

Sufficiency, Well-Being and Development within Planetary Boundaries

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Master of Science in Engineering Programme in Environmental
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Abstract:

Economic growth remains the primary focus of decision-making around the world today, with little to no room for any alternatives. One of these alternatives is the doughnut economy, a recent theory encompassing minimal social thresholds and maximum environmental impact. The purpose of the doughnut economy is ultimately to preserve the sustainable state of the earth, a project that resonates strongly with the current climate and biodiversity crisis, among others. To reach the safe operating space within the doughnut economy, this study focuses on the notion of sufficiency, a rather unpopular thought currently as it symbolizes for many a decline in quality of life and great sacrifices. Through a scoping review and interviews, this study looks at the notion of sufficiency through the lens of the doughnut economy in a holistic way to gain a general understanding of the current situation of sufficiency and its future. The study shows that not only is sufficiency ideal for the doughnut economy, it defeats the idea of sacrifice and demonstrates that sufficiency can be linked to well-being for both individuals and the planet.

Preface

Context

This fourth semester Master's thesis was completed by Antoine Brisson as part of the Master of Science in Engineering Programme in Environmental Management and Sustainability Science (EMSS) at Aalborg University.

Reading instructions

It is recommended to read the thesis in chronological order, as this allows the reader to better understand the decisions made in the report. The thesis follows the Harvard method for referencing sources (author name, year).

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Abbreviations

EIB: European Investment Bank

EU: European Union

GDP: Gross Domestic Product

IPCC: Intergovernmental Panel on Climate Change

OECD: Organization for Economic Cooperation and Development

PB: Planetary Boundaries

SDG: Sustainable Development Goal

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Introduction

1.1 Opening remarks

July 29 is the date that marks the 2021 Earth Overshoot Day, the day in the year when humanity has consumed as many resources and ecological services as the planet can regenerate in that same year ([Global Footprint Network n.d.](#)). According to the same source, the year 2020, affected by the COVID-19 pandemic, saw its Earth Overshoot Day postponed to August 22. This phenomenon results from the decrease in human activity and the slowdown of our globalized economy ([World Bank 2022](#)). Nevertheless, due to the increasing pressure exerted by humanity on Earth, the overshoot follows a tendency to occur earlier than the previous year and has been doing so since 1970 ([Santor *et al.* 2020](#)). Exceptionally, as with the COVID-19 pandemic, some events in the past had an impact on global economical flows and are consistent with the few temporary push-backs of the Earth Overshoot Day. These events include the two oil crises of 1973 and 1979 and the financial crisis of 2008. Each of them contributed to the postponement of the Earth Overshoot Day, not for simple financial reasons such as the variation in oil prices, but rather due to their significant impact on the global economy, temporarily halting the rapid expansion of the world ([Jancovici and Blain 2021](#)).

This rapidly expanding world is established based on economic growth, which has been the dominant feature of the human socio-economic system since the industrial revolution, to the point of being "culturally, politically and institutionally ingrained" ([Strand *et al.* 2021](#)). Parallel to the growth dogma put forward by accountable actors, research such as that of [Smulders *et al.* \(2015\)](#) suggest links between environmental degradation on the one hand and sources of growth (i.e., investments in GDP growth) on the other. In response to the threats of a "business as usual" continuity, green growth (or sustainable, resilient, etc.) has become an adaptation of growth to climate change and ecological collapse by assuming a long-term structural growth compatible with the ecology of our planet ([Hickel and Kallis 2020](#); [Jancovici and Blain 2021](#)). More precisely, green growth is based on the assumption of absolute decoupling of GDP growth from resource use and carbon emissions ([Hickel and Kallis 2020](#)). However, according to [Smulders *et al.* \(2015\)](#), environmental quality can only improve if resource use is below its natural regeneration point; beyond that, it appears impossible to maintain an increasing supply of resources without eventually exhausting them. This view is further reinforced by [Strand *et al.* \(2021\)](#), who argue that, on a global scale, growth has not been decoupled from resource consumption and environmental pressures and is unlikely to do so. Thus, by considering planetary boundaries, the limits of growth may have already been acknowledged, and the question of a contradiction between economic growth and sustainability arises ([Meadows *et al.* 2004](#); [Heikkurinen *et al.* 2019](#)).

Planetary boundaries provide a more detailed understanding of the Earth Overshoot Day and what it supposes. Based on the [Stockholm Resilience Centre \(n.d.\)](#), they are a set of nine quantitative boundaries defining the safe operating space in which humanity can sustain its development and prosperity. If these boundaries were to be crossed, the risk of generating abrupt or irreversible large-scale environmental changes would significantly increase. Therefore, with currently six planetary boundaries crossed, the urgent need for action to preserve the sustainable state of Earth has been recognized ([Steffen et al. 2015b](#); [Wang-Erlandsson et al. 2022](#)). However, as [Steffen et al. \(2015b\)](#) mentioned, planetary boundaries are a scientific endeavor and in no way provide a roadmap for addressing these threats. In an attempt to propose a roadmap for change in our current economic system, these planetary boundaries have been further explored by [Raworth \(2017a\)](#) by encompassing humanity's overall environmental, social, and economic footprint, resulting in Doughnut Economics.

Doughnut Economics advocates utilizing options for joint development and prosperity within a respected ecological ceiling (i.e., a safe operating space) coupled with social foundations ([Raworth 2017a](#)). One of these options is the essence of green growth advocates, namely efficiency through innovative, clean, and cost-effective technologies ([Smulders et al. 2015](#)). However, it will also inevitably require a rethinking of consumption to decouple prosperity and development from economic growth, a vision fundamentally different from solely consuming sustainable products and services ([Hickel and Kallis 2020](#); [Santor et al. 2020](#)). This way, two complementary options exist, efficiency and sufficiency, the latter implying a decrease in production and consumption depending on one's position ([Heikkurinen et al. 2019](#)). Nevertheless, sufficiency as a dominant trait poses an obstacle to green growth and the global economy, making its pursuit difficult due to the shifts it imposes on the dominant productivist economy ([Jungell-Michelsson and Heikkurinen 2022](#)).

The productivist economy, however, is faced with an unforeseen event, the war in Ukraine. Now, the EU seeks to end its reliance on Russian fossil fuels, as the conflict highlights an economic dependency on third countries for the supply of these strategic resources ([Chernysheva et al. 2019](#); [European Commission 2022](#)). Energy being the fundamental element of transformation, the conversion of fossil fuels into mechanical energy during the industrial revolution allowed for the exponential growth of the industrial park (i.e., the number of machines in operation) ([Jancovici and Blain 2021](#)). [Jancovici and Blain \(2021\)](#) further argue that this is precisely why, for decades, the change in world GDP growth has followed the change in world oil production. Today, fossil fuels remain the central resource, powering industries and economic growth, EU included ([Jancovici 2011](#)). For this reason, the EU seeks to support its growth by diversifying its energy supply and adopting efficiency strategies ([European Commission 2022](#)). However, in addition to fueling industrial growth and ensuring the operability of global value chains, the presence of fossil fuels in our daily lives, including in the needs of the ecological transition, is largely underestimated ([Dittmar 2013](#)). Although substitutes exist, such as the use of electricity for

mobility or biomass for plastics, [Jancovici \(2022\)](#) highlights the uneven balance of scale between current consumption and substitution possibilities and, therefore, suggests that some of that consumption may not be replaced. [Jancovici \(2022\)](#) further foresees that the result may either involve poverty or sobriety, depending on how this outcome is managed. Therefore, a competing idea to growth through a "frugal generation" driven by sufficiency is gaining momentum using a combination of behavioral, organizational, and technological innovations. As presented by the French Environment and Energy Agency, this vision calls for significant changes in all areas of society, affecting all aspects of life, so as not to depend on large-scale technological innovations that remain untested and uncertain ([ADEME 2022](#)). In the case of France, this includes a significant reduction in the demand for mobility (-26% of total kilometers traveled), a less meaty diet (divided by three), a transformation of consumer behavior, a relocalization of production, robust and repairable low-tech products, a sanctuary for nature, etc.

1.2 Scope of study

If planetary boundaries are aimed to be respected, and humanity is to live in the safe operating space, several options must be considered. These can be identified by the IPAT equation presented in Figure 1.1 below, which serves as the basis for defining the scope of study. The IPAT equation is a mathematical identity whose purpose is to represent what increases or decreases the environmental impacts on various subjects such as the economy, products, services, etc. ([Massachusetts Institute of Technology n.d.](#)).

$$I = P \times A \times T$$

Figure 1.1: Breakdown of the IPAT equation ([Massachusetts Institute of Technology n.d.](#))

The IPAT equation can be explained as follows:

1. Environmental impact (I)
2. Population (P) = The size of a chosen population
3. Goods & Services/Person (Affluence, A) = The level of consumption of that population
4. Impact/Goods & Services (Technology, T) = The efficiency of the used technologies

The three factors - Population, Affluence, and Technology - are not independent of each other but, on the contrary, interact ([Hickel and Kallis 2020](#)). An example of their interactions can be the Jevons paradox presented in Figure 1.2 below. If only Technology (T) progresses (efficiency), such as the success of ambitious decarbonization plans (same energy output at a lower cost), a rebound effect may eventually take place and lead to a growth in consumption (A) ([Sorrell et al. 2018](#); [Kurz 2019](#)).

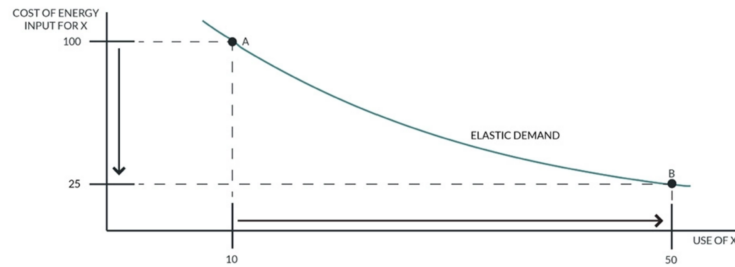


Figure 1.2: The Jevons paradox (Semke 2016)

In other words, the more efficiently an economy uses resources, the more it grows and the more resources it consumes, resulting in growth "consuming" efficiency (Kurz 2019; Hickel and Kallis 2020). So while efficiency is crucial, it appears relevant to develop all options as a whole (P, A, and T) given their interactions to avoid scenarios such as the Jevons paradox. Naturally, these three options can be prioritized where they will have the most impact, although without minimizing the other two. In this regard, along with efficiency, meeting planetary boundaries will require a reduction in production and consumption in already developed countries, as well as a shift away from the growth-oriented development agenda in the South (Hickel and Kallis 2020). The decrease in world population (P) could, according to the IPAT equation, also contribute to a decrease in impact (I). While this option is not an essential variable in developed countries, it may be in the South, where population growth is exponential (Meadows *et al.* 2004; Kurz 2019). Therefore, in a growth-oriented economy that emphasizes efficiency, this study aims to highlight sufficiency, the marginalized option. Here, sufficiency is defined as a practice of self-limitation of consumption and production directed at all stakeholders, including policy-makers, in recognition of ecological constraints and without a perceived sacrifice of well-being due to the consideration of minimum social thresholds, all to disengaging society from the prevalence of growth.

Furthermore, the research will maintain a global perspective and not be limited to the developed world. While sufficiency is most relevant for already developed countries, the need for the South to move away from a growth-oriented agenda, as indicated by Hickel and Kallis (2020), will require an entirely new economic thinking. Thus, this study argues in favor of sufficiency as a relevant mindset, both in the North and in the South, to structure a new development model. The purpose is to allow a return to the safe operating space of our planetary boundaries, which will require action by all countries, regardless of their level of development. To this end, an analysis through the lens of the doughnut economy was chosen for three reasons. First, the doughnut economy incorporates planetary boundaries as defined by the Stockholm Resilience Centre (n.d.) and used as the environmental indicators in this study. Second, it encompasses societies in a post-growth state of mind, thus echoing the arguments made in this thesis. Third, it has been downscaled to be applicable at different levels, notably at the level of states or local territories (cities, regions, etc.), whether they are developed or developing, thereby allowing for practical insights.

Conceptual review and problem analysis

2.1 Growth, our dominant feature

2.1.1 Understanding the exponential function

As mentioned earlier in Section 1.1 by [Strand et al. \(2021\)](#), growth is a dominant feature of the human socio-economic system. In our system, growth tends to follow the exponential pattern. Exponential growth, or to double every time, according to [Meadows et al. \(2004\)](#), is a phenomenon producing large numbers very quickly, in contrast to linear growth, as shown in Figure 2.1 below.

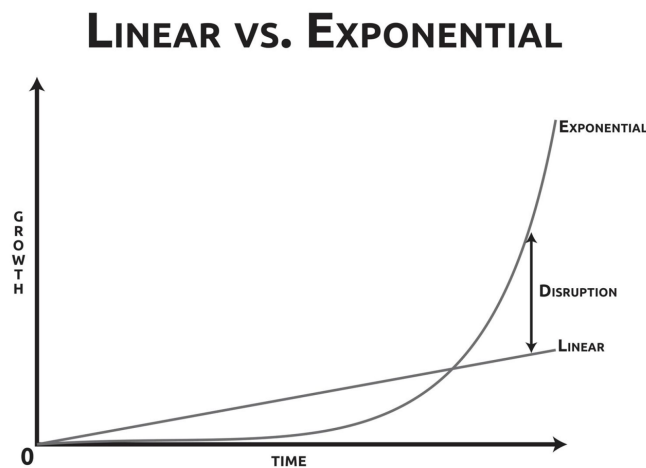


Figure 2.1: Linear vs. exponential growth ([Leonhard 2015](#))

Linear growth is an increase in quantity independent of the quantity already accumulated. In contrast, exponential growth increases quantity proportional to the already existing capital. According to [Martenson \(n.d.\)](#), exponential growth dominates and defines humanity and its relationship to its economy and all other resources. Despite its ever-present nature, [Martenson \(n.d.\)](#) quotes Dr. Albert Bartlett, who stated that "The greatest shortcoming of the human race is our inability to understand the exponential function." Therefore, understanding the implications of exponential growth is a necessary step to effectively anticipating and proactively preparing for the future. [Meadows et al. \(2004\)](#) identified two different types of exponential growth. First is self-generated growth, such as population or industrial capital. Humans give birth to other humans while machines and factories produce what is needed for more machines and factories. Second, derived growth, such as resource use or environmental damage, is the consequence of another growth. In both Figures 2.2 and 2.3 below, one can see the "great acceleration" of self-generated and derived growth developing exponentially at the same time around the 1950s ([Meadows et al. 2004](#); [Steffen et al. 2015a](#)).

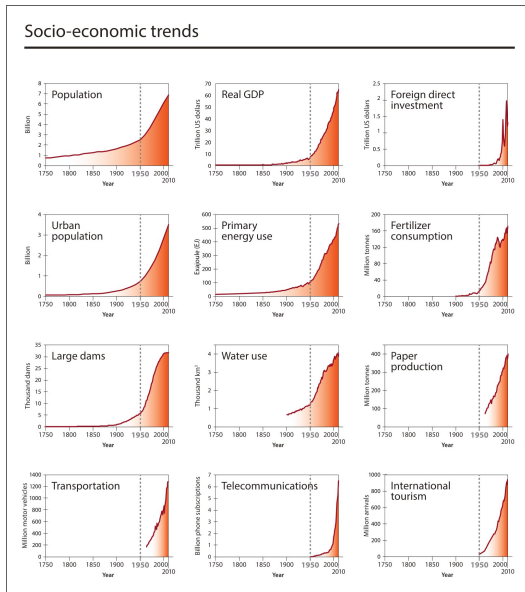


Figure 2.2: Growth of socio-economic trends (Steffen *et al.* 2015a)

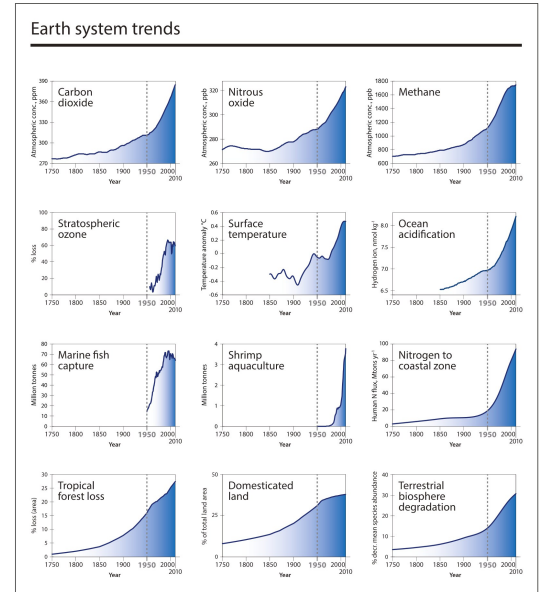


Figure 2.3: Growth of Earth system trends (Steffen *et al.* 2015a)

Based on Meadows *et al.* (2004), population and industry are considered the two leading exponential factors driving humanity beyond planetary boundaries.

World population: Prior to the exponential growth of the world’s population, as shown in Figure 2.4 below, the world population has stagnated without ever exceeding one billion since the first humans (United States Census Bureau 2021). After reaching one billion in 1805, 120 years were needed for the world population to reach two billion in 1925, only 35 years to reach three billion in 1960, and 14 years to reach four billion in 1974 (Our World in Data 2021).

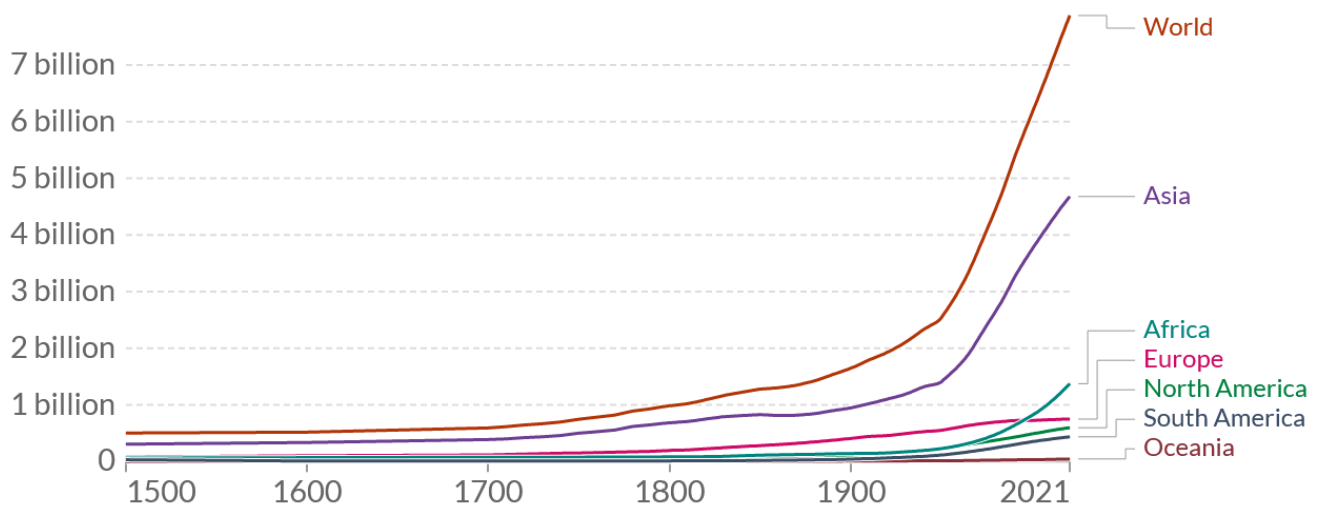


Figure 2.4: World population growth from 1500 to 2021 (Our World in Data 2021)

Despite the decline in the global birth rate per 1,000 people from 1950 onwards, as documented by the [United Nations \(n.d.\)](#), population growth, although decelerating, remains exponential. This is possible as human population growth is mainly supported by existing human capital, perfectly representing the exponential model.

