

Why only innovations based on degrowth principles can stop further ecological and social destruction

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Abstract

Conventional, technological innovation in a growth-oriented economy is not the solution to the existential problems we face today but rather the cause of them. It accelerates excessive consumption, depletes the natural environment, and leads to a socio-ecological crisis of which we are yet to understand the full consequences. We need to politicize this indispensable pillar of society because, in its conventional form, innovation is driving us towards a grim future. In this article, we review which conditions for innovation are necessary to mitigate current environmental and social crises. We argue that degrowth principles must lie at the basis of these conditions; using less material and energy in a just and democratic manner to improve well-being for all. We therefore plea that degrowth principles must be adopted as the new foundation for innovation.

Keywords: *Innovation, Degrowth, Planetary boundaries, Ecological economics, Climate solutions, Biodiversity loss.*

1. Introduction

In this paper, we start from the observation that ecological degradation is accelerating worldwide (Fletcher et al., 2024; Bradshaw et al., 2021; Ripple et al., 2017; Cardoso et al., 2020; WWF, 2024) while social indicators showing little or no progress (Sachs et al., 2024). Subsequently, we argue that this degradation is fueled by a socio-economic system driven by economic growth with innovation as its catalyst. We refer to innovation as the development of new products, markets and manufacturing methods and new forms of business organization (a Schumpeterian definition in Hospers, 2005), with the purpose of fueling economic growth, hereafter called ‘conventional innovation’. Conventional innovation drives efficiency, and new types and ‘modern’ series of consumer goods, leading to increasing material extraction and consequently energy, water, and land use, which in turn causes more chemical pollution, greenhouse gas emissions and irreparable biodiversity loss. Can we innovate ourselves out of the ecological and social conundrum we face? We argue that new principles for innovation, where we use ecological economics as foundation and principles of degrowth as

¹ Original draft.

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constructive elements, are imperative. Without that, resolving the current socio-ecological crisis will be hardly possible.

2. Conventional Innovation

Conventional innovation is firmly embedded in our society and dominates public discourse. Godin (2015) posits that it has evolved into a dominant paradigm that permeates policy and daily life. In every aspect of life we are pushed to be innovative; few professions, and even our private lives, are free from the innovation dogma (Russell & Vinsel, 2018). This is because conventional innovation, with its almost exclusively positive framing, is ideologically intertwined with our current cultural and economic paradigm (quotes from Robra et al., 2023): “1. Innovation delivers growth and prosperity for all and is thus inherently good” (productivism) (Jonsson & Wennerlind, 2023; Macekura, 2020; Schmelzer, 2023); 2. “Innovation is inevitable and unstoppable” (determinism). Conventional innovation is occasionally even referred to as “natural” (Lösch, 2017) or “neutral” (Pansera, 2024).

The ubiquitousness and almost exclusive positive connotation of conventional innovation, Schumpeter saw it as the main driver of progress (1943), serves as a Gramscian construct of cultural hegemony. It has become so ingrained in our daily lives that we overlook the power structures driving the forces of conventional innovation.

3. Critique on Conventional Innovation

3.1. Critique from an Economics and Power Perspective

We argue that there is little natural or neutral about conventional innovation. Its objective is to improve return on investment, or increase wealth for vested interests (Marcuse, [1964] 2003), often subsidized by governments (Mazzucato, 2018). Profit-seeking organizations use conventional innovation as a driver for more consumption, consequently leading to economic expansion (Stuart et al., 2020), this is a variant of Marx's description $M > C > M'$ (Marx, 1867 in Hean et al., 2003; Hickel 2020, p. 85). It could be written as $M > I > C > M'^3$, which is a self-reinforcing cycle.

C-level management and shareholders of big firms autocratically decide where money is invested and where it is not. Essentially, the market, and consequently capital, determines the direction of innovation and therefore society. For example: social media, a conventional innovation, was imposed on us, and with it also its dire consequences, especially for young people (Braghieri, et al., 2022).

