A broader landscape of post-growth pathways: review of sustainability scenarios integrating biophysical limits, sufficiency, equity and structural change

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Laura À. Pérez-Sánchez*, Aljoša Slameršak

Institut de Ciència i Tecnologia Ambientals (ICTA-UAB), Universitat Autònoma de Barcelona, Cerdanyola del Vallès, Barcelona, Spain

*Correspondence: Laura.perez.sanchez@uab.cat

Abstract

Most existing climate mitigation scenarios integrate the notions of continued economic growth and material abundance. They can purportedly be sustained with cleaner and more efficient production, greater material circularity, and carbon sequestration, whose technological feasibility and effectiveness are fiercely debated at such scales. The scenario literature for sustainable futures has only recently begun to explore degrowth and post-growth pathways and alternative scenarios with demand-side strategies, low energy demand, lifestyle changes and sufficiency frameworks. Our objective is to collect and analyse the scenario literature that may be of interest to post-growth scholars, encompassing both those explicitly defined as post-growth or degrowth and others with related terms and assumptions. We define 7 pillars through which models and scenarios represent post-growth: Biophysical limits, Low consumption, Activity levels and needs, GDP reduction, Reorganization of the economy, Equity and Technological change. We check the representation of these pillars across 60 economy-wide sustainability modelling studies and assess the underlying mechanisms, policies, fundamental assumptions and models. This way, we assess which post-growth aspects have thus far been explored in scenarios, and identify future research pathways, highlighting unexplored or underrepresented dimensions such as the representation of households, and Global North/Global South and gender inequalities.

Keywords: degrowth, post-growth, modelling, integrated assessment models, ecological macroeconomics, industrial ecology

Highlights:

- We explore economy-wide scenarios with biophysical limits, sufficiency, equity and structural change

- The post-growth framework includes Biophysical limits, Low consumption, Activity levels and needs, GDP reduction, Reorganization of the economy, Equity and Technological change
- Post-growth-related scenarios have emerged mostly in the last 5 years
- We present future research pathways such as gender inequalities and household representation

List of abbreviations

AR6	6th Assessment Report
CGE	Computable General Equilibrium
DLS	Decent Living Standard
EROI	Energy Return on Energy Invested
EU	European Union
GDP	Gross Domestic Product
GHG	Greenhouse Gases
IAM	Integrated Assessment Model
IOT	Input-Output Tables
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
LCA	Life Cycle Assessment
MFA	Material Flow Analysis
MRIO	Multi-Regional Input-Output
SDGs	Sustainable Development Goals
SSP	Shared Socioeconomic Pathway
WG	Working Group

1 Introduction

Scenarios are both qualitative and quantitative coherent descriptions of possible future states of the world. Formal models are quantitative tools but this does not mean that they are precise or politically and value-neutral, even more in the highly complex and embedded in social dynamics field of sustainability (Meadows, 1982; Saltelli et al., 2020, 2013; Sgouridis et al., 2022). So far, sustainability scenarios have mainly explored only a narrow part of the whole potential landscape. Most of them have focused on the continuation of business-as-usual (BAU) socio-economic trajectories together with rapid technological change following the Shared Socioeconomic Pathways (Cointe and Pottier, 2023; De Bortoli et al., 2025; Hickel et al., 2021; IPCC, 2022; Lauer et al., 2025a, 2024). More specifically, they include an over-reliance on carbon dioxide removal (CDR) technologies (Beck and Mahony, 2018; Creutzig et al., 2021; Fuss et al., 2014; Lamb et al., 2024; Vaughan and Gough, 2016; Warszawski et al., 2021), energy and carbon efficiency improvements not comparable to historical trends (Barrios-Sánchez et al., 2026; Brockway et al., 2021; Keyßer and Lenzen, 2021; Scott et al., 2022; Slameršak et al., 2024) and a narrow focus on carbon pricing as a mechanism for change, which is often defined simply as "climate policy" (Ellenbeck and Lilliestam, 2019; Keppo et al., 2021; Söderholm et al., 2011). These drawbacks from current scenario literature show that significant strengthening of policy ambitions is required to square the climate and ecological goals while ensuring high levels of human wellbeing globally. In this light, alternative approaches proposing deeper societal changes such as post-growth are emerging.

Post-growth aims to replace the goal of increasing GDP to prioritise human well-being, equity, and ecological sustainability (Kallis et al., 2025; Slameršak et al., 2026; Van Eynde et al., 2026). Despite the growing green growth scepticism and literature on the term, post-growth and degrowth quantitative modelling studies remain limited in scope and variety compared to the qualitative literature and the green growth scenarios (King et al., 2023; Polewsky et al., 2024; Suter et al., 2026). There are only two existing literature reviews of post-growth scenarios (Edwards et al., 2025; Lauer et al., 2025a). Lauer et al. (2025a) conducted a systematic review of 75 modelling studies related to post-growth and degrowth within the field of economics, finding considerable heterogeneity in the interpretation of these concepts and their representation in models. They assess the studies by their time horizon, geographical scope (26 papers are global), the dimensions represented (36 are bi/pluridimensional), modelling approaches and representation of degrowth/post-growth. They highlight the need to extend the review to studies that do not self-define as post-growth or degrowth yet develop scenarios that are coherent with their definitions. Edwards et al. (2025) published a review on 15 post-growth climate mitigation scenarios analysed through the “degrowth instruments” framework Kikstra et al. (2024): feasible technological change, the scale-down of harmful production, a good life for all, wealth redistribution, and international justice. Their smaller set of articles allows them to describe more in detail the findings of each paper.

Although scenario literature on post-growth and degrowth remains limited, multiple approaches of social change beyond technology with a diversity of transformation intensities have appeared (Kallis et al., 2025; Wiedenhofer et al., 2024). These include literature on demand-side changes (Creutzig et al., 2022, 2016), ‘high with low’ (Sugiyama et al., 2024), sufficiency (Jungell-Michelsson and Heikkurinen, 2022; Lage, 2022; Spengler, 2016), decent living standards (Rao and Baer, 2012; Rao and Min, 2018), voluntary simplicity (Rebouças and Soares, 2021), lifestyle changes (Akenji and Chen, 2016), and behavioural change. Pioneer quantification studies are the 1kW per capita paper by Goldemberg et al. (1985) and the two-kilowatt society (Kesselring and Winter, 1994). Concepts like sufficiency, lifestyle and behaviour changes have been used interchangeably (Bauer and Sterner, 2025). However, while terms like behavioural changes suggest individual decisions within existing provisioning systems and with limited decarbonization potential, concepts like sufficiency entail deeper societal transformations and consumption reductions.

These concepts often share common ground and are at times explicitly linked to post-growth (Kallis et al., 2025; Wiedenhofer et al., 2024)[1]. Despite the conceptual overlap with post-growth, many researchers may not use the terms of post-growth or degrowth, due to their negative connotations or a misinterpretation as only decreasing GDP (Drews and Antal, 2016; Krpan et al., 2025a). There are several reviews of scenarios and relevant concepts to post-growth such as: of sufficiency and lifestyle changes (Andreou et al., 2022, p. 202; Samadi et al., 2017; Saujot et al., 2021; Tröger et al., 2022; van den Berg et al., 2019; Wiedenhofer et al., 2024; Wiese et al., 2024b), justice (Hickel and Slamersak, 2022; Jafino et al., 2021; Kanitkar et al., 2024; Lauer et al., 2025b; Rubiano Rivadeneira and Carton, 2022; Zimm et al., 2024), structural change (Ciarli and Savona, 2019; Köhler et al., 2017), and other aspects such as material representation, and alternative indicators to GDP (López-Muñoz et al., 2025; Orbons et al., 2024; Pauliuk et al., 2017; Rye and Jackson, 2018; Van Eynde et al., 2024). We provide a more detailed overview of this literature in the Supplementary Material. Still, not all the studies assessed in those reviews could be considered as Post-Growth-Like, since they apply limited behavioral changes or the reviews may explore the integration of relevant concepts such as justice in a set of growth-oriented scenarios.

In this review, we analyse economy-wide sustainability scenarios that define themselves as post-growth or degrowth and those whose main characteristics are coherent with the umbrella definition of post-growth. We open the search to papers not necessarily explicitly defining themselves as post- or degrowth in order to provide a perspective of the relevant economy-wide scenario literature to post-growth scholars. We seek to analyse what aspects and mechanisms of post-growth are currently represented in the scenario literature and to what degree may the "post-growth-like" scenarios expand and complement the representation of post-growth principles.

To do so, we establish an analytical framework of 7 key elements ("pillars") of post-growth. This is followed by the methodological approach of this systematic review. After

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[1] Two examples of this diversity of concepts and their relationships are these two definitions found in reviews:

"Over the past 5 years, research under the labels of post-growth, degrowth, doughnut economics, wellbeing economics and steady-state economics has started sharpening the questions that need to be answered if the goal of prosperity without growth is to be achieved" (Kallis et al., 2025, p. 68)

"This emerging field of demand-side research draws upon multiple concepts and efforts, for example, beyond gross domestic product (GDP), sufficiency, post-growth, steady-state economics, sustainable consumption corridors, degrowth, sustainable circular economy, and material and resource efficiency." (Wiedenhofer et al., 2024, p. 252)

a bibliographical analysis, we explore briefly the narrative storylines and the inclusion of cultural and political transformation since these are distinctive for post-growth and challenging to model explicitly. The main results present how the seven pillars have been assessed by scenarios, detailing what models, assumptions and mechanisms they use. Finally, in the discussion, we deliberate on the under-represented parts of the post-growth scenario space, and on potential avenues for further research in both post-growth scenario modelling and for broader post-growth scholarship.

2 Post-growth pillars

Post-growth is an umbrella term for different growth-critical visions of socio-economic development, including steady-state economy, the doughnut economics, wellbeing economy, and degrowth (Kallis et al., 2025). Different post-growth perspectives vary in how they specify and prioritise the levers and mechanisms driving transformative change. We propose the following seven pillars for analysing post-growth futures (Figure 1):

- Biophysical limits.
- Decrease global material consumption.
- Activity levels and needs
- GDP reduction.
- Deep structural reorganisation of the economy.
- Equity.
- Technological change.

The pillars are present in scenarios through narrative storylines, assumptions and model mechanisms, are mutually interdependent and complementary. Some key aspects of models are in fact in the connection between pillars. For example, the "low consumption" pillar that indicates the level of use of energy carriers and material flows is connected to biophysical limits (primary energy or raw material extraction) through the representation of the mining and industrial sectors. Another example would be the link between "low consumption" and "GDP reduction", which presents the decoupling debate through final energy intensity. While we will consider these connections, we present the pillars as a framework that allows the analysis of the modelling exercises and addresses key aspects assumed by post-growth literature.