Economic growth: Like population growth, the world economy began its exponential phase in the 19th century. As described by [Roser \(2013\)](#), economic growth can be represented by the GDP, representing the total output of a country or, in this case, the entire planet. This total output is the monetary value of final goods and services produced during a given period. Economic growth is primarily driven by the expansion of the physical economy (i.e., the number of machines on the planet). Indeed, although less apparent, the service economy in developed countries continues to rely on manufactured products and is in no way a form of dematerialized economy. ([Jancovici and Blain 2021](#)). It should be noted that for [Meadows et al. \(2004\)](#), the financial economy is not taken into account for the reason that it is a social invention not subject to physical laws.

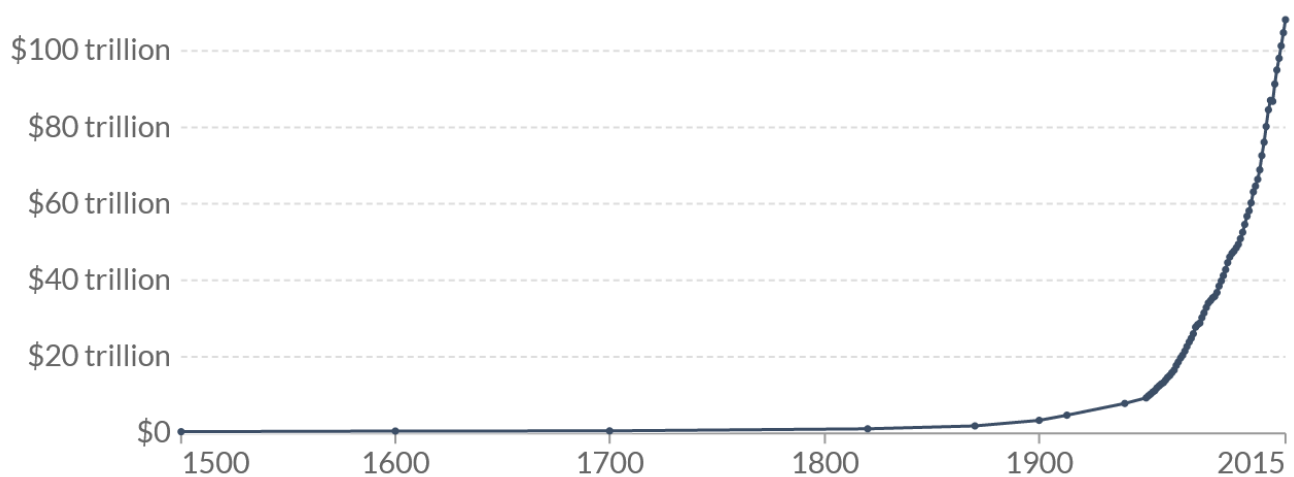


Figure 2.5: World GDP growth from 1500 to 2015 ([Our World in Data n.d.b](#))

As per [Meadows et al. \(2004\)](#), in a context of finite space and resources, the infinite doubling of the world economy faces a double constraint. First, the physical constraint of limited resource supply, and second, the environmental impacts of the economy, disrupting the sustainable state of the Earth and, by extension, the economy. These constraints were pointed out in the 1972 Club of Rome report, in which [Meadows et al. \(2004\)](#) predict that GDP growth shown in Figure 2.5 above will reach its limits in the first half of the 21st century and be followed by a "painfully dramatic decline" ([Dittmar 2013](#)).

To understand this reasoning, it may be relevant to look at the exponential growth that allowed all others in our system to occur in the first place, that is, the evolution of the annual world consumption of primary energy, as shown in the following Figure 2.6 ([Carbone4 2021](#)).

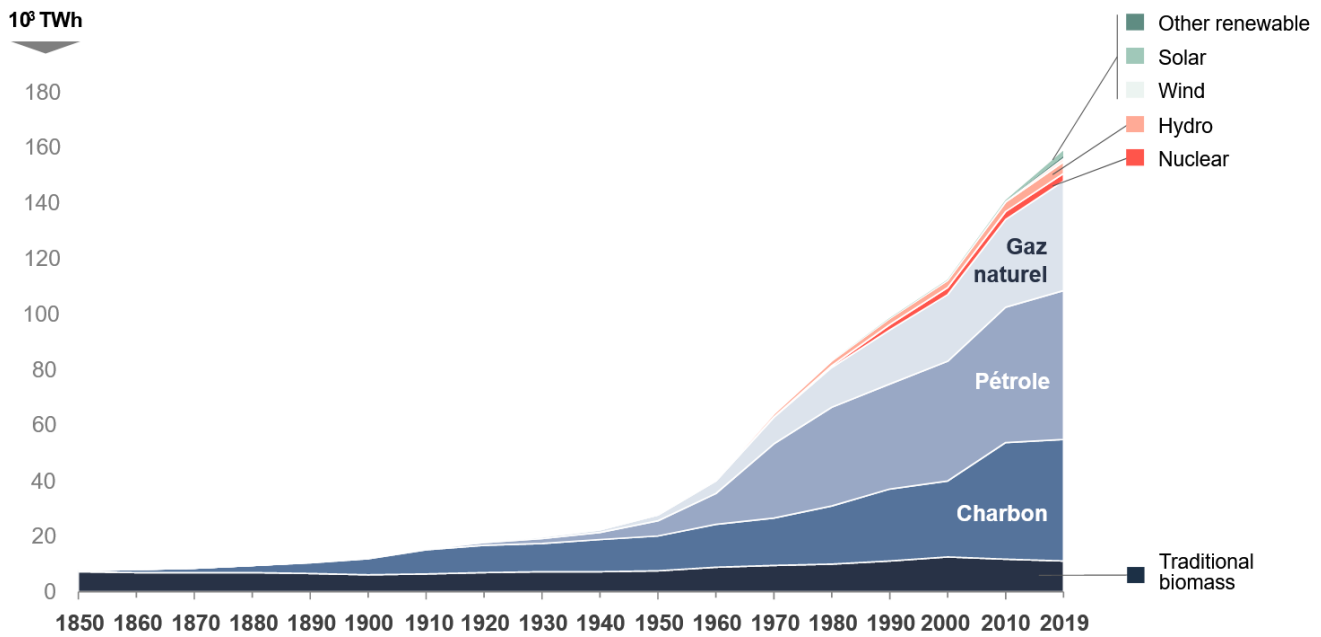


Figure 2.6: Annual world consumption of primary energy from 1850 to 2019 (Carbone4 2021)

Translation: Charbon = Coal, Pétrole = Oil, Gaz naturel = Natural gas

It may be that the exploitation of the vast availability of primary energy (i.e., the energy available in nature) has enabled the exponential growth of GDP and world population through access to better living conditions and higher quantities of food (Zabel 2009; Sorrell *et al.* 2018; Jancovici and Blain 2021). This increase in energy consumption can also be seen as an excellent example of Jevons' paradox or rebound effects (Sorrell *et al.* 2018). Jancovici and Blain (2021) characterize it as follows: between 1930 and 2020, machines provided 5 to 10 times more power for the same amount of energy, indicating real progress in efficiency. However, the industrial base continued to grow exponentially, resulting in a 10-fold increase in energy consumption between 1930 and 2000. Thus, growth consumed efficiency. Since primary energy is the precondition for development and electricity production, it is reasonable to assume that the economy cannot grow faster than its primary energy supply, as efficiency alone cannot compensate for the potential lack of that supply (Haberl *et al.* 2020). Consequently, the lack of primary energy or high energy prices may result in an unplanned reduction in consumption and production. Despite the growing appeal of increasingly affordable renewable primary energy, the transition of the global economy to a non-fossil fuel mix is challenged by the persistent centrality of these energy sources. Indeed, looking at Figure 2.6 above, renewable primary energy remains almost anecdotal compared to fossil fuels. Moreover, the use of oil and gas grew twice as fast as renewables between 2011 and 2016, revealing a perception gap with the actual pace of the energy transition (Sorrell *et al.* 2018; Jancovici 2022). This suggests that renewable energy deployment not only fails to meet the needs of a sustainable transition, but that growth is further widening the gap. This calls into question the feasibility of a net-zero, growth-oriented global economy by 2050, based on current practices that include decoupling as a key focus (International Energy Agency 2021).

2.1.2 Decoupling as a rationale for green growth

Decoupling, a key feature of green growth theory, is an outcome intended to address various challenges such as the possible reduction in energy supply, harmful emissions, and the growing need for rare metals, among others. As outlined by [Hickel and Kallis \(2020\)](#), decoupling can be observed in the occurrence of an increase in GDP simultaneously with a decrease in resource consumption and environmental impacts. Absolute decoupling occurs when the environmental variable remains stable or decreases while the economic variable increases, as opposed to relative decoupling. The latter is achieved when the environmental variable continues to grow but at a slower rate than the economic variable ([Carbone4 2021](#)). However, as demonstrated by [Strand *et al.* \(2021\)](#) in Figure 2.7 below, scientific evidence for absolute and global decoupling is lacking, highlighting a conflict between the continued increase in pressures on the Earth and the immediate need to reduce them. The only period approaching global decoupling is during the 2008 financial crisis, which cannot be qualified as a growth scenario, but as a reduction of human activities, amplifying the potential benefits of a global sufficiency approach.

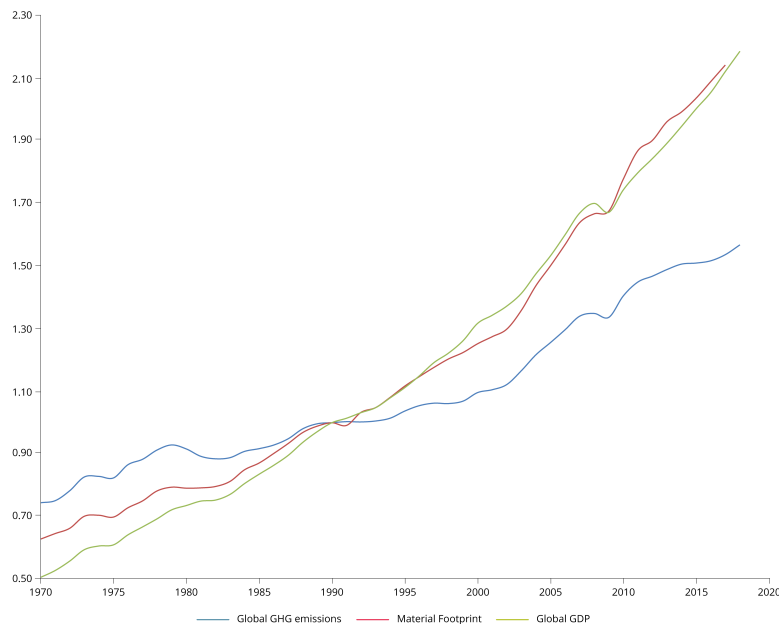


Figure 2.7: Global economic and environmental indicators from 1970 to 2018 ([Strand *et al.* 2021](#))

This analysis is consistent with the systematic literature review conducted by [Haberl *et al.* \(2020\)](#) analyzing possible evidence for the decoupling of GDP, resource use, and GHG emissions. In their study, the authors concluded that continuing the current growth-oriented economic trend will not achieve an absolute reduction in resource use or GHG emissions. Furthermore, this was also corroborated by [Strand *et al.* \(2021\)](#), suggesting that decoupling may never occur on a global scale in a way that sufficiently reduces the pressures on the Earth.

While the few cases of absolute decoupling observed in the past at a local scale may indicate that such scenarios could become more frequent, as predicted by [Haberl *et al.* \(2020\)](#), these decouplings have not been replicated on a global scale, making them inconsistent with the definition of decoupling by [Carbone4 \(2021\)](#) presented in Figure 2.8 below. These five indicators, absolute, total, global, sustainable, and swift, are considered by [Carbone4 \(2021\)](#) to be the unconditional components to target in the search for decoupling. These should be achieved in order to conclude that decoupling is indeed occurring.

We need decoupling:		Description	Example	Downgraded version
↙ ...absolute → ..total → ..global → ...sustained → ...swift	→	The variables are independent of one another, so are free to go in the opposite direction .	A rate of GDP growth of 2% is accompanied by absolute reduction in greenhouse gas emissions of 3%.	Relative decoupling: <i>GDP growth is accompanied by an ever-smaller rise in emissions.</i>
	→	GDP is uncorrelated with consumption of all finite resources and all environmental damage.	GDP manages to rise by consuming every finite resource at a sustainable level, not leading to any ecological (or humanitarian) damage .	Partial decoupling: <i>Coupling persists with some indicators of environmental damage or consumption of finite resources.</i>
	→	Decoupling takes place worldwide.	World consumption of fossil fuels falls whilst GDP continues to rise.	Local decoupling: <i>A given economy sees its GDP rise whilst its consumption of fossil fuels falls.</i>
	→	Decoupling takes place in a timescale sufficient for us to say that it is structural rather than short-term .	In the last 5 years, GDP has risen while greenhouse gas emissions have fallen.	Decoupling over time: <i>Very much one-off decoupling takes place (e.g. a given year), but it is not maintained over time.</i>
	→	Decoupling takes place quite fast to prevent irreversible environmental damage.	Rising GDP will be accompanied by absolute reduction in greenhouse gas emissions of 7.6% per year by 2030 .	Decoupling that is too slow: <i>Absolute decoupling, worldwide and sustainable, is taking place but is not fast enough to respect the Paris Agreement.</i>

Figure 2.8: Framework for an optimal decoupling ([Carbone4 2021](#))

As such, achieving the goals of the Paris Agreement requires new and more effective policies than those deployed to date. These policies should be based on absolute emission and environmental impacts reduction targets through an essential combination of both sufficiency and efficiency ([Haberl *et al.* 2020](#)). Despite this, one main reason for our growth-oriented system to remain dominant may be the role of organizations in their own interpretation of sustainable development, which emphasizes economic growth ([Dittmar 2013](#)). Therefore, it seems essential to study the different positions on sustainability, as these can influence and define the way societies behave ([Robra *et al.* 2020](#)).

2.1.3 Growth as an institutionalized theory

The European Investment Bank (EIB) conducted a citizen survey on the topic of climate change. When questioned about growth, it appears that Americans are the most optimistic about the economic benefits of climate action, followed by Europeans and then the Chinese, as presented in Figure 2.9 below.

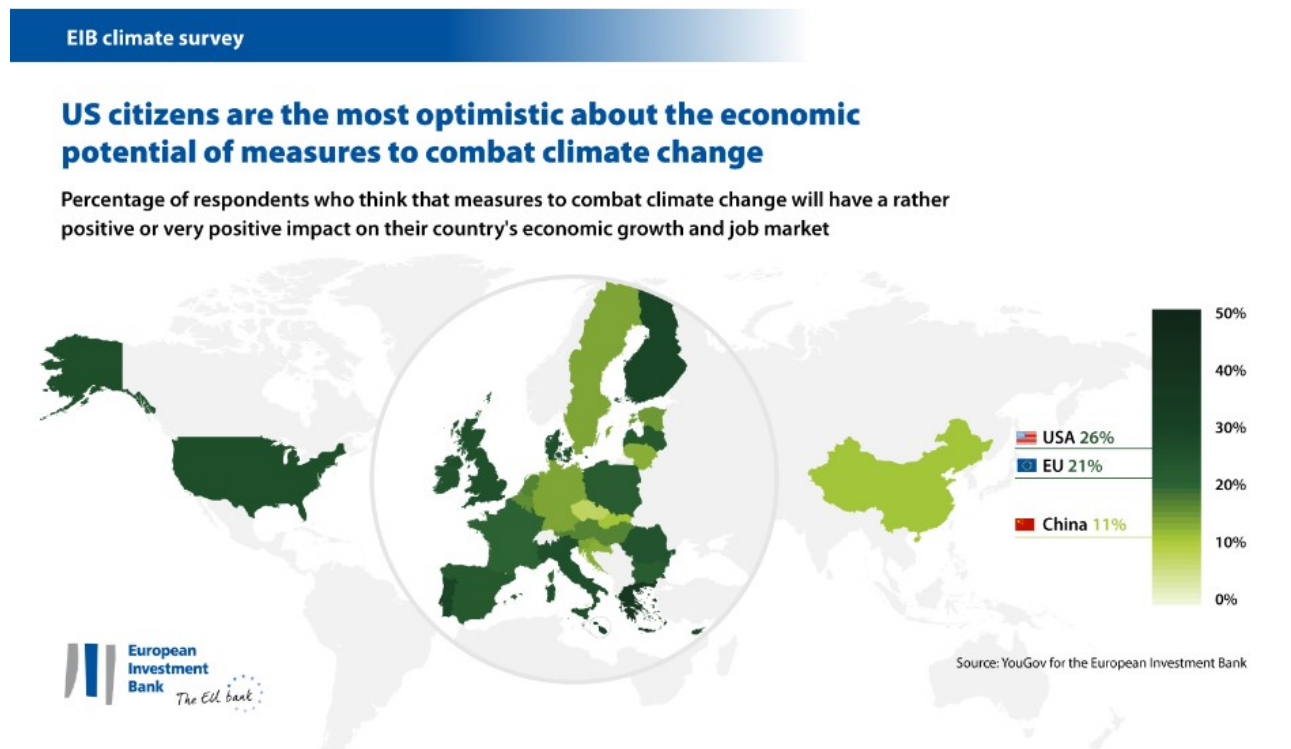


Figure 2.9: EIB Survey, the economic potential in climate action (EIB 2018)

This survey is interesting for two reasons:

First, it is found that a significant proportion of the public associate climate action with benefits to GDP growth. This is consistent with the observation of [Meadows *et al.* \(2004\)](#) that people seek growth based on the belief that it is synonymous with increased well-being. This emphasis on growth is also reflected in a survey conducted by the [Institut Montaigne \(2012\)](#), a French liberal think tank, suggesting that 81% of French people consider growth to be a priority objective in France and 72% in Europe.

Second, through its survey "What do citizens think about climate change and the capacity of climate action to create jobs and growth?" the EIB supports a growth-induced sustainability position, a mindset shared by most major organizations ([Smulders *et al.* 2015](#)). [Meadows *et al.* \(2004\)](#) further claim that decision-makers seek growth as a remedy for most issues, suggesting that in developed countries growth is seen as necessary for employment, social advancement, technical progress and environmental improvement, while in developing countries it is seen as the only way out of poverty.

Such an insight into organizations by [Meadows *et al.* \(2004\)](#) accurately reflects the view of the OECD as illustrated by its "Going for Growth" framework ([OECD n.d.](#)). The organization rightfully recognizes that the COVID-19 pandemic revealed weaknesses in the resilience of the global economy, placing the economic recovery as a major turning point and an opportunity to "build back better" ([OECD 2021a](#)). However, still according to the same source, these weaknesses arising from the COVID-19 pandemic have only exacerbated pre-existing challenges within the global economy, which are primarily a "sluggish productivity growth" and "declining business dynamics." Thus, to achieve a sustainable and resilient recovery, the primary objectives should be to address existing barriers to growth as well as boosting productivity ([OECD 2021a](#)). In fact, despite mentions of environmental sustainability, economic growth remains the focal point for decision-making.