The productivist claim that universal prosperity can be achieved through conventional innovation does not necessarily yield equitable outcomes. Rather, it often exacerbates socio-economic disparities, fuels processes like gentrification, and diminishes individual and community autonomy (Piketty 2014; Pansera, 2024). However, it is still commonly seen as a natural result of human ingenuity that should never be interrupted or guided. Amazon, Google and ASML (the world's largest supplier of the semiconductor industry based in The Netherlands) are not only put on a pedestal, they are society's examples of progress, consequently convincing politicians to give them tax benefits and subsidies that ordinary companies don't get (Hager & Baines, 2020).

³ M stands for Money. I stands for conventional Innovation. C stands for Commodity. M' stands for increase of money (Hickel, 2020a, p.85). This is a variant of $M > R > T > C > M'$ (in Erickson, 2022, p. 137). “With more growth there's more capital to invest in more research, to create more technology for more growth.”

Marketers who have internalized conventional innovation fuel the accelerating rapid production cycles of new consumer goods, creating artificial desires that drive the consumption of needless commodities and offering choices that add little value (Galbraith, 1956; Schumacher, 1973), e.g. automatic nose trimmers, automatic pot stirrers or the endless 'advancements' of skin care products. Under current conditions, product lifetime is the first casualty of restless innovation permeating our economy (Jackson, 2022). Herbert Marcuse called this the manipulation of false needs by vested interests (Marcuse, [1964] 2003). These false needs, or pseudo-satisfiers (Schumacher, 1973), are the driver of overconsumption as ideology (Stuart et al., 2020) in which people are transformed into "consuming animals" (Paci, 1972: p. 437), through machinery of enticement (Leach, 1993). But even seemingly useful innovations like electronic vehicles, or more efficient, cheaper refrigerators can be questioned if they finally increase our global resource metabolism. The primary focus of this paper is that deterministic productivism fosters unsustainability which is why we need new principles to judge if an innovation is contributing to better ecological and social circumstances.

3.2. Critique from an Ecological Perspective

Biodiversity, or 'life', is facing a severe crisis, with ecologists warning of a potential sixth mass extinction (Kolbert, 2014). The Amazon is close to the tipping point of irreversible savannization (Feng et al., 2021), Madagascar is threatened with dangerous levels of biodiversity loss (Ralimanana et al., 2022), and worldwide, the state and trend of biodiversity in various flora and fauna is very poor (IPBES, 2019; WWF, 2024). Climate change, extraction, land-use change and chemical waste disrupt natural processes, pollute the environment and lead to serious health problems (Bellard et al., 2022; Cousins et al., 2022). Plastics are emerging as a significant issue, with plastics literally raining down on us (Fan et al., 2022; Brahney et al., 2020). Experts are even referring to our era as the "Plasticene," due to the profound impact that plastic production and consumption have on earth's systems (Rangel-Buitrago et al., 2022). More broadly, the stability and resilience of the total earth system is at risk, six out of nine planetary boundaries for a livable earth have already been transgressed (Richardson et al., 2023).

Primarily, countries in the Global North are extracting and polluting on an unprecedented scale, both directly and indirectly (across borders). Over the past four decades, approximately 60% of all global human resource extraction has occurred (EEA, 2016). The growing global economy, measured by gross domestic product (GDP), is coupled to resource and energy use (Haberl et al., 2020; Wiedman et al., 2020; Ward et al., 2016; Hickel & Kallis, 2020), and from the current 100 gigatons of material extraction, it is projected to grow to 170 gigatons by 2050, according to the Circularity Gap Report (2023), which will contribute to even more biodiversity loss (Otero et al., 2020). Industrial agriculture is a well-known driver of loss of life, but research shows that the rapidly rising demand for new consumer goods in sectors such as clothing, building materials, and digital consumer goods also leads to, directly and indirectly, biodiversity loss (Wilting et al., 2017; Kan et al., 2023). Climate change poses a significant threat to biodiversity (IPBES, 2019; Wilcock et al., 2023; Bradshaw et al., 2021), and is further driven by increased production and consumption (Burke et al., 2015). It is a mutually reinforcing cycle: climate change accelerates biodiversity loss, and biodiversity loss, in turn, exacerbates climate change (IPBES, 2019). We are facing an existential problem; without well-functioning ecological processes and a healthy biodiversity, our access to oxygen, drinking water, food, clothing, building materials, and coastal protection is at risk (IPBES, 2019). Our expanding economy leads us, and all other lifeforms into a perilous future.