The framework of post-growth pillars in this paper was developed throughout the review process, to align with the features that can be identified in existing post-growth modelling studies. While comprehensive, it may lack fine detail on the topics that remain underrepresented in existing scenarios. Future development may therefore require further modifications to this analytical framework. For example, we have included an overarching pillar of "Reorganisation of the economy". When systemic change in models is improved and more frequently assessed, this pillar could be further disaggregated between policies and the change in institutions and infrastructure, for example. 4

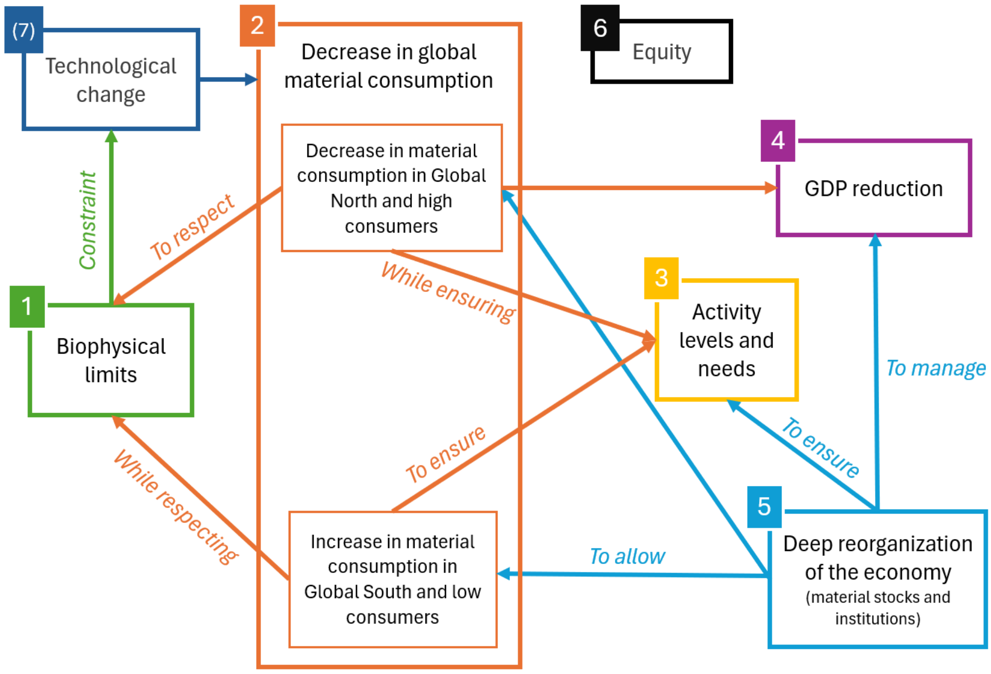

Figure 1 Relationships between post-growth pillars.

2.1 Biophysical limits

One post-growth perspective argues that biophysical limits fundamentally constrain the scale of economic activity. Factors that can impede the prospects of continuing economic growth include: availability of materials and fossil fuels, declining Energy Return on Energy Invested (EROI), land use scarcity, limited carrying capacity of ecosystems, thermodynamic efficiency limits, and climate change damages (Cleveland and Ruth, 1997; Daly, 1973; Georgescu-Roegen, 1993, 1971; Gomez-Baggethun, 2022a; Jackson et al., 2024; Kerschner and Capellan-Peréz, 2017). This multiplicity of factors and the potential environmental problem shifting cautions against single issue framing of the ecological crisis, such as the focus on GHG accounting and climate change. For example, decarbonisation efforts may successfully reduce greenhouse gas emissions but simultaneously increase pressures on land-use change and diminish the availability of rare earth minerals (Wood Hansen and Van Den Bergh, 2024). While environmental respect is still fundamental, another degrowth perspective emphasizes collective self-limitation. It considers the requirement to restrict the scale of the economy to an aspiration of autonomy and of social limits to growth such as working time availability (Kallis, 2021).

2.2 Low consumption

Post-growth scholarship concludes that the aggregate throughput of resources and energy must be constrained to withdraw within the sustainable biophysical limits and to reduce social impacts and inequalities. Ensuring a just approach to such limitation requires reducing excessive consumption in the Global North and high consumers, to enable space for increased access to basic needs in the Global South.

This pillar quantifies the inflows of final energy and material use. Therefore, this pillar is based on a relatively simple indicator of resource use within the technosphere but we include it due to its prevalence within the literature. Many models do not get to representing either activity levels or biosphere flows that can be put in context of biophysical limits such as raw material extraction, primary energy or GHG emissions. Therefore, this pillar considers resource use from the society side, looking at societal metabolism of final consumption, but its feasibility with depend on availability and quality of raw and secondary materials and of primary energy sources (e.g. ore grades, EROI, etc.).

2.3 Activity levels and needs

Even in a context of transgression of planetary boundaries, human needs are still not universally met. The current economic system satisfies less-necessary consumption in high-income countries, while leaving vast portions of the global population living below minimum decent living standards (Akizu-Gardoki et al., 2020; Arto et al., 2016; Fanning and Raworth, 2025; O'Neill et al., 2018; Wiedmann et al., 2020).

In the post-growth perspective, the ultimate objective of the economy is to fulfil needs and to achieve well-being. While basic human needs are finite and satiable, defining what *basic needs* are and how they can be fulfilled through satisfiers is a challenging task, due to the important role of culture and context (Brand-Correa et al., 2020; Brand-Correa and Steinberger, 2017; Gough, 2020; Tamberg et al., 2026). Needs are modelled through these satisfiers and activity levels, for example m^2 of dwellings and pas·km of transport. This pillar focuses on lifestyles and service consumption at the average individual level or showing the inequalities of consumption with per capita indicators.

2.4 GDP reduction

A reduction of the provisioning of goods and services can lead to a decline or slowdown in GDP, especially in the Global North. While post-growth does not seek GDP reduction as a goal, it does recognise this is a possible consequence of a planned downscalling of ecologically and socially destructive economic activity. Unlike green growth proponents, post-growth researchers tend to have a sceptical approach to the possibility of fast and global absolute decoupling of emissions, energy and exergy from GDP (Aramendia et al., 2021; Haberl et al., 2020; Hickel and Kallis, 2020; Jackson, 2019; Kovacic et al., 2018; Wiedenhofer et al., 2020). These material, carbon and energy intensities per value added in monetary terms are not only an academic debate for decoupling and the possibility of green growth. They are also used broadly as parameters for calculating biophysical demands and impacts in IAMs, which lack a comprehensive material representation

(Aramendia et al., 2026, 2023; Pauliuk et al., 2017). Therefore, they are key assumptions in many scenarios.

In the following sections and for the scenario analysis, we label this category as "GDP reduction" for the sake of simplicity, but we consider approaches that include steady-state GDP per capita, and GDP reduction only in Global North countries. While is a large diversity of approaches towards GDP reduction in post-growth, the scenario literature is dominated by growth-oriented studies, most notable example being the Shared Socioeconomic Pathways (Buhaug and Vestby, 2019; Dellink et al., 2017) and scenarios represented in the scenario database for the IPCC AR6 Working Group (WG) III assessment (IPCC, 2022).

2.5 Reorganization of the economy

Post-growth calls for reorganising the economy towards a sustainable provisioning for human needs. These structural changes affect institutions, infrastructure and other macro-level systems. Without this reorganization of the economy, a decrease in consumption would possibly mean a decrease in wellbeing. Post-growth scholars propose policy mechanisms and transformation of the monetary economy to tackle the possible challenges of GDP degrowth, to transform provisioning systems in order to allow a global decrease in consumption of resources while ensuring livelihoods and universal fulfilment of needs, decreasing inequality and respecting planetary boundaries (Figure 1).

Structural change is an enabling condition for a transition to a lower-demand ways of living. Daily life is greatly pre-defined by the built environment, institutions and societal rhythms (Akenji and Chen, 2016; Jungell-Michelsson and Heikkurinen, 2022; Lage, 2022; Røpke, 2009). Moreover, the current individualization trend with more people living alone usually requires increasing resources. Sharing and economies of scale can help reduce consumption (Ivanova and Büchs, 2023; Pérez-Sánchez et al., 2022; Yates, 2018). Radical reductions in consumption and increase in equality can only be achieved through system-scale transformations of infrastructure and institutions, such as universal basic services, from communal housing or co-housing to ecovillages, and commoning (Bohnenberger, 2020; Büchs, 2021a; Daly, 2017).

A deep structural reorganization of the economy can also be related to the monetary flows and employment. It is necessary to ensure a well-functioning economy with a potential global or country-level GDP reduction. Growth dependency is one of the fundamental arguments of green growth scholars against post-growth proposals (Keyßer et al., 2025). Meanwhile, post-growth scholars argue that economies in high-income countries already show signs of stagnation, the monetary system is unsustainable, and that structural changes might be necessary to maintain welfare public systems and macroeconomic stability in a GDP degrowth or stagnation context (Büchs, 2021b; Corlet Walker et al., 2021; Driouich and Kallis, 2025; Jackson, 2019; Kovacic et al., 2018; Olk et al., 2023). Some paradigmatic policies for increasing inequality, tackle growth dependencies and improving daily lives are related to the redistribution of paid and unpaid work among working age population (working time reduction, job guarantee and job sharing), and redistribution of income (universal basic and care income, wealth taxes and caps) (Bohnenberger, 2022, 2020; Büchs, 2021a; Fitzpatrick et al., 2022; Kallis et al., 2025; Morrison et al., 2025), and also reorganization of care work either with professionalization in public services, a care income or by commoning care (Dengler, 2024; Dengler and Lang, 2022).

Accomplishing such structural transformations requires increasing democratisation of the economy, or even a more radical revolutionary rupture (Demaria et al., 2013; Koch, 2020; Steinberger et al., 2024). A central debate within post-growth scholarship revolves around whether incremental reforms to capitalism suffice, or if radical and systemic political shifts are required (Hofferberth, 2025; Lauer et al., 2025a; Wiedmann et al., 2020).

2.6 Equity

Justice and equity are post-growth transversal values (Buch-Hansen, 2025; Kallis et al., 2025; Sandberg et al., 2019). Here, we focus on distributional justice in terms of the allocation of resources access to goods and services, economic benefits and damages. The allocation of fair shares of consumption is complex since countries have different infrastructural capacities, historical appropriation of resources and responsibilities for ecological debts (Hickel, 2020; Hickel et al., 2022b; Hornborg and Martinez-Alier, 2016). Moreover, the issue of equity can be found across all pillars. First, there is an unequal allocation of resources for consumption and planetary boundaries (Dooley et al., 2021; Hickel, 2020; Hickel et al., 2022b). Another perspective is to ensure need satisfaction for all, which may require different activity levels depending on the context. For example, rural areas depend more on private mobility, and Global South countries may even lack roads, railways and vehicles to sustain mobility. These different contexts would generate different levels of impacts and resource consumption for meeting the same needs. Equality can also be represented in terms of income or labour hours per capita, which feature prominently in the unequal exchange literature (Chang, 2002; Godé et al., 2026; Hickel et al., 2024; Pérez-Sánchez et al., 2021; Reinert, 2008).

2.7 Technological change

Research shows that technological improvements are unlikely to accomplish mitigation goals alone (Warszawski et al., 2021). Still, technological change is necessary for tackling climate mitigation and other impacts: electrification, transformation of production processes in high-carbon industries, etc. There are many approaches to technological change in post-growth (Kerschner et al., 2018; Pansera and Lloveras, 2025). Post-growth is critical of mitigation solutions that rely on technology as the only lever for climate mitigation and other environmental and social impacts, and is risk-averse against low-maturity tech-fixes such as carbon capture and storage (Kallis et al., 2025). Degrowth literature is generally more critical on the technological solutions, arguing that innovation cannot outpace increasingly scarce resources. Instead, some researchers advocate for a low-tech economy based on local resources and a very reduced material footprint (Alexander and Yacoumis, 2018; Mocca, 2020).

