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RESEARCH ARTICLE

The interdisciplinarity of degrowth: cross-fertilising disciplines for well-being

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Abstract
The aim of this paper is to constructively critique the degrowth approach, which is often referred to as a disliked theory by mainstream economics, and to promote the professional dialogue on this research avenue directing towards qualitative growth. It first shows that the current socio-economic configuration does not allow sustainable development to be achieved, hence the need for a more radical shift towards qualitative growth is in order. It then provides a critical presentation of the concept of degrowth-transition as a way forward qualitative growth by also highlighting the system-theoretical shortcomings of the concept, the ambiguity of its nexus with capitalism and democracy, and the neglect of the relevant role of modern industrial policy. In addition to a narrow interpretation of the concept, the transdisciplinary nature of the degrowth transition will be explored by incorporating relevant aspects of evolutionary science, systems theory and neuroscience. The paper then concludes by deciphering five key insights going way beyond what we so far know about the concept of degrowth.

Keywords Degrowth · Qualitative growth · Innovation · Capitalism · Interdisciplinary

JEL Classification O10 · O40 · L16 · P40

1 Introduction

It is widely acknowledged that one of the main drivers of global environmental problems is our socio-economic development, which has been driven by technology and based on continuous quantitative economic growth over the past centuries. It is hardly a coincidence that a scientist's confrontation with reality has also brought to the surface a concept of curbing this insidious force (i.e., limitless quantitative

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economic growth) via planned and democratic reduction of overproduction and overconsumption with the aim at reducing environmental pressures and, through this, blunting inequalities and raising well-being. This current stream of thought is called *degrowth*.

Albeit the concept of degrowth has started to garnering attention in the circles of environmentalists, ecologists, climate scientists and that of social scientists like economists,[1] the general impression is that, beyond the fact that the concept is still in a wispy phase, these works are still only scratching the surface and generalities without trying to grasp the interdisciplinarity of the concept (i.e., outlining the complex amalgam emerging by looking at various degrowth concepts and approaches).

This paper is to provide a critical analysis of the concept of degrowth by going far beyond the literature and becoming ever-more transdisciplinary in nature. As a starting point, it explores the question that is there a realistic basis for achieving sustainable development in the current socio-economic configuration? It illustrates that, although addressing the polycrisis would require achieving sustainable development, the current systemic configuration based on overproduction and overconsumption and being pervaded by the endlessness of quantitative growth does not allow for this. Consequently, there is a need for an effective shift from quantitative growth to qualitative growth. It will then present the short history of the development of the degrowth concept and expose its shortcomings, such as its systemic deficit, its lack of clarity on the nexus with capitalism and democracy, and its complete neglect of the role of modern industrial policy. Beyond a narrow interpretation of the concept, our paper deciphers the transdisciplinary nature of the degrowth transition by drawing on relevant aspects of evolutionary science, systems theory and neuroscience. We conclude with five key insights that we hope can move the degrowth research agenda forward in a meaningful way and can also stimulate scientific dialogue on a broader platform.

2 Why degrowth: the illusion of sustainable development

The advanced economies have entered into a permanent crisis mode. A complex configuration of severe and often intertwined challenges has emerged (polycrisis), such as tipping inflation, the health crisis caused by pandemic COVID-19, uncertainties related to the ongoing industrial revolution (Industry 4.0) (e.g., cyber-attacks on critical infrastructure and businesses, the as yet hardly demonstrable productivity gains of Industry 4.0, etc.), migration and refugee crises, antibiotic resistance, demographic problems (rising inequalities, shrinking middle class, etc.),[2] unprecedented and growing manifestations of natural disasters and climate change, structural shifts in emerging markets (e.g. China's increasing service orientation), the sovereign debt crisis and its consequences, the rise of populism, the advance of illiberalism and the proliferation of various war conflicts that risk escalation. These multiple challenges,

[1] See: Roser (2021), Krugman (2023).
[2] See: OECD (2019), Soriano (2024).

by their very nature, require not only effective action but also a decisive way forward in the field of sustainable development, with the potential to revitalise the well-being of all.

However, the feasibility of sustainable development in the current configuration of the socio-economic system is an illusion. Research claiming the opposite simply ignores the social, environmental and political constraints to which both political economy and ecological economics seek to draw attention. It is not just that studies often fail to take into account the nature of the political and institutional constellation, which affects the nature of coordination mechanisms and, through them, the very nature of the SDGs (Allain-Dupré, 2020; Reich 2021).[3] Rather, it is that the mainstream, which is also concerned with sustainable development, has remained complacent enough to refuse to acknowledge the glaring incompatibility between quantitative economic growth and environmental protection (Fiksel 2003; Banerjee 2003; Jones et al. 2016; Demaria and Kothari 2017; Edwards and Nelson 2021). While advocates of sustainable development stress the need to transform our economies into a system of more equitable relationships between individuals, natural resources and society as a whole (Ferraro et al. 2015), they stop at this point and do not really say much about what this would require on the production and consumption sides.[4] In other words, they neglect the issue of circular reproduction (Martins 2016), and fail to incorporate the literature that aims to demonstrate the crucial importance of striving for sustainable critical natural capital in preserving people's future capabilities (Martins 2013; Pelenc & Ballet 2015; Sen 1999). Sustainable Development Goal No. 8, for example, continues to consider economic growth (both on the production and consumption side) as a precondition for human well-being (Hepple 2019). Moreover, in the context of Sustainable Development Goal No. 12, which aims to promote sustainable production and consumption, the World Bank notes that economic growth will continue to be achieved at the expense of natural resources. Advocates of sustainable development do not accept that even a shift to sustainable production (green economy) (i.e., installing more sustainable, more energy-efficient technologies in favour of low-carbon energy systems, etc.) can be costly and contribute to further depletion of natural resources (Acemoglu et al. 2012; Maris & Holmes 2023; WMO 2024).[5] In this way, the society of the developed world cannot escape the technological merry-go-round it has been locked into

[3] One can consider that the degree of decentralisation of the institutional structure is not indifferent, as higher levels of decentralisation tend to embed a wider range of parallel learning opportunities, i.e., a more intensive innovation mindset across the system (European Commission 2012), while at the same time the implementation of the SDGs in a more decentralised structure requires a higher degree of vertical coordination (van Driel et al. 2022).

[4] Except for some recent work that mentions *nudging* in the context of SDG No. 12 and the withdrawal of various fiscal subsidies to make consumption more sustainable. See: Fischer et al. (2023).

[5] According to World Bank (2017), 3 billion tonnes of metals and minerals will be needed to meet global energy transformation needs by 2050. In the next 30 years, we will extract more material from our planet than the total amount of material extracted since the beginning of mankind. The report highlights the paradox that while critical raw materials are essential for a clean energy future, their extraction and use has long been contributing to greenhouse gases and being harmful to the environment.

since the first industrial revolution.[6] This means that following the myth of the green economy is also just a representation of our misguided but entrenched belief that without radically changing our behaviour and lifestyles, civilisation and the globe can be saved if and when we continue to rely on our technological capabilities. This is a multi-faceted view, because economic history tells us that we have indeed created newer and newer technologies to deal with certain problems, but at the same time we have created newer and more complex ones. Even if it were possible to make the production of certain products more eco-efficient, the inherent logic of the capitalist system would already be pushing the process towards overproduction and overconsumption of the product in question being entailed with further resource exploitation and environmental pollution. In the concept of green economy, therefore, overproduction and overconsumption, and even excessive inequalities, can arise just as easily as without (Fulai et al. 2011; Schandl et al. 2016; Fernandes et al. 2021). This means that the so-called strong sustainability (Ekins et al. 2003; Dedeurwaerdere 2014), with the pursuit of *highly likely* sustainable critical natural capital as a central element (Baumgärtner & Quaas 2009), is compromised.

The concept of green growth is therefore more of a pipe dream[7] and is viewed with distrust by many voters (Banik 2022). Concepts that continue to proclaim the primacy of quantitative economic growth do not actually take into account the risk of future degradation of our human capabilities and elementary functions (e.g., a reduction in the diversity of human activities, a deterioration in access to healthy raw materials for adequate nutrition, a decline in physical and mental health, etc.), which is exactly the opposite of what is conveyed by the work of Nobel Prize winner Amartya Sen (1999).[8] Hence, in line with Sen's (2010:348) message (we need to look beyond quantitative economic growth to understand the nuances of social well-being), a fundamental change is needed at both the theoretical and practical levels to meaningfully match our social needs with the potential of our planet. This is to favour qualitative growth over quantitative growth. Then, achieving strong sustainability and, at the same time, cultivating the aforementioned capability approach in economic governance practices would seem realistic.

[6] See: Galbraith (1958), Mumford (1971), Elull (1973).

[7] Green growth allows for a growing economy (Bowen & Hepburn 2014). It postulates that modern technologies can combat climate change and decarbonise our economies. However, a growing number of studies conclude the opposite, see: Le Quéré et al. (2019), Vadén et al. (2020) or Hubacek et al. (2021).