In practice, the OECD follows the trade-off principle, allowing for the substitution of one capital for another. In other words, the organization consent to the consumption of natural resources as long as they provide a product of equal economic value, thus contributing to increased welfare ([Nasrollahi *et al.* 2020](#)). Therefore, when natural capital decreases, the economic dimension increases. The overall framework, including the trade-offs, are explained in the 2021 OECD report "Going for Growth" and illustrated in Figure 2.10 below.

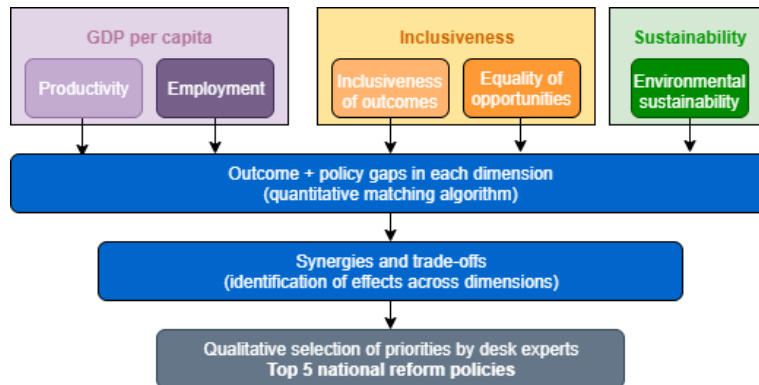


Figure 2.10: OECD "Going for Growth" framework ([OECD 2021b](#))

The considerations for inclusiveness and sustainability have been added recently, 2017 for the former and 2019 for the latter. The first step is to pair a variety of economic outcome indicators across the three dimensions to determine the best possible outcome for each of these pairings within the spectrum of economic evidence established by the OECD and other institutions. The results of these pairings are compared to the OECD average to determine whether, for a given country, pursuing an outcome is of significance (i.e., below the OECD average) or not. In the case of incorrect measurement or limited comparability, the relevance to growth will be further investigated by experts. Trade-offs are then analyzed across dimensions before selecting the five most appropriate reform policies for a given economy. Such a position is a well-established perspective in what can be defined as neoclassical environmental economics ([Smulders *et al.* 2015](#)).

This view of sustainable development can be extended to most major international organizations, as shown in Figure 2.11. Three positions can be distinguished in the debate on sustainable development. First, some support the status quo, such as the OECD, and represent a vision based on trade-offs and a techno-centered approach to environmental sustainability fostered by economic growth. Some examples are the World Bank and the World Business Council for Sustainable Development. The EU, given its recent Green Deal, would require further investigation. Yet, it appears that the promotion of economic growth seems to take precedence over other considerations, which is characteristic of the current position of the EU in Figure 2.11 (Laurent 2020). The second position is that of those who promote the reform of the economic system, such as the original vision of the Brundtland report or the IUCN organization. It should be noted that within the same position, perceptions can change. For example, the organization ATTAC, while being in the same position as IUCN, is not eco-centered. Thus, these positions are only trends but not a grouping of shared ideas. At the other end of the spectrum, the last position calls for a total transformation of the system.

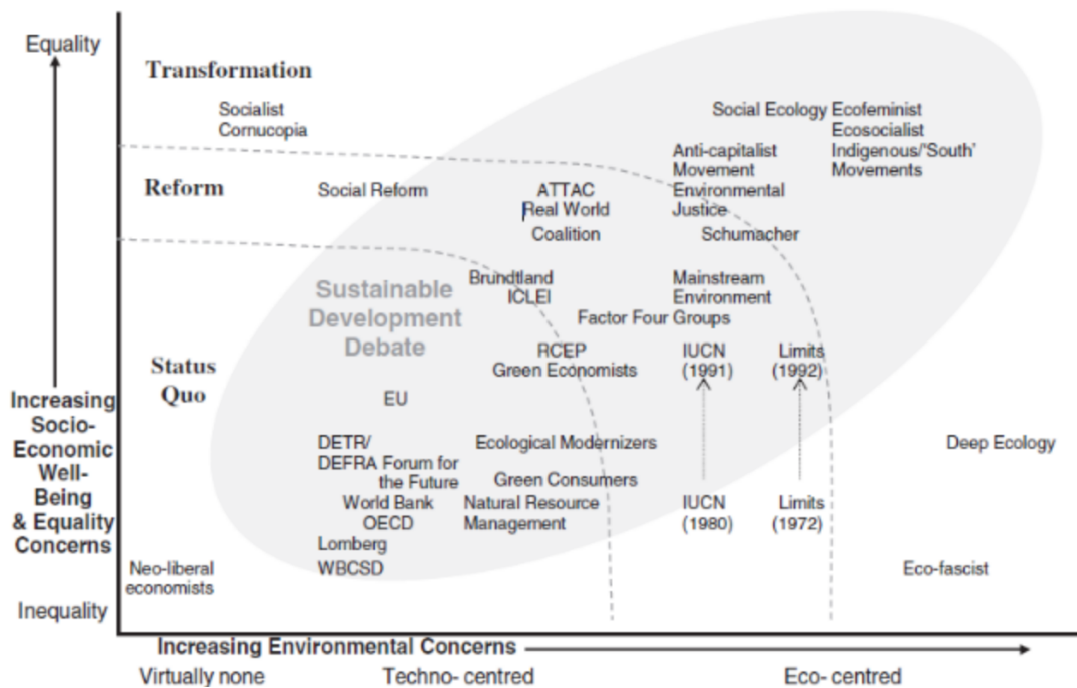


Figure 2.11: Sustainability perception of miscellaneous actors (Davies 2013)

In the opinion of Hickel and Kallis (2020), questioning economic growth is politically impossible. They proceed to quote Wackernagel and Rees (1998): "What is politically acceptable is ecologically disastrous, while what is ecologically necessary is politically impossible." Despite these assertions, Hickel and Kallis (2020) refute the political impasse and call for relying on scientific facts to draw conclusions rather than jumping to "palatable conclusions and ignoring inconvenient facts." Additionally, the current focus of organizations on efficiency in support of growth rather than sufficiency has been defined by Robra *et al.* (2020) as a setback in achieving results from a strong sustainability perspective.

2.1.4 Weak and strong understanding of sustainability

With over 300 definitions, the meaning of sustainability is undoubtedly contested, and among the wide range of interpretations, two types of sustainability stand out, a weak and strong one (Davies 2013). Taking into account the understanding of Nasrollahi *et al.* (2020), the analysis of weak and strong sustainability is relevant as both sides consider the same factors as contributing to sustainability, namely those in the IPAT equation previously mentioned in the scope of study. To recap, these are Impact (I), Population (P), Affluence (A), and Technology (T).

- **Weak sustainability:** Strategies relying on efficiency are consistent with weak sustainability theory as they 1) assume that different capital (environment, economy and society) can be substituted, 2) focus on relative efficiency gains, 3) largely ignore consumption and the rebound effect (Heikkurinena *et al.* 2019; Nasrollahi *et al.* 2020). In this view of sustainability, man-made capital has more value than natural capital, as shown in Figure 2.12 below (Davies 2013).
- **Strong sustainability:** The strong sustainability strategy focuses on sufficiency, recognizing that nature, economy, and society are complementary to each other and that no sacrifice is allowed (Nasrollahi *et al.* 2020). It is based on the idea that natural capital cannot be reproduced and that nature is given the highest priority, as shown in Figure 2.12 below. Indeed, given the conflicts between natural capital and human capital with respect to land use, financing, or impacts, among others, the representation below is only a theoretical estimate; it is unlikely that the high sustainability scenario will achieve the same level of human capital as in the low sustainability one (Davies 2013). As such, natural capital is considered non-substitutable, the limits to growth and the Jevons paradox are acknowledged, and global consumption levels are addressed (Davies 2013; Heikkurinena *et al.* 2019).

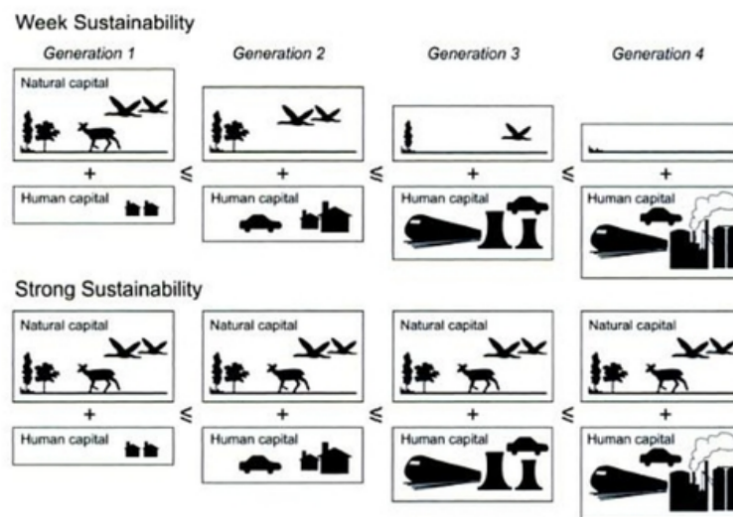


Figure 2.12: Weak and strong understanding of sustainability (Davies 2013)

2.2 Our nine planetary boundaries

With the increasing exploitation of the planet's resources, the ecological footprint increased until it exceeded the sustainability threshold in the late 1970s, as illustrated in Figure 2.13 below by the [Global Footprint Network \(n.d.\)](#). It, therefore, seems relevant to understand what the limits of our planet are and how growth exerts its pressure. While this study focuses primarily on the work of the [Stockholm Resilience Centre \(n.d.\)](#), it should be noted that this is one among many approaches to describe the functioning of the Earth system and the ways to calculate the human footprint on it. Other methods may be complementary and add value to the problem at hand ([Steffen *et al.* 2015b](#)).

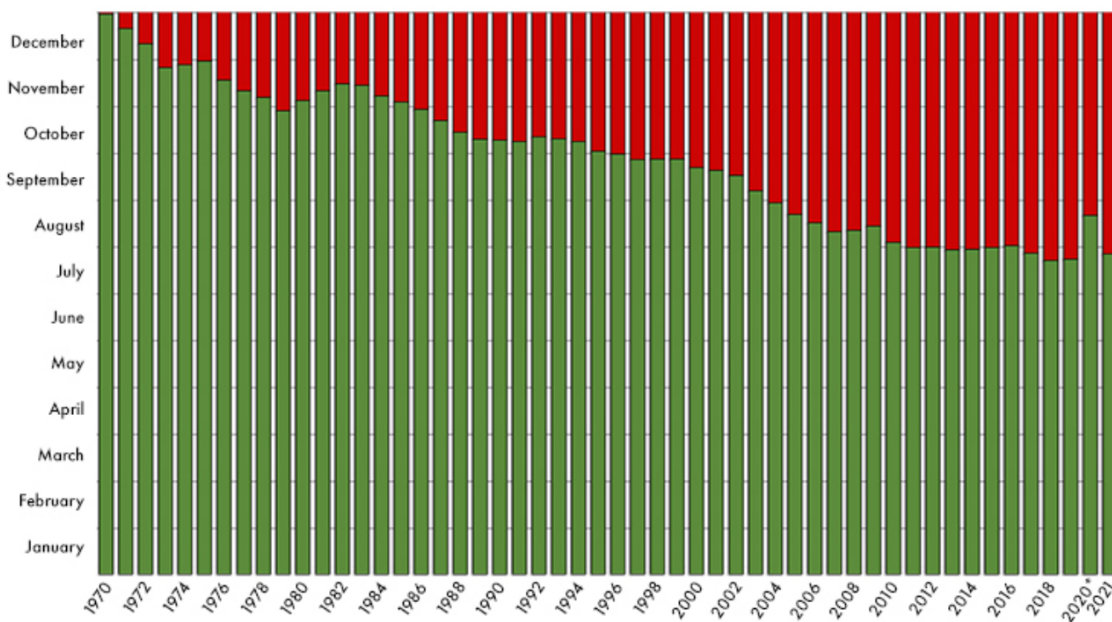


Figure 2.13: Earth overshoot day from 1970 to 2021 ([Global Footprint Network n.d.](#))

As mentioned in the introduction, planetary boundaries seek to define a safe operating space for human societies to develop and thrive over the long term ([Stockholm Resilience Centre n.d.](#)). This PB framework argues for the recognition that human activity intrinsically affects the Holocene epoch, that is, the state of the planet that can best support contemporary society ([Steffen *et al.* 2015b](#)). Now, with compelling evidence, humanity can, for the first time, consider whether it is in danger of destabilizing the global Earth system ([Rockstrom 2018](#)). The pressure being exerted on the Earth is such that it is now suggested that we have entered a new geological era, less favorable to long-term human development: the Anthropocene ([Crutzen 2002](#)). These anthropogenic disturbances are signatures of the "emergence of humanity as the greatest force of change on the Earth's systems" ([Rockstrom 2018](#)). Planetary boundaries are evidence of these human pressures by identifying the processes regulating the Earth to understand what is essential for humanity to live on a reliable planet ([Stockholm Resilience Centre n.d.](#)). In total, nine planetary boundaries were identified, each representing a vital Earth system. These nine planetary boundaries are represented in Table 2.1 below.

Table 2.1: Our nine planetary boundaries (Steffen *et al.* 2015b)

Earth system processes	Control variables
Climate change	<ul style="list-style-type: none"> . Atmospheric CO₂ concentration . Energy imbalance at top-of-atmosphere
Change in biosphere integrity	<ul style="list-style-type: none"> . Genetic diversity: Extinction rate . Functional diversity: Biodiversity Intactness Index (BII)
Stratospheric ozone depletion	<ul style="list-style-type: none"> . Stratospheric O₃ concentration
Ocean acidification	<ul style="list-style-type: none"> . Aragonite saturation state of mean surface ocean
Biogeochemical flows: (phosphorus and nitrogen cycles)	<ul style="list-style-type: none"> . P Global: P flow from freshwater systems into the ocean . P Regional: P flow from fertilizers to erodible soils . N Global: Industrial and intentional biological fixation of N
Land-system change	<ul style="list-style-type: none"> . Global: Area of forested land as % of original forest cover . Biome: Area of forested land as % of potential forest
Freshwater use	<ul style="list-style-type: none"> . Global: Maximum amount of consumptive blue water use . Basin: Blue water withdrawal as % of mean monthly river flow
Atmospheric aerosol loading	<ul style="list-style-type: none"> . Global: Aerosol Optical Depth (AOD), but much regional variation . Regional: AOD as a seasonal average over a region
Introduction of novel entities	<ul style="list-style-type: none"> . Trend in production of novel entities . Trend in release of novel entities . Unwanted impact of novel entities on earth system processes

Although a return to the Holocene is impossible, if humanity respects these boundaries, it would significantly improve sustainability within the Anthropocene and reduce the risk of driving the Earth system into a much less hospitable state (Steffen *et al.* 2015b; Rockstrom 2018). However, due to the strong interaction between the systems of the Earth, should one of these systems be transgressed, the risks multiply, and the other systems become more vulnerable (Rockstrom 2020). Conversely, because of the stabilizing or destabilizing retroactions, resolving one of the boundaries can participate in the resolution of another, provided that all boundaries are addressed simultaneously (Steffen *et al.* 2015b). To address these planetary boundaries, stabilizing and destabilizing factors must first be identified within each of the Earth systems to identify the problem at hand and the appropriate response needed to reverse the negative trends and strengthen the stabilizing factors when possible (O'Neill *et al.* 2018).

The first and best known planetary boundary is the Earth's climate, which, along with the biodiversity boundary, are the core boundaries that impact all others (Steffen *et al.* 2015b). However, of the 15 major biophysical systems that regulate global climate (i.e., stabilizing factors), nine are approaching their irreversible state known as tipping points (Rockstrom 2020). Once reached, they cannot be stopped from compromising the sustainable state of the Earth. These include the melting of ice caps, the death of coral reefs, thawing of permafrost or forest fires. Therefore, limiting the global temperature increase (i.e., destabilizing factor) to 1.5 degrees Celsius is only part of the solution to stabilize the Earth's climate boundary and eventually return to the safe operating space (Rockstrom 2015).

Biodiversity, the Earth's second core system, is in an even more fragile state than is the climate. So much so that if current practices in agriculture and anthropization, among others, are maintained, biodiversity will continue on its path towards a human-induced sixth mass extinction (Barnosky *et al.* 2011). Despite 68% of the world's wild animal population lost in less than 50 years, tipping points in the biodiversity system remain difficult to determine due to the complexity of life (Attenborough and Rockstrom 2021). Nevertheless, the boundary has undoubtedly been crossed beyond critical. If an agreement similar to the Paris climate agreement were to be reached for biodiversity, the target would have to translate into a zero biodiversity loss (Barnosky *et al.* 2011). Considering all planetary boundaries presented in Figure 2.14 below, the critical status of biodiversity (biosphere integrity) is clear.

In addition to biodiversity and climate, four other Earth systems are beyond their safe operating space. These are novel entities (e.g., plastic pollution), biogeochemical flows, land-system change, and green water. Note, as illustrated, that not all boundaries have yet been measured.

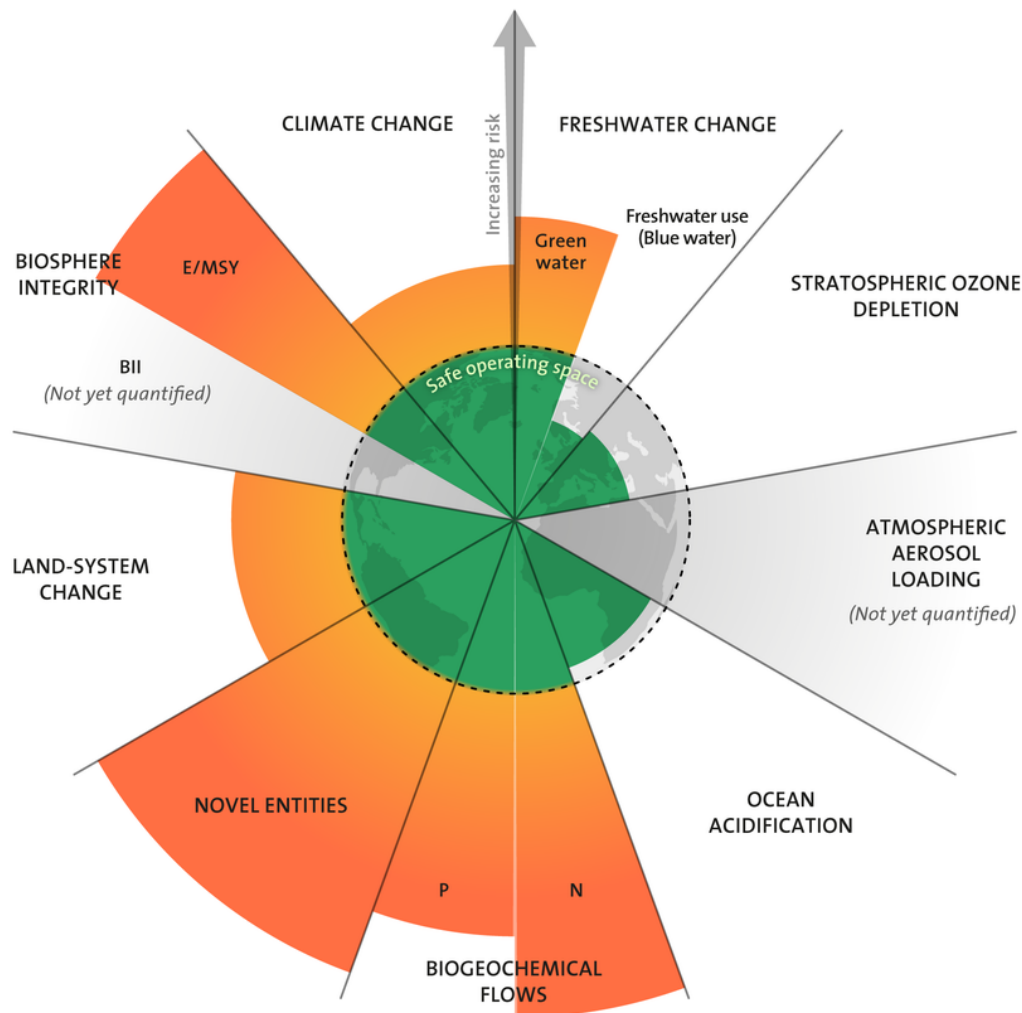


Figure 2.14: State of planetary boundaries (Potsdam Institute for Climate Impact Research 2022)

In 2022 alone, research has revealed that two new planetary boundaries are now being transgressed, namely those of novel entities and green water (Persson *et al.* 2022; Wang-Erlandsson *et al.* 2022). Importantly, in the 1970s, the planetary boundary for ozone depletion was well beyond its safe operating space in comparison to its current level. The identification by the scientific community of its causes and the resulting international agreement (i.e., the 1987 Montreal Protocol) reversed the trend by reducing and eventually eliminating the ozone-depleting substances (i.e., the destabilizing factors), as shown in Figure 2.15 below (Barnes *et al.* 2021).