3 Methods

In this review, we aim to explore quantitative scenarios that are relevant for post-growth scholars including those not self-defining as post-growth. We performed a systematic literature review searching through Scopus, applying inclusion criteria and conducting backward and forward snowballing. We primarily searched through Scopus using the search string in Table 1 in July 2025. We limited the subject areas to Environmental Science, Energy, Social Sciences, "Economics, Econometrics and Finance" and Multidisciplinary. We complemented this search with recently published literature reviews on this topic (Andreou et al., 2022; Lauer et al., 2025a; Wiedenhofer et al., 2024) and snowballing.

3.1 Inclusion criteria

We applied the following inclusion criteria to the papers in the database search:

- Are quantitative analyses and define themselves as post-growth or degrowth, or include concepts and assumptions that fit the framework (see supplementary materials for more details).
- Include some kind of environmental dimension (GHG emissions, energy, land use, etc.).
- Have an economy-wide national/global scope.
- Are written in English.
- Are published in peer-reviewed scientific journals between January 2010 and July 2025.

Table 1 Search string

Sub-string A: methodologies	TITLE-ABS-KEY (("integrated assessment model" OR "life cycle assessment" OR "macroeconomic model" OR "input-output analysis" OR "EEIO" OR "MRIO" OR "econometric" OR "energy-environment model" OR "climate-economy model" OR "system dynamics" OR "energy system model" OR "stock-flow consistent model" OR "scenario" OR "pathway" OR "storylines" OR "agent-based model" OR "general equilibrium" OR "MuSIASEM" OR "Material Flow Analysis") AND
Sub-string B: concepts and	("post-growth" OR "post-growth" OR "post growth" OR "degrowth" OR "de-growth" OR "decent living standards" OR "decent living" OR " sufficiency" OR "doughnut

labels related to post-growth	economics" OR "wellbeing without growth" OR "well-being without growth" OR "good life for all" OR "good life" OR "beyond growth" OR "steady-state economics" OR "prosperity without growth" OR "sustainable and inclusive wellbeing" OR "low energy demand" OR "sustainable prosperity" OR "human need satisfaction" OR "human needs satisfaction" OR "inequality reduction" OR "redistribution" OR "consumption corridors" OR "production corridors" OR "redistributive scenario" OR "working time reduction" OR "universal basic income" OR "job guarantee" OR "care income" OR "demand side strategies" OR "demand side solutions" OR "lifestyle change" OR "lifestyle changes" OR "biophysical limits" OR "EROI" OR "limits to growth" OR "peak oil" OR "resource constraints") AND
Sub-string C: impacts	("climate mitigation" OR "biodiversity" OR "energy" OR "sustainability" OR "planetary boundaries" OR "GHG emissions" OR "greenhouse gas emissions" OR "carbon emissions" or "CO2 emissions" OR "Land use" OR "materials") AND
Other	AND PUBYEAR > 2010 AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "re")) AND (LIMIT-TO (LANGUAGE , "English"))

3.2 Article selection

Our search query in Scopus in July 2025 produced a list of 1155 articles. In the initial filtering stage, we screened these articles for relevance on the basis of the title, abstract and keywords. After conducting the initial filtering, we passed the 161 remaining for the subsequent detailed review. In the next step we made a thorough full-text revision where we analysed more in detail the scope and assumptions according to our inclusion criteria (see supplementary materials). From this systematic review, we included 39 articles in our definitive list.

To ensure inclusion of a broad variety of concepts and approaches that explore sustainable outcomes through social change we complemented our literature search with literature lists from previous reviews (Andreou et al., 2022; Lauer et al., 2025a; Wiedenhofer et al., 2024) and snowballing. The number of articles selected from those existing reviews is shown in Table 2. The first step consisted in making a first selection from their supplementary material scenario lists based on regional and sectoral scope (passed first screening). Afterwards, we made a more in-depth assessment of the papers, reading the whole manuscript and supplementary materials ("Added to the final list"). Recovered from these existing reviews, we added 7 papers to our final list. Table 2 also presents the number of articles in each existing review that is present in this paper (some papers might be already in the Scopus search). For example, only 18 post-growth or degrowth studies reviewed by Lauer et al. (2025a) are considered here, as our scope is limited to economy-wide assessments and they include sectoral scenarios and scenarios other than peer-reviewed papers.

We further extended the literature list with 14 articles that we were previously aware of but were not on our filtered list, and also found through snowballing. The final list encompasses 60 articles that pass the post-growth sieve (Table 2) and can be consulted in the Supplementary Material.

Table 2 Number of papers included in each step of the paper selection process by source including the final list

Reference	Publication years reviewed	Labels	Existing literature review	First Search	Passed first screening	Added to final list	In our list
Our search (2025)	2010-2025	Degrowth, post-growth and concepts that could be within the umbrella definition		1156	161	39	
Lauer et al. (2025a)	2000-2023	De-growth and post-growth modelling studies	75		23	4	18
Wiedenhofer et al. (2024)	Before September 2023	High service provisioning with lower energy and material demand / demand-side changes	77		8	2	6
Andreou et al. (2022)	2007-2022	Lifestyle changes	96		10	1	4
Snowballing and previously known to the authors						14	
Total articles						60	

4 Results

4.1 Bibliographical analysis

4.1.1 Time distribution

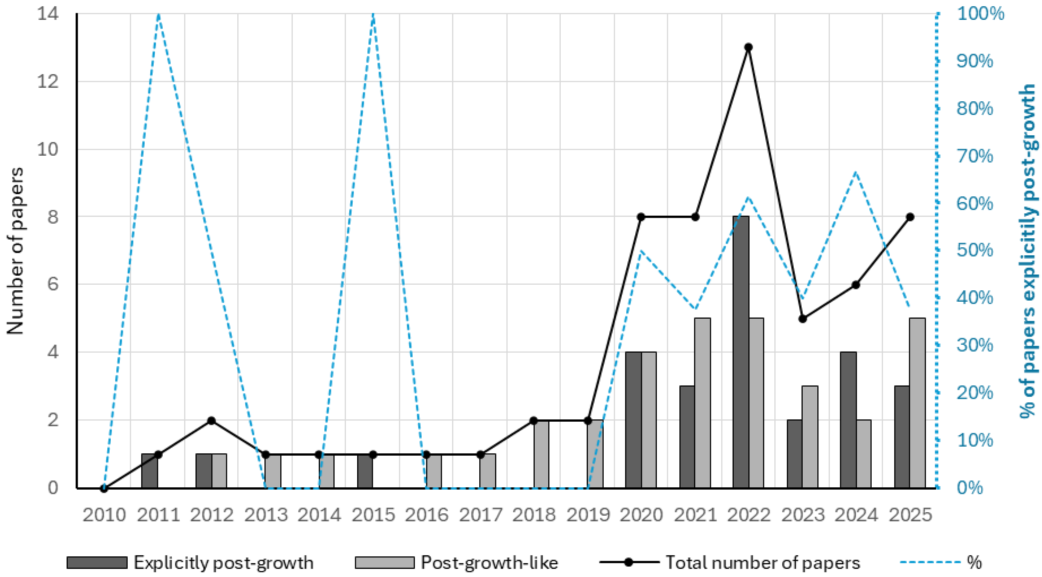

Figure 2 Publishing of post-growth articles over time and the share of those articles that explicitly define themselves as post-growth. Note: the systematic search was conducted in July 2025, and thus 2025 only includes about half of the year.

Our sample consists of 60 papers, of which 27 are explicitly post-growth (45%), published between January 2010 and July 2025. Most of these scenarios have been published only recently, with 80% of papers published after 2019 (Figure 2). Only up to 2 papers per year have been published up until 2019. Year 2020 marks a turning point, with the same number of articles (8) published as the 6 previous years together. 2022 was the year when most articles were published, both in terms of the whole selection of literature (13), and the Explicitly post-growth (8). We don't find a continuous growth of publications, since 2023 and 2024 dropped to less than half the yearly articles in 2022. However, if the pace of publication in 2025 continued as in its first half, 2025 would be the year with most papers in the time series.

4.2 Regional scope

The most common regional scope of the selection of papers is global (30) followed by specific Global North countries (21) and the EU (6), which sum 27 papers (Figure 3). Within Global North countries, we find Sweden and UK 3 times, Germany, Australia, Canada and Denmark 2 times. Only 3 papers had scenarios for Global South countries, and all were Explicitly Post-Growth.

	Number of papers		
	TOTAL	Explicitly post-growth	
Global	30	12	40%
EU	6	1	17%
Global North country	21	11	52%
Global South country	3	3	100%

Figure 3 Regional scope of scenarios and number and percentage of Explicitly Post-growth

4.3 Storylines and justification narratives for cultural and political changes

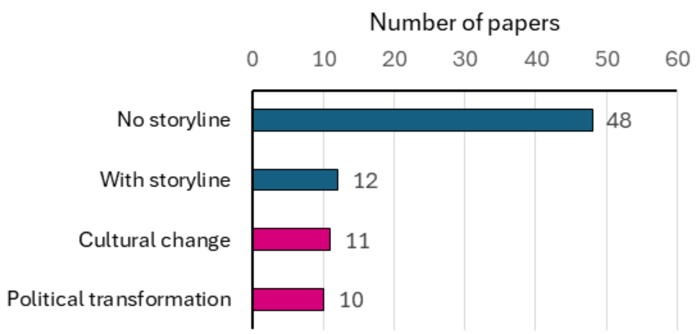

Figure 4 Prevalence of storylines and justifications for cultural and political change in the scenarios

Quantification of scenarios is inherently limited by the constrained scope and capacities of models to represent reality and most importantly, uncertain future conditions and trends. Many key aspects of wellbeing and sustainability, for example meaningful relationships and autonomy, cannot be modelled. Narrative elements in a story-and-simulation approach can provide a broader and a more illustrative vision of futures compared to quantitative values in the scenario alone (Alcamo, 2008), and they also help in communicating with broader audiences and even across disciplines. However, in most of the reviewed articles, scenarios take the "what if" perspective by assuming policies and consumption levels and "feeding" them as inputs to the model, without providing scenario storylines (48 papers) (Figure 4).

Only 12 articles include storylines envisioning post-growth/-like futures. A table summarising some key factors such as GDP trends, urban-rural relationships, and international trade is presented in the Supplementary Materials. The most complete and diverse are four beyond growth scenarios in Sweden with different levels of urbanization and technology, working hours, power of businesses, government and society, etc. (Fauré et al., 2019; Skånberg and Svenfelt, 2022; Svenfelt et al., 2019). Lallana et al. (2021) contrasts low-tech, rural and local degrowth with a scenario of high-tech post-growth green new deal. Similarly, Veerkamp et al. (2020) explores biodiversity futures through narratives in Priess et al. (2018), focusing more on the urban-rural divide and the technological level in the agricultural sector. Soergel et al. (2024) and Weindl et al. (2024) present the scenario Resilient Communities with local organization and regional diversity. They establish post-growth in the Global North, which they define as convergence to stable GDP/cap.