3.3 Critique from a Justice Perspective

This ecological urgency generates an immediate social imperative for transformation, particularly from a justice perspective. People that have contributed least to environmental collapse and biodiversity extinction experience the most damaging consequences (Hickel et al., 2022; IPCC, 2022a). Droughts and floodings and, as a consequence, failed agricultural harvests will lead to mass migrations. The nearly 32 million displacements caused by extreme weather-related hazards in 2022 represents a 41 percent increase compared to 2008 levels (UNHCR, 2023). Already 600 million humans live outside the human climate niche (Lenton et al., 2023), most in the Global South. And new research shows that there could be a possible global GDP reduction of 19% (Kotz et al., 2024), due to ecological disruption, also effecting the poor countries the most.

The profit-seeking production apparatus, depicted in $M > I > C > M'$, generates unsustainable forms of inequality and injustice. Wealthy countries are responsible for 74% of all material use in the last 50 years (Hickel et al., 2022), and at the national level, studies show that the highest income group within a country has a material footprint four times higher than the lowest income group (Buhl et al., 2019). Despite the scarcity of global material footprint research of the super-rich, we do know that the carbon footprint of the top 1% is thousands of times higher than the average global citizen (Barros & Wilk, 2021; Oxfam, 2024). There is no reason to believe that this is not the case on a material level, given the lifestyles of the wealthiest people on our planet. Wiedmann et al. (2020) unequivocally state that the world's most affluent individuals are responsible for the most ecological impact.

Conventional innovation is associated with justice issues, particularly as we recognize its inherent lack of neutrality. It leads to competitive advantage of Global North companies and can lead to uneven power relations (Pansera & Owen, 2018a). Pansera and Fressoli (2021) write that "Innovation can reinforce unequal dominant positions on a market, limit the access of certain resources and social goods to specific societal sectors or quickly disrupt traditional ways of doing things." And this holds from a macro perspective, leading to ecological unequal exchange (Dorninger et al., 2021). The omnipresence of innovation even permeates development discourse, leaving market-driven solutions as the sole means of creating value (Pansera & Owen, 2018b).

The conventional view of innovation perpetuates imaginaries, ideas and practices that erode our ecological and social world (Pansera & Fressoli, 2021). If we do not fundamentally reconsider our expansive economic design and its biggest culprit, conventional innovation, the production engine will desiccate our primeval forests and, with them, life itself. This is also an interspecies justice issue, emphasizing the rights of non-human species. The economist, and conventional innovation proponent, Schumpeter might, with today's knowledge, have looked differently at his famous theory of creative destruction: the continuous replacement of technology and processes driven by conventional innovation (Schumpeter, 1942; Robra et al., 2023). Although he predicted the collapse of capitalism, he did not foresee that it could be through collapse of ecosystems. Creative destruction has turned into destructive creativity. His most promising student, Nicolas Georgescu-Roegen, understood this, and became a seminal figure in Ecological Economics.

4. An Ecological Economics View

Ecological economics can help us synthesizing the critiques mentioned above by offering a holistic view for the construed problems. Ecological economics argues that the human economy cannot exist without a healthy ecology. Any economist who views nature as an externality considers the economy as an externality of the larger whole, as if it doesn't exist on earth. The economy is a subsystem of our non-growing environment (Daly, 1996) as energy, matter, and biomass are the basis of all life. Nicholas Georgescu-Roegen (1971) asserted that every economic activity is rooted in physical reality.