[8] Amartya Sen and Martha Nussbaum (Nussbaum 1986) are the names behind the so-called capability approach, which focuses on improving free access to the means to a full life, a complex manifestation of development.

3 Toward qualitative growth: the narrow view to degrowth

3.1 Origins, objectives and policy perspective

Since André Gorz coined the term in 1972,[9] the degrowth literature has been based on the belief that the exponential growth of the world economy is self-defeating and that we need to bring it down to a more sustainable, but lower, level. This approach is closely aligned with the thinking of ecological economics, which conveys that the environment cannot be treated as a mere factor of production, but must be understood and analysed as an integral part of the whole ecological system (Fisher 1981; Constanza 2008; Neo 2009). In the 1970s, this kind of ecological economics was also advocated by Nicholas Georgescu-Roegen, who, alongside Gorz, entered the economic elite under the wing of Joseph A. Schumpeter, one of the great theorists of innovation-based growth theory. He stressed that whatever economic activity we undertake is accompanied by an irreversible degradation of the natural resources we use (Georgescu-Roegen 1971). Eight years later, he outlined a more elaborated narrative in La décroissance (Georgescu-Roegen 1979), whose subtitle (Entropy, Ecology, Economy) suggested a more holistic analytical framework. One of its central tenets was that restraining growth is also the duty of modern societies. Roegen's path also attracted others, all of whom essentially argued that *degrowth should mean the deliberate and democratic restraint of production and consumption* (Alexander 2012; Phyffer 2022; Fakhri et al. 2023) in order *to mitigate and address climate change and other ecological problems* (Latouche 2022), while also *calling for the alleviation of income and wealth inequalities* that have been rampant in developed economies in recent decades,[10] and thus seeks *to promote well-being* for all (Latouche 2009; Whitehead 2013; Kallis 2019; Weiss & Cattaneo 2017; Hickel 2021; Parrique 2021; Ramcilovic-Suominen et al. 2022).

Despite the emergence in the 1970s of a research ambition to take into account our growth constraints and our interactions with the environment (Meadows et al. 1972), mainstream economics has remained fairly intact, i.e., quantitative growth-critical concepts (Lehmann et al. 2022) have simply not been able to break through the echo bubble of mainstream economics to allow the concept of degrowth transition to be embedded in substantive discourse. The 2008 crisis and its aftermath provided a better opportunity for this, with a near-death experience of global capitalism and a spectacular intensification of criticisms of economic growth and GDP accounting (Stiglitz et al. 2010; Enquete-Commission 2012), and, what is more, some academic scholars on degrowth (Baykan 2007; Fournier 2008; Latouche 2009; Kallis 2011, Bonaiuti 2012; Paech 2012; D'Alisa et al. 2016; Balderjahn 2024) have

[9] See: https://ehne.fr/en/encyclopedia/themes/material-civilization/transnational-consumption-and-circulations/degrowth-history-idea.

[10] More extreme concentrations of income and wealth are usually associated with higher environmental pressures. Global carbon inequality is substantial: nearly half of all emissions are attributable to one-tenth of the world's population, typically from the richest countries. See: World Inequality Report (2022). In this way, the so-called shared prosperity, see Khan et al. (2024), can be fostered in a more meaningful way.

begun to disseminate their research on the new concept in large numbers, and have subsequently been more widely adopted in the Anglo-Saxon, Mediterranean and Far East regions (Saito 2023). At this point, it is important to distinguish between degrowth and the so-called post-growth concept. In short, post-growth is a broader approach, while degrowth is a more specific agenda within the post-growth framework. Post-growth partly arose in German-speaking areas by representing a broader framework than degrowth advocating for a shift away from growth as the primary economic and social goal by prioritising well-being over material consumption. Post-growth studies—like the pioneering works of Paech (2012), Paech and Folkers (2020) or that of Jackson (2016, 2021)—are typically addressing the issue whether the nature of enterprise, the jobs, the structure of investments, the role of the money etc. can be culturally and technologically changed to be geared toward a prosperity without growth. Importantly, post-growth does by no means consider what degrowth does namely that the planned and democratic reduction of production as well as consumption patterns in an effort to mitigate environmental pressure while dampening inequalities with the final aim at pursuing well-being. If we only look at the current situation, the countries with outstanding growth and competitiveness, and what is more, innovation performance, are exactly the ones that are also world leaders in terms of waste production per capita—such as South Korea, Denmark, Germany, Switzerland or Finland[11] –, then we can easily argue in favour of the need to moderate the growth dynamics.

Of course, degrowth is not without its critics. Mainstream economics sees it as a complete fallacy. One of the most striking criticisms is that the vast majority of degrowth research is nothing more than opinion rather than scientifically grounded and carefully developed analysis (Savin and van der Bergh 2024). There are voices that argue that the point of sustainable development or degrowth research on resource depletion (and depletion) is not convincing, as real prices of commodities have remained more or less stable since 1930, even though world demand has exploded (Tupy 2018). This relates to Julian Simon's insight (Simon 1981), which posited that human ingenuity is the resource that can bridge the scarcity of natural resources and turn them into abundance. Indices of abundance (such as the Yale Environmental Progress Indicator) seem to convey the same message. In other words, as Simon (2001), Goklany (2007), Bailey (2015) or Desrochers and Szurkmak (2018) have tried to point out, population growth has not led to a significant decline in natural resources simply because as population growth has been accompanied by the globalisation of technological development, it has allowed the depletion of natural resources to be offset and cleaner technologies to be adopted (e.g.: some even argue that rich countries with greater economic freedom have reduced GHG emissions, see Bjørnskov (2024)). As a corollary, there is a degrowth-critical narrative that believes that the only environmental problem worth mentioning at present is climate change, and that we need not degrowth but merely human ingenuity and technology to overcome it.

[11] See: https://www.developmentaid.org/news-stream/post/158158/world-waste-statistics-by-country Accessed on: 28.11.2024.

Let us quickly underscore that such critical narrative of degrowth by the mainstream, however, is extremely naive, as it undoubtedly lacks a systemic approach. Thus, it does not take into account complex interactions, non-linearity, positive and negative feedbacks, and the wider global embeddedness of processes. A larger population is not necessarily the engine of technological progress, which can be a direct route to prosperity and sustainability, as the case of China makes crystal clear.[12] Mokyr (2001) has refuted point by point Simon's thesis that assumed a link between population growth and technological progress. Moreover, the fact that richer countries are improving their greenhouse gas emissions is precisely the result of outsourcing production (e.g., to China), which leads to higher overall CO_2 emissions (IPCC 2014; Plumer 2017). In this case, the correlation that rich countries are more complex in terms of knowledge and technical capacity, and thus their environmental performance is better (Lee and Olasehinde-Williams 2022),[13] says essentially nothing. Even if we consider that natural resources are abundant (Tupy and Pooley 2023), the problem of overproduction and overconsumption remains to be solved, as it leads to unhealthy, dangerous and damaging social, economic and environmental problems. At best, humanity would like to believe that the only significant environmental threat is climate change. Without being exhaustive, there is the 'evil twin of global warming'—ocean acidification, which negatively affects the chemistry of marine waters due to a sharp increase in carbon dioxide in the air. Furthermore, plastic pollution of the oceans, the overuse of fertilisers leading to dead zones, and many other problems (e.g., the technological development of agriculture has led to the overproduction/overconsumption of proteins and fats, which has led to an increase in obesity, causing serious health problems, especially in the USA, China and India) are here to stay.[14] All this requires more, not less, technological development, which should be driven by the spirit of R&D and innovation, as Mokyr (2014) has stated, but should be pursued within a qualitative rather than quantitative growth paradigm by recognising that while humanity can address problems through technology (while creating new challenges), it is better to leave open the possibility that we need to consciously change our behaviour and lifestyles. As behavioural studies convey, contextual influences over decision-making are out there (Garces-Velastegui 2024), and the illusion of sustainable development suggesting the inevitability of degrowth-transition is the new context to be reckoned with.

The degrowth transition calls for decisive steps to increase the efficiency of state predistribution and redistribution, thus reducing extreme concentrations of income and wealth, to advocate for a more just and equitable distribution of resources (Walker et al. 2021; Li 2023; McGann and Murphy 2023), and to develop technologies to make the degrowth transition sustainable. At the level of practice, this means

[12] Research on the relationship between economic growth and subjective well-being suggests that how the economy grew is more important than how much it grew. See: De Neve et al. (2018). In other words, *quality* over *quanto* is in order.

[13] UNICEF (2022) demonstrated that the wealth of a nation is no guarantee that it will provide a healthy natural environment for its children.

[14] Globally, the number of obese adults has more than quadrupled (from 194 million in 1990 to 878 million in 2022). See https://www.obesityevidencehub.org.au/collections/trends/adults-global.

expanding and intensifying the range of mechanisms for reducing pre-tax inequalities (e.g., modernising private and public education, cultivating corporate training, skills development programmes, etc.) and redistribution (benefits, basic income schemes, etc.). With regard to promoting degrowth-compatible technology, education and cultural change (Prádanos 2015; Bobulescu 2022; Díez-Gutiérrez and Palomo-Cermeño, 2023), they point out that technologies that are ready to minimise resource use and negative environmental impacts should only and exclusively be prioritised, while pluralistic ecological and critical thinking should be promoted at the most diverse levels of education.