Cultural and political transformations are considered as a core condition for lifestyle changes and post-growth (Akenji and Chen, 2016; Krpan et al., 2025b; Meadows, 1999; Shove et al., 2012; Warszawski et al., 2021). These major breaks from historical trends are associated with high feasibility challenges. None of the articles we assessed explicitly model the socio-political and cultural processes driving change. Instead, exogenous assumptions like radical consumption changes are contextualised by narratives of cultural change and increased awareness in society in 11 articles, or a more systemic political change in 10 articles.[2]

Narratives of transformative change tend to be unspecific and the range of analysed scenarios barely scratches the surface of the complexity found in the literature on post-growth and degrowth storylines, particularly in terms of political and institutional change (Costanza, 2000; Eversberg and Schmelzer, 2018; Fitzpatrick et al., 2025; Lauer et al., 2025c; Svenfelt et al., 2019). For example, an anarchist model built around highly local, rural economies bears little resemblance to a high-tech, urban social-democratic state with an expansive welfare system. Despite the challenges in modelling cultural change, political transformations have effects in the material aspects provisioning systems that can be currently modelled, such as broader access to public services or different degrees of trade and reliance on local resources (Büchs, 2021a; Corlet Walker et al., 2022).

4.4 Pillars

In this section, we analyse which post-growth pillars are represented in the scenarios. All papers have included at least two pillars and the most frequent values is 4 pillars (30% of the articles) (Figure 5). Only one article encompasses all 7 post-growth pillars. It is important to note, however, that the inclusion of a pillar does not necessarily entail comprehensive coverage of all its dimensions and mechanisms. The following

[2] Examples of storylines for cultural and political change are:

> *"in this scenario, where the intrinsic motivation of European consumers, employees and firms is assumed to induce an all-embracing transition towards a sufficiency-oriented EU27-economy [...]" (Distelkamp & Meyer, 2019, p. 97)*
>
> *"The sharp rise in environmental and climate awareness among the population is leading to (i) energy-sufficient lifestyles (with emphasis on mobility and housing behaviour), and (ii) a high level of social acceptance for the mix of policy measures required to implement the energy transition." (Schmidt et al., 2025, p. 7)*
>
> *"There is extensive literature on the process of reorganizing the economy towards a degrowth-oriented system through democratic and participatory institutions. We assume this a priori in this article and instead focus on the implications of such a transformation for the food and land system" (Bodirsky et al., 2022)*

subsections provide a more detailed analysis of each pillar, considering specific mechanisms and exogenous assumptions found in the analysed scenarios.

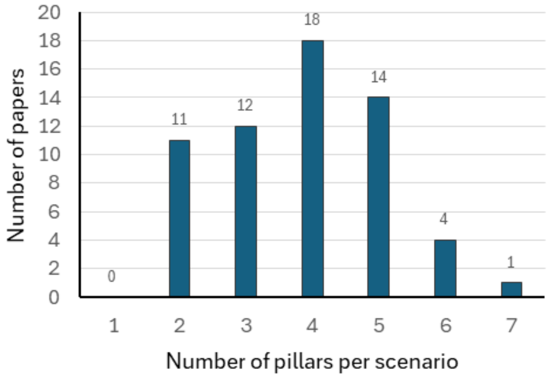

Figure 5 Number of pillars addressed by each scenario

	Number of papers					
	TOTAL		Explicitly post-growth		Post-growth-like	
TOTAL	60		27		33	
Biophysical limits	41	68%	17	63%	24	73%
Low consumption	37	62%	15	56%	22	67%
Activity levels	28	47%	5	19%	23	70%
GDP reduction	24	40%	20	74%	4	12%
Reorganization of the economy	23	38%	16	59%	7	21%
Equity	32	53%	14	52%	18	55%
Technological change	46	77%	21	78%	25	76%

Figure 6 Number of papers addressing each post-growth pillar, divided by explicitly post-growth and post-growth-like. Percentages are in relation to the total number in each column.

Figure 6 shows the number of articles addressing each of the 7 post-growth pillars divided by post-growth and post-growth-like. The most represented pillar is Technological change (78%), while Reorganization of the economy is the least represented (35%).

		Modelling approaches						
		process-based LCA	IOT	MFA	IAM	system dynamics	stock-flow consistent	Total papers
	TOTAL	9	20	3	17	15	6	60
		15%	33%	5%	28%	25%	10%	
	Time series	3	14	3	14	13	6	49
		33%	70%	100%	82%	87%	100%	82%
post-growth	Explicitly post-growth	0	8	2	8	9	6	27
	Post-growth-like	9	12	1	9	6	0	33
	Explicitly post-growth	0%	40%	67%	47%	60%	100%	45%
	Post-growth-like	100%	60%	33%	53%	40%	0%	55%
	Explicitly post-growth	0%	30%	7%	30%	33%	22%	
	Post-growth-like	27%	36%	3%	27%	18%	0%	
pillars	Biophysical limits	4	11	3	17	11	1	41
	Consumption	7	13	3	11	10	1	37
	Activity levels	9	11	3	8	1	0	28
	GDP reduction	0	7	2	10	8	4	24
	Reorganization of the economy	0	8	1	6	7	5	23
	Equity	8	10	3	6	5	3	32
	Technological change	8	14	3	16	12	5	46
	TOTAL	11	39	9	44	36	11	125
	Biophysical limits	44%	55%	100%	100%	73%	17%	68%
	Consumption	78%	65%	100%	65%	67%	17%	62%
	Activity levels	100%	55%	100%	47%	7%	0%	47%
	GDP reduction	0%	35%	67%	59%	53%	67%	40%
	Reorganization of the economy	0%	40%	33%	35%	47%	83%	38%
	Equity	89%	50%	100%	35%	33%	50%	53%
	Technological change	89%	70%	100%	94%	80%	83%	77%
	Biophysical limits	10%	27%	7%	41%	27%	2%	
	Consumption	19%	35%	8%	30%	27%	3%	
	Activity levels	32%	39%	11%	29%	4%	0%	
	GDP reduction	0%	29%	8%	42%	33%	17%	
	Reorganization of the economy	0%	35%	4%	26%	30%	22%	
	Equity	25%	31%	9%	19%	16%	9%	
	Technological change	17%	30%	7%	35%	26%	11%	

Figure 7 Relationships between post-growth pillars and modelling approaches

	Biophysical limits	Low consumption	Activity levels	GDP reduction	Reorganization of the economy	Equity	Technological change
Biophysical limits	**41**	26	19	16	12	23	32
Low consumption	26	**37**	21	13	10	22	30
Activity levels	19	21	**28**	5	6	17	25
GDP reduction	16	13	5	**24**	15	11	19
Reorganization of the economy	12	10	6	15	**23**	13	17
Equity	23	22	17	11	13	**30**	24
Technological change	32	30	25	19	17	24	**46**

Figure 8 Combination of pillars found in scenarios

4.4.1 Biophysical limits

For the Biophysical limits pillar, we found more Post-growth-like scenarios (24 papers and 73%) than Explicitly post-growth (17 and 63%) (Figure 6). Of the 41 articles considering Biophysical limits, five use the concepts of a socio-economic collapse or recession. These studies do not consider possible adaptations of the economy and lifestyles in response to these impacts or scarcity.

Many of the analysed articles do not feature biophysical limits because: (i) they only assess final energy or materials and not the GHG emissions, primary energy, or other planetary boundaries (Kikstra et al., 2021; Lallana et al., 2021; Millward-Hopkins et al., 2020; Vélez-Henao and Pauliuk, 2023) (ii) they do not take the perspective of a limited Greenhouse Gas (GHG) budget, but rather model climate mitigation in terms of relative reduction of emissions or a year to reach net-zero emissions (Costa et al., 2021; D'Alessandro et al., 2020; Jackson and Victor, 2011, 2020).

4.4.1.1 Mechanisms and assumptions

Figure 9 shows the more specific mechanisms and assumptions in scenarios across the Biophysical limits dimension. The most common mechanism is GHG budgets (25 papers) represented in 61% of the papers within this pillar. GHG budgets are applied in three distinct ways: (i) 6 articles use a GHG budget as a feasibility control of the scenario quantifications, (ii) 15 articles include a GHG budget constraint as part of the model which affecting the scenario results, and (iii) 4 articles distribute the stipulated global GHG budget among countries, making different assumptions regarding fair shares, depending on historical responsibility and capabilities (Dekker et al., 2025; Fanning and Hickel, 2023; van den Berg et al., 2020; Williges et al., 2022).

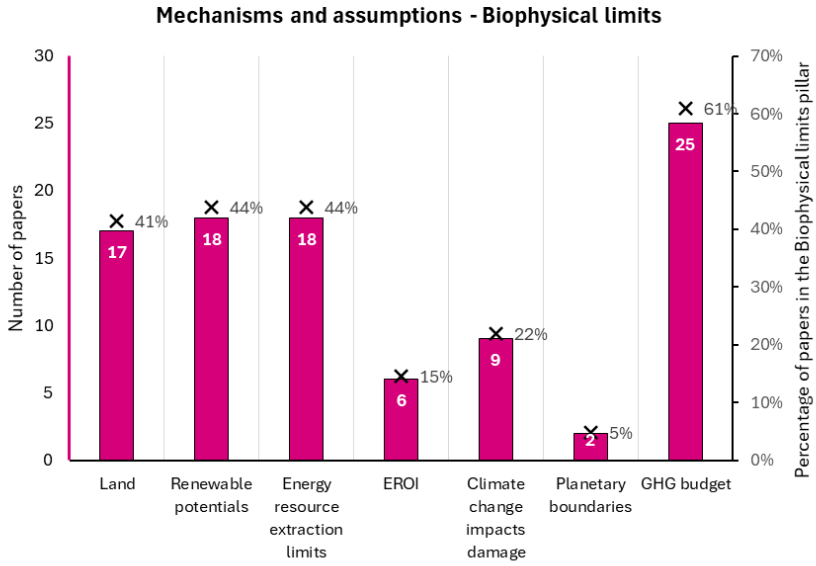

Figure 9 Mechanisms and assumptions for the Biophysical limits pillar

Other limits such as renewable potentials (18), energy resource extraction limits (18) and land (17) were also thoroughly included. For some papers, the energy resource extraction potentials were the main topic of analysis and assumptions of the scenarios. Therefore, they focused on the uncertainty of these geological estimates and how these biophysical limits can constrain economic growth (Capellán-Pérez et al., 2015; Espinoza et al., 2022a, 2022b; Mediavilla et al., 2013; Nieto et al., 2020b, 2020a). In other articles, this kind of assumptions are not fully transparent nor directly accessible, and have to be traced back to the original methods publications.

Six models represented in the analysed studies include the Energy Return on Energy Invested (EROI) as a mechanism of scarcity.