Any attempt at redefining innovation that does not reference ecology or planetary boundaries is incomplete because it assumes that size, or what the late Herman Daly called "scale" (1991), does not exist. It is physically impossible; the magnitude of throughput, material and energy use, must fall within the Earth's planetary boundaries in the long term (Murphy, 2022). This is not a new idea, as John Stuart Mill, one of the fathers of modern economics, introduced the concept of the Steady State, an economy that does not grow, in his "Principles of Political Economy" (1849, Ch 6). When conventional growth economists refer to the real economy, Georgescu-Roegen's concept of physical reality is marginalized. Economist Thimothée Parrique (2019, p.78) puts the latter critical: "the real economy (production of goods and services) is embedded within – and therefore limited by – a real-real economy of energy and material flows." He continues: "Nature has non-negotiable market power, and humans can only use what nature supplies." Without incorporating biodiversity, planetary boundaries, and pollution into the production and innovation apparatus, we should question the realism of our economic design. The human economy is always an ecological economy.

Georgescu-Roegen argued that all economic activity leads to entropic degradation (1971, p. 279): 'The economic process is entropic, it neither creates nor consumes matter or energy, but only transforms low into high entropy,' or more colloquially: waste (Murphy, 2022; Rammelt, 2024). Even seemingly sustainable innovations have a significant ecological impact. The highly praised electric car embodies this one-dimensionality. It evidently emits less CO₂ but significantly increases material extraction and plastic pollution as a significant source of micro plastics in the oceans is tire rubber dust (An et al., 2020; Reddy et al., 2020; Roychand & Pramanik, 2020). We save the climate while destroying our biodiversity. The same goes for decentralized sustainable energy generation; lower CO₂, but higher material footprint (Regueiro-Ferreira & Alonso-Fernández, 2023). Besides Georgescu-Roegen, also Herman Daly stressed the importance of limiting resource use: they are the limiting factor in the economy on the long run (Daly, 1996). The goal in any economic design should be to "maximise life", (Daly, 1996, p.32), because biodiversity, or 'life', is inherently anti-entropic, at least locally, as it restores balance to our entropic biophysical economic system (Brillouin, 1949; Nelson, 2003; Schneider & Sagan, 2005; Schrödinger, 1944). Entropy needs to be foundational in the search of setting new principles of innovation.

Additionally, as ecological economics also acknowledges the importance of well-being and social progress (Dodds, 1997; Jackson, 2016), conventional innovations based on the growth fiction have a questionable social reputation. Overuse of social media for example, leads to depression (Keles et al., 2020) and a significant number of young people are addicted to gaming (World Health Organization, 2018), and at the macro level, the average person is less happy due to our consumption culture (Ditmarr & Kapur, 2011). "Shop till you drop" can be taken quite literally. Chatting with friendly cashiers at the supermarket is becoming scarce. Christiaan Weijts (2023) writes in a well-known Dutch paper: 'Do-it-yourself technology turns service providers into controllers.' Conventional innovation often leads to environmental or cognitive and emotional disconnect (Kronenberg et al., 2024). Which innovation withstands scrutiny in terms of planetary boundaries and well-being? Adam Smith, the *pater familias* of free market economics, argued that we would ultimately develop different definitions of progress not based on growth (in Boulding, 1973). Georgescu-Roegen, came to the ultimate conclusion of creative destruction: "if we depend on destruction to move forward, what will happen when there is nothing left to destroy?" (in Pesch, 2018).