Even though the approach is strong at the level of philosophical imaginations and theorising (Polewsky et al. 2024), its "*How*s", that is to say, policy front is lacklustre even though the welfare aspect is of a central concern in degrowth theory (Demaria et al. 2013; Cosme et al. 2017; Theuer and Hopp 2019). Apparently, all degrowth theorists agree on the overall goal of degrowth, as described earlier. Still, nuances in views are observable mainly with respect to the extent of degrowth (i.e., whether downscaling should be radical, as Kallis (2017) argued, or moderated, as Eversberg and Schmelzer (2018) suggested); to the issue of what should be emphasised more within the well-being goal (i.e., either emphasise more the reduction of material production and consumption in enhancing social and mental well-being, as for instance Dietz and O'Neill (2013) noted, or put more focus on the promotion of more equitable access to basic resources to fulfil basic needs via mitigating wealth and income inequalities as Buch-Hansen and Koch (2019) or Betts-Davis et al. (2024) demonstrated); and to the role of technology (i.e., whether technology should be bolstered in a conspicuous way, as Edwards and Espelt (2020) showcased, or we should moderately support technological advancement since it may be a driver of unsustainable overproduction and overconsumption, as Heikkurinen (2016) illustrated). It is hardly by chance that advocates of degrowth do not offer a holistic policy roadmap for reaching out such transition but a supermarket of non-tested ideas based on strong assumptions (Table 1).

Table 1, without being exhaustive, illuminates that degrowth-transition is to be understood as a sort of sociogenesis that shall be promoted on many grounds by deploying national or even supranational economic policy, social policies and by building on global policies as well. Accordingly, the standard degrowth narrative puts forward a decisive shift from GDP-orientation to well-being centric understanding of development; and while it is to democratically downscale overproduction and overconsumption (i.e., fostering participatory decision making), it tries to build up cushions as well (e.g., UBI, reducing working hours, while reintroducing progressive tax regimes to mitigate inequalities etc.) to be coupled with instruments and international agreements in nudging as well as shaping the actors' activities toward an ecologically more aware functioning.

Even the listed indicative policy recommendations make it clear that the transition to degrowth means "doing with less" or "less is more", that is to say, in order to stop accelerating the extraction of scarce resources and thereby the destruction of the natural environment and with it our civilisation, we shall start reducing our overproduction, overconsumption, environment-neglecting investment, some government spending and even trade, i.e., we consciously and deliberately reduce the

Table 1 Indicative policy recommendations under the confine of degrowth

Economic policies	Social policies	Global policies
Reducing GDP dependency: Shift focus from constant economic growth to well-being indicators like happiness, life expectancy, and ecological sustainability. See: Heikkinen (2020), Paulson and Paulson-Smith (2021),	Promoting sufficiency and well-being: Shift cultural values away from materialism and consumerism towards community, social connections, and intrinsic goals. See: Kongshøj (2023)	Debt cancellation or increasing debt-tolerance and fairer trade: Address global inequalities by cancelling unsustainable debt burdens and promoting fair trade practices that prioritize people and planet over profit. See: Monios and Wilmsmeier (2022), Saving and van den Bergh (2024)
Universal Basic Income (UBI): Providing a guaranteed income for all would decouple work from income and allow individuals to choose work arrangements based on values and sustainability, not just survival. See: Alexander (2012)	Guaranteed public services: Ensure universal access to healthcare, education, and essential services, reducing dependence on material consumption for individual well-being. See: Dukelow and Murphy (2022), Heikkinen (2020)	International resource sharing and redistribution: Establish mechanisms for equitable sharing of resources and technologies between developed and developing nations. See: Corvellec and Paulsson (2023)
Reduced working hours with job guarantees: Shorter workweeks could distribute work more fairly, reduce overall resource consumption, and improve well-being. See: Alcott (2013)	Democratic participation and degrowth planning: Encourage public participation in decision-making processes related to degrowth strategies and implementation. See: Deriu (2012), Koch (2024)	Global degrowth movement and collaboration: Strengthen international cooperation and knowledge sharing among degrowth advocates to promote systemic change. See: Ford and Kuetting (2024), Käyrä and Kuhmonen (2024),
Support for local economies and alternative currencies: Encourage localization of production and consumption, and explore alternative currencies that value sustainability and local well-being. See: Balaguer Rasillo (2021), Gómez and Prado (2020), Dittmer (2013), Weber et al. (2019)	Progressive taxation: Higher taxes on the wealthy and corporations could redistribute wealth, incentivize sustainable practices, and fund social programs. See: Alexander (2012), Spangenberg, (2014), D'Alessandro et al. (2020)	Regulations on resource extraction and use, international tax agreements: Implement stricter environmental regulations, carbon pricing, and resource depletion quotas. See: Germain (2017), Fritzpatrick et al. (2022), Fyock (2022)

Source: own compilation

level of economic growth in terms of GDP to an ecologically more sustainable level. Degrowth is therefore not at all a subversion of the superficial approaches of post-growth or zero growth, but a research programme within the broad framework of post-growth advocating decisive growth reduction with a temporary effect. In other words, degrowth is not a glorification of Bertrand Russell's idleness, but a movement to develop the huge task of demonstrating credibly that: there will be no unforeseeable harmful consequences of temporarily reducing capital accumulation, and that it is even necessary to leave behind the culture of material accumulation, i.e., to focus on ecological and social needs rather than sheer profit (e.g.: in Greece, during the great shock of the 2008 crisis, subjective well-being only temporarily declined, eventually bouncing back to pre-recession levels[15]; in Japan, a model of economic stagnation, generations born during wasted decades no longer prioritise material values, and therefore their subjective well-being index outperforms that of Germany, South Korea, not to mention China[16]); an innovation-based but lower-growth economy will not collapse once excessive financialisation is curbed or if financial resources are not flowing so rapidly from the banking system to the real economy, because we want a smaller pie[17]; there is no harm in further indebtedness of the state by injecting additional R&D and innovation resources in a non-Keynesian way into areas of ecological sustainability in the event of recessionary crises; nor is there necessarily anything wrong with giving preference not to technological innovations that promise even more sophisticated labour-saving, but to those that stimulate social and ecological efficiency.

3.2 Critical reflections on degrowth transition

As it is still in its embryonic stage and is essentially a new research avenue proposing a novel ontological framework, there are a number of shortcomings and criticisms or questions that can be raised. In the following, we present four key areas where the degrowth concept still needs refinement and along which both international and domestic research on degrowth can be transcended: (i) shortcomings in systems view; (ii) lack of clarity on the nexus with capitalism and (iii) democracy; (iv) the neglect of industrial policy as a policy interface between quantitative and qualitative growth.

Shortcomings in systems view: In an effort to evaluate the systemic nature of the degrowth concept, it may be sufficient to answer the question whether a more radical limitation of quantitative growth should be interpreted in a static way, encompassing both developed and developing countries, and universally targeting the well-known 1.5 °C temperature goal of the Paris Agreement? In other words, will a *one-size-fits-all* approach take us forward in the push for the degrowth transition? The degrowth

[15] See: Komatsu and Rappleye (2024). And in terms of the eco-innovation index, Greece is among the EU Member States that outperform the EU27 and have made significant progress (European Commission 2024).

[16] See: Hommerich (2024).

[17] See more on the expanded financial universe at the expense of the real economy: Kovacs (2023).

literature does not really address the heterogeneities that arise due to regional and historical specificities, and therefore its systems approach certainly needs to be further developed, especially because it does not seek to explore synergies with other fields of research (economics, political economy, ecological economics, history, etc.).[18] Researchers on the possibility of a degrowth transition generally fall into two camps. The first group sees the need for a radical degrowth transition only for high-income countries (Hickel 2020a,b; Hickel et al. 2022a), while the second argues that a profound degrowth transition is needed worldwide (Kallis et al. 2012, 2020; Trainer 2021). Importantly, it is not only that neither camp takes into account that we are talking about economies with different growth models (e.g., undoubtedly, post-socialist Central and Eastern European countries, especially the so-called Visegrad countries (Czechia, Hungary, Poland and Slovakia), of which growth has been predominantly based on foreign capital, certainly require very different degrowth-oriented policies than Nordic countries with a more capital-rich and innovative growth model, etc.), but also that none of these groups treat the global world ecosystem as an open, complex and adaptive dynamic system, permeated by heterogeneity, which makes it meaningless to set and universally cultivate context-independent average targets (e.g. 1.5 °C). To generalise such a target would assume that global warming is evenly distributed across our planet, which is absurd. In short, the socio-economic ecosystem embedded in the environment is a complex adaptive system, full of nonlinearities, non-ergodic spillover effects, positive and negative feedbacks, bifurcations and tipping points, where cumulative causality, fluctuations and phase transitions can occur, making it almost impossible to restore a previous system configuration (Kovacs 2022). This implies that it is wrong to consider idealised averages as overall targets.,[19][20] The experience of the absolute decoupling of carbon emissions and GDP growth is precisely that it has been very realistic in some parts of the world economy at certain times, and not at all in others.[21] It can be argued, therefore, that the existence of global interactions and heterogeneities does not call for a one-size-fits-all, but dynamic degrowth approach in both developed and developing countries. Given that the distribution of emissions between rich and developing countries has changed dynamically over the past decades,[22] some countries may need more degrowth than others to promote strong sustainability and to preserve people's capabilities. Consequently, contemporary degrowth research needs more humility and self-criticism.