4.4.1.2 Modelling approaches

All of the studies using Integrated Assessment Models (IAMs) include Biophysical limits. Moreover, the IAMs are the modelling approach with most examples of Biophysical limits across all the methodologies considered, as41% of the articles with Biophysical limits were based on IAM methodology. IAMs integrate different dimensions of socio-ecological systems such as the economy, energy and land and estimate scenarios constrained by a stipulated GHG budget as an exogenous condition. Climate impacts are partially represented in some IAMs, but these assumptions tend to be heuristic with high uncertainty and limited coverage of impacts (López-Muñoz et al., 2025; Nikas et al., 2019; Pauliuk et al., 2017).

The system dynamics models included biophysical limits in 11 out of 15 articles (73%). We highlight the implementation of limits by WoLim and MEDEAS. WoLim, while not integrating the biophysical limits in the same model, it does check whether the desired demand can be met with estimated resource extraction limits (Capellán-Pérez et al., 2014; Mediavilla et al., 2013). MEDEAS, an advanced evolution of WoLim, directly integrates limits for energy resources for both renewable and non-renewable energy, modelling the negative feedback of supply-side energy scarcity on the GDP (Capellán-Pérez et al., 2020; Nieto et al., 2020b, 2020a). This is contrary to most IAMs, where the GDP trajectory is stipulated exogenously. Assessment of biophysical limits typically involves conducting of sensitivity runs with different assumptions of resource availability, to account for uncertainty. In these scenarios, we can see how an exogenous expected GDP growth rate is limited by reserves and EROI.

Another example of the use of GHG budgets as feasibility checks are static exercises of biophysical limits use Life Cycle Assessment (LCA) of decent living standards or IOT assessments of good life impacts (4 papers). This is the *ex-post* tool which is also used for the only 2 papers where all planetary boundaries are considered (Kromand et al., 2025; Schlesier et al., 2024). They calculate impacts from "what if" scenarios of consumption requirements for a good life and then evaluate whether a good life for all is compatible with the planetary boundaries under a "per capita" allocation or GHG emissions.

4.4.2 Low consumption

This pillar is defined by the inclusion of a global decrease in final energy or material use (MJ and kg). These are aggregate indicators of consumption that not specific with respect to activities or final services (pillar Activity levels). 37 articles include scenarios with decreasing consumption (62%), making it the third most often addressed pillar, with the post-growth-like scenarios having an even higher representation (67%). And it is in fact in post-growth-like scenarios where we find the largest decreases in final energy use [SM], where Decent Living Standards analyses show a floor of minimum consumption for meeting basic human needs. Of the 37 articles showing a decrease in consumption of final energy and/or materials, eight have it as an exogenous assumption either as a mere input of MJ or as sectoral decreases in energy consumption.

4.4.2.1 Modelling approaches

This pillar has been considered frequently for all the represented modelling approaches, with the exception of stock-flow consistent models. Of the 6 articles using stock-flow consistent models in our selection, only one includes final energy (Cieplinski et al., 2021). Stock-flow consistent models focus on the monetary representation, and typically only provide GHG emissions regarding the environmental dimensions.

4.4.3 Activity levels

28 of the selected articles incorporate Activity levels, representing less than half of the selected papers (47%) (Figure 6). Post-growth seeks to shifting economic priority from GDP growth to human need satisfaction, yet only 19% of the explicitly post-growth papers actually model Activity levels and needs (Figure 6). However, 70% of Post-growth-like

scenarios include this pillar. This prevalence is explained by the high number of alternative concepts to post-growth in the search string in the fields of sufficiency and lifestyle change compared to other potentially post-growth-like concepts.

4.4.3.1 Modelling approaches

Two types of modelling approaches including Activity levels stood out in our review, namely the (1) studies combining Life Cycle Assessment (LCA) alongside Input-Output Tables (IOT), and (2) IAM and energy system models.

All scenarios using LCA in our review consider activity levels for citizens in a given year. The LCA methodology is suitable for accounting of life-cycle impacts of this pillar. This is because LCA is based on biophysical reference flows such as m^2 of buildings, and passenger kilometres of different modes of transport. However, LCA databases do not integrate many services such as all kinds of office work and it is thus combined with IOT (9) in order to ensure the completeness of the system.

The studies using LCA and IOT often provide higher sectoral detail at the cost of the temporal representation. Only 67% of the articles covering the Activity levels pillar provide time-series data rather than single-year estimates, representing the lowest percentage of all pillars. These “snapshot” approaches typically a explore the effects of radical changes to consumption compared to the current average consumption in the Global North, using terms such as “sufficiency” and “decent living standards” (Huo et al., 2023; Kikstra et al., 2021; Kromand et al., 2025; Mastrucci et al., 2020; Millward-Hopkins et al., 2020; Rao et al., 2019; Schlesier et al., 2024; Vélez-Henao and Pauliuk, 2023). Only a single article that represents services by combining LCA and IOT is explicitly post-growth (McElroy and O’Neill, 2025).

IAM and energy system methodologies are the ones that have explicitly used the term “post-growth” in this pillar (4 times). However, references to post-growth in this literature is recent, with the first study including Activity levels published in 2022, and the rest in 2025 (3). This turn toward post-growth is not merely terminological, as it reflects a shift toward more radical lifestyle-change assumptions in the latest IAM scenarios.

4.4.3.2 Relationship to other pillars

The lifestyle changes and sufficiency literature acknowledge the role of infrastructure together with attitude, which includes culture, interactions and personal awareness and know-how (Akenji and Chen, 2016; Lage, 2022). However, only 5 of the 28 papers within the category Activity levels have some representation of structural changes (Figure 8), and these changes are not necessarily directly related to a different type and level of Services. This lack of representation is happening in terms of the economic structure associated with “sufficient and sustainable consumption”, the country infrastructure stocks, and the policies required to reach the sufficiency objectives.

4.4.4 GDP reduction

A total of 24 articles assume a decreasing or steady-state GDP per-capita at least in the Global North, which represents 40% of the entire scenario set (Figure 6 and Figure 10). It is important to highlight the large differences between the explicitly post-growth scenarios, 74% of which fall into this category, and Post-growth-like scenarios where only 12% of the scenarios fall into this category.

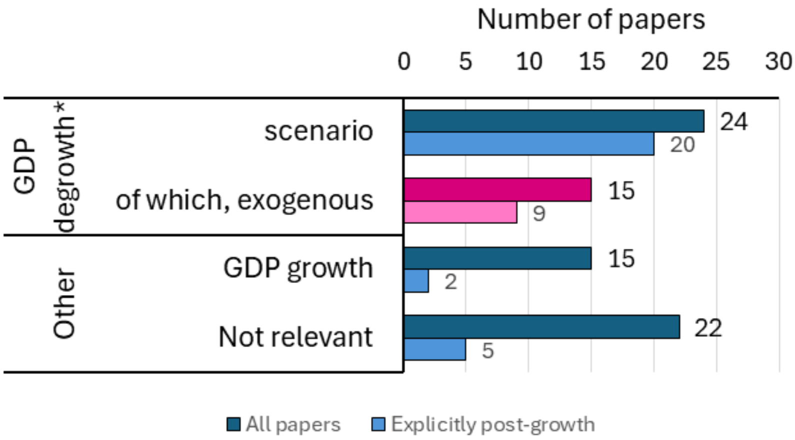

*Figure 10 The number of scenarios that assume GDP reduction, growth, or make no mention of GDP in the reviewed list of scenarios. * By GDP reduction, we define all of the scenarios that assume steady-state or negative per-capita GDP in the Global North, or beyond.*

4.4.4.1 Assumptions

From the 24 of GDP-degrowth studies, 15 of them define GDP exogenously in complex models such as IAM or energy system models (Bauer and Sterner, 2025; Moyer, 2023; Soergel et al., 2024; Veerkamp et al., 2020) or in simpler exercises calculating GHG emissions through GHG emissions intensities and GDP trends to evaluate the effectiveness of decoupling (Keyßer and Lenzen, 2021; Priewe, 2022). The remaining 9 articles model GDP as an endogenous output of the model. In those articles, this reduction occurs as a result of resource scarcity (e.g. Capellán-Pérez et al., 2020; Nieto et al., 2020), or a decrease in expenditures and lower propensity to consume, or government expenditure (D'Alessandro et al., 2020; Distelkamp and Meyer, 2019; Kikstra et al., 2024; Li et al., 2023; Victor, 2012). Yet resource scarcity does not always lead to GDP decline in all scenarios.

Within this category, we also find approaches that explicitly conflate degrowth with recession (Andrés et al., 2024; Priewe, 2022), omitting economic adaptations that seek to counter the negative implications of this kind of downscaling.

Figure 10We identify 15 studies (24.5%) assuming continuous GDP growth (Figure 9), most of them originating from the SSP framework. Two Explicitly post-growth scenarios include GDP growth (and one of them is for a Global South country) (Cieplinski et al., 2021; Espinoza et al., 2022b). GDP growth is combined with downscaling in energy consumption in 10 articles, thus assuming major energy-GDP decoupling. The feasibility of these scenarios has been questioned, in the light of the dependency of economic activity on available final energy (Fiorito, 2013; Keyßer and Lenzen, 2021; Scott et al., 2022; Slameršak et al., 2024).

In the remaining 16 articles, GDP is not explicitly mentioned, most notably in the case of LCA studies, where the monetary dimension is not represented. However, while not referring to GDP-degrowth, several articles do assume substantial reductions in household income or expenditures, which would likely entail a decrease in GDP (Bodirsky et al., 2022; McElroy and O'Neill, 2025).

4.4.5 Deep structural reorganization of the economy

We have included in the Reorganization of the economy pillar actions that range of from post-growth transformative policies to direct changes of the economic structure, institutions and physical stocks, or system changes beyond the current capitalist system. We identify 21 articles within this category, which is the lowest number among the four pillars (35%). One of the main differences between Explicitly-Post-Growth and Post-Growth-Like scenarios is that the explicit scenarios incorporate these dimensions much more frequently (56% of all the articles), than the Post-Growth-Like scenarios (18%).

4.4.5.1 Mechanisms and assumptions

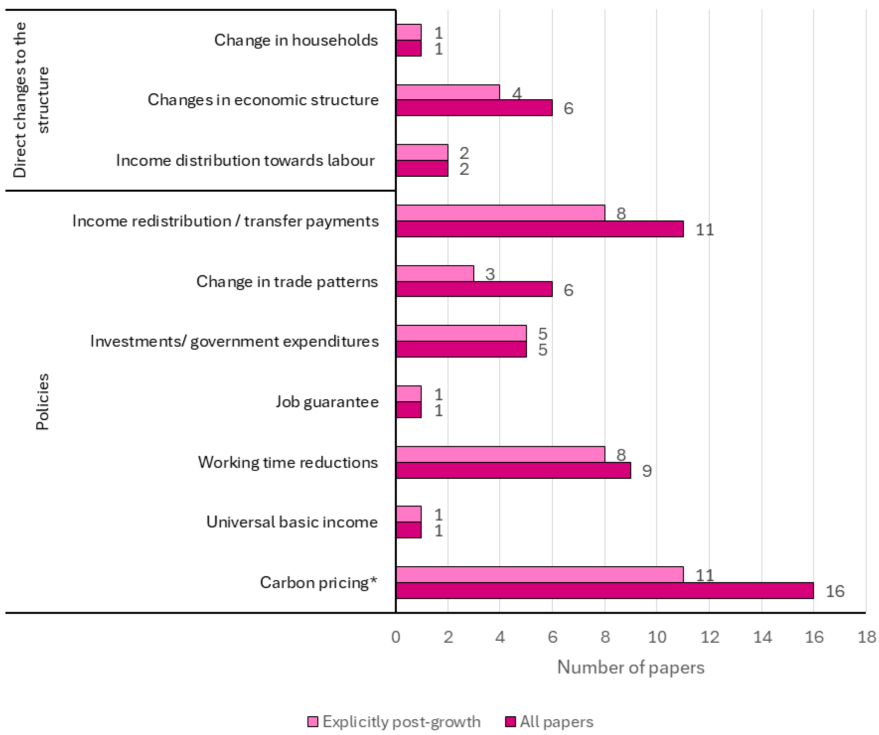

Figure 11 Mechanisms and assumptions in the set of modelling studies for Deep structural reorganization of the economy. Note that Carbon pricing in itself is not considered as a post-growth policy.