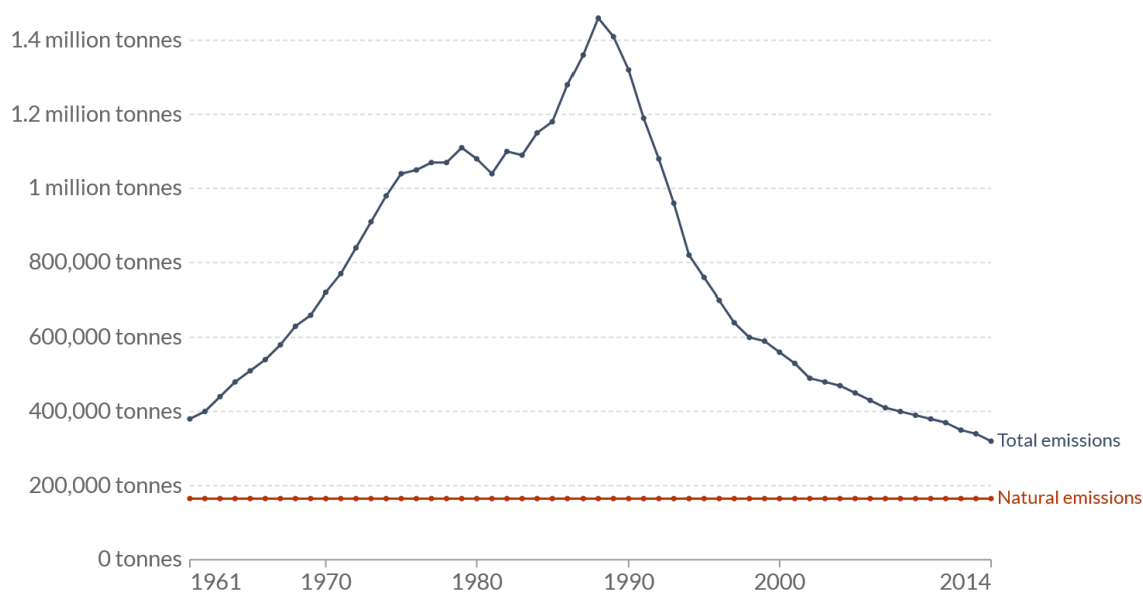


Figure 2.15: Ozone-depleting substance emissions from 1961 to 2014 (Our World in Data n.d.a)

There is no guarantee, however, that planetary boundaries currently in their safe operating space will remain so if humanity continues with business as usual practices. Indeed, Earth systems that are currently in the green do not necessarily reflect sustainable practices but only the current state of the system (Attenborough and Rockstrom 2021).

Although planetary boundaries were primarily developed in a scientific context and do not provide a roadmap, Steffen *et al.* (2015b) argue for the relevance of a strong "PB thinking" at different scales such as states, regions, or local communities. Within this "BP thinking," sufficiency can be recognized as a significant and decisive contribution to achieving strong sustainability. Indeed, to deliver a high level of satisfaction for the global population under current consumption patterns, the level of resource use is expected to be two to six times the sustainable level, according to O'Neill *et al.* (2018). They argue that the challenge is first and foremost to recognize overconsumption as a significant cause of social and environmental harm to societies as well as to move beyond the goal of GDP growth to new measures of progress.

2.3 Seeking enough through sufficiency

In the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), [Working Group III \(2022\)](#), author "Climate Change 2022: Mitigation of Climate Change", places great importance on sufficiency measures. These are defined as "a set of measures and daily practices that avoid demand for energy, materials, land, and water while delivering human well-being for all within planetary boundaries." Also, [Jungell-Michelsson and Heikkurinen \(2022\)](#) conducted a systematic literature review on sufficiency (which can be used interchangeably with eco-sufficiency). This section seeks to develop a comprehensive approach to sufficiency using both the systematic literature review and the publication of Working Group III.

2.3.1 Demand-side mitigation

[Jungell-Michelsson and Heikkurinen \(2022\)](#) emphasize sufficiency as a concept based on the recognition of ecological constraints and a means to meet them, reflecting the strong vision of sustainability presented in Section 2.1.4. Similarly, [Working Group III \(2022\)](#) believes that demand-side solutions, such as low-energy pathways, can significantly contribute to the achievement of the Paris Agreement and support the ability of humanity to stay within planetary boundaries. These demand-side mitigation strategies are also analyzed by [Jungell-Michelsson and Heikkurinen \(2022\)](#), although their analysis indicates that there is no single persistent and unanimous strategy to operationalize sufficiency. Indeed, in their systematic literature review, they recognize that demand-side strategies are only one part of the pathway to sufficiency and that an extension to producers is essential to effectively achieve strong sustainability at the micro- and macroscales. Therefore, the analysis focuses on both consumers and producers, but operationalizing the concept requires further research, according to the authors. Table 2.2 below is a synthesis of sufficiency on the demand-side mitigation based on the systematic literature review by [Jungell-Michelsson and Heikkurinen \(2022\)](#).

Table 2.2: Micro- & macroscale sufficiency of consumers ([Jungell-Michelsson and Heikkurinen 2022](#))

Sufficiency	Consumers
Microscale	Most frequently mentioned strategy. Characterized by a voluntary, self-imposed restriction toward reduced and moderate consumption to distance oneself from dominant consumerist ideas without compromising well-being. It uses a variety of strategies, including taking advantage of product longevity , absolute reduction , sharing behaviors , and modal shifts .
Macroscale	Requires a supportive social and institutional climate in which consumption as a means to well-being is re-evaluated. The ability of the current capitalist system to generate social and environmental benefits is challenged. Thus, current consumption patterns must therefore be transformed in significant ways. For substantial societal learning to take place and for sufficiency to become a mainstream phenomenon, a wide range of stakeholders, such as politicians, influencers, and social structures, must exert their influence.

The [Working Group III \(2022\)](#) analysis of demand-side mitigation complements the systematic literature review by providing additional insight through a different perspective. Their analysis identifies five different social actors to be distinguished in consumption patterns, which include individuals, groups and collectives, corporate actors as well as institutions and infrastructure actors. The behavior of these actors falls into two categories. First, those with high-carbon consumption patterns and a GDP growth trajectory, and second, those with low-carbon consumption patterns and a transition to a welfare and equity economy. In its search for a framework to theorize sustainable consumption patterns, the IPCC created the "Avoid, Shift, Improve" or A-S-I model. It is presented in Figure 2.16 below, applied to mobility by the [Transformative Urban Mobility Initiative \(2019\)](#). Not limited to mobility, this principle can be applied to various consumption areas of goods and services. Similarities can even be found with the strategies highlighted in bold in Table 2.2 above. Here, absolute reduction, sharing behaviors, and modal shifts are part of the "avoid" and "shift" pathways while taking advantage of the longevity of products involves both a change in consumption and the ability to rely on products made to last as well as the right to repair, among others.

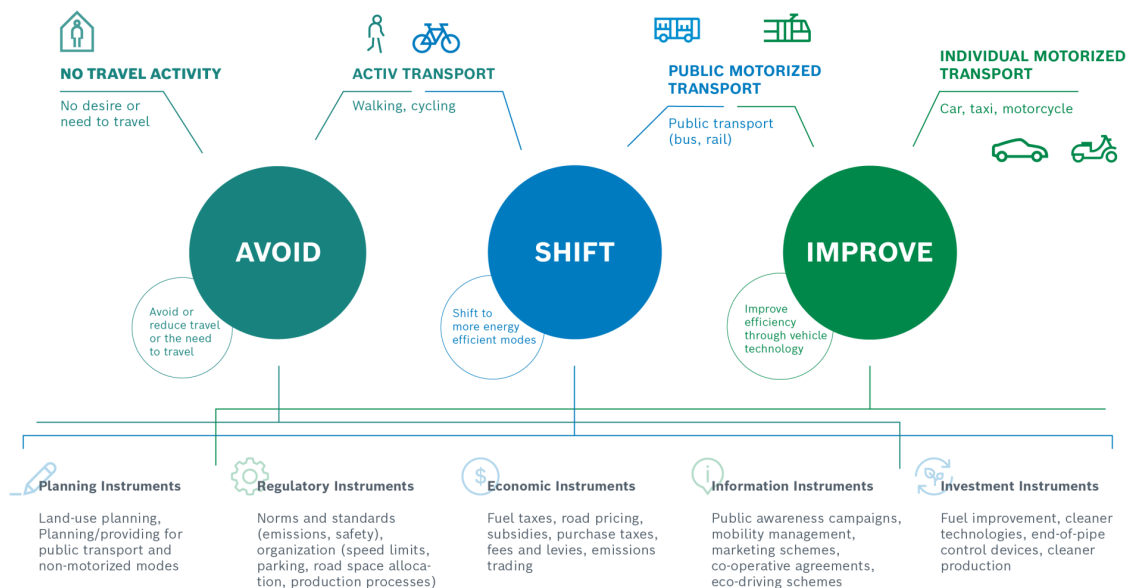


Figure 2.16: A-S-I framework applied to mobility ([Transformative Urban Mobility Initiative 2019](#))

Furthermore, the implementation of a sufficiency-based approach to the consumption practices of all five social actors could, according to [Working Group III \(2022\)](#), reduce emissions by approximately 40-70% by 2050. Nevertheless, efforts must be proportional to the impact of each individual as such a reduction is only possible if consumption patterns are first addressed by those who consume the most. Indeed, 10% of the richest households in the world contribute to about 40% of global emissions, while 50% of the poorest households contribute to about 15% ([Working Group III 2022](#)). However, it was

also mentioned by [Working Group III \(2022\)](#) that the motivation of individuals is relatively low, as the "Avoid" choices involve significant behavioral and cultural changes that may not be consistent with current consumption patterns. At the macroscale, [Working Group III \(2022\)](#) recognizes the need for coordinated action with the five social actors to bring about effective change at the demand side through a variety of triggers. These can be bottom-up, such as collective action (e.g., Fridays for the Future), or top-down, such as targeted education, information, and engagement of influencers of all kinds to enable change. While in agreement, the analysis of [Jungell-Michelsson and Heikkurinen \(2022\)](#) appears more disruptive with mentions of challenging capitalist ideas for sufficiency to become the prevailing phenomenon as mentioned in Table 2.2 above.

2.3.2 Supply-side mitigation

On the producers’ side, sufficiency is regarded as the least evident component due to the fact that it calls into question the growth objectives sought by companies. Table 2.3 below represents the summary of sufficiency on the producer side at micro- and macroscale, based on the systematic literature review by [Jungell-Michelsson and Heikkurinen \(2022\)](#).

Table 2.3: Micro- & macroscale sufficiency of producers ([Jungell-Michelsson and Heikkurinen 2022](#))

Sufficiency	Producers
Microscale	Mostly prevalent in NGOs and non-profits, as it involves a willingness to sacrifice potential profits and growth. Corporate responsibility is met through direct and indirect actions. Indirectly, the need to influence consumers through consumption moderation strategies such as product-service systems, slower innovation and renewed product cycles, targeted communication on sustainability, etc. Directly, it will require producers to limit supply. Together they require a paradigm shift in the concept of growth and value creation for companies.
Macroscale	Sufficiency aims to bring production and consumption within planetary boundaries and thus constrain economic growth. This implies a rethinking of GDP and calls for changes in economic policy. However, with the exception of energy production strategies, specific research in the area of producer sufficiency is scarce.

On this approach, [Working Group III \(2022\)](#) advances two contrasting arguments. One is the observation that the COVID-19 pandemic and the resulting economic recession may have reduced financial resources for climate change mitigation, which would be consistent with the view that climate action is strongly correlated with economic growth. However, they also recognize that both GDP and population growth are the two main drivers of environmental impacts, assuming a projected population of 8.5 to 9.7 billion people by 2050 and global GDP growth of 2.7 to 4.1% per year between 2015 and 2050. The difficulties in enabling change, as mentioned by [Jungell-Michelsson and Heikkurinen \(2022\)](#), confirm that the approach to production and its actors (mainly companies and decision-makers) are confronted with the need to consider the need for different business models at the microscale and a change in the approach to the global economy at the macroscale.

Research framework

3.1 Research question

On the basis of Chapters 1 and 2, the argument is made to challenge the dominant discourse on economic growth. To this end, sufficiency is explored to determine its potential to undertake the transition to a safe operating space within planetary boundaries. In order to upscale sufficiency, it requires to think about it within an alternative economic system to the current one, considering the many obstacles to the acceptance of sufficiency on a large scale by growth-based economies. The research question is, therefore, the following:

How can sufficiency assist in reducing the environmental impacts necessary to transition back into the safe operating space associated with planetary boundaries?

The two following sub-questions will be explored to guide the answer to the research question:

1/ To what extent does sufficiency currently contribute to the doughnut economy mindset?

As suggested by the IPCC, any transition, its speed, depth, and direction, is determined by choices in the environmental, technological, economic, socio-cultural and institutional domains ([Working Group III 2022](#)). In this case, the transitions are multiple, namely the increase of sufficiency, the shift away from growth-driven societies, and the return to planetary boundaries while ensuring social foundations. From this premise and with the use of a scoping review, the place of sufficiency within the doughnut economy can be analyzed, and possible practical applications of sufficiency can be proposed.

2/ How is sufficiency currently perceived and understood in the sustainability debate?

Sufficiency remains a marginalized topic in public debate, both in its potential to combat climate change and in a more general sense as a plea for a simpler life. Because of the necessary transition it imposes, sufficiency suffers from a misconception associated with regressive beliefs and the renunciation of pleasures and comforts currently strongly associated with (over)consumption ([Jungell-Michelsson and Heikkurinen 2022](#)). Consequently, the idea of another form of progress based primarily on the satisfaction of needs is often overlooked when discussing sufficiency. To assess sufficiency in the face of environmental challenges, it seems relevant to understand the perceptions around sufficiency, its definition, its scope, its importance, and its future perspectives.

3.2 Research design

Figure 3.1 below represents the overall structure of the research. First, Chapter 1 introduces the context and the scope of the research subject. Second, Chapter 2 provides an in-depth overview of three important components, specifically growth, planetary boundaries, and sufficiency. Next, Section 3.1 presents the research question and its two sub-questions. In order to provide findings and information that aid and support the research objectives and ideas, a research theory in Chapter 4 and methods in Chapter 5 were selected to direct the analysis of relevant information to answer the research question. The chosen theory is doughnut economics, and the two methods are a scoping review and interviews. Although the two methods can provide information to answer both sub-questions, the scoping review is primarily intended to answer the first and the interviews the second. Thereafter, Chapter 6 will be intended for discussion, and Chapter 7 will conclude the study.

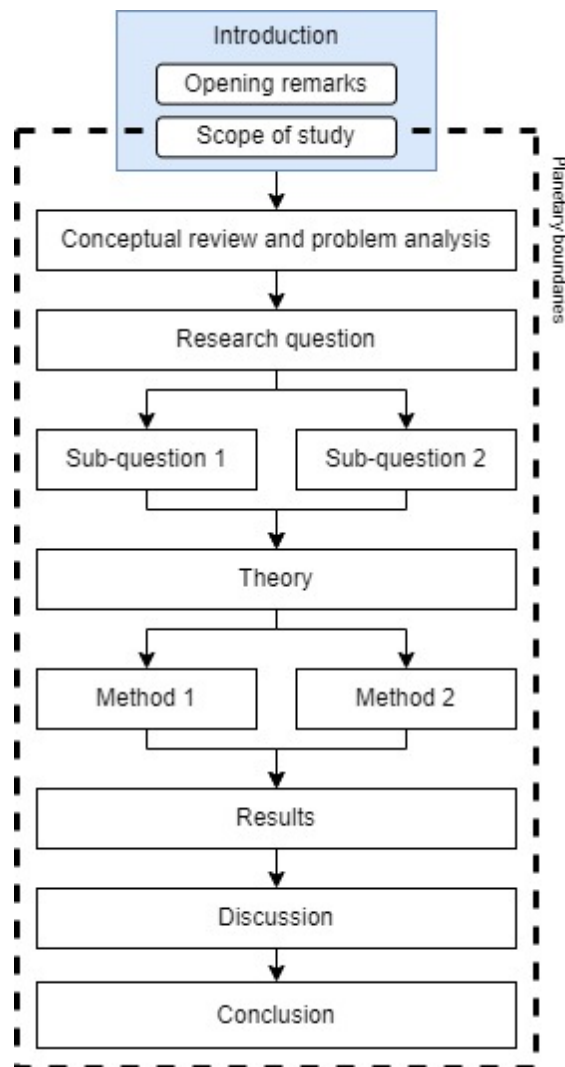


Figure 3.1: Illustration of the research design (Own elaboration)

Theoretical framework

The theoretical framework refers to the reasoning applied to conduct the research. The economic theories of the mid-20th century, which viewed the environment as an externality, are still driving the global economy, despite the new awareness of ecological challenges (Raworth 2018). Thus, the doughnut economy as an alternative pathway is chosen to serve as a theory to aid research on sufficiency.

4.1 The theory of doughnut economics

4.1.1 Seven ways to think of system change

First introduced by economist Kate Raworth in 2012, the theory of doughnut economics opposes the current mainstream economic thinking, based on what she argues are unproven assumptions of infinite growth or decoupling (Doughnut Economics Action Lab n.d.a; Raworth 2017a). In contrast, the doughnut economy emphasizes certain factors such as the centrality of energy, the finite nature of resources, or the disruption of the environment by humanity, all of which are discussed in Chapter 2. To be complete, the model also addresses the social inadequacy of the current economy. With both social and ecological aspects, the model seeks to deliver a regenerative and distributive economy as opposed to a linear, productivist, and unequal one (Raworth 2018). It is illustrated in Figure 4.1 below.