[18] On the shortcomings of synergies, see: Savin and van der Bergh (2024).

[19] Nobel laureate Giorgio Parisi has shown the interactions between disorder and fluctuations in physical systems, from the atomic to the planetary scale, pointing to the high degree of heterogeneity that leads to out-of-equilibrium systems.

[20] This heterogeneity is also reflected in the climate policies of small states, see Carter et al. (2019).

[21] See: Warlenius (2023).

[22] In 1970, rich countries emitted 69% of greenhouse gases, but this has now fallen to 33%. Emissions from high-income countries are falling slightly, while emissions from the developing world are rising rapidly. See https://clcouncil.org/blog/emissions-growth-in-the-developing-world/.

Nexus between degrowth and capitalism: Beyond the inevitability of degrowth, especially in industrialised economies,[23] there is a sense of an unresolved clash between degrowth and capitalism. The degrowth literature itself stresses that degrowth goes beyond capitalism (Kallis 2019; Schmelzer et al. 2022), because it implies a kind of "eco-socialist modernisation", a shift to a more frugal, ecologically sustainable, self-limiting consumer model (Gorz, 2013). Degrowth thus rejects the blind faith in the eternal viability of quantitative economic growth, highlighting the ecological and social costs of continued growth, which leads to the urgent task of shifting to a lower growth path.[24] The inherent logic of capitalism, however, is that production and consumption should be constantly expanding, and profits and employment should be ever higher, because this is how economic and individual welfare can be raised (Cassiers et al 2017). According to the operating principle of capitalism, abandoning quantitative growth leads to economic instability and job losses (Saito and Bergstrom 2024:150). Some argue that degrowth and capitalism are therefore incompatible with each other, thus a systemic shift towards alternative economic models is needed (Vandeventer et al. 2019; Robra and Nesterova 2023). And, of course, there are others arguing that degrowth is feasible within capitalism—as it implies a shift to a lower growth path—but this requires us to adopt major policy interventions and a cultural shift towards more sustainable coexistence (D'Alisa and Romano 2023). That said, the literature leaves the issue whether degrowth is a real alternative to a capitalist market economy at loose ends.[25]

To nuance the nexus, we draw on the work of Janos Kornai on capitalism. According to Kornai (2010), the dynamism of capitalism is basically due to five factors: decentralised initiation (i.e., a kind of liberalisation so that anyone with an innovative idea who wants to start a business can get the green light); competition (as a process of continuous exploration of efficiency improvement opportunities, which of course also provides Darwinian selection); high rewards (those who come up with risky innovations can realise higher incomes and profits, which they can reinvest); flexibility of financing (there should be an efficient financial intermediation system that provides the necessary resources with due diligence); and finally, room for experimentation (the system should be able to tolerate failure and to support new and young entrepreneurs, since innovations are mostly risky[26]). Keeping these in mind, it turns out that degrowth is navigating towards a system that by its very nature and according to Kornai seems to (1) constrain decentralised initiative due to the extensive control of resources and the constraints imposed (i.e., the

[23] The richest can block the stabilisation of global warming at 1.5 °C. On this, see Gössling and Humpe (2023), and on the role of the Global North in this, see Hickel and Slamersak (2022), Hickel et al. (2022b).

[24] The Beyond Growth conference in Brussels in 2023, for example, argued that the ecological crisis is caused by continued economic expansion and capital accumulation. We must therefore urgently move away from the dominant economic growth model. All stakeholders must prioritise social and ecological well-being over the pursuit of profit. See: Marquis (2024).

[25] See: Pineault (2019), Andreucci and Engel-Di Mauro (2019), Isikara (2020).

[26] 71% and 67% of manufacturing and services businesses respectively survive the first two years. See: https://stats.oecd.org/index.aspx?queryid=21581.

degrowth transition requires entrepreneurs to refrain from innovations that further deplete natural resources, that favour purely productivity gains or that are directed against social well-being, while preferring innovations that break with the focus on the dynamics of selling and buying[27]); (2) it does not leave the sanctity of competition intact by eliminating and/or restricting economic activities that excessively deplete natural resources and contribute to the perpetuation of an increasingly unjust society[28]; (3) it replaces high rewards/profits for social well-being, which can thus lead to a society with less inequality; (4) requires that the attention of the financial sector be oriented towards investments for long-term social and environmental sustainability (i.e., much better coordination of what to finance and what to invest in[29]); and (5) reshapes the space for experimentation by making the market more managed. The innovations of such a system should promote technologies that protect or improve the ecosystem, reduce social inequalities, which is in line with the striking advocacy of the degrowth movement (see Kallis et al. 2020). If we add to this the need for a more systemic degrowth approach (context-dependent and dynamic degrowth transitions), discussed earlier, we can argue that capitalism with conscious state involvement may well have a future in a degrowth framework that stimulates more qualitative growth.

In response to the criticism of degrowth, the most vociferous of which is that degrowth is politically unfeasible (Piper 2021; Naudé, 2023; Savin & van den Bergh 2024), it is worth considering what Karl Polanyi showed in his epoch-making work *The Great Transformation* (Polanyi 2001|1944), namely that, historically, even the market economy was born and institutionalised through a series of often violent but still concerted state measures around the world. Given the polycrisis and the ecological challenge it poses, there may well be a justification for a state functioning as outlined above. Since capitalism is a system of growth and crisis, and since it will never be a voluntary supporter of degrowth, it is up to the state to democratically negotiate and conclude the social contract that can lead to the priority of a system with degrowth rules. Degrowth is therefore not a utopia, but rather a possible form of Hodgsonian *evotopia*,[30] i.e., a system capable of becoming more self-disciplined and environmentally conscious, while remaining on the path of creativity and learning, in order to steer the economy towards well-being. Importantly, *degrowth and the structural change it entails can only be temporary*, with a lower growth potential as the goal, while a sustainable transition to degrowth and subsequent qualitative growth must be supported by a synergistic combination of state and grassroots innovation in a democratic framework.

Nexus between degrowth and democracy: Studies often neglect the underlying presumption here, namely that the future of modern civilisation depends on our

[27] These are what the literature calls convivial innovations. See Illich (1973), Robra et al. (2023).

[28] See: Burkhart et al. (2020).

[29] The aim is to incentivise the financial sector to give greater weight to firms with lower environmental externalities. See the results of the Harvard Business School's Impact-weighted Accounts project, https://www.hbs.edu/impact-weighted-accounts/Pages/default.aspx.

[30] See: Hodgson (1999).

ability to unleash dynamic degrowth transition by catalysing *social learning which is best nurtured by a democratic systemic configuration*. Addressing serious challenges require intense social learning via new ideas resulting in innovations and exaptations (i.e., the functional repurposing of a given innovation, already available technology or even processes and approaches, including policy) that are of immense importance in the transition process and afterwards, as well.[31] Not only the literature in economics (especially on innovation dynamism),[32] but also other scientific fields, such as evolutionary biology, have provided evidence on that successfully addressing challenges relies heavily on how quickly the society can improvise, innovate, collaborate and learn. Democracy with its decentralised and pluralist nature serves as a hotbed for, often parallel, learning which is of essence when it comes to a degrowth-oriented sociogenesis.[33]

The relationship between the degrowth transition and democracy is also a matter of debate (Hausknost 2017; Koch and Buch-Hansen 2021). The systemic imperative of degrowth requires not only bottom-up degrowth initiatives, but also top-down ones, as it is about reprogramming the complex socio-economic system.[34] Two views are clashing, and a third is beginning to take root. The first two views are based on the notion that efforts for degrowth will be followed by cultural transformation for an even more eco-centric world, while the third argues that it is worth pushing for cultural transformation first, and then it will be easier to manage degrowth sustainably.

The first view asks whether the degrowth transition should be carried out by economic governance based on experts from a position of power, i.e., in a kind of authoritarian way; the second argues that deliberative democracy or discursive democracy allows for more participatory decision-making, which could gradually lead to a transformation of this worldview. Since there is a consensus in the degrowth literature that the sustainability of the degrowth transition makes a democratic framework indispensable, the second view is worth addressing in a little more detail. Bearing in mind that unleashing dynamic degrowth transition shall be accompanied with catalysing *social learning, which is best nurtured by a democratic systemic configuration,* some principles are beginning to emerge in relation to the nexus between degrowth and democracy: (i) Advocating broad public participation in decision-making processes about how society is organised and which sectors of the economy should be prioritised or discouraged in the degrowth transition.[35] (ii)

[31] On innovation and exaptations, see: Kovacs (2024).