Typical mechanisms for Reorganization of the economy refer to specific policies, notable examples being the policies of income redistribution (in 11 articles) and working time reduction (in 9 papers). Other distinguishing post-growth policies however were very seldomly represented, with the job guarantee and universal basic income featuring in only one single article. Several post-growth strategies, including universal care income, redistribution of paid and unpaid work, decommodification, universal basic services haven't been represented in any of the analysed studies.

We find carbon pricing is the most frequently modelled policy (16). However, we do not consider it to be a post-growth mechanism, unless it is implemented in combination with redistribution measures. We include it in the figure for comparison purposes, given its prominence in the mainstream scenario literature (Ellenbeck & Lilliestam, 2019; Söderholm et al., 2011).

Six articles have modelled structural change through a transformation of the economic structure, which in many cases is made via direct changes to the technical coefficient matrix (A) of input-output tables or in changes in hours worked per sector. These studies change the structure on the basis of what-if assumptions, and do not specify the interventions for achieving such changes. Only Lallana et al. (2021) and Distelkamp and Meyer (2019) show the final sectoral organisation of the economy in terms of labour and value added. Six papers assume a decrease in international trade. While some articles assume major systemic changes such as "transcending capitalism" in their narratives, they do not model their impacts on the economic structure.

Reorganization of the economy has focused so far on policies and a direct change in the economic structure. Therefore, the existing changes in institutions and structures for have been overlooked for households and material structures. In one paper, there is a simple assessment of the effect of increasing household sizes in GHG footprints (Ivanova and Büchs, 2022). There is a lack of exploration of other changes in the domestic life. Regarding material structures, only three articles include Material Flow Analysis through which the evolution and possible transformation of building stocks could be tracked (Barrett et al., 2022; Soergel et al., 2024; Weindl et al., 2024). This integration of IAMs and energy system with industrial ecology tools was claimed by Pauliuk et al. (2017) and, in this review, we can already see the first integrations. Still, MFA methodology has been mostly used for sectoral assessments (Wiedenhofer et al., 2024), which are out of the scope of this review.

4.4.6 Equity

More equitable outcomes are reported in 32 articles, and cover a similar share between Explicitly Post-Growth (53%) and Post-Growth Like studies (55%). Inequity is most often considered through income at the international or national level among countries or regions and doesn't address more specific intersectional aspects: gender, race, etc.

Approximately half of the reviewed articles (28) do not explicitly address equity. Some of these studies have a global or regional scale without breaking down consumption or income per regions or across the population distribution, by for example using Gini coefficients. In other cases, although equity is not directly considered, we could expect some level of international convergence because these studies have a Global North scope and they assume degrowth of resource use, which implicitly would narrow disparities.

4.4.6.1 Mechanisms and assumptions

More equitable outcomes have been pursued through different strategies, which are acting within the rest of pillars (Figure 12). Fair allocation of budgets of national or per-capita GHG emissions that are used in fourteen of the reviewed studies, are the most common mechanism to assess equity in our set of scenarios. These GHG budgets are based on the mechanisms already presented for Biophysical limits pillar (section 4.4.1), although not all the GHG budgets integrate the equity dimensions.

We can find that the fair allocation of GHG budgets has been estimated using two different approaches. First, the most straightforward equal per capita distributions have been used when assessing the feasibility of LCA and IOT-based impact accounting, or when included within IAMs and energy system models as a constraint, except in the study by Barrett et al. (2022), which takes a stronger equity perspective. Other distributions of GHG budgets incorporate responsibility historical emissions or the ability to pay for carbon mitigation or a decent life. Studies considering these more elaborated and more stringent equity perspective are stand-alone and don't address the implications for the socio-economic system. These articles are typically only classified into the pillars "biophysical limits" and "equity" and don't use the label "post-growth". In several of the alternative equity criteria for the allocation of the remaining GHG budgets, countries in the Global North have negative budgets (Dekker et al., 2025; Hickel et al., 2022b; van den Berg et al., 2020; Williges et al., 2022).

Eight articles use GDP or income to explore scenarios of full global convergence or substantially reduced income disparities through redistribution, income caps or/and floors (Bruckner et al., 2022; Millward-Hopkins, 2022; Millward-Hopkins and Johnson, 2023; Tian et al., 2024).

Five articles model equity exogenously through pre-assumed income and energy Gini trajectories. We also find other mechanisms, including the convergence of Energy consumption (4), Service levels (5), or through other biophysical limits (typically planetary boundaries).

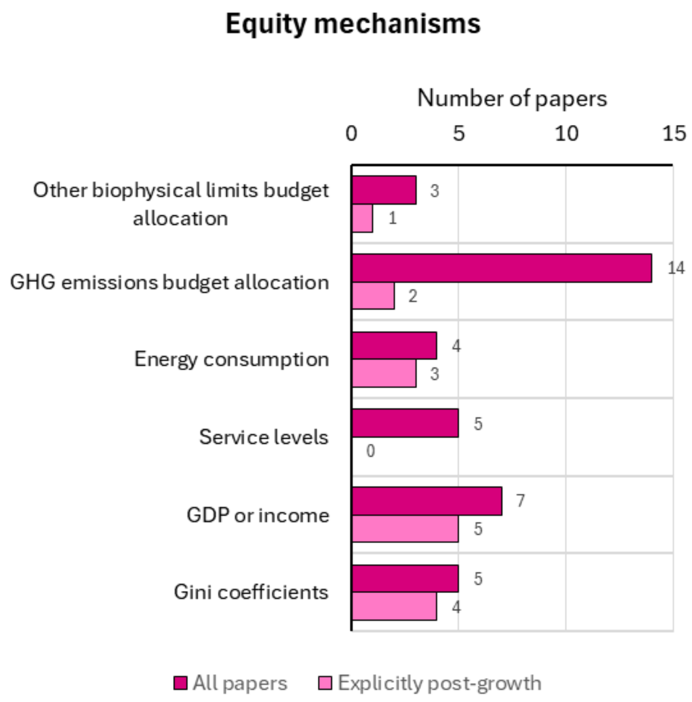

Figure 12 Mechanisms for Equity

4.4.7 Technological change

The most represented pillar is Technological change which features in 78% of the reviewed studies. In many studies technological change is represented via simplistic assumptions with regards to improvements in energy or carbon intensities of GDP. The few studies that do not include technological change explore scenarios of fair partitioning of the GHG budgets, equitable redistribution of income with current emission factors of sectors, or sufficiency-oriented consumption with the current technologies. Low-tech futures which are associated with some degrowth approaches (Kerschner et al., 2018), are underrepresented.

A systematic analysis of the feasibility of technological change and bottom-up parameters in models is out of the scope of this review due to the large diversity of sectors and potential detail. Nevertheless, through our analysis of methods for the article siege and posterior classification in pillars, we can point out the need for more detailed sectoral analysis of assumptions in models. While there is a lot of attention in the literature on large-scale decoupling of GDP to GHG emissions and other resources and impacts, there is large diversity in the bottom-up assumptions and mechanisms that can also generate an overcoming of limits. For example, the LED scenario has a narrative of a grand restoration and technological innovation in the agricultural sector, which, is quantifiably represented by the assumption of doubling agricultural yields in 2100 compared to 2010 (Grubler et al., 2018). Thus, the major agricultural productivity improvements are instrumental to overcome land scarcity. Other scenarios have more a complex modelling for the land sector. Mediavilla et al. (2025) uses a land-use module based on system dynamics for estimating yields, with four different typologies (traditional, industrial, low-input, regenerative and transition) and factoring in the climate change impacts and soil degradation.

5 Discussion and conclusions

Although modelling studies in line with post-growth date back to the Limits to growth report and the 1kW per capita scenario (Goldemberg et al., 1985; Meadows et al., 1972), the modelling of post-growth scenarios has only truly emerged in recent years. Most of the studies analysed in our review do not explicitly define themselves as post-growth but have overlaps with post-growth characteristics. We have analysed and reviewed 60 economy-wide scenarios within post-growth or related concepts through a framework with seven main pillars: (1) Biophysical limits, (2) Low consumption, (3) Activity levels, (4) GDP reduction, (5) Reorganization of the economy, (6) Equity and (7) Technological change.

Fewer than one third of the assessed studies address more than four of the seven post-growth pillars, indicating a limited degree of holistic integration across key post-growth elements. Yet there is a lack of representation of structural changes in terms of institutions, infrastructure and transformative policies, which is consistent with the general difficulties in modelling for representing deep transformations that break with historical trends, for which it is difficult to estimate parameters and dynamics. Only one paper has represented all pillars, but not to the broadest sense.

Such incomplete integration of post-growth dimensions is understandable, given the relative novelty of post-growth modelling and the intrinsic limitations of modelling. Some modelling architectures still have green growth assumptions at their core. In general, models have a specific scope, power, limitations and values (Meadows and Robinson, 1985; Saltelli et al., 2020; Sgouridis et al., 2022). For example, stock-flow consistent models have a detailed representation of monetary aspects while making a streamlined estimation of GHG emissions based on emission intensities per value added. For a detailed description of the scope of different model typologies, see Wiedenhofer et al. (2024). Meanwhile, recent research has advanced towards the integration of different modelling approaches, for example combining Material Flow Analysis with the well-established Integrated Assessment Models. Even while we can still complexify models to integrate more detail and mechanisms, we can also try to learn from the results from each scenario in order to understand the limits and potentials. In general, representing the whole of the economy in a single model is impossible, since models are by definition a simplification of reality. Each model typology tended to consider some dimensions and pillars more than others. IAMs were only used in 27% of the reviewed post-growth/-like scenarios, confirming the need to extend the methodological scope in IPCC scenario databases which currently is based on IAM requirements, in order to ensure representativeness of a broader scope of possible futures (Cointe, 2024; Gambhir et al., 2022).

Extending the literature search to scenarios which do not use explicitly the term post-growth but consider relevant terms such as sufficiency with post-growth aligned assumptions helps filling some gaps that have been less often considered in post-growth scenarios, such as the representation of Activity levels. Another large difference between Explicitly Post-Growth and Post-Growth-Like scenarios is the inclusion of GDP reduction. In some cases, Post-Growth-Like scenarios don't address the monetary side of the economy but in others, they combine large decreases of final energy and GHG emissions with GDP growth.

