure 2 makes clear, the option of *governance innovation* incentivizes the firm to move much further to the right and thus it can implement much higher levels of sustainability performance, compared to *re-balancing* its internal decision process of *optimization*.

In analogy to our argument for the macro level, we now employ the practical syllogism to formulate a novel argument for the micro level that excels the initial "*balancing*" argumentation. We draw attention to the interesting fact that there is a comparatively superior option for making firms realize environmental protection and social well-being without sacrificing profit.

We do so by leaving the (1) normative premise unchanged, by improving the positive premise (Δ2), and thus deriving a new conclusion (Δ3):

Novel argument (micro level):

(1) Normative premise: It is morally desirable to establish a sustainable CE.

(Δ2) Positive premise: There are (at least) two opportunities for private firms to approach circularity and thus sustainability desiderata:

(1) Re-balanced optimization.

(2) Governance Innovation for sustainable profit-seeking.

The second option of *governance innovation* has a comparatively greater potential to create market-conform incentives for profit-oriented firms to conduct the still missing circularity activities that are highly desirable from a sustainability perspective.

(Δ3) **Conclusion**: Instead of re-balancing a three-dimensional optimization, we should aim to re-program governance taking the *profit motive into service* for a better achievement of the environmental and social desiderata of a sustainable CE.

Faced with a dissent between the prevalent perspectives of post-growth and pro-growth, we show that both perspectives possess a weakness regarding their paradigm of static thinking. The post-growth perspective tends to underestimate the option of unleashing market forces for innovative growth that decouples modern processes of production and consumption from environmental damage, whereas the pro-growth perspective underestimates the option of unleashing business forces for green growth that re-create an enabling institutional environment for sustainable profit-seeking from innovative governance. Our analysis thus leads to two insights that may help CE gain new momentum. The first refers to the macro level, the second to the micro level: In contrast to a post-growth perspective, a pro-growth strategy is superior with regard to effective

protection against climate change. The approach of re-balancing the profit motive is clearly inferior when compared with a strategy of governance innovation for improved sustainability performance.

3 | IMPLICATIONS AND CONCLUDING REMARKS

This article (re-)formulates and (re-)conceptualizes the argumentative structure of the two dominant perspectives on growth in the current CE debate. It proposes a reconciliation and improvement of both perspectives. This is based on identifying "unforced errors" in the recent reasoning on the compatibility of CE and economic growth, thus encouraging scholars to foster discursive learning processes in the scientific debate. The analytical tool of the practical syllogism proves helpful in this endeavor by pointing out that dissent among scholars does not result from different normative principles but from different positive premises. This is of utmost importance for creating a common ground to improve mutual understanding via conceptual clarification.

Such clarification refers to interdependencies between facts and theories. This is fully in line with Milton Friedman who stated that "[a] theory is the way we perceive 'facts', and we cannot perceive 'facts' without a theory" (Friedman, 1953, p. 166). Our contribution to gaining common ground therefore refers to the fact that some sustainability strategies run the danger of arousing opposition. They are likely to meet the resistance of systemic actors (people and organizations) who want to avoid individual disadvantages. However, to change the perspective from win–lose strategies to win–win strategies requires a re-conceptualization of the theoretical mindset. In this regard, we offer two insights that are of theoretical importance, that is, important for re-thinking theory. These insights refer to the macro and micro levels, respectively.

On the macro level, the first insight is to recommend the superior option of an intensive growth trajectory for decoupling resource consumption and economic wealth. To gain general support, four further points are noteworthy.

First, it would be helpful to have a clearer public understanding that *extensive* growth means more output from more input, while *intensive* growth means more output from less input (due to improved knowledge). Indeed, green growth and effective protection against climate change require "More from Less" (see for further reading McAfee, 2019).

Second, it would be helpful to have a clearer public understanding that negative externalities should not be perceived as "market failures" but as "missing markets" or "missing exchanges."