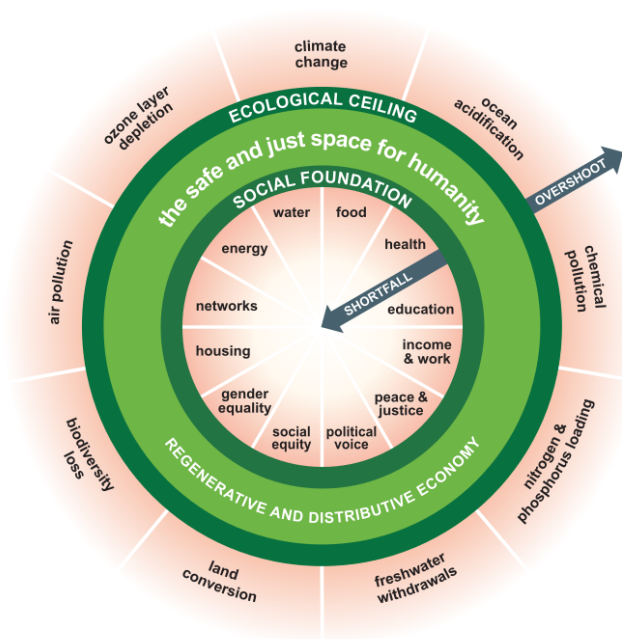


Figure 4.1: Representation of the doughnut economy (Doughnut Economics Action Lab n.d.a)

Following the theory of doughnut economics, all people below the social foundations are considered to be falling short in one or all 12 of the social pillars defined by Raworth and based on the SDGs (Raworth 2018). At the same time, humanity should not exceed the ecological ceiling defined by the nine planetary boundaries of the Stockholm Resilience Centre (n.d.) and used in this economic model. Therefore, the objective is to meet the needs of all while respecting the needs of the planet. However, as illustrated in Figure 4.2 below, at a global scale, all 12 social pillars are beneath the social foundations, in addition to six of the nine planetary boundaries that are above the ecological ceiling¹.

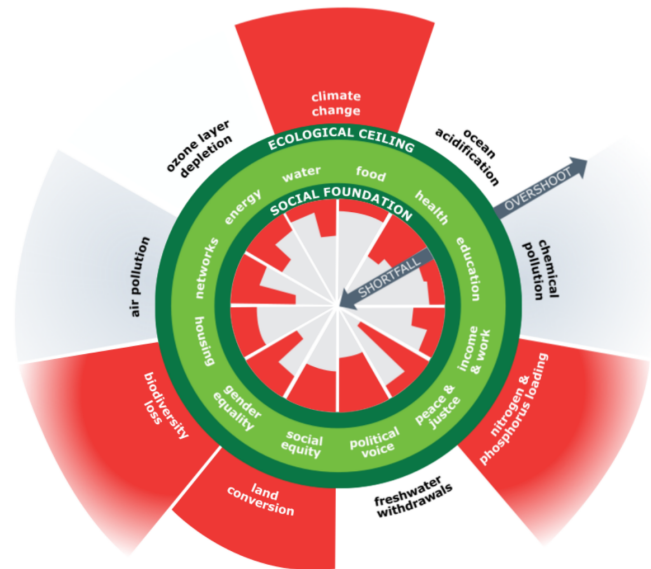


Figure 4.2: State of the social foundations and ecological ceiling (Raworth 2017b)

As the name of her book, "Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist," suggests, Raworth (2017a) proposes a set of seven ways to think about the economic transition. These seven principles are detailed here as per the Doughnut Economics Action Lab (n.d.b).

- **1st principle:** "Change the goal, from GDP to the doughnut"

This first reflection corresponds to what has been exposed throughout the study, namely that continued GDP growth is leading to an environmental crisis that may result in ecological collapse. In addition, the social aspects are mentioned through the increase in inequalities and the persistence of social deficiencies despite growth. As such, meeting social and ecological challenges requires a new economic mindset.

- **2nd principle:** "Tell a new story, from the neoliberal narrative to a story fit for our times"

The current representation of economics in our society is represented by the neo-liberal approach of the circular flow of income, a closed-loop model tracking the circulation of money. It defends,

¹The most recent exceeded planetary boundaries are not represented in Figure 4.2 as it has not yet been updated

among other things, the efficiency of markets, the need for trade, or the incompetence of the state to assist the economy. This model is illustrated in Figure 4.3 below, where households and firms are the fundamental relationships in the market. Households receive wages and profits in exchange for the provision of labor and capital. Using the money, households can engage in consumption expenditures and purchase goods and services, while some of this money goes to leakages. However, the environment nor the commons are mentioned. The former are but externalities, and the latter privatized under the theory of the tragedy of the commons.

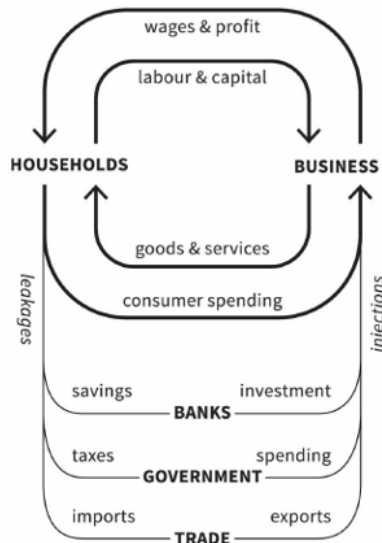


Figure 4.3: The circular flow of income (Raworth 2018)

The embedded economy, as presented in Figure 4.4 below, is the alternative thinking model in which the dependence of the economy on society, energy consumption, and the Earth is recognized, and in which the state and the commons are reintegrated into financial flows.

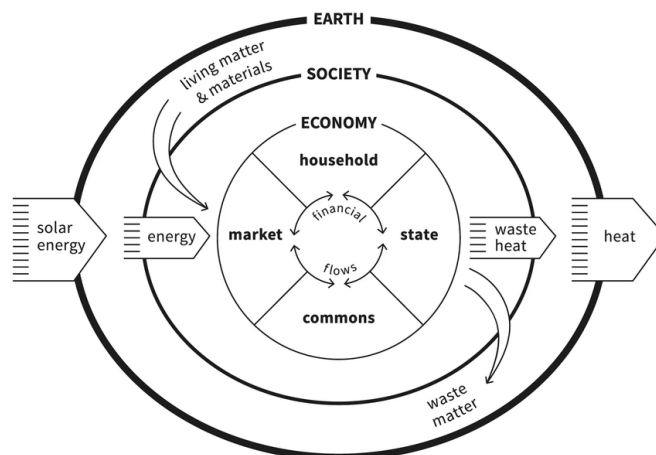


Figure 4.4: The embedded economy (Raworth 2018)

- **3rd principle:** "Nurture human nature, from rational economic man to social adaptable humans"

The rational economic man has been the representation of humanity to fit the neoliberal approach. The Homo Oeconomicus is solitary and self-centered, whose calculations and decisions bring him maximum profit, giving him a dominant position over a living world that he deteriorates. The alternative thinking calls for a new portrait of humanity with values of empathy, cooperation, and a deep connection to nature, depending on it rather than dominating it.

- **4th principle:** "Get savvy with systems, from mechanical equilibrium to dynamic complexity"

Inspired by physics, 19th and 20th-century economics developed their own mathematical laws of motion, resulting in market equilibria but failing to take into account the "boom and bust" of the real world, such as the financial crisis of 2008. To deepen the understanding of economics and to be better equipped to face challenges, a new approach based on systems thinking can pave the way to account for the complex interactions between economies, societies, and the living world.

- **5th principle:** "Design to distribute, from 'growth will even it up' to distributive by design"

In the 20th century, the leading economic theory, based on the Kuznets curve, argued that inequality must first worsen before it improves, with growth ultimately delivering equality. The alternative thinking is based on a distributive approach, with value being offered to all those who contribute to its generation, both in terms of income and wealth. These current inequalities have been quantified by the [World Inequality Lab \(2022\)](#), highlighting the persistent inequalities in income and wealth. In fact, the wealthiest 10% currently capture 52% of the world's income, while the poorest half earns 8.5%. As for wealth ownership, the poorest half is barely represented with only 2% in comparison to the wealthiest 10%, who own 76% of the world's wealth.

- **6th principle:** "Create to regenerate, from 'growth will clean it up' to regenerative by design"

As with inequality, increasing pollution is seen as necessary before it can be reduced by growth. The new thinking argues that environmental degradation is the result of a degenerative and linear design. Similar to the butterfly diagram of the Ellen MacArthur Foundation, a circular economy is advocated, as shown in Figure 4.5 below ([Ellen MacArthur Foundation 2019](#)).

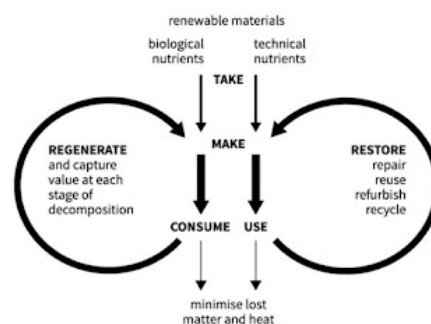


Figure 4.5: The regenerative economy ([Raworth 2018](#))

- **7th principle:** "Be Agnostic about growth, from growth addicted to growth agnostic"

GDP is the predominant factor driving public policy as the current economy is indexed to growth, be it welfare, business, or finance. As such, growth is not only desired but expected in order to provide services of all kinds such as wages and pensions and address challenges such climate change or unemployment (Jancovici and Blain 2021). The global crisis resulting from the COVID-19 pandemic has demonstrated the impact of a swift and unplanned reduction in GDP. Indeed, as a result, the world debt grew exponentially so as to compensate for the lack of growth needed in this system (OECD 2021b). Alternative thinking proposes another path, sober to GDP, whether it is growing or declining, with the goal of prosperity for humanity and the Earth.

4.1.2 From theory to practice, downscaling the doughnut

More than 150 nations were examined by O'Neill *et al.* (2018) through the lens of planetary boundaries and social thresholds in an approach closely related to the doughnut economy as defined by Raworth (2017a). Seven environmental pressure indicators were considered, including four planetary boundaries (climate change, land system change, freshwater use, and biogeochemical flows). Two additional indicators are added, the ecological footprint and the material footprint. For greater precision, the research considers integrated resource use and includes the effects of international trade. In addition, a total of 11 social indicators are considered, nine of which are indicators of satisfaction of needs (nutrition, sanitation, income, access to energy, education, social support, equality, democratic quality, and employment), and two are measures of well-being (self-reported life satisfaction and healthy life expectancy). The concept of "strong sustainability" as presented in Section 2.1.4 is endorsed in this study by considering critical natural capital stocks to be maintained as well as critical human and social capital. Figure 4.6 below illustrates the comparison between Denmark and the Central African Republic.

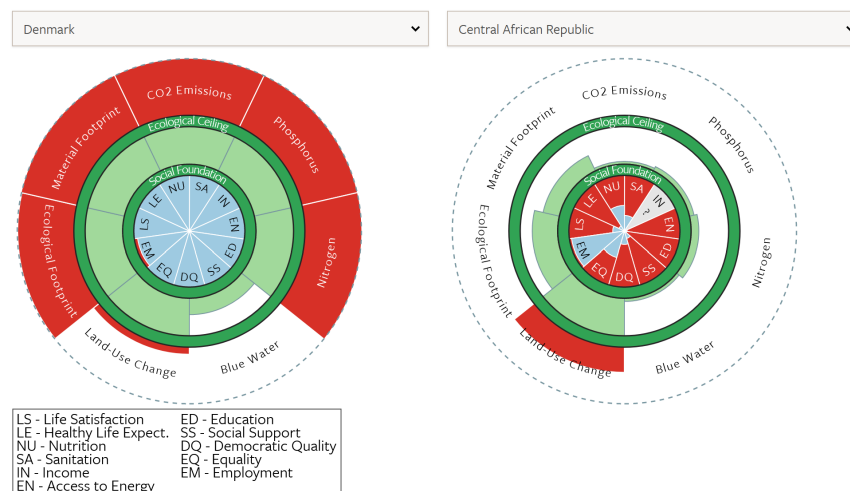


Figure 4.6: Doughnut comparison Denmark - Central African Republic (O'Neill *et al.* n.d.b)

Among the findings of the study, it has been revealed that just 34% of countries are within the per capita climate change boundary, making it the least achieved boundary. Altogether, only 16 countries remain within all seven per capita boundaries, while 48 countries exceed six or more. In all, none of the studied countries meet all 12 social foundations while remaining in the safe operating space relative to the planetary boundaries. As indicated by [Hickel and Kallis \(2020\)](#), the transformation pathway is different for all countries, yet with two main pathways for both developing and developed countries, as shown in Figure 4.7 below.

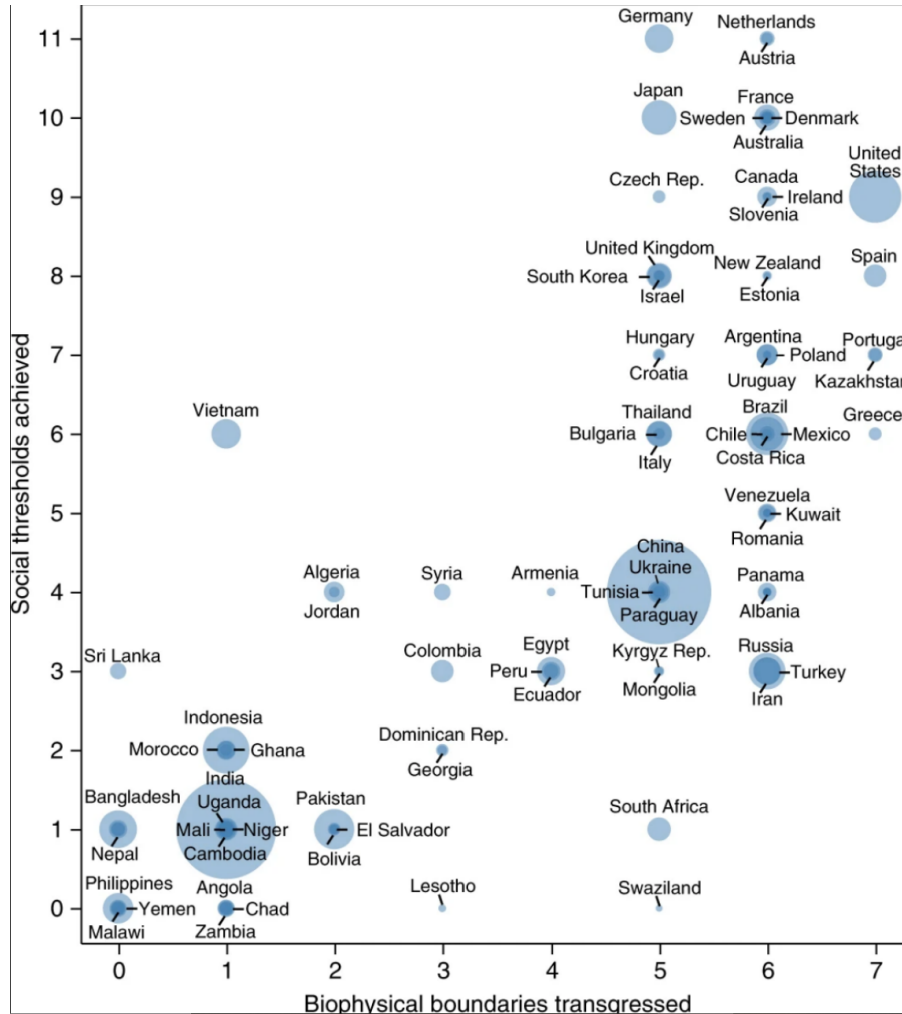


Figure 4.7: Exceeded planetary boundaries vs. achievement of social thresholds (O'Neill *et al.* n.d.a)

The goal for all countries is to reach the upper left corner, with all social foundations secured without compromising planetary boundaries. The developed countries are in the upper right corner, with strong social foundations but high environmental impacts. Consequently, the environmental impacts must decrease while preserving social achievements. On the other hand, in the lower left corner are the developing countries, with little to no planetary boundaries exceeded but with weak social foundations. Therefore, social foundations must be achieved while preserving the ecological capital.

Methods

5.1 Scoping review

5.1.1 Introduction

Presentation of the protocol

The methodology follows the PRISMA protocol by [Tricco *et al.* \(2018\)](#) for scoping reviews. However, this protocol is defined for stand-alone scoping reviews. Therefore, the protocol was adapted, and simplifications were made to better fit the context. The protocol is presented in Figure 5.1 below.

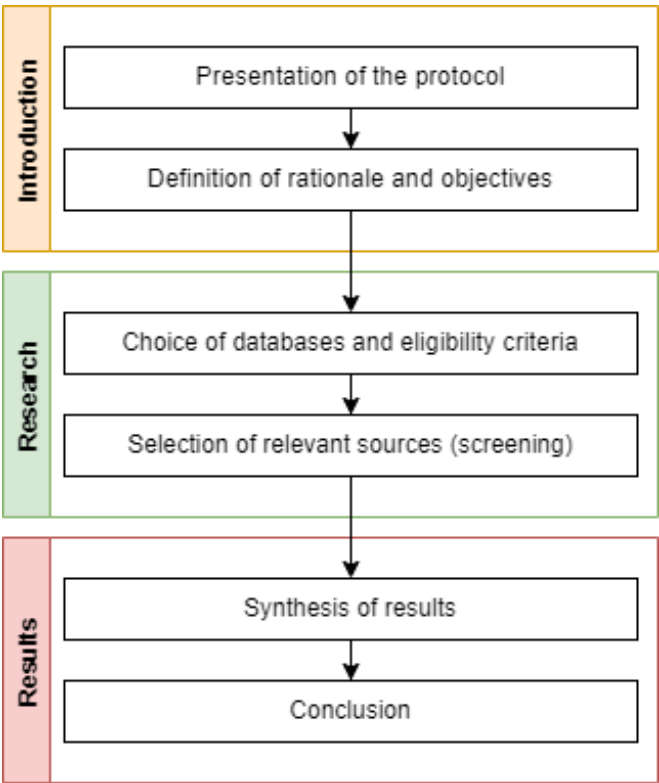


Figure 5.1: Protocol of the scoping review (Own elaboration)

Definition of rationale and objectives

Quoting the Canadian Institutes of Health Research, [Peters et al. \(2020\)](#) support their definition of scoping reviews as "exploratory projects that systematically survey the available literature on a topic, identifying key concepts, theories, data sources, and research gaps." [Peters et al. \(2020\)](#) classify the usefulness of scoping reviews into four points, explaining the relevance of conducting such a method:

1. When investigating a topic or attempting to answer a question, a scoping review examines the breadth, scope, and nature of the available research literature relevant to the case at hand.
2. A scoping review can be used to determine the relevance of undertaking a full systematic review.
3. In the case of a large amount of heterogeneous data, the scoping review allows to summarize and diffuse their results.
4. Scoping reviews provide guidance for future research by identifying research gaps.

The point made that a scoping review can be used prior to a systematic literature review raises the question of identifying the differences between the two and arguing why a scoping review is a more appropriate approach in this particular case. According to [Peters et al. \(2020\)](#), a systematic literature review is an approach better suited to decision-making, while a scoping review is preferred in situations where an emerging field needs to be assessed and understood. The latter will identify, map, report, or discuss the characteristics or concepts of that field. As such, systematic reviews are considered to be of a more explanatory nature with a narrower research question than scoping reviews, which are broader in scope due to their exploratory nature. Following the approach of [Peters et al. \(2020\)](#), there are multiple reasons for this study to conduct a scoping review.