We have also found that post-growth-related terms have been used sometimes interchangeably, such as sufficiency and lifestyle changes. We flag out the need for a **conceptual clarification** of this universe of terms stemming from beyond technology social transformations towards sustainability in order to understand their differences and overlaps.

5.1 Storylines and diversity of post-growth futures

Only one fifth of the assessed studies feature a **storyline**, as most scenarios remain hypothetical what-if exercises with a set of assumptions without a complete narrative. Storylines help in communicating and synthesizing scenarios, and allow the inclusion of factors that are difficult to model such as cultural and political changes. The few storylines that we found only outline general characteristics of political changes. While politics and institutions are fundamental drivers of change for provisioning systems and resource consumption, there is the challenge of modelling social dynamics that generate political and cultural change. Despite these barriers, some political decisions have fundamental effect on provisioning systems and whole systems that could be modelled and are still underresearched, for example, degrowth proposals for more localized and rural economies.

The range of conceivable post-growth futures is broad. However, in many cases, papers in our selection have a **single degrowth or post-growth scenario** that is compared to a business-as-usual or green growth scenario. Generally, they don't propose different types of post-growth. Exceptions are a couple of examples comparing post-growth and degrowth scenarios, and other papers more focused on the biophysical part that include sensitivity analyses of technology parameters, with different levels of technological innovation or resource availability.

Among the set of papers, we have found a relative diversity of different post-growth futures and narratives that we have not explored in depth and clustered due to the limited availability of storylines and the more general scope of this review. Further review work could analyse how the scope of pillars, their intensity, and different mechanisms can represent different versions of post-growth futures, from steady-state economics to the most radical degrowth futures.

This review signals the need for a formulation of more comprehensive post-growth narratives and quantifications that would capture the diversity in the post-growth literature. We need to move from singular representations of "the" post-growth pathway toward a plurality of post-growth futures, considering different institutional arrangements, welfare regimes, cultural norms, and North–South relations. Rather than treating post-growth as a homogeneous alternative to green growth, future scenario work could explicitly map trade-offs between different post-growth configurations—for example, between more localized versus globally coordinated economies, or between market-based and largely decommodified provisioning systems.

To ensure a broad inclusion of key post-growth principles from the literature, and ensure a wide coverage of conceivable scenario space, this post-growth scenario framework should ideally be a result of a joint effort from the post-growth modelling community. An example to follow could be an adaptation of Shared Socioeconomic Pathways framework (O'Neill et al., 2014), put forward by an alternative SSP1 (as proposed by Eric Kemp-Benedict) or from the SSP0 proposed by Otero et al. (2020).

5.1.1 Biophysical limits

Scenarios confirm the inequality and inefficiency of business-as-usual trends. Based on geological assumptions of recoverable resources, some scenarios with initial assumptions of green growth appear unfeasible. There are still uncertainty and debate on technical aspects of resource availability. Moreover, as other reviews have already pointed out, we need to flag that some biophysical limits such as climate impacts are underrepresented and this could further constraint the economy and the option space of feasible futures.

Most scenarios in this review address GHG emissions or energy, and some in recent years have expanded with the SDGs or the planetary boundaries. However, **biodiversity** remains underrepresented. Despite its potential, the Nature Futures framework (Durán et al., 2023; Martin et al., 2024; Okayasu et al., 2025; Pereira et al., 2020) has not been adopted in any of the scenarios, even though three papers focus on land use. The Nature Futures framework emphasizes the importance of values and ways to relate with nature, structured around three main axes: nature for nature (management intensity), nature as culture (importance of culture) and nature for society (utilitarian intensity). However, it is a fully relational structure that allows for mixed perspectives.

5.1.2 Activity levels

Post-growth pathways can provide wellbeing through alternative provisioning systems that enable a radical decrease in consumption of resources. Studies in this review such as (Kromand et al., 2025; Schlesier et al., 2024) made assessments of 'decent living' consumption baskets within a sufficiency and planetary boundaries framework. In those studies, we can see how respecting planetary boundaries requires a profound transformation of lifestyles in the Global North, alongside alternative development pathways for developing countries. However, these studies assume **equal per capita distributions of GHG budgets**. If we considered alternative fair distributions of GHG emissions considering historical responsibility, the challenge becomes larger for Global North countries. Also, they don't specify alternative social organizations or a whole systems perspective, only a decrease in activity levels in the Global North and increase for low consumers. Therefore, we need **detailed assessments of alternative provisioning systems and development pathways** which increase sharing and economies of scale such as universal basic services in order to ensure needs fulfilment.

All **methodological approaches come with inherent limitations and specific scopes**. For example, Life Cycle Assessment is an adequate approach for capturing the biophysical flow requirements of production processes, but lacks the capacity of representing monetary flows, which is the strength of stock-flow consistent models. We find that the assessment of Activity levels and Reorganization of the economy are the post-growth pillars least considered in common in scenarios. Activity levels are typically considered through LCA and IOT. Despite the need to have a debate and participation to define needs and their satisfiers, we see that even the current studies, which decrease significantly consumption compared to current Global North averages, could have problems to respect planetary boundaries. These studies also lack representation of the monetary flows and employment implications, and the whole system-scale provisioning systems that could allow wellbeing with lower consumption and of the transitions. Also, we see how Activity levels have been more typically assessed through conceptual frameworks such as decent living standards, sufficiency and lifestyle changes instead of post-growth.

5.1.3 GDP reduction

GDP reduction as a reductionist typical misunderstanding of degrowth and post-growth. Exogenous GDP trajectories are typical and a central driver in IAMs, and therefore the simplified version to adapt models to degrowth is to introduce exogenous negative GDP trajectories, sometimes combined with other tweaks such as changing utility functions. While GDP reductions are a likely outcome for non-essential sectors and activities in high-income countries and among wealthier social groups, reducing aggregate GDP has never been an objective in itself. Some of the works that focus their scenarios on biophysical limits and GDP degrowth have used the terms **"collapse" or "recession",** but they haven't considered any structural transformation of the economy. This shows the importance of the combination of the post-growth elements and the need to avoid the oversimplified understanding of degrowth as simply a GDP reduction.

We found some papers that drop sharply energy consumption through lifestyle changes but keep GDP growth (using typically SSP2) and therefore **assume large decoupling rates**. Energy is vital for the functioning of society. Therefore, we question whether a high value added and large economic activity is compatible with a very low energy demand. In this sense, we flag the need for feasibility benchmarks and assessments of energy intensities as in Keyßer and Lenzen (2021). The review of post-growth climate mitigation scenarios by Edwards et al. (2025) analyses more in-depth the relationship between energy and economy and proposes the integration of exergy in models as a way to represent more clearly energy efficiency and rebound effects.

5.1.4 Reorganization of the economy

On the contrary, Reorganization of the economy has been the least included pillar and mostly only through policies in stock-flow consistent models. Implications of several post-growth policies in are yet to be assessed in quantitative models, including the universal basic care, universal basic income, or decommodification. Post-growth policies are highly transformative and aim to change people’s lives and culture. Currently, models change the size of flows, but it is difficult to represent or estimate the mid-term deeper structural changes, derived from cultural change or third-order effects of policy.

Working time reduction in the market economy is one of the central post-growth policies that has been most often modelled in our set of scenarios. More empirical and modelling research is needed for exploring the synergies and trade-offs of these proposals. Researchers should more explicitly state their assumptions of technological change, which can also overcome the time use limit by increasing labour productivity, and is tightly linked also to the economic structure and the technical context (Bohnenberger, 2022; Gomez-Baggethun, 2022b; Hardt et al., 2020; Jackson, 2019; Kallis, 2013; Mair et al., 2020; Sorman and Giampietro, 2013) . To assess equity implications, time-reductions must be assessed from the lens of unequal exchange. The Global North imports significant amounts of embodied labour time from the Global South, resulting in labour footprints that nearly double the actual working hours performed locally, while Global South workers have larger working hours (Hickel et al., 2024; Hornborg, 2003; Hornborg and Martinez-Alier, 2016; Pérez-Sánchez et al., 2021; Sakai et al., 2017).

It is lacking the modelization of profound transformations and regime shifts, such as changing institutions, culture, infrastructure and the mechanisms for allocation of resources. The methodological challenges for m**odelling deep structural change and regime shifts are** common to all types of modelling, including business as usual pathways (Ciarli and Savona, 2019; Köhler et al., 2017) but even more relevant for post-growth since it expects more radical transformations and a full reorganization of the economy.

While sufficiency and lifestyle change oriented models represent deep changes in the consumption structure and volume, they do not explain how this was achieved (e.g. via universal basic services) and what infrastructural changes are required in the provisioning systems. Moreover, the models that are based on statistical relationships and calibrated on the current socio-economic systems, are inherently incapable of modelling deep transformations which are associated with structural brakes from the historical trends. Transformative mechanisms are commonly represented exogenously. The lack of endogenous dynamics and large reliance on exogenous inputs is similar to what van den Berg et al. (2019) found in their review of lifestyle changes in IAMs.

The relatively small consideration of structural strategies and effects of deep transformation of the economy has made us collect all kinds of strategies under the same pillar. However, future assessments of post-growth scenarios could expand this category to differentiate between different aspects of system change such as institutions, global north/global south relationships, households, etc.

5.1.5 Equity

Equity is a very complex matter. Income as an equity dimension (either through GDP or income per capita, income Gini coefficients) has been a relatively frequent mechanism for introducing equity in models. The focus in many post-growth frameworks has been in energy consumption (Edwards et al., 2025; Kikstra et al., 2024). However, the same income and energy may provide different service levels depending to the geographical context (existence of infrastructure, rural/urban differences, climate) and the personal conditions (disabilities, dependent persons, household unit typology). Also, post-growth pursues decommodification with measures such as Universal Basic Services, where monetary purchasing power does not play a role anymore. Apart from including historical responsibility, the focus should be shifted from GHG budgets and income to ensuring needs fulfilment for all equitably.

5.1.6 Technological change

While there is some literature on technological change and innovation in degrowth, literature explicitly reflecting on post-growth tech futures is lacking. What we find in the few storylines of Explicitly post-growth scenarios are trends more in line with the business as usual. A detailed analysis of all technological change assumptions embedded in existing models lies beyond the scope of this paper. Nevertheless, we highlight the need for a systematic assessment of these assumptions in order to distinguish between different post-growth visions and to evaluate their feasibility.

Biophysical limits such as land use, primary energy availability and GHG budgets can be overcome by not only large decoupling rates, as it is already widely debated in the literature, but also through **bottom-up sectoral parameters** such as productivity and yield improvements. We have not assessed systematically these values in detail but through the exploration of methods for the classification of scenarios we have found potential “decoupling” through techno-optimistic bottom-up parameters. However, technical potentials of further efficiency improvements and substitutability are biophysically and thermodynamically constrained (Allwood, 2018; Cullen and Allwood, 2010; Georgescu-Roegen, 1979; Gutowski et al., 2013). We flag the need for more detailed feasibility and sensitivity assessments of technological parameters that are limited by biophysical limits and nature laws and that require specific sectoral expertise. Currently, feasibility assessment frameworks used in the IPCC are high-level, including analyses of biomass and wind potentials at the global level, or CO_2 emission reductions over a decade (Brutschin et al., 2021; IPCC, 2023). Bottom-up parameters such as production factors and agricultural yields can be evaluated in technical terms (Saltelli and Lo Piano, 2018, 2017), unlike abstract and high-scale parameters such as carbon intensity which are generally compared to historical trends. While this exercise was beyond the scope of the present review, we can nonetheless highlight the research potential of detailed feasibility assessments of sectoral parameters in models both for ensuring the quality of post-growth pathways and checking the feasibility of green growth scenarios.