5. Jevons Paradox

Techno-optimists, or ecomodernists, act as if the realities described above do not exist (King, 2020). They assert that we are inventive with unparalleled creativity, ingenuity and even "power". (Ecomodernist Manifesto, n.d.). Obviously, this is partly true. Mobile video calling with family that live

in different parts of the world? Previously unimaginable, now commonplace. And that everyday commonality is the breeding ground for ecomodernists: we innovate our way out of problems because human ingenuity knows no boundaries. CO₂? Electrification. Pollution? Innovation. Sustainability? Green growth. Material and energy use? Efficiency. And the latter is also true; through conventional innovation we are becoming more efficient. The irony is that improved efficiency at the margin almost always leads to more material or energy use in the aggregate (Erickson, 2022, p. 137). More efficient flying, for example, leads to increased usage (Alcott et al., 2012) or, more efficient energy production leads to more energy usage (Brockway et al., 2021). More efficient production results in freed-up resources that are reinvested (Wallenborn 2018, Polimeni et al., 2015), leading to more resource use. This is the Jevons paradox: we become more efficient at consuming more resources and energy (Alcott, 2005; Lange et al., 2021). This efficiency-overcomes-all conventional innovation paradigm is also referred to as eco-efficiency; a reduction in energy and resource use per unit produced, translating into a reduction of production cost, ultimately leading to an increase in absolute material and energy use terms (Dylick & Hockerts, 2002). Eco-efficiency is on face value a conventional innovation attempt to help us overcome our ecological problems, but has a chronic order of importance: capital accumulation first, sustainability second (Nesterova and Robra, 2022). Zooming out, Pansera & Owen (2021) articulate that innovation, often fueled by science, improves productivity and efficiency that, in turn, boost economic growth. This is not a novel insight; Illich, in "Tools for Conviviality" (1973), already articulated the dangers of uncontrolled economic expansion due to the proliferation of tools that exceed the limits of a sustainable society. Solutions frequently fail to account for the fact that improvements in efficiency are often counterbalanced by increases in consumption. This underscores the importance not only of what we purchase but also the quantity thereof (Stuart et al., 2020).

6. Degrowth Innovations

Our growth economy with conventional innovation as its catalyst exacerbates ecological and social problems. Therefore, we argue, our economies must degrow. We have to equitably downscale production and consumption to increase human well-being and enhance ecological conditions at the local and global level, in the short and long term (Schneider et al., 2010). As Mill suggested in his essay 'Nature': we need an economy in harmony with nature (Mill, 1874; Stephens, 2015). With reduced consumption and production, our emissions, material use, and pollution will decrease. The IPCC report (2022b) confirms this: degrowth is an effective way to reduce extraction, emissions, and material use with high certainty. It requires no investment or innovation; we can start tomorrow. And that brings us to the central thesis of this paper: without innovations based on degrowth principles, we will not be able to stop the current socio-ecological destruction. Conventional pro-growth innovation cannot be considered innovation fit for the future. Every responsible, sustainable innovation must bring humanity one step closer to the safe space within planetary boundaries and well-being for everyone, not just the human life or the well-off in wealthy countries. Although degrowth represents a fragmented discourse, encompassing a social movement, a research field, and a utopian and political project (Martinez-Allier, 2009; Schneider et al., 2010; Kallis, 2011; Demaria et al., 2013; Parrique, 2019) its underlying principles can be synthesized⁴ and should serve as the foundation for a new standard of innovation. We argue that innovations grounded in degrowth principles must meet the following four conditions:

1. Our reality is entropic, the world's throughput must reduce to levels that don't exceed the safe operating space.

⁴ Based on definition commonalities of recent key papers in degrowth academia: Büchs & Koch, 2019; Cosme et al., 2017; Degrowth.info; Demaria et al., 2013; Escobar, 2015; Fitzpatrick et al., 2022; Hickel 2020; 2021; Jackson, 2009; Jungell-Michelsson & Heikkurinen, 2022; Kallis, 2011; 2018; Latouche, 2009; Martinez-Allier, 2009; Princen 2005; Research & Degrowth, 2010, p. 524; Schmelzer et al., 2022; Schneider et al., 2010; Trainer, 2002 and on Parrique (2025).

2. Enhance social and economic justice for all;
3. Improve and secure well-being for all life;
4. Foster and enhance democracy.