[32] See the literature on how decentralised democratic institutional setting, having local autonomy, especially in case of federalism, can catalyse parallel social learning, Rose-Ackerman (1980), Weingast (2014); Saam and Kerber (2013).

[33] For a potential evolutionary biology narrative on how democracy, and by no means the authoritarian and uniformising system, offers more fertile ground for learning and adaptation, enough to see the works of Charles Darwin (1871) suggesting that diversity and quick adaptation boil down to the exchange of different viewpoints and learning.

[34] As Tsagkari et al (2021) have shown, while local and small-scale energy systems have the potential to promote ideas related to degrowth, their ability to reduce energy consumption and challenge the growth orientation of societies remains limited.

[35] See: D'Alisa and Kallis (2020).

Involving communities in participatory budgeting, democratic deliberation to define the parameters of a socially just and ecologically sustainable economy.[36] (iii) Prioritising democratic control of resources, envisioning a system in which vital resources and industries are brought under democratic control and emphasising the priority of collective needs over the pursuit of private profit. It can entail with the reduction of working hours—which is by no means just a recent desire[37]—and the redistribution of labour as a general mechanism for reducing production and consumption levels, as this allows more leisure time for social participation and involvement in democratic processes[38] by keeping in mind that intense interpersonal relationships and socio-economic change is intertwined.[39] And (iv) focusing on well-being (i.e., liberal democratic systems are more likely to be associated with higher level of life satisfaction and subjective well-being, which is acknowledged and to be preferred by degrowth-transition research).[40] The practical implementation of the above principles, i.e., degrowth-oriented democratic economic planning, is greatly facilitated by the increasing use of artificial intelligence and Big Data.[41] The third view—known as ecological or eco-social constitutionalism[42]—is that larger-scale ecological transformation requires that the entire social and constitutional order of developed countries be transformed. This means that each of the four components (preamble, declaration of fundamental rights, constitutional principles, and the structure and organisation of the state) of the classical constitutional order of these states must be given an ecological profile. As a consequence, the specific nexus of degrowth with capitalism and democracy tends to point in the direction of a new social contract to ensure the sustainability of the degrowth transition.

The neglect of industrial policy: The degrowth literature has so far failed to examine the policy that could be an important channel for the transition (i.e., the shift from quantitative to qualitative growth), namely industrial policy, of which *raison d'être* has been long entangled to productivity-oriented, that is to say, quantitative growth, and which is currently enjoying a renaissance. As industrial policy aims to promote structural change in the economy (Juhász et al. 2023), this policy dimension is key to the degrowth transition. At first sight, industrial policy and degrowth-oriented policy may seem incompatible. Industrial policy focuses on promoting economic growth and competitiveness, while degrowth advocates slowing economic growth to achieve more ecologically sound socio-economic systems. Still, it cannot be said that industrial policy does not have a key role to play in the degrowth transition, because the literature itself identifies some tasks (Hickel et al. 2022) where it can have an impact, such as reducing and rationalising excess production or creating green jobs. A closer look at the nexus between industrial policy and degrowth

[36] See: Durrant and Kohen (2024).
[37] See: Astinova et al. (2024).
[38] See: D'Alisa et al. (2016).
[39] See: Tassinari (2023).
[40] See: Prati (2022), Speth (2012).
[41] See: Schlichter (2024).
[42] See: May and Daly (2015), Kotzé (2016).

reveals common motives: (i) Focus on efficiency: degrowth does not mean a complete stop of production or consumption, but an increase in efficiency, a reduction of waste, a shift away from consumption patterns that are harmful to well-being in a way of cultivating a lower quantitative growth path.[43] Of course, industrial policy as such can continue to partly be about increasing productivity and competitiveness, which is linked back to quantitative growth, but it can also be equipped with a dedicated green spirit (green industrial policy), which can more effectively steer economies towards eco-efficient production structures (e.g., correcting the underpricing of carbon emissions in case of certain activities, and green industrial policy subsidies can accelerate the uptake of environmentally mitigating technologies).[44] (ii) Sustainable innovation: degrowth encourages the development of innovative technologies and business models that use fewer resources and seek to minimise environmental damage. This is in line with industrial policy objectives to promote sustainable economic growth.[45] (iii) Social justice: degrowth also focuses on addressing the uneven distribution of economic growth and as such seeks to reduce poverty and inequality.[46] This overlaps with the objectives of industrial policy to promote equitable economic development and sustainable production, which is also a key component of strong sustainability.[47]

Consequently, the degrowth transition and modern industrial policy are compatible in several ways. At least three such interrelated ways can be identified. First, the promotion of a circular economy emerges. The circular economy is an economic model in which products are used, improved and recycled for as long as possible. This can help to reduce resource use and waste, in line with the goals of degrowth. Industrial policy can support the circular economy by encouraging circular business models, developing waste management infrastructure and promoting sustainable consumption.[48] Secondly, the promotion of job creation. Indeed, degrowth does not necessarily mean job losses,[49] but can create new jobs in the green economy, sustainable agriculture and the care sector and elsewhere.[50] Thirdly, changing consumer behaviour can be mentioned. Indeed, degrowth implies changing consumer behaviour (including buying more ecologically responsible but less goods and services; favouring more durable consumer goods; cultivating a culture of servicing and recycling). Industrial policy can help change consumer behaviour by promoting sustainable products and services (e.g., through Industry 4.0 and 5.0), educating people to consume responsibly and introducing regulations to encourage sustainable

[43] See: Whitehead (2013); Ramcilovic-Suominen et al. (2022).
[44] See: Aiginger and Ketels (2024).
[45] See: Yülek (2018).
[46] See: Walker et al. (2021).
[47] On context-dependent industrial policies, see Juhász et al. (2023). For an action framework for strong sustainability, see de Oliveira Neto et al. (2018).
[48] See: European Committee of the Regions (2019), Henriques et al. (2022), UNIDO (2022), Ekhdal et al. (2024).
[49] See: Alcott (2013), Hoffmann et al. (2023).
[50] See: Allan et al. (2021), Alami et al. (2023).

lifestyles.[51] What is more, the quintessence of coherence between industrial policy and degrowth is to redirect domestic capital as well as foreign capital inflows towards more qualitative investments (e.g., decarbonisation, etc.)[52] while curbing (making more expensive) resource-exhaustive production and consumption behaviour. This can be managed through conditionality. Keeping in mind the traditional instruments classified as industrial policy interventions (Juhász et al. 2023), and bearing in mind what we have emphasised so far, one can conclude that a range of industrial policy measures can be equipped with a degrowth orientation (see Fig. 1).

Without being exhaustive, the following broad degrowth-compatible industrial policy instruments can be identified to create a well-being economy: (1) Investing in sustainable technologies and infrastructure: governments to invest in renewable energy, energy efficiency and the circular economy. (2) Regulation: governments to regulate the environmental impacts of production and consumption through stricter environmental standards or product design criteria. In doing so, the importance of better designing investment conditionalities (standards and guardrails) is growing. Governments can also manage financial markets in a way that makes capital holders interested in directing more capital to degrowth-friendly areas. (3) This raises the issue of fiscal incentives: governments can provide tax breaks or subsidies to sustainable businesses while taxing polluting activities. (4) Public procurement: through public procurement, governments can give preference to sustainable products and services provided by, for example, local entrepreneurs. (5) Awareness raising and education: governments can launch campaigns to promote degrowth principles and raise environmental awareness among consumers and businesses. Let us add that current initiatives are not yet designed in a sufficiently mission-oriented way (Rodrik 2015, Tønurist 2023). Instead of the old approaches to industrial policy, it is worth working on a context-specific and dynamic approach to degrowth-compatible industrial policy, i.e., an industrial policy in which *the mitigation of excessive quantitative growth* (initiating and sustaining the degrowth transition) *is a central and mandatory* element of the objective function of industrial modernisation.

4 Transdisciplinary roots of degrowth

In this section, we show that degrowth thinking has long had deeper interdisciplinary roots that have been neglected in the literature on degrowth. A review of these reveals that the degrowth research agenda can draw inspiration from a wide range of fields and can be much broader than the narrative that has been focused on a narrow understanding of degrowth. Thus, a variety of degrowth approaches emerges by improving our freedom of choice with respect to degrowth transition.

[51] See: Stiglitz (2017).

[52] The influx of foreign capital has a negative impact on waste production, which can be seen as a direct indication of the creation and maintenance of patterns of overproduction/overconsumption. The experience of OECD countries between 2000 and 2020 showed that a 1% increase in FDI resulted in a significant increase in OECD waste from 0.00904% to 0.00935% (Shah et al. 2023).