5.2 Blind spots

Within this representation gap, we flag the need for more analysis of **Global South countries, unequal exchange dynamics** and potential strategies to delinking. Existing studies have mostly addressed converging distribution of GHG budgets, consumption, income and service levels (through the “Equity” pillar). They haven’t assessed directly the structural issue of net resource transfers from Global South to Global North (time, materials, etc.) (Hickel et al., 2024, 2022a; Hornborg, 2009; Hornborg and Martinez-Alier, 2016; Pérez-Sánchez et al., 2021). They have also overlooked the mechanisms how to reach them or the implications in the economic system (i.e. the structural changes): the role of debt, potential financial and employment challenges due to a decrease of consumption in the North (Gräbner-Radkowitsch and Strunk, 2023; Leoni, 2024), ecological reparations (Schmelzer and Nowshin, 2023) as well as ensuring equitable access to infrastructure (Fisch-Romito, 2021; Streeck et al., 2025; Watari et al., 2021).

We find a gap in representing households beyond their expenditures or consumption. This hinders the exploration of highly transformative strategies such as alternative domestic arrangements and household units, collective housing and food provisioning, and the redistribution of activities among unpaid and public work (both in the direction of converting paid work into unpaid more amateur activities with lower labour productivity (Nørgård, 2013), and professionalization of care activities). These domestic aspects have implications in institutions, materials and buildings, energy and time use (Hayden, 1984, 1981, 1978; Pérez-Sánchez et al., 2022; Puigjaner, 2014).

This lack of representation of households is related to the lack of representation of the full social reproduction and activities out of the monetary sphere. Time use could be considered as a biophysical limit and allows the accounting the whole economy, including subsistence production, leisure and the paid and unpaid care economy (Aslaksen et al., 1996; Beneria, 1992; Folbre, 2006; Gershuny et al., 2019; Wagman and Folbre, 1996). The inclusion of time use would make it possible to explore different futures of care within existing or alternative welfare regimes that release pressure on carers, increases time wealth and allows household arrangements beyond the nuclear family. Finally, time use goes beyond care activities. Current time pressures and the acceleration of life are a key issue for wellbeing, have a connection to resource use, impacts and unequal exchange (Druckman et al., 2012; Jalas and Juntunen, 2015; Klein et al., 2021; Pérez-Sánchez et al., 2022; Wiedenhofer et al., 2018).

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7 List of papers

Title	Journal	Reference
Productivity and work in the 'green economy': Some theoretical reflections and empirical tests	*Environmental innovation and societal transitions*	(Jackson and Victor, 2011)
Growth, degrowth and climate change: A scenario analysis	*Ecological Economics*	(Victor, 2012)
Global energy modelling — A biophysical approach (GEMBA) Part 2: Methodology	*Ecological Economics*	(Dale et al., 2012)
The transition towards renewable energies: physical limits and temporal conditions	*Energy Policy*	(Mediavilla et al., 2013)
Fossil fuel depletion and socio-economic scenarios: An integrated approach	*Energy*	(Capellán-Pérez et al., 2014)
More growth? An unfeasible option to overcome critical energy constraints and climate change	*Sustainability Science*	(Capellán-Pérez et al., 2015)
Exploring the implications of lifestyle change in 2 °C mitigation scenarios using the IMAGE integrated assessment model	*Technological Forecasting and Social Change*	
The potential of behavioural change for climate change mitigation: a case study for the European Union	*Mitigation and Adaptation Strategies for Global Change*	(van de Ven et al., 2018)
Pursuing necessary reductions in embedded GHG emissions of developed nations: Will efficiency improvements and changes in consumption get us there?	*Global Environmental Change*	(Bjørn et al., 2018)
A low energy demand scenario for meeting the 1.5°C target and sustainable development goals without negative emission technologies	*Nature Energy*	(Grubler et al., 2018)
Four low-carbon futures for a Swedish society beyond GDP growth	*Journal of Cleaner Production*	(Fauré et al., 2019)
Pathways to a Resource-Efficient and Low-Carbon Europe	*Ecological Economics*	(Distelkamp and Meyer, 2019)
Providing decent living with minimum energy: A global scenario	*Global Environmental Change*	(Millward-Hopkins et al., 2020)
Future projections of biodiversity and ecosystem services in Europe with two integrated assessment models	*Regional Environmental Change*	(Veerkamp et al., 2020)
The transition to a sustainable prosperity-a stock-flow-consistent ecological macroeconomic model for Canada	*Ecological economics*	(Jackson and Victor, 2020)
Feasible alternatives to green growth	*Nature sustainability*	(D'Alessandro et al., 2020)
Macroeconomic modelling under energy constraints: Global low carbon transition scenarios	*Energy Policy*	(Nieto et al., 2020b)
An ecological macroeconomics model: The energy transition in the EU	*Energy Policy*	(Nieto et al., 2020a)
MEDEAS: a new modeling framework integrating global biophysical and socioeconomic constraints	*Energy & Environmental Science*	(Capellán-Pérez et al., 2020)
Implications of various effort-sharing approaches for national carbon budgets and emission pathways	*Climatic Change*	(van den Berg et al., 2020)
Decent living gaps and energy needs around the world	*Environmental Research Letters*	(Kikstra et al., 2021)
The decarbonisation of Europe powered by lifestyle changes.	*Environmental Research Letters*	(Costa et al., 2021)
Expanding the IPAT identity to quantify backcasting sustainability scenarios	*Futures and Foresight Science*	(Skånberg and Svenfelt, 2022)
Assessing energy descent scenarios for the ecological transition in Spain 2020-2030	*Sustainability mdpi*	(Lallana et al., 2021)
A sustainable development pathway for climate action within the UN 2030 Agenda.	*Nature Climate Change*	(Soergel et al., 2021)
Modeling of persistence, non-acceptance and sufficiency in long-term energy scenarios for Germany	*Energies*	(Kost et al., 2021)
1.5 C degrowth scenarios suggest the need for new mitigation pathways	*Nature Communications*	(Keyßer and Lenzen, 2021)

Title	Journal	Reference
Coupling environmental transition and social prosperity: a scenario-analysis of the Italian case	*Structural Change and Economic Dynamics*	(Cieplinski et al., 2021)
Implications of shrinking household sizes for meeting the 1.5 °C climate targets	*Ecological Economics*	(Ivanova and Büchs, 2022)
Integrating degrowth and efficiency perspectives enables an emission-neutral food system by 2100	*Nature Food*	(Bodirsky et al., 2022)
Energy demand reduction options for meeting national zero-emission targets in the United Kingdom	*Nature Energy*	(Barrett et al., 2022)
Low energy demand scenario for feasible deep decarbonisation: Whole energy systems modelling for Ireland	*Renewable and Sustainable Energy Transition*	(Gaur et al., 2022)
Narrative-driven alternative roads to achieve mid-century CO2 net neutrality in Europe	*Energy*	(Rodrigues et al., 2022)
Ecological macroeconomic assessment of meeting a carbon budget without negative emissions	*Global sustainability*	(Sers, 2022)
Growth in the ecological transition: green, zero or de-growth?	*European Journal of Economics and Economic Policies: Intervention*	(Priewe, 2022)
Assessing climate policies: an ecological stock–flow consistent perspective	*European Journal of Economics and Economic Policies*	(Dafermos and Nikolaidi, 2022)
Systems Dynamics Model of SDGs: A Case Study of Iran	*Challenges in Sustainability*	(Chapariha, 2022)
Analysis of energy future pathways for Ecuador facing the prospects of oil availability using a system dynamics model. Is degrowth inevitable?	*Energy*	(Espinoza et al., 2022a)
Energy Transition Scenarios for Fossil Fuel Rich Developing Countries under Constraints on Oil Availability: The Case of Ecuador	*Energies*	(Espinoza et al., 2022b)
Inequality can double the energy required to secure universal decent living	*Nature Communications*	(Millward-Hopkins, 2022)
Fairness critically conditions the carbon budget allocation across countries	*Global Environmental Change*	(Williges et al., 2022)
Material Requirements of Decent Living Standards	*Environmental Science and Technology*	(Vélez-Henao and Pauliuk, 2023)
Emission pathways and mitigation options for achieving consumption-based climate targets in Sweden	*Communications Earth and Environment*	(Morfeldt et al., 2023)
Integrated assessment modelling of degrowth scenarios for Australia	*Economic Systems Research*	(Li et al., 2023)
Modeling transformational policy pathways on low growth and negative growth scenarios to assess impacts on socioeconomic development and carbon emissions	*Scientific reports*	(Moyer, 2023)
Compensation for atmospheric appropriation	*Nature Sustainability*	(Fanning and Hickel, 2023)
Measuring the doughnut: a good life for all is possible within planetary boundaries	*Journal of Cleaner Production*	(Schlesier et al., 2024)
Multiple pathways towards sustainable development goals and climate targets	*Environmental Research Letters*	(Soergel et al., 2024)
Food and land system transformations under different societal perspectives on sustainable development	*Environmental Research Letters*	(Weindl et al., 2024)
The key role of sufficiency for low demand-based carbon neutrality and energy security across Europe	*Nature Communications*	(Wiese et al., 2024a)
Downscaling down under: towards degrowth in integrated assessment models	*Economic Systems Research*	(Kikstra et al., 2024)

Title	Journal	Reference
The welfare effects of degrowth as a decarbonization strategy	*Applied Economic Analysis*	(Andrés et al., 2024)
Energy requirements for securing wellbeing in Switzerland and the space for affluence and inequality	*Nature Communications*	(Millward-Hopkins et al., 2025)
The labour and resource use requirements of a good life for all	*Global Environmental Change*	(McElroy and O'Neill, 2025)
Developing sufficiency-based sharing principles for absolute environmental sustainability assessment using decent living standards and planetary boundaries	*Sustainable Production and Consumption*	(Kromand et al., 2025)
Analysis of the competition between land, energy and food using the TERRA module of WILIAM system dynamics IAM	*Renewable and Sustainable Energy Reviews*	(Mediavilla et al., 2025)
Impacts of lifestyle changes on energy demand and greenhouse gas emissions in Germany	*Renewable and Sustainable Energy Reviews*	(Bauer and Sterner, 2025)
Need for speed: Co-creating scenarios for climate neutral energy systems in Austria in 2040	*Energy Policy*	(Schmidt et al., 2025)
Navigating the black box of fair national emissions targets	*Nature Climate Change*	(Dekker et al., 2025)
The Global Renewable Energy and Sectoral Electrification (GREaSE) Model for Rapid Energy Transition Scenarios	*Energies*	(Hopeward et al., 2025)

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