Innovation, derived from the Latin term *innovatio*, refers to the act of introducing something new. However, novelty for its own sake is not necessarily future-proof. We define future-proof innovations as those rooted in the mentioned four essential principles ‘*Degrowth innovations*.’ Degrowth innovations can involve technological or social advancements and practices, with the latter encompassing activities driven by the pursuit of addressing social needs, and in our thesis, ecological needs (Mulgan, 2006).

1. Degrowth innovations are not technophilic or technophobic. In our view we can rely on technological innovation for a better future, but only to return us back to the carrying capacity of our planet, and eventually, development within these limits in a steady state economy (Daly, 1991). A degrowth innovation can be a consumer product, but biodegradable and repairable. It can be used for sustainable mobility as long as it leads to more use of public transport or non-motorized vehicles (Winkler et al., 2023). Degrowth innovations in agriculture should always lead to less (CO₂, methane, nitrogen) emissions and pesticide usage (Sharma et al., 2019), and a restoration of soil-, water- and air quality (Nelson & Edwards, 2020). They can be supply-side technological such as bio-building materials and bioplastics made with elephants grass, *Miscanthus* (Pereira Dias, et al., 2021), but also demand-side social, by changing behaviour and diets from meat to plant-based. We need furniture, but never at the expense of forests. In fact, every furniture purchase should lead to reforestation, in both The Netherlands and Malawi, via e.g. international untradeable forest bonds (Hall et al., 2017). Illich acknowledged this in his approach to convivial innovation, where preservation and enhancement of ecosystems should be of paramount importance (1973). In other words: biophilic, entropic and frugal.

2. Social and economic justice is a second principle of degrowth innovations. Citizens in the Global South should increase their access to and use of energy and materials to enhance their quality of life, while those in the Global North should reduce their consumption, maintaining a high level of well-being (Demaria et al., 2013). This thought aligns with the development/culturalist critique of e.g. Latouche (1993; 2009) and Escobar (2015) as the growth of the global social metabolism is a source of justice conflicts and exploitation (Kallis, 2018, Scheidel et al., 2020; Moore, 2017). An example of this second principle for degrowth innovation is true and fair pricing (Maxwell, 2007). True pricing for cleaning up unsustainable externalities that deteriorate the environment (e.g. heavy chemical pollution in the agro-industry or mining activities in pristine rainforests), and fair pricing for ensuring a decent living wage for all people (Kara, 2023). The Earth System Justice framework could guide how the global community can share limited ecospace for current generations (intragenerational justice), past and future generations (intergenerational justice) and non-human life (interspecies justice) (Gupta et al., 2023).

3. Research that reduce our footprint while enhancing well-being for all should be further continued. Costa Rica is a prime example (Hickel, 2020b). This country managed to have low emissions per capita, a quarter the size of the United States, with a higher average well-being, because of what sometimes is called the Amerindian “sweet life”; or “Pura vida”, with emphasis on balance and sufficiency (Powers et al., 2019), actively pursued by the Costa Rican national and local governments (Fletcher et al., 2020). Active governance of sufficiency are also seen in the movement of Fearless Cities (Fearless cities, n.d.; Saito, 2023,), where civilian life is explicitly prioritized over multinational cooperations and economic growth. A notable example is Barcelona's Superblocks initiative (Barcelona City Council, n.d.). Through greening of public spaces, limitation of car and flight traffic and reactivation of local economic fabric, they are a potential frontrunner in this movement. Secondly, not only human life should be considered in this third principle of degrowth innovations. We consider

enhancing all life to be of existential importance, overlapping with the principle of justice for non-human life, or interspecies justice (Gupta et al., 2023). An interesting example of a degrowth innovation enhancing well-being of all life, is the Zoonomic movement: the world's first organizational model that safeguards the interests of all life (Zoop, n.d.). Currently, there are 14 organizations, including commercial ones, with the predicate Zoonomy.