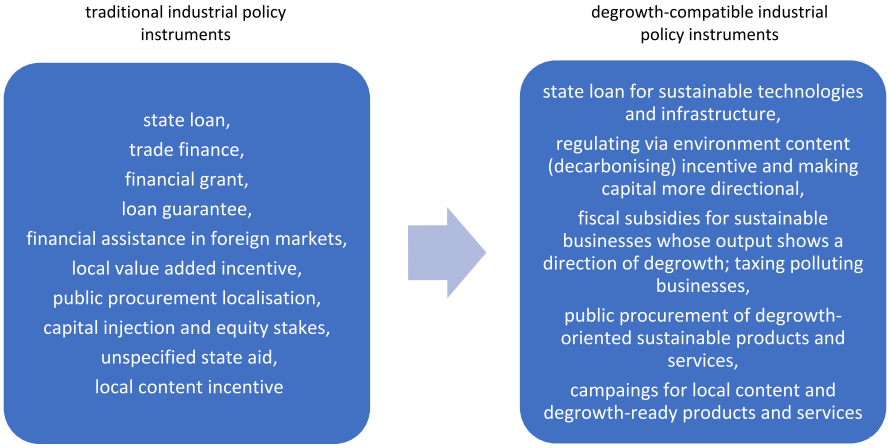

Fig. 1 Examples of degrowth-oriented industrial policies. *Source:* own compilation

4.1 Evolutionary science directing economics toward degrowth

As for evolutionary biology, it emphasises the finite nature of resources and the limitations of adaptation (Smith and Szathmary 1997). Organisms cannot grow indefinitely, as they are constrained by environmental factors, competition, and internal limitations. This resonates with degrowth's core tenet of questioning the sustainability of endless economic expansion. It is sufficient to go back to Charles Darwin, who cherished the intellectual legacy of the ancient philosopher Heraclitus, whose life's work clearly shows that it is worth guarding against so-called 'runaway phenomena', i.e., when a change that initially appeared beneficial at the level of the individual goes beyond the optimal scale and eventually becomes a self-defeating mechanism that endangers not only the individual but also the species as a whole. This was the case with the peacock's huge coloured tail feathers, which were intended to attract the attention of the opposite sex, i.e., to serve the higher social purpose of species preservation, but the animal's movements became more difficult and more conspicuous, making it easy prey for predators, thus reducing the species' chances of survival.[53] Growth is embedded in the environment, and it is precisely for the sake of interaction that growth should be limited.

Both evolutionary biology and the concept of degrowth emphasise (i) resource limitations; (ii) adaptation and change (i.e., both highlight the importance of adaptation and change in response to changing conditions. In evolution, species adapt to survive and reproduce in changing environments. Degrowth proposes adapting our economic system to be more sustainable and resilient in the face of environmental challenges); and (iii) diversity and complexity (i.e., both recognize the value of diversity and complexity. In evolution, biodiversity is crucial for resilience and ecosystem health. Degrowth emphasizes the importance of diverse economic models

[53] See: Csanyi (2012).

and localized solutions instead of a one-size-fits-all approach.). And today, more and more evolutionary biologists are trying to bring this to a wider audience, such as Edward O. Wilson (2017) and Sir David Attenborough.[54] Recent—albeit undeservedly overlooked—work, born out of the combined thinking of economics and evolutionary biology, also underscores the suicidal nature of our growth paradigm (Snower and Wilson 2022), where cooperation rather than competition can be the panacea (Burlando and Tartaglia 2022).

Bearing the above mentioned in mind, a defining feature of socio-economic evolutionary development is the preference for patterns of behaviour that seek sustainability, the abstinence and restful, collaborative, if you like, wise idleness that is often necessary for an active later life. This kind of understanding had been long started to infiltrate into social sciences like economics.

The issue of overburdening nature was known to social scientists, including economists, long before the work on *The Limits to Growth*. Economics, moreover, deals precisely with the paradoxical problem of unlimited human desires and limited resources (i.e., scarcity), that is to say, it recognizes and acknowledges in principle the existence of strict limits. Perhaps Thomas R. Malthus was the first champion of the idea that we should take into account natural limits, because he believed that food production is arithmetic, while population growth is geometric, and therefore there will not be enough food for everyone. Malthus (1798) ignored technological progress and migration, and the fact that population growth encourages better technologies having a positive impetus on agricultural productivity, which provides the basis for satisfying a growing number of hungry mouths, and so there are always feedback effects. Nevertheless, following Malthus, a message for today seems valid: the state will be very much needed in the degrowth transition, because the more the rate of population growth declines (a very typical phenomenon in today's world economy[55]), the less the incentive to strive for ever greater efficiency and more effective technological development. Less than half a century after Malthus, John Stuart Mill also pinpointed the possibility of general overproduction and argued at length for a limitation of agricultural land (Mill 1848, p. 30). Almost 50 years later, Alfred Marshall (1890) underscored the peculiarity of human nature in relation to consumption, namely that people seek much more than the mere satisfaction of primary needs, suggesting that human activity must necessarily meet the limits of nature. Albeit in the 1920s the idea that consumption might entail negative externalities (where one person's increasing consumption could limit the access of others to certain goods) emerged—see the pioneering work of Pigou (1920)—such negative effects were then mainly understood as temporary aberrations. It was only later, mainly with population growth, that the issue began to gain traction.

The issue of creating harmful artificial wants appeared yet another half century later when John Kenneth Galbraith published Affluent Society (1958) which

[54] See Sir David Attenborough's RSA (Royal Society for the encouragement of Arts, Manufactures and Commerce) President's Lecture: https://overpopulation-project.com/people-and-planet-sir-david-attenboroughs-take-on-overpopulation/.

[55] See: UN (2024).

concluded that modern American society has been going through a runaway phenomenon since it shifted from the narrative of scarcity and production to affluency and excessive consumerism grounding malignant inequalities and environmental degradation. 1958 was also the year when, at an American symposium, the doyen of growth theory, Sir Roy Harrod, mentioned that growth is indeed limited, but no one paid any attention to his remark at the time. As for the European front is concerned, for instance, Wilhelm Röpke—who in his work *Civitas Humana* exactly warned that the inclusion of dimensions beyond supply and demand in economic analysis is indispensable—repeatedly referred to the 1938 work of the German biochemist Ehrenfried Pfeiffer entitled "*Bio-Dynamic Farming and Gardening*". For example, Fred Hirsch (1976), in his undeservedly forgotten work *Social Limits to Growth*, coined a special term 'positional goods' most of which are given but for which the demand appears to be unlimited, such as the ozone layer, clean air, drinkable water, natural beauty, infrastructure (e.g., roads, sewers) etc. What is more, since the information revolution that began in the 1970s, there has been repeated work on how growth is becoming more and more limited. And in the age of the knowledge economy, brought about by the information revolution of the 1970s, it is even more true that those with more knowledge can buy more and buy smarter, driving patterns of overproduction and overconsumption.[56]

Indeed, social science research now emphasises that over the past 40–50 years our economic system has lost its old charm in applying the infinite desire for growth (Derviş, 2016; Cohen 2020), i.e., it has become systemically characterised by expulsion and extraction, as the sociologist and economist Saskia Sassen (Sassen 2014) neatly documented. It seems that even the most prominent members of the economic mainstream cannot remain completely immune, and are forced to think about the limits of quantitative growth. Among other things, a serious reflection is underway within the *Global Agenda Council on New Growth Models*[57] under the umbrella of the World Economic Forum, led by Nobel laureate Michael Spence. Another equally prominent scholar, Joseph E. Stiglitz is not in favour of degrowth, but he encourages qualitative growth via high level public investments with more powerful regulation and apt environmental pricing (Stiglitz 2019). What is more, contemporary discussions over fiscal and monetary policies have started to lend support to degrowth and green economy thinking (Blanchard 2023; Olk et al. 2023), in addition, the business sphere has also been recognising the opportunity to tap by pursuing not-for-profit activities (Hinton and Maclurcan 2016).

The process of shifting from the life ideal of profit to a more pro-social and value-based production and consumption system, being permeated by cooperation as well as moderation, has been one of the core tenets of a research programme within economics on happiness as well. The springboard for happiness research was Richard A. Easterlin's observation (Easterlin 1974) that the growth of income and happiness are departing from each other after a certain point. Research on happiness is related

[56] See: Dinkova et al. (2021).

[57] See: https://www3.weforum.org/docs/GAC/2014/WEF_GAC_NewGrowthModels_ChallengesStepsGrowth_Report_2014.pdf Accessed on: 28.11.2024.

to the concept of degrowth in several ways. First, studies have shown that a long-term decline in economic standards, as seen in Japan, has not necessarily led to a decline in subjective wellbeing, supporting the case for degrowth (Komatsu et al. 2022). Second, the movement towards degrowth involves a critique of wealth indicators, such as GDP per capita, and a rediscovery of alternative goals for happiness and wellbeing, such as "frugal affluence" and joyful sobriety (Latouche 2020). Third, the concept of Gross National Happiness (GNH) from Bhutan challenges the dominant GDP metrics and places socio-cultural, political-economic, and spiritual-ecological wellbeing at the center of national development, offering a holistic alternative to degrowth (Verma 2017). To the latter, the spirit of Schumacher (2010) or Brown (2017) does also touch upon degrowth by calling for a culture of suffering-mitigation coupled with self-restraint. One of their important insights is that the paradigm of no-growth cannot be forgiven for the fact that serious steps need to be taken to ensure that the majority of people have the capacity for self-fulfilment and constructive use of the extra leisure time that is offered (e.g., artificial intelligence is recently estimated to make 40% of jobs redundant (IMF 2024), further reinforcing the gloomy employment outlook in rich countries given by Industry 4.0, automation and robotisation[58]).[59] And, of course, this stream of research dwells also on the question of "What can be considered sufficient?" (Plomteux 2024; Róna et al. 2024), which is of particular relevance for degrowth, as it is a planned, democratic mitigation of overconsumption and overproduction.