First, an exploratory study seems to be an appropriate method to address the relatively new phenomenon of alternatives to growth. This novelty is not to be understood as the emergence of a critique of growth that has been around for a long time and is widely covered, as evidenced by the 3840 results on Google scholar using "sufficiency" AND "degrowth" or the 1420 results using "sufficiency" AND "post-growth." In this case, novelty is understood as the emergence of concrete representations of alternative models to growth, studied by the scientific community and put into practice in the field, such as the doughnut economy. Nonetheless, the available information on sufficiency within the doughnut economy mindset is not yet clear. Therefore, the exploratory study likely outweighs the narrower, more explanatory approach that a systematic literature review can provide to answer the first sub-question:

To what extent does sufficiency currently contribute to the doughnut economy mindset?

Second, the scoping review can be used to identify research gaps in sufficiency driven by considerations of the doughnut economy. Thus, it will show the maturity or otherwise of the topic and hence assess whether a systematic literature review is needed. In addition, the intention will also be to utilize the sources found to highlight concrete sufficiency measures similar to what would be done in a systematic literature review and its explanatory nature. As such, the approach is somewhat hybrid in order to both answer the question of the scope of sufficiency in the doughnut economy mindset as well as to put forward concrete proposals for the implementation of sufficiency.

An additional consideration is to provide a research framework that distances itself from the systematic literature review conducted by [Jungell-Michelsson and Heikkurinen \(2022\)](#) on sufficiency to provide valuable information different from their review. In their work, the primary objective is to examine, within peer-reviewed sources, the premises and conceptualization of sufficiency in the general realm of sustainability. It also uses these sources to examine the changes that sufficiency implies in a broad behavioral sense for consumers and producers rather than providing a practical roadmap and specific actions to undertake. The scoping review differs in that it considers sufficiency in a specific alternative mindset, namely the doughnut economy, analyzes the scope of this approach beyond the peer-reviewed published articles, and highlights the measures that emerge from it.

5.1.2 Research

Databases and eligibility criteria

Two databases were chosen to conduct the scoping review: Google Scholar and the Aalborg University Library (AUB) platform, the latter of which includes several databases such as ScienceDirect and ResearchGate, providing access to a wide range of journals and books.

- **Aalborg University Library:**

- The research was conducted in May 2022.
- Only articles from peer-reviewed journals were considered.
- Only English language sources were selected.
- The time period considered spanned from 2018 to 2022, with no records found prior to 2018.
- The research was conducted by keyword selection. Articles must contain "sufficiency" AND ("doughnut economy" OR "doughnut economics") to assist in answering the first sub-question.
- This produced 48 results.
- The initial screening was done independently of the content of the sources. Only those with mention of the doughnut economy, doughnut economics, or sufficiency in the title, abstract, or keywords were retained. This reduced the total amount to 7 articles. Self-sufficiency was not considered following the review by [Jungell-Michelsson and Heikkurinen \(2022\)](#), who considered it out of scope.

- **Google Scholar:**

- The research was conducted in May 2022.
- Only English language sources were selected.
- The time period considered is from 2017 to 2022. The year 2017 was chosen due to it being the year of publication of the book on the doughnut economy by Kate Raworth ([Doughnut Economics Action Lab n.d.a](#)).
- The research was conducted by keyword selection. Using the same keywords as for the Aalborg University Library yielded 580 results. In order to reduce the total number of results, "environmental sustainability" has been added to the keywords, providing a narrower focus on the topic at hand. The search is, therefore, "sufficiency" AND ("doughnut economy" OR "doughnut economics") AND "environmental sustainability."
- This produced 247 results.
- The initial screening was done independently of the content of the sources. Only those with mention of the doughnut economy, doughnut economics, or sufficiency in the title, abstract, or keywords were retained. This reduced the total amount to 35 sources. Self-sufficiency was not considered following the review by [Jungell-Michelsson and Heikkurinen \(2022\)](#), who considered it out of scope.

A total of 42 sources were found. The second screening was similar for both research databases. The following were discarded: Master's theses (2), duplicates (1), as well as those mentioning sufficiency only in passing without any valuable contribution to the analysis (18), and those without full access to the source (5). This resulted in 16 sources remaining.

- **Snowball sampling:**

In addition to the databases, the snowball sampling method was used to identify important sources that may have been missed. In the context of this research, snowball sampling consists of researching the reference lists of initially identified sources for other potentially relevant ones ([Hiebl 2021](#)). This approach was extended to interviews in which sources were suggested by interviewees. Still according to [Hiebl \(2021\)](#), the snowball sampling method can account for a significant amount of the total sources when combined with the keyword sampling method. Although the snowball sampling method is not intended in this study to represent the majority of sources, its addition seems relevant to overcome certain limitations. While the use of the doughnut economy as a keyword is the central idea of the scoping review, a system change only occurs through the actions that make one system different from another. Therefore, shifting from a growth-based economy to the doughnut economy is not simply a matter of will but of concrete actions. The snowball sampling search will therefore mitigate the limitations of the keyword search by identifying relevant sources operationalizing sufficiency and referenced by the final pool of selected sources and interviews. As the final pool of sources is composed of sufficiency-based

content, specific criteria were introduced in order to preserve consistency in the selection process and only retain those that have a genuine added value. Nevertheless, it has been recognized by [Hiebl \(2021\)](#) that the main disadvantage of the snowball selection method is generally the lack of transparency. To ensure the greatest transparency possible, the criteria are as follows:

- The research was conducted in May 2022.
- All types of documents were considered, with the exception of Master’s theses, documents without full access, and duplicates already identified in the research of the two databases.
- The time period considered is from 2017 to 2022.
- Only sources that complement the final pool of data have been retained.
- This produced four results.

5.1.3 Charting

20 sources will be used for the analysis and are distributed as follows:

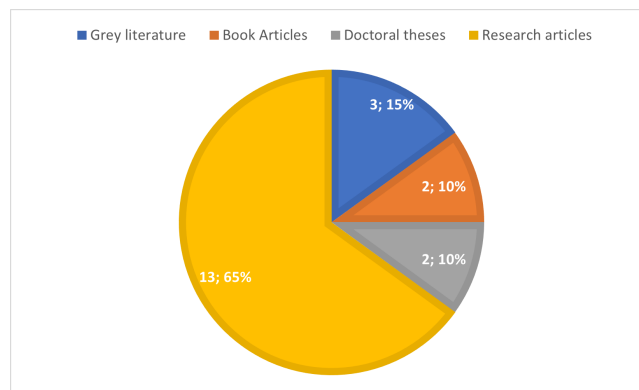


Figure 5.2: Distribution of the scoping review documents by type (Own elaboration)

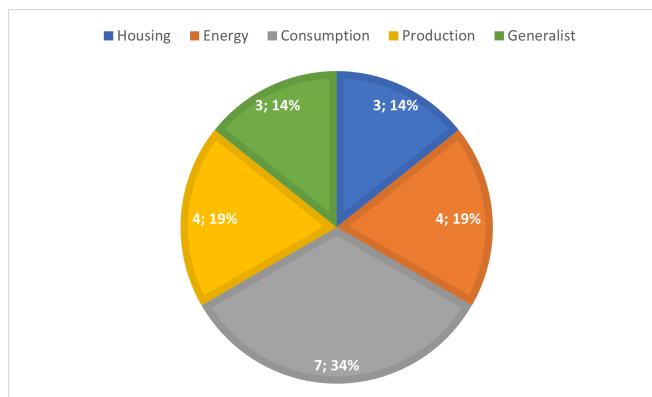


Figure 5.3: Distribution of the scoping review documents by subject (Own elaboration)

Here the amount equals 21 as one particular source addresses consumption and production in a very distinct way

5.1.4 Results

The analysis will be conducted according to the distribution of the topics shown in Figure 5.3 above. While a separate analysis is performed for housing, production, consumption, and energy, it is understood that all sources can contribute to all topics, as can the generalist sources.

Housing

One of the main challenges of the housing sector is its long-term impact (Friends of the Earth Europe 2018). Indeed, housing is a significant contributor to the energy consumption of individuals, along with their nutrition and mobility (Lorek and Spangenberg 2019). In addition, the impact of housing continues to grow, as the trend is for ever-increasing per capita living space (Cohen 2020). This increase in impact is a combination of several factors. First, energy consumption for heating and cooling, ventilation use, and lighting. Second, the larger the floor area, the more appliances the household is likely to use, which may also be larger, increasing the energy consumption of that household. Third, increased floor space is one of the main drivers of land change, resulting in loss of biodiversity and greater material flow, fueling production and consumption (Lorek and Spangenberg 2019). A high sustainability scenario to meet planetary boundaries for high-income countries would imply, given current practices, the need for an 85% improvement in resource consumption for residential housing (Cohen 2020).

Given these implications, sufficiency is primarily achieved through a reduction in per capita living space, as presented in Figure 5.4 below.

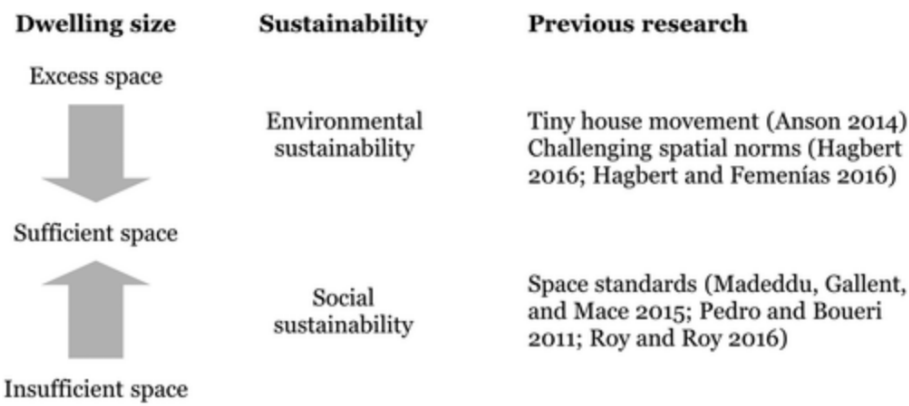


Figure 5.4: Dwelling size and sufficiency (Sandberg 2017)

While energy efficiency is just as important crucial as sufficiency, it must be moderated in its emphasis in environmental thinking to allow for an equal share between sufficiency and efficiency. This shared importance was quantified by demonstrating that an additional 45% of GHGs can be avoided when sufficiency is applied to an energy-efficient household (Lorek and Spangenberg 2019). This is shown in Figure 5.5 below and further explained by Lorek and Spangenberg (2019) in the paragraph below.

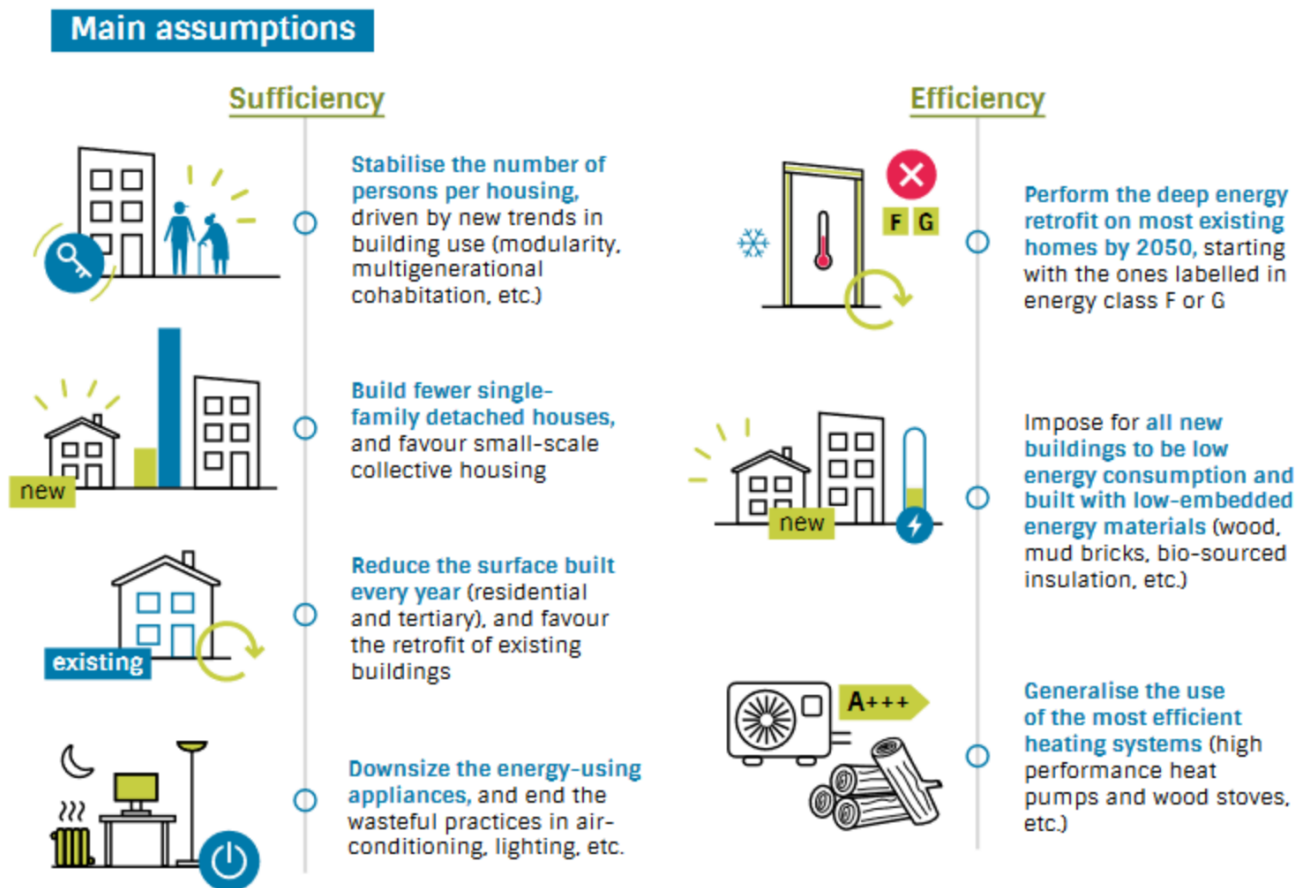


Figure 5.5: Sufficiency and efficiency applied to housing (NégaWatt 2022)

Various ways of operationalizing sufficiency have been proposed in the literature. At the planning stage, new buildings should be designed as vertical villages, with a limitation of private space but an increase in the supply of community-valued space, accessible for free or for rent. According to Lorek and Spangenberg (2019), this is part of a larger idea of the need to change the perception of "house" to "home," the former being centered on the idea of an efficient and techno-engineered approach, while the latter goes beyond the physical and material approach, leading to an alternative discourse better suited to sufficiency. Indeed, "home" will extend the idea of comfort to include the household within a neighborhood and what it offers in terms of social life, mobility, proximity to products and services, etc. This approach effectively addresses the three main energy-consuming sectors for individuals as mentioned above, namely their nutrition, mobility, and housing. Therefore, households should not be considered as single houses, but as a community with common needs. Practically speaking, this can be translated into the concept of the 15-minute city, for example. This is supported by Cohen (2020), who observes the widespread use of cars in high-income countries and the current pattern of city planning evolving around car ownership and "hypermobility," resulting in sprawling housing detrimental to the formation of healthy and socially vibrant communities. Furthermore, the expansion of telecommuting could have a significant impact by reducing mobility needs (NégaWatt 2022).

Second, new ownership models, such as cooperative houses, self-organized housing projects, or shared houses, all of which may require a specific number of tenants per square meter, can act as a sufficiency lever (Lorek and Spangenberg 2019). As cooperative houses and self-organized housing projects remain a limited trend and shared houses are primarily outside the scope of voluntary sufficiency (for financial reasons among students, for example), financial incentives can be offered to make these alternatives more widespread (Sandberg 2017; Lorek and Spangenberg 2019). These have been identified by Lorek and Spangenberg (2019), and three major ideas can be identified: 1) an increase in housing allowances exclusively for these housing alternatives 2) mortgages and credits that are currently based on property as a commodity could be modified to take into account the number of users 3) real estate sales taxes could be reduced for sellers in cases where the number of new homeowners is higher, thus encouraging sales and the transition to a better-sized home for each party.

Lorek and Spangenberg (2019) continue with the analysis of the role of stakeholders. When it comes to the transition to sufficient housing, it must be primarily supported by architects and planners, who can act as leaders of this transition through their daily work. However, at present, comfort is mainly perceived in terms of increased space and therefore construction. Municipalities also have an important role to play in all of the above options by promoting them and including new requirements in their tenders and development plans. Policy levers have also been used, such as the net increase rule. Under this rule, new housing should only be allowed in cities where the number of inhabitants increases. Another less coercive solution would be to set up a fixed number of tradable permits similar to the carbon market, in which building permits could be sold and bought. Finally, circular principles should not be forgotten and enforced through building "take-back" obligations. In other words, this would require builders to develop and implement plans to deconstruct buildings after their period of use and to renaturalize, where possible, the former built area.

As in many sectors, but even more so in housing, sufficiency can be perceived negatively, and without a change in the perception of small living spaces, downsizing is unlikely to gain traction (Sandberg 2017). As such, housing sufficiency can be one of the most difficult endeavors, which is consistent with the fact that downsizing is one of the least discussed topics (Sandberg 2017; Cohen 2020). It should be noted that in developing countries, most of the sufficiency practices mentioned are relevant, although the primary objective is to bring citizens to a sufficient level of consumption (Friends of the Earth Europe 2018). In this respect, it might be appropriate to take advantage of these blank bases for a new perception of housing, as it would allow fulfilling the environmental and social sustainability, as presented in Figure 5.4 above.

Production and supply

The circular economy is currently one of the dominant themes in the rhetoric of decoupling and green growth. Businesses are major contributors to environmental degradation (resource use and greenhouse gas emissions), and questions are emerging about the circularity of current business practices that do not provide absolute environmental benefits (Persson and Klintman 2021). Three observations were made by Bocken *et al.* (2022) pointing in this direction. First, a large majority of products manufactured today are not designed to be in the circular economy loop and/or are not economically viable to recycle. Second, circularity in the context of ever-increasing consumption and production will not have the capacity to reduce environmental pressure on the Earth and in no way compensates for the growth rate of the economy. Third, rebound effects have been identified, such as the increasing energy and resource requirements associated with powering recycling facilities, managing complex recycling loops, remanufacturing and refurbishing processes as well circularity-based businesses stimulating demand for products to be recycled, shared, and refurbished, which ultimately increases resource loops.

To achieve a true circular economy, economic growth and what it entails in terms of resource use, production and consumption must undergo a shift towards a circular economy based on sufficiency, as shown in Figure 5.6 below. In this representation, the sufficiency-based circular economy is placed above certain visions of a sustainable society. This step goes beyond the models underneath, which are efficiency, net-zero, and the current mainstream circular economy. This is only one step, however, as it is still short of the ultimate objective in the context of strong sustainability. Following this framework, two more steps are needed in this transition. First, net-positive companies, meaning that they contribute more positively than the impact they produce, and second, "flourishing," which implies being agnostic about wealth and economic growth. According to Niessen and Bocken (2021), sufficiency will have to become the essential component to achieve strong sustainability in industrial sustainability.