Third, this article highlights the necessity to change the theoretical perspective(s) on CE. Instead of regarding it as an institutional option for the *internalization of negative externalities*, it should better be perceived as an institutional device for the *spreading of positive externalities* that result from innovation as the source for value creation and value capture (see for further reading Baumol, 2010).

Fourth, this article elaborates on the idea by Freeman (2008, p. 163) who stated that "we would have a more useful ethics if we built into our normative ideals the need to understand how we create value and trade." To realize this aim, we need to initiate the diffusion of rents from innovation to society by taking the profit motive *into the service* of implementing environmental and social desiderata.

On the micro level, the second insight is that decision-makers need specific competencies and capabilities to realize the transition from linear to circular thinking. To gain general support, some further points are noteworthy.

Instead of encouraging managers to think in *balancing paradigms* between profits and environmental (and social) desiderata, we argue that three major competencies are essential for managers to overcome the disorienting balancing paradigm and to successfully promote productive and innovative value creation activities. Therefore, this article avoids advising managers to enter balancing activities and to run the danger of getting lost in tensions by pursuing "anti-market dreams." Instead, we encourage managers to develop market-conform sustainability strategies that enable profit-oriented firms to pro-actively contribute to environmental and social sustainability aspects. While traditional optimization competencies remain crucial in a CE, they should be complemented by two governance competencies—argumentative clarification and institutional (re-) configuration (Pies et al., 2010).

First, governance competence to realize argumentative clarification within CE value networks: Here, an argumentation competence of managers is essential to disclose conflicting interests, but particularly to enlighten common interests of all value network participants. Decision-makers are advised to participate in and (re-)direct discourses with multiple actors to actively shape the prerequisites for governmental (first order) and private (second order) ordering. In fact, they must identify not yet realized value creation potentials with (actually and potentially) participating value network actors (see for further reading Will & Pies, 2018).

Second, governance competence to (re-)configurate value network structures: Here, managers are advised to realize the necessity to create (or enter) CE-enabling environments beyond immediate industrial boundaries—i.e., building strategic alliances and networks with actors in other industries and sectors (even when at first glance there appeared to be no win–wins in the past). So, managers need to realize and innovatively create mutual opportunities for the collective introduction of functional inter-industrial and intersectoral (self-)commitments that could not be realized in the past due to the fear of (mutual) exploitation between actors. This requires trust building via credible commitments (see for further reading Williamson, 1983).

Since the primary purpose of this forum article is to serve as an incubator for a new way of thinking in the field of CE, future research is essential to theoretically underline and empirically test the arguments and implications proposed in this article. Thus, we understand this forum article as

one means to present preliminary theoretical stepping stones to address the emergent CE theme and to encourage further inquiries in this flourishing research area. Hereby, we invite fellow researchers to constructively criticize our proposed argumentation and conceptualization, and to join us in strengthening the important CE field that in our perspective can create critical momentum for the necessary improvements on sustainable development.

ACKNOWLEDGEMENTS

Open access funding enabled and organized by Projekt DEAL.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data sharing not applicable – no new data generated, the article describes entirely theoretical research.

ORCID

Felix Carl Schultz https://orcid.org/0000-0002-2467-1891

Ingo Pies https://orcid.org/0000-0003-2068-4529

NOTES

[1] This discussion is not only a phenomenon in CE research. Please, see King et al., 2023 for further insights in sustainabilty science.

[2] The CE possesses an enormous potential to significantly contribute to the achievement of the 1.5°C target (Aguilar-Hernandez et al., 2021).

[3] "The production function is the technical relationship between physical inputs and physical outputs, ceteris paribus. It describes the maximum feasible output of … an economy, for every possible combination of inputs, given existing knowledge and technology" (Samuelson, 1989, p. 372). Notable economists who have made significant contributions to the theory of production functions also include Alfred Marshall (1890), Joan Robinson (1953), Robert Solow (1957), among others. Our graph differs from the usual production functions used in the literature because—unlike normal resource inputs—CO_2 emissions can have negative values. Therefore, technological progress shifts our production function not only upward, but also to the left.