Overall, it can be seen that the questioning of quantitative growth, the inclusion of dimensions beyond growth, and increasingly interdisciplinary thinking have also made their mark within economics, but not by a large margin. Evolutionary biology is pushing the degrowth research agenda towards the multidisciplinary, sharing valuable insights not only about the limited nature of resources, but also about adaptation through self-limitation and the power of diversity in complex systems. Understanding these interlinkages can inform debates on sustainable development and economic alternatives.

4.2 Systems theory in the service of degrowth-aware economics

The work of many authors in the field of degrowth gives the impression that many of them seem unaware that they are building on the field of systems theory, complexity theory or network science when they talk about things like critical instability, bifurcation, heterogeneity and qualitative transformation (becoming).

As far as critical instability, and bifurcation and heterogeneity are concerned, Bak (1996) emphasised self-organised criticality as a basic constituent of nature, namely that critical instability refers to the analysis of system instability and the detection of upcoming critical transitions in complex systems. Such critical transition is

[58] See: Frey and Osborne (2017), Acemoglu and Restrepo (2020).

[59] Needless to say, in a degrowth society, employers shall tolerate much more the lack of job experience of candidates when it comes to hiring (which otherwise causes discrimination nowadays, see: Baert et al. (2017)).

envisioned and propagated by degrowth theorists in critiquing the growth-compelled capitalist economy with the aim at reaching out smaller and more equitable social metabolisms. It means that a bifurcation induced turning point emerges after which there is no point of return to the previous functioning of the system. The concept of degrowth builds on the line of thinking that constant economic growth leads to such a bifurcation point (Max-Neef 1995; Lawn 2005), after which an unsustainable process may continue, or we may enter a "post-growth" phase. The significance of the bifurcation-induced turning points was already vividly demonstrated before the trend towards degrowth, for example by Ludwig von Bertalanffy (1968), a pioneer in systems theory, and after him by such figures as Hermann Haken (1983), who founded the theory of synergetics, and the biochemist and ecologist Frederic Vester (2007). With respect to instability and bifurcation, the Russian-Belgian biochemist, Ilya Prigogine's oeuvre, particularly his theory on dissipative and far-from-equilibrium systems does offer important ammunition for the concept of degrowth. Prigogine (1977, 1980) showed that closed systems tend towards disorder and increasing entropy (disorganization). Degrowth argues for reducing resource consumption and economic expansion to limit environmental degradation and maintain ecological balance, aligning with the idea of minimizing entropy increase. Prigogine also explored how small changes in open non-linear systems can amplify to the macro level by leading to drastic, even irreversible, consequences (i.e., bifurcation) (Prigogine and Stengers 1984). Degrowth emphasizes the potential for environmental tipping points and advocates for precautionary measures to avoid them, suggesting scaling back economic activity to stay within safe ecological boundaries. Axel Leijonhufvud (2000), who analysed the economy from a systems perspective by relying on the works on bifurcation, also drew attention to the inherent instability of the capitalist system and therefore urged that it was time for re-evaluating and reimagining our economic systems to achieve genuine sustainability. But the findings of scholars working on complex living systems today could also be incorporated into the degrowth paradigm, since it is not necessarily true that there will be a precisely calculable limit, which will mark a bifurcation-induced turning point in the life of our modern society. Ritchie et al. (2023) for instance concluded that it is not necessary for the rate of warming to reach a certain critical limit during climate change to arrive at a bifurcation; they even suggest that it may be sufficient for the rate of the phenomenon to accelerate so that we are still within the theoretical limit. For the degrowth transition, this suggests not only that there is not much time to start the process, but also what we concluded earlier: a context-dependent dynamic degrowth transition, accounting for heterogeneity and with different speeds, is needed, rather than some universal growth-reduction.[60]

As for becoming, Prigogine did also suggest that far-from-equilibrium systems can evolve and create new order due to exchange with their environment. Degrowth

[60] Clearly, developed and rich countries need to be prioritised in the degrowth transition (Daly 1999; Meadows et al. 2004; Woodward and Simms 2006; Stiglitz et al. 2010; Alexander 2012:364). Even Pope Francis has said that "[…] the time has come to accept decreased growth in some parts of the world, in order to provide resources for other places to experience healthy growth" (Francis 2014, p. 141).

argues for transitioning to new, sustainable economic models and encourages experimentation and innovation within constrained resource use. Degrowth needs to address how to minimize entropy increase while still nurturing innovation and development within a reduced-consumption model. The key in the concept of degrowth is the *planned as well as deliberated* transition initiated both at the micro (grassroots) and macro (economic governance, public policies) levels. Becoming, i.e., structural transition to a sustainable degrowth socio-economic innovation ecosystem, very much depends on whether such collective initiation has a real perspective or not. To answer this question, we can draw on our knowledge of economic history. First, as far as economic history is concerned, Charles Kindleberger (1978) argued that serious change has only been achieved in very exceptional cases—such as wars that shatter the existing institutional set-up, or defeats that create new ones. The Roman Empire fell, and then succumbed to barbarian invasions, when the coherence of the imperial socio-civic virtues had become infinitely weak, as Edward Gibbon's seminal six-volume *History of the Decline and Fall of the Roman Empire* indicated as early as the eighteenth century (see Gibbon 1776). Arnold J. Toynbee's twelve-volume, *The Rise and Fall of Civilizations*, concluded that certain societies rise via technological advances and collapse when they fail to create and develop social cohesion (Toynbee 1934). In addition, the 1987 magnum opus of Paul Kennedy sensitively illustrated that the runaway of great powers will eventually lead to their perceptible fall since the more states increase their power, the larger the proportion of their resources they devote to maintaining it. It implies that the overextensions of our economies will prove to become an ecologically incompatible economic system. If we take into account that humanity is manoeuvring itself into an "exceptional" situation that is real and perceived by an increasing number of people, then there is a possibility of change strictly from the point of view of economic history. In his famous work, Karl Polányi (1944|2001) not only showed that the price of development can be social upheaval if and when countervailing mechanisms are not established; he also pointed out that the capitalist market economy was not the result of a bottom-up "unguided" process, but that its institutionalisation was based on a series of violent state actions and interventions. To this, Hodgson (2023) added that the time span was also relatively short, i.e., institutions were destroyed and built as deliberated acts. Of course, degrowth advocates underline that economic, social, cultural and ethical change is of essence. Many argue that this is almost impossible (Alexander 2012). The western style of excessive consumerism shall be abandoned and it shall come from the grassroots voluntarily (Alexander 2013). Joel Mokyr (2018), however, argued that all major transformations in economic history have been accompanied by, or even driven by, cultural change (which is why we cannot say that reducing consumption is a utopia, because a sociogenesis based on cultural change can emerge, in which it can be a kind of naturalness).

4.3 Neuroscience directing economics toward degrowth

So far, the literature has not tried to decipher the nexus between degrowth and the newly emerging concept of brain capital or that of the brain-healthy economy which

is basically a neuroscience-informed approach to economics. The concept of a *brain-healthy economy* focuses on creating an economic system that promotes individuals' and communities' cognitive, emotional, and social well-being. This involves factors like equitable income distribution, access to education and healthcare, strong social networks, and opportunities for meaningful work (Smith et al. 2021; Avan et al. 2023; Eyre et al. 2024; Lock 2023). A brain-healthy economy aims therefore at nurturing creativity, innovation, and critical thinking, fostering an environment conducive to human flourishing.

If one takes a mere glimpse on the basic objectives of the concept of brain capital or brain-healthy economy, it emerges that the three objectives are overlapping with degrowth, partly feeding back to what has been presented so far on degrowth, by highlighting important mutual learning opportunities between the two research areas. On the objective of well-being and the quality of life, the concept of brain capital or brain-healthy economy prioritises policies and practices that promote mental and cognitive health, reducing stress and facilitating work-life balance; while degrowth is to downscale excessive economic activity and consumption to improve overall quality of life, focusing on social well-being, community, and reducing stress associated with overwork and material accumulation. What is more, degrowth, by reducing material consumption and work pressures, could free up time and resources for individuals to invest in self-care, learning, and social connection, potentially contributing to a brain-healthy environment. On the underlying objective of environmental sustainability, the concept of brain capital or brain-healthy economy recognises the impact of environmental factors on mental health and advocates for sustainable practices to protect the environment and promote well-being (i.e., even a model of *Green Brain Capital* has been proposed as an environmentally focused type of brain capital[61]); while degrowth explicitly desires to reduce resource consumption and environmental impact by shifting towards a less resource-intensive and more equitable economic model. And on the objective of social equity, the concept of brain capital or brain-healthy economy considers the fostering of policies that are capable of addressing social inequalities, recognising that disparities in access to resources and opportunities can negatively impact mental health[62]; while degrowth advocates for a more equitable distribution of resources and wealth, challenging the current economic system that often exacerbates social inequalities. Furthermore, degrowth's emphasis on local economies and community resilience could foster stronger social networks and a sense of belonging, both crucial for mental well-being.