4.1. We advocate for more than a mere redefinition of innovation, but for a broader *modus vivendi*. As the market, and consequently capital and power, currently determine the direction of innovation and therefore society, we need to bring innovation to the macro-political sphere where citizens have direct influence of the direction of innovation and, thus, society. For instance, the impact of large language models, like ChatGPT, a conventional innovation, on our society will be enormous. Experts are claiming that it will exacerbate inequality (Romei, 2024) and ecological degradation (Saenko, 2023). The decision making trajectory of innovations should be subject to a direct democratic decision-making vehicle; citizen initiated, binding and proactive (Altman, 2010). A proposal could be to organize *eco-convivial innovation counsels*, following the example of the Citizen's convention for Climate (Giraudet et al., 2021) or the Civilian Counsel in the Netherlands (bureauburgerberaad, n.d.). This should be a direct democratic vehicle with 150 randomly selected civilians as a mirror of society, that debates and advises parliament bindingly on innovation with an entropic and biophysical boundaries foundation with a strong emphasis on frugality to save biodiversity, on civilian autonomy, inequality and power relationships, and on well-being and social and economic justice. This vehicle should also be transnational, guided by the principles of Earth System Justice: ensuring an equitable distribution of nature's benefits, rights, risks, and associated responsibilities among all people globally, within the safe and just boundaries of Earth's systems, to provide universal support for life (O'Neill et al., 2018; Gupta et al., 2023).

4.2. There is an urgency for economic democratization, not only political. Many proponents of degrowth argue that smaller, socially, cooperatively and democratic organized economic entities—particularly cooperatives and other businesses focused on the common good—are more likely to produce in an ecological and social just way without the imperative for economic growth. This is because they are not subjected to the pressures of accumulation and competition imposed by investors and shareholders (Schmelzer, 2022). Sociologist Isabelle Ferreras provides a framework for transforming larger, often publicly-traded, firms (Ferreras, 2023). She observes that these firms function as political entities, as their decisions impact a wide array of stakeholders, both human and non-human. Ferreras argues for moving beyond the exclusive political rights of capital owners in business and introduces the concept of the "bicameral firm." In this model, decision-making occurs within two chambers: a shareholders' assembly and a workers' assembly. Ferreras demonstrates that democratically governed companies tend to exhibit lower levels of absenteeism, increased sustainability, better protection against aggressive capital pressures, reduced inequality, and greater financial stability. She advocates this predistributive approach as a complement to redistributive strategies. Another variant of this idea could be the 'tricameral firm', where natural stakeholders are also represented, by e.g. the judicial system, following the rights of nature movement (Putzer et al., 2022).

7. Conclusion

This paper proposes new principles for innovation to show a pathway to a cleaner and just future. Every layer of society should embrace degrowth innovations as the solution to our socio-ecological crisis, because as Samantha Sweetwater postulated: "The majority of what we see as creativity is currently destructive" (Hagens, 2024). To achieve this objective, we need to decolonise our imaginary

(Latouche, 2009). Our collective imagination is captivated by the industrial and productivist forces in civilization propagandizing the ubiquitous positivity of conventional innovation. As extensively argued in this article, we are convinced that with the help of degrowth innovations we can restore ecological and social degradation in a just way. Saying goodbye to conventional innovation in a growth economy may be the biggest innovation the modern era needs. Let's deconstruct destruction and internalize creativity, imagination and a degrowth *modus vivendi* for a just pathway for all life. Because, conventional innovation leads to the extinction of many species, a world lost forever.

Declaration of external funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT in order to improve the readability and language of the manuscript. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

Acknowledgements

For proof reading this article we would like to thank Crelis Rammelt, Assistant Professor Environmental Geography and International Development Studies at the University of Amsterdam, Frans Melissen, Professor Sustainability Transitions at the Breda University of Applied Sciences, and Harald Buitendijk, researcher and senior lecturer at the Breda University of Applied Sciences.

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SUGGESTED CITATION:

Felix van Hoften and Rob van der Rijt, "Why only innovations based on degrowth principles can stop further ecological and social destruction", *real-world economics review*, issue no. 110, March 2025, pp. 10–24, <http://www.paecon.net/PAEReview/issue110/HoftenRijt110>.

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