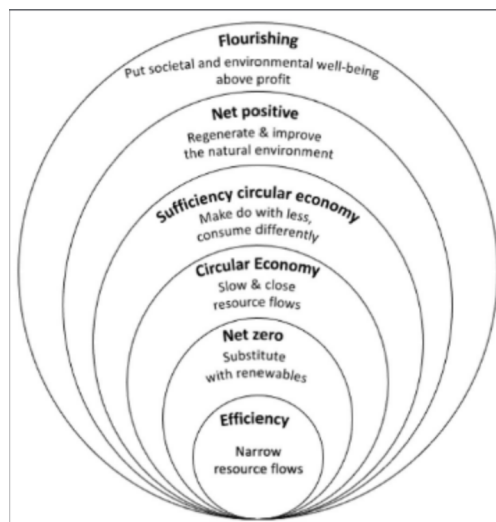


Figure 5.6: A sufficiency circular economy (Bocken *et al.* 2022)

Sufficiency strategies have been described by [Niessen and Bocken \(2021\)](#) under a Business for Sufficiency (BfS) framework, which can be divided into three non-exclusive strategies (Rethink, Reduce, Refuse) as presented in Figure 5.7 below.

	Rethink <i>Consume differently</i>	Reduce <i>Consume less</i>	Refuse <i>Don't (over)consume</i>
Less clutter <i>Simplified & less</i>	No ownership (N.O.) Personalised production Green alternative	N.O. + price incentive Demand reduction service	Moderating sales Question consumption
Less speed <i>Slower & more reliable</i>	Reuse Personalised production Green alternative	Life extension service Long product warranties	Question consumption
Less distance <i>Regional & disentangled</i>	Green alternative	Short distance promotion	Question consumption
Less market <i>Beyond commerce</i>	Open-Source creation Exchange platforms	Support for repair & reuse Exchange platforms	Support for self-sufficiency
	Design	Awareness-raising	

Figure 5.7: Business for Sufficiency (BfS) framework ([Niessen and Bocken 2021](#))

- **Rethinking strategies** are the first step toward sufficiency. Supply-side actors invite consumers to be more sustainable but not necessarily to consume less. This can take the form of exchanges and reuse offers, local production, or products as services ([Kropfeld and Reichel 2021](#)).
- **Reduction strategies** go further with conscious sustainability choices to provide consumers with the willingness and ability to consume less through lifetime guarantees, elimination of planned obsolescence, or repair services ([Friends of the Earth Europe 2018](#)). This implies a greater dialogue with consumers in their use phase as compared to companies that only focus on selling their products ([Kropfeld and Reichel 2021](#)).
- **Refuse strategies** focus on avoiding the act of consumption whenever possible by promoting self-sufficiency and limiting supply and/or sales ([Niessen and Bocken 2021](#)).

Among sufficiency-oriented companies, the refuse strategy remains relatively minimal in comparison to the rethink and reduce strategies. Furthermore, it was observed by [Bocken *et al.* \(2022\)](#) that sufficiency-oriented companies rarely use the term "sufficiency" in their communication. As in other sectors, sufficiency remains a topic particularly related to the perception of sacrifice that does not align with the productive and consumerist society of today. Because sufficiency is still a niche market, the voluntary use of the term "sufficiency" may scare off potential consumers and investors, even if business owners follow a sufficiency motto ([Niessen and Bocken 2021](#)). However, given the close relationship between a sufficiency company and its consumers, who are integrated into the process of economic, social, and environmental value creation, more vocal advertising to further develop the concept of sufficiency is expected ([Kropfeld and Reichel 2021](#); [Bocken *et al.* 2022](#)). In addition, the corporate sufficiency community has proven to run very deep, potentially gaining greater impact through common campaigns such as the anti-Black Friday initiative. In a snowball effect, this may lead to other companies wanting to join a growing movement, as their competitive advantage, while still questionable today, is very likely to grow with each passing year ([Kropfeld and Reichel 2021](#)).

Financing these business models is, therefore, a critical issue. Given the short-term returns expected by mainstream financial actors, it remains difficult for these companies to engage with the traditional financial market, although sufficiency can be a competitive and profitable strategy ([Bocken *et al.* 2022](#)). While sufficiency is hardly compatible with current market trends, both culturally and structurally, some alternative financial models have been identified, such as crowdfunding and impact investing ([Friends of the Earth Europe 2018](#); [Niessen and Bocken 2021](#)). To support these companies, additional financial levers are proposed, such as increasing taxes according to the amount of raw materials and resources used to encourage sobriety and allow sufficiency companies to gain a competitive advantage ([Bocken *et al.* 2022](#)). Consequently, companies and shareholders may be held responsible for the negative externalities of their activities. A practice that can be extended to investment funds as well. Ultimately, policy intervention is needed to achieve strong sustainability outcomes within businesses, both to incentivize ineffective strategies to adopt one and to enable existing sufficiency businesses to thrive and develop ([Hotta *et al.* 2021](#)). To address these social and environmental imperatives, policies on redefining the purpose of the corporate world could reshape business strategy, for example, B-Corp or social enterprises are doing ([Bocken *et al.* 2022](#)). Policies can also push to reduce or even ban the production of non-repairable items or programmed obsolescence by supporting the right to repair and DIY movements ([Bocken *et al.* 2022](#)). In the long term, it will be necessary, according to [Bocken *et al.* \(2022\)](#), to start implementing quotas on the use, sale and, consumption of resources, a rather controversial proposal that they acknowledge but argue will be very likely in the future. According to [Niessen and Bocken \(2021\)](#), quotas could be combined with bans on certain products or services where appropriate alternatives exist. Finally, [Niessen and Bocken \(2021\)](#) note that the majority of products are currently not sold at their true price, including environmental damage. Therefore, re-establishing a price for goods and services that equals their impact would incentive their redesign.

Consumption and demand

The current use of the expression "sustainable consumption" presents some limitations unfavorable to the strong sustainability understanding. [Friends of the Earth Europe \(2018\)](#) and [Marco and Vianna \(2019\)](#) express their concern that "sustainable consumption" is not a determining factor in stimulating changes in consumption volumes, on the contrary. They further explain that the weak sustainability mindset has been promoted enough to become the very definition of sustainable consumption. It is characterized today by an increase in industrial development, allowing growth to provide the necessary solution to environmental challenges, given the assumption of future technologies and increased economic competitiveness, both fostered by an increase in green consumption ([Callmer 2019](#)). The opposite mindset, that is, strong sustainable consumption, can be defined as satisfying human needs while ensuring environmental justice (i.e., the ecological capital must be preserved as it is, if not enhanced). Importantly, sufficiency should not be seen as a retrograde move to an earlier time when consumption was less, but life was more difficult ([NégaWatt 2022](#)). It must be planned with the ideas of joy and creativity in order to minimize the role of material goods and services in the fundamental definition of well-being ([Hotta et al. 2021](#); [NégaWatt 2022](#)). However, this thinking remains politically weak ([Marco and Vianna 2019](#)). The emerging concept of consumption corridors, which are oriented towards strong sustainability, could be an opportunity to expand sufficiency. Consumption corridors raise the question of how to satisfy human needs within ecological and social constraints ([Callmer 2019](#)). The multiple benefits of sufficiency in relation to consumption corridors have been presented by [Wiese et al. \(2022\)](#) in Figure 5.8 below.

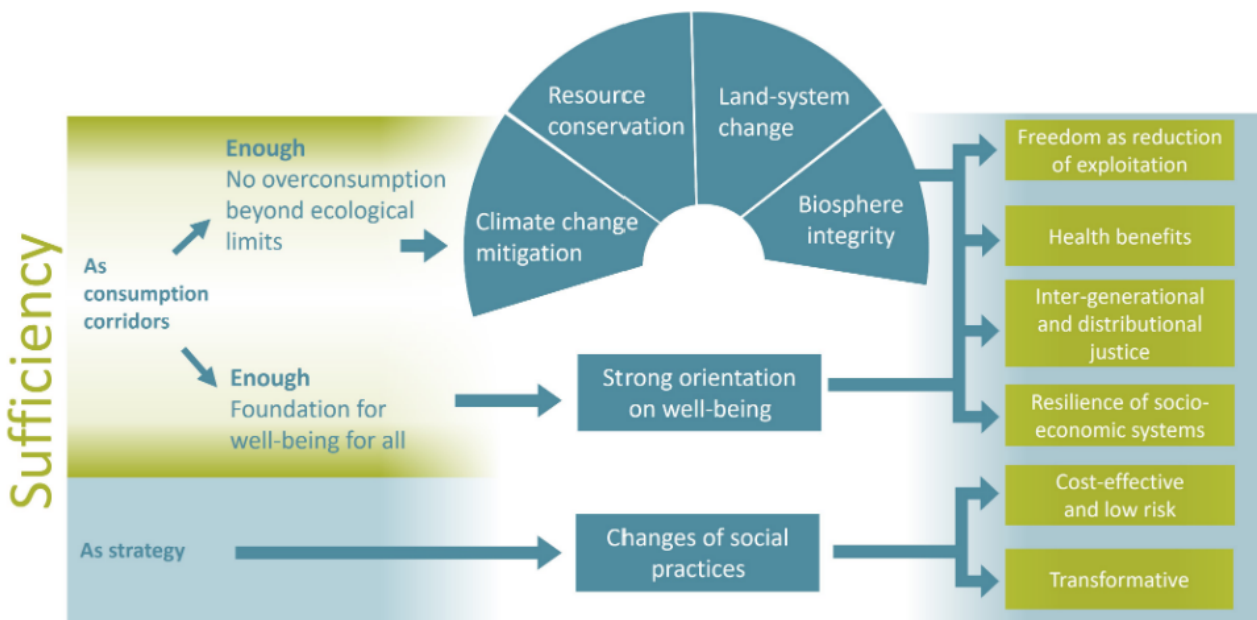


Figure 5.8: Potential benefits of sufficiency, a multidimensional perspective ([Wiese et al. 2022](#))

Here, [Wiese et al. \(2022\)](#) present some of the benefits of sufficiency as highlighted throughout this study. These include sufficiency as a strategy for changing social practices, as a mindset for improving well-being, and as a sustainable practice for addressing planetary boundaries. However, their analysis goes further by considering the multidimensional nature of sufficiency. "Freedom as a reduction of exploitation" refers to consumption as a result of influences that must be addressed from the top-down on consumers to direct consumption towards strong sustainability. The health benefits are at both the individual and societal levels. Reducing consumption and possession of goods and services can alleviate stress and bring greater peace of mind. These behaviors of sufficiency, because of their impact on the surroundings (environment, urbanism, etc.), have a collective impact that benefits the health of everyone. "Intergenerational and distributive justice" calls for a duty of responsibility by current generations to allow future generations the development they deserve in a safe operating space. The resilience of territories is strengthened by the decrease in consumption and production as less subject to the uncertainties of energy and resource supply. Therefore, a majority of sufficiency measures can be implemented immediately and without requiring future technology development or complex engineering processes in terms of manufacturing, resources, infrastructure, and skills. Sufficiency is thereby a cost-effective, and low-risk transition, as the most important investments in mobility and land-use planning will be less costly than techno-focused solutions to climate change that have more uncertain returns. Finally, once embraced, sufficiency is one of the most empowering practices to date, which has the potential to challenge current economic trends of GDP growth and may offer a pathway for transforming the growth-dependent economy. The main challenge remains, however, to define the minimum and above all, the maximum in terms of the satisfaction of human needs, as the right of one to achieve well-being should not prevent others from doing the same ([Godin et al. 2020](#)).

In terms of specific policies, past practices for health reasons such as tobacco could be extended to environmental considerations. This would include, for example, limiting or even banning advertising for unsustainable products and services. This first argument is reported by [Bocken et al. \(2022\)](#) and followed by a second one, namely higher taxation on non-sustainable products and industries such as aviation, which is still very attractive economically speaking and therefore preferred by many consumers. To complement this idea, subsidies for more sustainable practices such as rail travel could lead to a change in consumption patterns, as affordability is a key element in ensuring a fair transition for all people ([Niessen and Bocken 2021](#)). Hence, choices must be made about what intensities of activity to discourage or prohibit in different sectors ([Darby and Fawcett 2018](#)). Overall, the policy measures to be taken are not clearly defined, and no single plan of action will be adequate as consumption is practiced as differently as there are variations within the global population and within a given country (urban vs. rural, highly educated vs. little educated, rich vs. poor) ([Spangenberg and Lorek 2019](#)). To conclude, consumers in the sufficiency sphere have been defined by [Kropfeld and Reichel \(2021\)](#) as "Prosumers." In other words, without their involvement and sense of belonging to a new paradigm, there cannot be sufficiency-oriented practices that change and shape business models and consumer practices.

Energy

Energy sufficiency has been defined by [Darby and Fawcett \(2018\)](#) as a state in which the basic needs of people for energy services are met in an equitable manner within planetary boundaries. Energy is assessed in terms of what work it can perform, taking into account social, environmental, and strategic factors. These energy services include those previously discussed (i.e., housing, consumption and production in addition to mobility, communication, agriculture, health, leisure, etc.) In other words, energy is a service provider and the common denominator of all industries and human activities without exception. However, relatively few of the energy policy measures analyzed by [Zell-Ziegler *et al.* \(2021\)](#) can be considered energy service reduction policies aiming to reduce energy demand levels. Instead, most policies aim to shift demand toward less energy-intensive services (for example, modal shift in mobility). Although these modal shifts are part of sufficiency practices and allow for energy reduction, their approach has been to analyze sufficiency in European National Energy and Climate Plans (NEECs) and Long Term Strategies (LTS). In both cases, sufficiency in the EU is currently poorly supported by concrete policy measures in both the short and long term.

In the area of mobility, [NégaWatt \(2022\)](#) presents some ideas for sufficiency-based practices in which modal shifts are included, as shown in Figure 5.9 below.

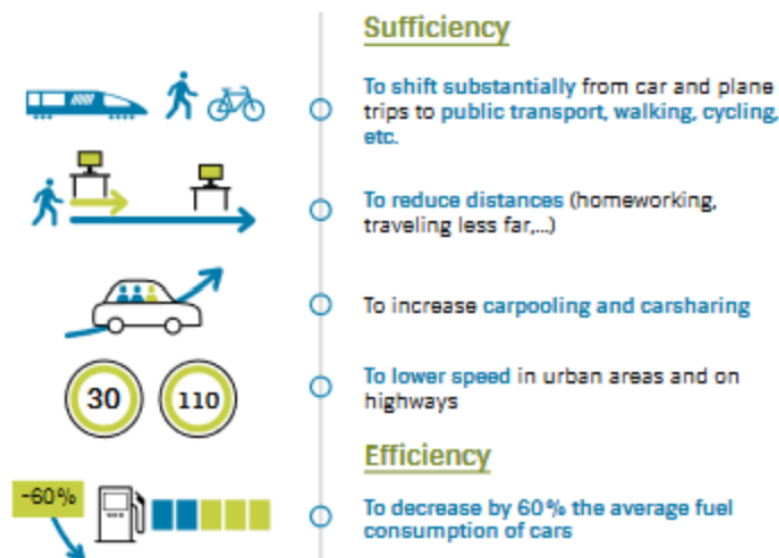


Figure 5.9: Sufficiency and efficiency applied to individual mobility ([NégaWatt 2022](#))

Here, common practices of sufficiency can be recognized. Their analysis also extends to freight mobility, with suggestions such as promoting local production, increasing truck load factors and shifting freight from road to rail and water. As with mobility, it may be useful to consider sufficiency in all new policies to ensure a better sustainability transition between sectors and stakeholders as part of a multidimensional sustainability strategy ([Spangenberg and Lorek 2019](#)).

5.1.5 Conclusion

As mentioned in the introduction of the scoping review, the first sub-question the review attempts to answer is rather broad as it explores sufficiency in a specific context, the doughnut economy, with no similar study existing to date. In addition to exploring the place of sufficiency in this line of thought, the maturity and potential gaps in the research are investigated. The first sub-question goes as follows:

To what extent does sufficiency currently contribute to the doughnut economy mindset?

The sources analyzed focused on different perspectives of the doughnut economy, all of which can find a place in one of the seven ways of thinking presented in section 4.1.1. These include, for example, a critical analysis of economic growth (7th principle), minimum and maximum limits within the safe operating space (5th principle), and consumption corridors (2nd principle). In a sense, sufficiency can be seen as the broader term by which these notions operate with planetary boundaries as a common denominator. Nevertheless, studies clearly connecting the doughnut economy with the precise use of the term "sufficiency" are not abundant. Indeed, while the sources are very comprehensive in the information they provide, not all sectors are considered and none of them specifically addresses topics such as agriculture and nutrition, mobility, tourism, digital, etc. Given these elements, it does not seem necessary to conduct a systematic literature review.

The reasons for such a gap in the literature are multiple. One of which is a recurring rhetoric about the lack of acceptance of sufficiency and its regressive connotation for many in society including businesses and decision-makers. Moreover, the theory of the doughnut economy is still recent, and it may take time to embed sufficiency into this particular framework in a comprehensive way. As a result, in a growth-oriented society, the impression is given of a conflict between sufficiency and efficiency. In fact, the literature calls for both to be considered equally. Overall, the results of the scoping review clearly indicate that sufficiency is a cross-sectoral approach with great potential for applicability and is a perfect fit with the doughnut economy in providing the minimum necessary per individual while respecting the ecology of our planet.

Two major limitations are to be highlighted in the operationalization of sufficiency. First, the negative perception of sufficiency, which is above all linked to the abandonment and sacrifice of a sense of well-being that is nowadays very strongly linked to consumption. The second is the absence of an unequivocal metric to quantify the contributions of sufficiency both in terms of well-being and in the absolute reduction of environmental damage. Thus, future studies may focus both on sufficiency in sectors not examined through the lens of the doughnut economy in this study and on the metric(s), where appropriate, needed to support sufficiency in a concrete way.

5.2 Interviews

5.2.1 Introduction

Three interviews were conducted virtually using Microsoft teams, all three with relevant actors in the field of sustainability. The interviews are conducted using the framework of narrative analysis. Narrative analysis is a method of conducting interviews that recognizes the value of individual stories in making sense of larger changes. In other words, this method uncovers the positions underlying the stories being told as well as the larger context that creates these narratives (Breheny and Stephens 2015). The objective of these interviews is, therefore, to give voice to three different profiles on which to reflect. Naturally, each individual has a different opinion on sufficiency and society. Hence the interviews are not meant to represent a general trend but allow for constructive reflection on the necessary transition towards sustainability.

Although the main topic is sufficiency, the semi-structured interviews were prepared in such a way as to allow a great deal of freedom in the way the topic was approached, allowing the personal experiences of the interviewees to emerge. This is in agreement with Adams (2015), who argues that the agenda for semi-structured interviews, while guided, are not fully scripted. The objective of these interviews is, therefore, to answer the second sub-question:

How is sufficiency currently perceived and understood in the sustainability debate?