Let us underscore that, however, degrowth, if not carefully implemented, could also lead to economic insecurity and increased stress, negatively impacting mental health. At this point, researchers and economic policy practitioners shall

[61] Green Brain Capital distinguishes between the formation of capabilities (e.g., ecological intelligence, digital literacy, green skills, environmental determinants of brain health) and the utilisation of acquired capabilities (e.g., whether for work, leisure or contributing to a sustainable and resource-efficient society). See: Ibanez et al. (2024).

[62] This paves the way for a so-called care economy, see Slavich et al. (2021).

acknowledge the fact that, despite the common grounds outlined, differences remain in crucial aspects, namely that degrowth primarily focuses on ecological and social sustainability, while a brain-healthy economy directly emphasizes individual and community well-being. Moreover, degrowth proposes systemic changes to economic structures, while a brain-healthy economy can be applied within different economic models. To the latter, brain healthy economy is about optimising each person brain performance—which should lead to greater productivity and growth[63]—but that is not the point.[64] Advocates of brain healthy economy do by no means think that such approach hitches its wagon inexorably to degrowth (Occhipinti et al. 2023, 2024), what is more, brain healthy economics is about growth of innovative new products, new medicines and treatments, creativity and research in the interest of all in the socio-economic and environmental systemic configuration.

Nevertheless, this does not exclude the possibility that the degrowth transition can incorporate neuroscience (including the brain-healthy economy concept) in order to increase prosperity in favour of a more ecologically sustainable system. If only because, and undoubtedly, degrowth transition is about the shift from quantitative growth to qualitative growth which requires the cultivation of cognitive and emotional skills, as well as brain and mental health in the course of building upon the micro sphere's innovation activities (including exaptations, i.e., when an existing innovation or available technology is used for a different purpose elsewhere)[65] in a liberal fashion. The latter is of course conditional on the preservation of individuality in societies, which is the catalyst for the emergence of new ideas, the paving of new paths. It also follows, of course, that a future society based on degrowth must be liberal, open and democratic based on well-functioning virtues as representations of safeguarded mental-health.

As far as well-functioning virtues are concerned, importantly, a separate research programme could be devoted to the question of how the consolidation of the social foundations of degrowth has been hindered. This could be aided by the analysis of the *virtues* necessary for social learning and well-being,[66] since these are the virtues that we have known since the Greeks to be the basis for creating, maintaining, abolishing or modifying institutions and organisations, and for changing our attitudes and actions.[67] These are prudence (originally the spirit of exploiting arbitrage opportunities in the present and self-interest, maximising profit, a sense of what is practical and reasonable for the individual), curiosity (synonymous with the search for change and risk-taking challenges, a capacity to take into account context and

[63] Even the productivity-oriented OECD, which initiated the *Global Forum on Productivity*, started to emphasise more the human side of productivity, hence accentuating the role of policies playing a crucial role in reinvigorating productivity growth such as management training, education & training, social benefit and tax system, as well as immigration policies that are, undoubtedly, having impacts on people's mental health as well. Studies on cognitive ability and brain health still have a predilection to think within the paradigm of quantitative growth, see: Burhan et al. (2023), Nail-Beatty et al. (2024).

[64] By developing mental wealth observatories. See: Occhipinti et al. (2024).

[65] See: Kovacs (2024).

[66] See the increasingly growing body of literature on eudaimonic well-being (Niemiec 2014; Ryff 2017).

[67] See: McCloskey (2007).

the long term), fairness (which is a sense of what is good, and an inclination to search for it), and temperance (which is the embodiment of self-care, self-control and longer-term planning, an awareness and sense of limits). Together, these mark the boundaries, the zones of moral comfort and discomfort where a mind-set change is inevitable. In the context of prudence, economic growth and the pursuit of profit have caused serious cracks in the virtue of prudence, e.g., the systemic preference for greater profit in the present has resulted in a breakdown of the harmony between the real and financial sectors (Kovacs 2023), with capital investment becoming the dominant preference rather than real economic investment. The question of courage arises because the overexpansion of the financial system and the marginalisation of the real economy have strengthened the dominance of large firms, distorting the ability to challenge markets and weakening the selection mechanism of intense competition. Justice also became a problem because of the deliberate dismantling of progressive tax systems, which led to increased inequalities, the proliferation of the financial system and the erosion of the sustainability of public finances at the expense of future generations. Temperance has also been compromised, as illustrated by the systemic risk-inducing indebtedness trend in the private and public sectors. A systemic degrowth research programme should therefore unravel how to act in rehabilitating such virtues.[68]

Neuroscience and its recent transformational approaches like brain capital is to be reckoned with when it comes to the transdisciplinary degrowth research simply because the need to leave behind quantitative growth by grounding qualitative growth necessitates the cultivation and building of brain capital to better understand what is at stake and why we need degrowth transition. Brain capital is of key importance to rehabilitate important virtues with the aim at acting systemically and unlocking innovative solutions to address the degrowth transition.

5 Conclusion

The starting point of our paper was that, while addressing the polycrisis would require achieving sustainable development, the current configuration of the socio-economic system based on overproduction and overconsumption and the endlessness of quantitative growth makes this a pipe dream. Consequently, there needs to be an effective shift from quantitative growth to qualitative growth. This is the purpose of the degrowth research programme, which does not in fact aim to reduce human capabilities, but rather to preserve them, since it seeks to promote the reduction of environmental pressures, the reduction of inequalities and, through this, the cultivation of well-being, by means of a planned and democratic reduction in overproduction and overconsumption.

We have taken a critical approach that goes beyond the usual literature on the degrowth transition, since, in addition to the clash of divergent views, we have

[68] Nurturing brain capital can be conducive to the process of acquiring virtues as Khaliqi (2021) demonstrated.

identified shortcomings of the concept in some areas, such as the deficit of its systems view, the lack of clarity of the nexus with capitalism and democracy, and the neglect of the relevant role of modern industrial policy. In addition to a narrow interpretation of the concept, the transdisciplinary nature of the degrowth transition has been explored, drawing on relevant aspects of evolutionary science, systems theory and neuroscience.

Our paper suggests at least five insights that go beyond what we so far know about the concept of degrowth. *First*, a static and universal strategy would be meaningless and futile in a complex and heterogeneous global economy, and therefore a dynamic and context-dependent degrowth transition is needed. *Second*, although capitalism is a system of growth and crisis, it can never be a field of deceleration by choice, and the state must therefore set a direction for the system, and to do so it must work out a new social contract for degrowth orientation. *Third*, degrowth and the structural change (degrowth transition) that goes with it shall be temporary in nature, after which the aim may be to maintain a lower growth potential. A sustainable degrowth transition and subsequent qualitative growth should be supported by a synergistic combination of state and grassroots innovation in a democratic framework, with the mission of ensuring a more ecologically sound system and well-being. *Fourth*, it is essential to involve modern industrial policy and give it a degrowth orientation, because it is one of the key drivers of the shift from quantitative to qualitative growth. *Fifth*, degrowth literature has so far failed to incorporate the messages coming from a variety of fields meaning important interdisciplinary roots for the concept of degrowth (e.g., evolutionary science, systems theory, neuroscience), so instructive feedback loops shall be explored between degrowth research agenda and other disciplines whereby the research programme can become much broader than the established work suggests.

Of course, a myriad of questions remains open waiting for answers: Is it a relative downscaling of production and consumption or absolute? Shall some growth dimensions remain and grow further? Is it possible to establish some kind of ranking (priority chain) and decide on the timing of reducing production and consumption (e.g., whether it is worth starting with those sectors or product types where overproduction and overconsumption are most serious)? Can we identify fields at all of which downscaling would not increase extraction of natural resources elsewhere? How fast should the degrowth transition be and what speed differentials are needed between heterogeneous developed countries? The latter is of crucial importance as countries are heterogeneous in terms of their growth model as well by presumably calling for context-dependent degrowth policies (e.g., Central and Eastern European countries, especially the so-called Visegrad countries (Czechia, Hungary, Poland and Slovakia) have a foreign capital-based growth model being in a diametrical opposition to northern countries' innovation-based growth paradigm). How should the presence of zombie firms, often condemned by mainstream economics, be interpreted within the degrowth concept, should the degrowth transition mean that these vegetating but still remaining in the market firms become systemic features of a degrowth-oriented economy? How can international cooperation under the ecological constitutionalism for the degrowth transition be promoted? What can we do to bring degrowth into the mainstream? How can the scientific architecture, that has been established

and operated over many years, be changed so that riskier but boundary-pushing, transdisciplinary exploratory research, such as degrowth, is not relegated to the background?

All in all, there is an urgent need not only to initiate real transdisciplinary dialogue on degrowth, but also to move towards qualitative growth. To this end, we are convinced that disciplinary eclecticism can fertilise the degrowth research agenda.

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Declarations

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