[4] "The profit function is a function of the output and input prices which gives the value of the maximized profit of a profit-maximizing and price-taking firm endowed with a given technology" (Lau, 1972, p. 281). Various economists have contributed to the development and understanding of the profit function. Prominent economists such as Adam Smith, Alfred Marshall, and Lawrence Lau have made significant contributions to the study of profits and their functions, among others. The illustrated marginal profit functions (MPs) in Figure 2 literally represent the first derivative of the profit functions.

[5] This terminology is based on Williamson's understanding of governance as "the means by which to infuse *order*, thereby to mitigate *conflict* and realize *mutual gain*" (Williamson, 2010, p. 674, emphasis in original).

REFERENCES

Aguilar-Hernandez, G. A., Rodrigues, J. F. D., & Tukker, A. (2021). Macroeconomic, social and environmental impacts of a circular economy up to 2050: A meta-analysis of prospective studies. *Journal of Cleaner Production*, *278*, 123421.

Baumol, W. J. (2010). *The microtheory of innovative entrepreneurship*. Princeton University Press.

Bauwens, T. (2021). Are the circular economy and economic growth compatible? A case for post-growth circularity. *Resources, Conservation and Recycling*, *175*, 105852.

Bednar, J., Obersteiner, M., Baklanov, A., Thomson, M., Wagner, F., Geden, O., Allen, M., & Hall, J. W. (2021). Operationalizing the net-negative carbon economy. *Nature*, *596*, 377–383.

Bruel, A., Kronenberg, J., Troussier, N., & Guillaume, B. (2019). Linking industrial ecology and ecological economics: A theoretical and empirical foundation for the circular economy. *Journal of Industrial Ecology*, *23*(1), 12–21.

Circle Economy. (2022). *The circularity gap report 2022* (pp. 1–64) Circle Economy. https://www.circularity-gap.world/2022#Download-the-report

Corvellec, H., Stowell, A. F., & Johansson, N. (2022). Critiques of the circular economy. *Journal of Industrial Ecology*, *26*(2), 421–432.

DeAngelo, J., Azevedo, I., Bistline, J., Clarke, L., Luderer, G., Byers, E., & Davis, S. J. (2021). Energy systems in scenarios at net-zero CO_2 emissions. *Nature Communications*, *12*, 6096.

Detz, R. J., & van der Zwaan, B. (2019). Transitioning towards negative CO_2 emissions. *Energy Policy*, *133*, 110938.

Freeman, E. R. (2008). Ending the so-called "Friedman-Freeman" debate. *Business Ethics Quarterly*, *18*(2), 162–166.

Friedman, M. (1953). The methodology of positive economics. In D. M. Hausman (Ed.) 2008, *The philosophy of economics: An anthology* (3rd ed., pp. 145–178). Cambridge University Press.

Hansen, J., Sato, M., Kharecha, P., von Schuckmann, K., Beerling, D. J., Cao, J., Marcott, S., Masson-Delmotte, V., Prather, M. J., Rohling, E. J., Shakun, J., Smith, P., Lacis, A., Russell, G., & Ruedy, R. (2017). Young people's burden: Requirement of negative CO_2 emission. *Earth System Dynamics*, *8*, 577–616.

Hickel, J., & Kallis, G. (2019). Is green growth possible? *New Political Economy*, *25*(4), 469–486.

Hielscher, S., Pies, I., Valentinov, V., & Chatalova, L. (2016). Rationalizing the GMO debate: The ordonomic approach to addressing agricultural myths. *International Journal of Environmental Research and Public Health*, *13*, 476.

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

Homann, K., & Pies, I. (1994). Wirtschaftsethik in der Moderne: Zur ökonomischen Theorie der Moral. *Ethik und Sozialwissenschaften*, *5*, 3–14.

King, L. C., Savin, I., & Drews, S. (2023). Shades of green growth scepticism among climate policy researchers. *Nature Sustainability*, 1–5.