As mentioned, the interviews were semi-structured, and therefore, an interview guide consisting of closed and open-ended questions was developed to ensure the collection of relevant data (Adams 2015). Interviewees were contacted by email and agreed to an interview of approximately 1 hour. These interviews were recorded and the interview material presented in the study is based entirely on the information provided by the interviewees, without any further research or additions. The objective is to reflect their point of view on the subject as accurately as possible in a transcript-like presentation. These interviews were conducted with:

- Dr Joanne Wade (Energy Sufficiency)
- Martin Kruse (Copenhagen Institute for Futures Studies)
- François Richard (The Shifters)

5.2.2 Energy Sufficiency



Dr. Joanne Wade has worked primarily on energy efficiency for the past 30 years and holds a Ph.D. in sustainable transportation. She developed an interest in the social benefits of energy policies, which at the time were often ignored in favor of quantifying carbon emissions. She currently holds a part-time position as Chief Strategic Advisor for a trade association in the UK, working with various energy sector organizations interested in local energy and energy community ownership. In addition, she works with the academic community and local governments focusing on local energy systems and community responses to energy issues. As a board member of the European Council for an Energy Efficient Economy (eceee), she participated three years ago in the development of the Energy Sufficiency initiative and led the project. This initiative was launched as the topic of sufficiency gained momentum within the eceee community, with an increasing number of papers presented at the eceee conferences held every two years. The eceee can be defined as an information center bringing together researchers, practitioners, and policy-makers. Its membership is heterogeneous, with opinions ranging from green growth and techno-centered solutions all the way to degrowth and everything in between.

The Jevons paradox was the first topic mentioned, which is considered somewhat extreme by the interviewee, particularly concerning demand-side energy efficiency. Although a rebound can occur in these cases, she states that we rarely exceed what energy consumption used to be. On the other hand, as far as energy supply is concerned, she recognizes trends of increasing energy consumption, which would be consistent with the analysis of the correlation between growth and energy consumption in Section 2.1.1. Nevertheless, she argues that it is important not to consider rebound effects as the main reason for system change but rather to finally recognize planetary boundaries as a major concern. Therefore, new technologies should not be an obstacle to change, as the interest is primarily in doing things differently. She goes on to use the example of electric vehicles. Of all the environmental (pollution) and social (inequality) problems created by the current transportation system, electrifying that system addresses only carbon emissions and nothing else. Regarding innovation, Dr. Joanne Wade touches on a topic highlighted in one of the energy sufficiency workshops, namely the type of innovation environment needed to ensure that sufficiency-based ideas are the ones that are put forward. This will depend on the innovation we support, that is, the framework put in place to support innovation, which includes the strategic orientation of both policy and funding.

However, in her experience, a key challenge faced by Energy Sufficiency is to ensure that the subject is taken into account by politicians, businesses, and the media to an extent that makes a difference. For

politicians, the concept may be unpopular with voters; for businesses it fundamentally goes against their current mindset, while for the media, it is simply not worth the headline. To overcome this challenge, sufficiency must be presented as a profitable alternative, examples of which were presented in the scoping review of this study. For politicians, it is time for the debate to accept the presence of limits, yet she believes that the top-down approach is not quite mature enough despite the need for rapid change. As a strong advocate of a bottom-up approach, she has seen how significant its impacts can be and how it can pressure national governments to act. In the UK, for example, it seems that local authorities are responding rather quickly and effectively, with two-thirds of them having declared a climate emergency and set a climate neutrality target earlier than the national government.

For sufficiency to gain traction and be properly operationalized, she suggests that the movement not make the same mistakes as the efficiency community. She believes that there has been a tendency to present efficiency as the solution and answer to challenges, although without actually defining the problems at hand. "What we are doing is good, and therefore, you should listen to us," she says. Good local sufficiency practices are beginning to appear, such as the active travel movement in the UK, with the example of the Greater London Active Travel Plan. It is not developed because walking or biking is superior, but it is strategized and planned to target predefined issues such as air pollution and obesity, for which active transportation has been proven to be effective. This is part of "getting the language right," as sufficiency is always negatively associated, which is consistently noted in the literature and in the interviews conducted. Therefore, the appropriate language should be used, which is to emphasize the notion of healthy living within limits. One of the benefits of sufficiency is that it can be used as a tool to fight poverty and inequality, as it ensures that every consumer, and by extension every citizen, receives what they need, as the doughnut economy shows. To achieve this, however, she also raises the need to discuss the issue of having too much. To bring about the necessary system change, it seems clear that GDP is not the appropriate measure to achieve this and that we need to distance ourselves from it. She quotes Mark Carney, Governor of the Bank of England, who published a book on how value and values have become disconnected. In other words, we only value monetary assets when our values are much broader than that. The fact that people in the financial sector are talking about this is a good sign, yet the conflict between growth and limits is still a long way from being highlighted.

The interviewee was asked about her three wishes for the future. First, she mentioned the debate about a maximum income to close the loop, which started with ensuring that everyone has enough, which can hardly happen with overwhelming inequalities. Second, a celebration of how people do things differently. It is about shifting the conversation to what people want and need. In other words, a bottom-up approach where developing countries, but not only, can be offered development from within and on the basis of their own will rather than a common international framework. Third, strengthening small communities such as the C-40 cities, a shared vision for common prosperity. She wants to see these initiatives grow to give people a voice.

5.2.3 Copenhagen Institute for Futures Studies



Founded in 1969, the Copenhagen Institute for Futures Studies is an initiative of former Finance Minister and OECD Secretary-General Professor Thorkil Kristensen. According to its website, the institute is described as an independent, not-for-profit think tank. The interviewee is Martin Kruse, senior advisor and futurist at the Institute. He leads research on the environment and resources, as well as foresight and future studies. His work involves envisioning the future to make better decisions in the present. Risks and opportunities are analyzed to understand how society might evolve and how organizations and companies should anticipate and react in order to safeguard their activities. The institute advises governments and companies worldwide, most of which are Fortune 500 companies. While most studies are conducted with climate change in mind, its importance varies from case to case.

Given climate change and the energy transition, the predominant question according to Martin Kruse is not whether business models should change but how. One of the challenges is to adapt the entire supply chain of businesses as everything has to be remodeled, every product and every service. The interviewee emphasizes the magnitude of the changes to come, and because of the sheer magnitude of these changes, it can be said that we haven't even started.

On the topic of consumption, the interviewee presented a recent study conducted by the institute on how Danes perceive climate change and sustainability and what they are doing to address it. He interpreted the results as showing a significant gap between what people say they do and what they actually undertake. For example, cycling or sorting waste, which he said are actions that would be done independently of climate change and cannot be defined as concerted actions. In addition, willingness to pay for more sustainable, sufficiency-based products and services is questionable, as most people outside the green consumer group are unwilling to pay more, he added. Nevertheless, some sufficiency behaviors are beginning to emerge, as the mindset that money will not bring happiness increases. People are looking for financial security above all, instead of wealth. Therefore, they are looking for more leisure time than working hours. He believes that sufficiency is particularly relevant to symbolic consumption, such as owning certain cars or clothes. In these cases, there may be a rationale behind sufficiency. However, given the radical changes involved, Martin Kruse does not believe that sufficiency is driven by consumers. In his view, consumers will not accept to just "make do." If a company pursues a sufficiency strategy, consumers will likely interpret it as a lack of functionality and, therefore, an inferior service to what they would get elsewhere.

On the business side, implementing sufficiency is equally challenging as it inhibits growth, which is the ultimate goal of businesses. While we cannot do without sufficiency, it is unlikely that it will become the main driver of businesses and societies. In his experience, companies want more sustainability and to provide some sort of sufficiency services. One of the reasons they don't is the lack of people willing to pay for it, leading back to one of his earlier statements about willingness to pay the price. He also believes that corporate efforts are misunderstood as board discussions are not made public. In addition, some companies do not make a conscious commitment or do not communicate their efforts to protect themselves from accusations of greenwashing. If a company dedicates 20% of its business to sustainability and/or sufficiency, the other 80% will be the focus of public debate. This misperception of companies is unfair to them, he says, since they are primarily competing with other companies, meaning that profitability must be taken into account.

In terms of the overall place of sufficiency in society, the change is such that only two scenarios exist for sufficiency to become widely implemented. First, if decisions are made at a higher level, without which, there will be no great change in the next 20 or 30 years. Therefore, the first possibility is a top-down approach, including carbon taxes. Second, the interviewee perceives sufficiency primarily as a situation experienced in non-abundant societies, as something that is imposed rather than chosen. The second possibility, then, would be sufficiency imposed by resource scarcity. In this respect, he believes that this is very unlikely, as the scarcity of resources such as iron, etc., is not an issue. Given their availability and abundance, there are actually very few finite resources, he says.

The interviewee makes a strong case for green growth as the essential path. The main question is how to get it. The carbon tax, as mentioned, was suggested as emissions are the major problem before all others. The carbon tax can solve the lack of consideration of negative externalities. Today, he considers that short-term risks are put forward and that there is no generational solidarity. If we took into account the effects of our actions in our methods, change would occur. While decoupling is the objective, he believes that it is unlikely to happen fast enough on a global level and that it will be too late when it does happen. Nevertheless, the idea of growth should not be questioned, as the economic system is relative. In his view, if Denmark stops growing, it will become relatively poorer, which will make it more difficult to get loans or to support the social welfare system in its entirety, which currently needs growth to provide its services. Developing countries should also grow with the support of current green technologies. He believed that we now have the capacity to decarbonize the economy but that prices must come down. Therefore, funding, research, and technological development should be directed towards current knowledge rather than betting on uncertain progress in the future.

5.2.4 The Shifters



The Shifters is a network of volunteers with a wide range of backgrounds, experiences, and skills who share a common interest in the carbon transition of the economy. Their mission is threefold: 1) to support The Shift Project (think tank) in its work 2) to inform, debate, and educate themselves on the decarbonization of the economy under different aspects (scientific, technical, and political) 3) to communicate the ideas and work of The Shift in their own networks and develop new ones. François Richard, the interviewee, is now retired after spending almost his entire career at Orange, a French telecommunications company. François has an engineering background in applied computer science and has been involved in various activities at Orange, such as research, marketing, and strategy. He is also co-author of the report "Deploying Digital Sobriety," a 2020 Shift Project report. François also worked on the use of new technologies in city management, the so-called smart cities.

Early in his career, François was involved in the first large-scale deployments of new technologies for the general public, such as telephone coverage of the French territory, followed by computing. He observes a shift from the idea of an intelligent, cultured, and conscious democracy empowered by access to information to an opposite result dominated by virulent marketing, especially by GAFAM, in which liberation has turned into bondage. One evolution that can be learned from his career is that simultaneously, as technological progress occurred, Orange was privatized and turned from a public service into a profit-making enterprise with newly arrived shareholders. The objectives of the public service, which were defined in a charter to provide public services, were redirected to make profits for these shareholders and to ensure the development of the company. At that time, the notions of sobriety and sufficiency were therefore irrelevant. Thus, legislative constraints will be necessary to ensure the implementation of sufficiency, as the scenarios of natural state monopolies have been abolished by liberalism. These legislative constraints will help to restrain the market, which is not capable of inducing change. For that, multilateralism is essential considering the global sense of planetary boundaries.

On the subject of natural monopolies, François believes that this could have made a difference on a large scale, sustainably, and rapidly due to its benefit of long-term planning. Strategic planning is particularly complicated to implement in a liberal system and seems to be out of fashion. In his example, before privatization, France Telecom (now Orange) carried out short-, medium- and long-term strategic planning in order to develop France Telecom socially, technologically, and societally. Privatization has brought competition and the impossibility of pursuing a strategy in isolation, as each company

seeks to surpass the other, and all have to compete in the very short term given the uncertainties of the market that do not exist in a natural monopoly. This made society reactionary rather than planful.

One of the main challenges of digital is that its impact is invisible to most people. It is also one of the sectors with the highest growing environmental impact, both in terms of energy and resource consumption. Moreover, the programmed obsolescence of digital technology is particularly developed, says François. In this sense, sufficiency will become more and more important. The main obstacle according to him, is that digital sufficiency is subject to accusations of promoting degrowth, which makes people rather uncomfortable. He uses the example of 5G and French President Macron naming Amish those in French society who have called for a moratorium on 5G deployment. François goes on to point out that the environmental impact of 5G should be studied. As a standalone service, it seems that it allows great energy savings compared to the previous 2,3, and 4G (amount of information transferred per unit of energy). However, it should be remembered that 5G is not a standalone service as it does not replace the older generations. He believes that rebound effects will occur despite a 10x reduction in energy consumption, as this will result in a 10x increase in infrastructure requirements and an increase in consumption. François emphasizes that he is not calling for a complete halt to 5G deployment but that, given the environmental crisis, digital should not be exempt from sustainability considerations. Its use can be interesting if it is seen as a societal advance rather than a technological one, which raises the question of where precisely 5G is needed.

There is a need for technological progress to propose reductions in energy consumption that are absolute and not relative. According to François, developing countries are quite capable of this since they have revenue and resource constraints leading to innovations that are less damaging to the environment. The concern is that these developing countries must at the same time respond to international organizations such as the IMF, which require them to meet growth and value-added objectives rather than seeking a form of development that is more attentive to the needs of the planet. Overall, the criteria imposed on developing countries does not allow them to propose an alternative development model. If these countries are looking for funds, they have to apply the same criteria as we do, which makes little sense as our system is not the appropriate one if we want to respect planetary boundaries.

François was asked about his three personal wishes for the future. First, he recognizes that air travel is overused and that sufficiency is particularly important in this area, as an absolute reduction in air travel is essential to achieve greater sustainability. For him, this goes hand in hand with the promotion of closer tourism. Second, to find a way to reshape strategic thinking to enable long-term strategic planning. Third, localism in both production and consumption to empower people to regain control over their local environment. Moreover, he points out the unreasonable use of unlimited services, a subject rarely discussed in the literature yet fraught with consequences. François takes the example of unlimited mobile plans that have a strong impact on the environment but are invisible to consumers.

5.2.5 Conclusion

It should be remembered that these three approaches do not represent a general trend or consensus among one's peers. Nevertheless, these interviews are enriching in that they come from three individuals whose personal and professional experiences are radically different. The three interviews offer different perspectives on sufficiency but also on growth, decoupling, and sustainability in general. Combined, they provide valuable insights to answer the second sub-question, which is:

How is sufficiency currently perceived and understood in the sustainability debate?

First, all three interviewees acknowledge the existence of planetary boundaries, a fundamental precept of sufficiency. However, the importance of these boundaries is ranked differently with respect to their importance. On the one hand, the willingness to be massively engaged in reducing emissions rather than addressing resource scarcity, and on the other hand, a more moderate emphasis on emissions in favor of a holistic approach. Similarly, the importance of efforts to implement sufficiency among consumers, producers, and policy-makers was affirmed by all three interviewees, but again to different degrees from a bottom-up to a top-down approach.

The interviews allowed for topics that were not mentioned in this study to be addressed. One of these topics is the digital world, which is indeed highly significant due to its increasing penetration in society and the growing pressure it places on the ecology of our planet, thereby making its integration into the theme of sustainability and sufficiency urgent. Other topics included allegations of "green-washing" that may discourage major companies, the role and future of innovation as well as the place of sufficiency in developing countries. The very perception and importance of sufficiency is also not unanimous. Such differences can be explained by the different views on society as a whole and its relation to green growth.

Some ideas for operationalizing sufficiency were mentioned. These include establishing scientific rigor and strengthening the link between sufficiency and well-being, integrating sufficiency as a policy in its own right in decision-making, and greater consumer awareness of their environmental impact.

Discussion

This study analyzed sufficiency in a broad context as a means to achieve a strong sustainability transition through the lens of the doughnut economy. Such an approach can be both a limitation and an asset. As a limitation, it does not provide a clear roadmap for sufficiency in any given area and is rather diffuse relative to what could be achieved through a more local and/or sector-specific study. The upside is that it identifies potential research gaps to further advance the overall issue of sufficiency. Indeed, the scoping review identified the preferred research topics, yet given that the idea of sufficiency is theoretically applicable to all sectors and services, it is worth mentioning those sectors that have received little or no mention throughout this study. These include agriculture and nutrition, tourism, culture and sports, entertainment, military and defense, etc. Among the questions to be asked include: how can these sectors integrate sufficiency into their practice? How to ensure equal access to all people and thereby avoid inequalities in access to these goods and services? How can we ensure that these services and goods respect planetary boundaries? In addition, two main challenges were identified that could be relevant subtopics for further study, namely the quantification of sufficiency in terms of the benefits it provides and the very perception of sufficiency by individuals. Regarding the quantification of sufficiency, whenever sufficiency has merit, it must be systematically associated with clear, scientifically-based measures to ensure its place in the decision-making process, also known as EBPM or Evidence-Based Policy-Making (Hotta *et al.* 2021). In terms of the perception of sufficiency, its democratization should allow it to transcend its current position, largely confined to the academic sphere.

While planetary boundaries must be respected, it must be remembered and emphasized that sufficiency is not an obstacle to progress, development, and innovation, even if they must be redefined, both technologically and societally, by freeing them from the pursuit of economic growth. As such, the important task is to define how continued progress, development, and innovation are shaped in a society operating within the safe operating space of the doughnut economy. For technology, this is an enormous challenge, given its increasing omnipresence. This will require a different relationship with technology, driven by purpose, and new indicators to measure its appropriateness within the doughnut (Pansera and Fressoli 2021). Therefore, according to Kerschner *et al.* (2018), the next step is to "define, refine, and develop criteria for the design, evaluation, and governance of appropriate technologies."

Finally, perhaps one of the most pressing issues for all of the above to bear meaning is the transition to a sustainable welfare state, that is, one that operates in a safe operating space beyond the growth paradigm, disengaged from the GDP mindset, and in which its financing is decoupled from economic growth in favor of an ecosocial compass (Hirvilammi 2020).

Conclusion

Environmental protection and sustainability continue to play a discrete part in decision-making at all levels rather than being the common lens through which all other policies pass. The same can be said of sufficiency, if not more so, as debating consumption and production volumes is simply contrary to the current paradigm of economic growth in developed and developing countries alike, the latter tending to follow the Western development model. In fact, the notion of sufficiency does not appear anywhere in the Paris agreement. One reason for this is that sufficiency continues for most to symbolize a decline in quality of life and great sacrifices, whereas the study suggests that sufficiency can go hand in hand with increased well-being. Nonetheless, the current system pursues its ambition of decoupling, a phenomenon still at the stage of theory if we follow the necessary criteria presented in the study (absolute, total, global, sustainable and swift). The theory of decoupling driven by green growth and efficiency has been pursued for several decades yet without any conclusive evidence at a time in which every year dominated by the growth-oriented policies is a year lost for the planet and its boundaries. Given the pace needed for protecting the climate and biodiversity, the speed with which sufficiency can be deployed and the relatively inexpensive cost of many of the sufficiency measures can be decisive in putting us on track to achieve strong sustainability.

The doughnut economy offers an alternative. This theory is based on two elements. First, a minimal level of consumption and supply of goods and services for all in order to satisfy 12 social foundations synonymous with well-being. Second, a maximal consumption and production level to prevent exceeding the 9 planetary boundaries synonymous with the planet's sustainable state. To accomplish this, sufficiency is not only important but undoubtedly required. However, to this day, sufficiency remains confined to a few actors who act for its democratization, including individuals voluntarily committed and invested in reducing their consumption volumes and a few companies following a sufficiency business model. Nevertheless, Sufficiency cannot be reduced to a strategy to fight climate change, it implies much more. In any case, eventually, there is a strong probability that this voluntary choice of sufficiency becomes the norm, either as the result of an increase in environmental awareness or forced upon us by the laws of physics. Indeed, we must remember that Mankind does not produce energy, it is only extracted from nature, then transformed for its own uses. The same goes for the other resources. However, there is no guarantee that the non-fossil energies will be sufficiently important to compensate the decline of the fossil energies which at the same time continue to increase the economy and consequently the need for non-fossil energies. The energy transition, while the most important, remains one of many harms caused by humanity's growing unsustainable activities on the planet for which sufficiency has its place in acting on them.

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