Kirchherr, J. (2022). Circular economy and growth: A critical review of "post-growth" circularity and a plea for a circular economy that grows. *Resources, Conservation and Recycling*, *179*, 106033.

Kjaer, L. L., Pigosso, D. C. A., Niero, M., Bech, N. M., & McAloone, T. C. (2019). Product/service-systems for a circular economy: The route to decoupling economic growth from resource consumption? *Journal of Industrial Ecology*, *23*(1), 22–35.

Lau, L. J. (1972). Profit functions of technologies with multiple inputs and outputs. *The Review of Economics and Statistics*, *54*, 281–289.

Lieder, M., & Rashid, A. (2016). Towards circular economy implementation: A comprehensive review in context of manufacturing industry. *Journal of Cleaner Production*, *115*, 36–51.

Marshall, A. (1890). *Principles of economics* (8th ed.). Mc Millan.

McAfee, A. (2019). *More from less: The surprising story of how we learned to prosper using fewer resources—And what happens next*. Scribner.

Moreau, V., Sahakian, M., Van Griethuysen, P., & Vuille, F. (2017). Coming full circle: Why social and institutional dimensions matter for the circular economy. *Journal of Industrial Ecology*, *21*(3), 497–506.

Mothersill, M. (1962). Anscombe's account of the practical syllogism. *The Philosophical Review*, *71*, 448–461.

Parrique, T., Barth, J., Briens, F., Spangenberg, J. H., & Kraus-Polk, A. W. (2019). *Decoupling debunked: Evidence and arguments against green growth as a sole strategy for sustainability*. European Environmental Bureau.

Pies, I., Beckmann, M., & Hielscher, S. (2010). Value creation, management competencies, and global corporate citizenship: An ordonomic approach to business ethics in the age of globalization. *Journal of Business Ethics*, *94*, 265–278.

Pies, I., & Schultz, F. C. (2023). The governance of sustainable business model innovation—An ordonomic approach. *Scandinavian Journal of Management*, *39*(1), 101246.

Robinson, J. (1953). The production function and the theory of capital. *The Review of Economic Studies*, *21*(2), 81–106.

Samuelson, P. (1989). *Economics: An introductory analysis* (13th ed., p. 372), McGraw-Hill.

Schreck, P., van Aaken, D., & Donaldson, T. (2013). Positive economics and the normativistic fallacy: Bridging the two sides of CSR. *Business Ethics Quarterly*, *23*(2), 297–329.

Schröder, P., Bengtsson, M., Cohen, M., Dewick, P., Hofstetter, J., & Sarkis, J. (2019). Degrowth within: Aligning circular economy and strong sustainability narratives. *Resources, Conservation and Recycling*, *146*, 190–191.

Schultz, F. C. (2022). The circular economy and economic growth—An irreconcilable tradeoff? *Resources, Conservation and Recycling*, *183*, 106351.

Siderius, T., & Poldner, K. (2021). Reconsidering the circular economy rebound effect: Propositions from a case study of the Dutch circular textile valley. *Journal of Cleaner Production*, *293*, 125996.

Solow, R. M. (1957). Technical change and the aggregate production function. *The Review of Economics and Statistics*, *39*, 312–320.

Will, M. G., & Pies, I. (2018). Sensemaking and sensegiving: A concept for successful change management that brings together moral foundations theory and the ordonomic approach. *Journal of Accounting and Organizational Change*, *14*(3), 291–313.

Williamson, O. E. (1983). Credible commitments: Using hostages to support exchange. *American Economic Review*, *73*, 519–540.

Williamson, O. E. (2010). Transaction cost economics: The natural progression. *American Economic Review*, *100*(3), 673–690.

Zink, T., & Geyer, R. (2017). Circular economy rebound. *Journal of Industrial Ecology*, *21*(3), 593–602.

How to cite this article: Schultz, F. C., & Pies, I. (2024). The circular economy growth machine: A critical perspective on "post-growth" and "pro-growth" circularity approaches. *Journal of Industrial Ecology*, *28*, 17–24. https://doi.org/10.1111/jiec.13450