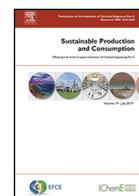




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# The end of business-as-usual? – A critical review of the air transport industry's climate strategy for 2050 from the perspectives of Degrowth

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## ABSTRACT

In discourses around sustainability, increasing eco-efficiency through technological developments are highly popular as they promise the continuation of business-as-usual and appeal to economic actors whose primary motivation is to follow the paths of economic growth. Dominant narratives and visions about the bioeconomy also fit into this line of thinking by giving a central role to technological problem solving and decoupling, the opportunities of sustaining economic growth and advancing the extended use of renewable resources. In 2020, major actors of the air transport industry under the frame of the Air Transport Action Group issued Waypoint 2050 a global, sector wide strategy to tackle climate change and halve CO<sub>2</sub> emissions by the middle of this century. As we will establish in this paper, their sustainability strategies strongly rely on bioeconomic solutions such as sustainable air fuels and renewable energy, while their need to grow remains unquestioned. However, achieving sustainability is a wicked problem that needs clumsy solutions. And clumsy solutions only come about when highly different viewpoints are put on the table. Degrowth perspectives can most certainly enrich dialogues on sustainability transitions such as the current challenges the air transport industry faces. This paper aims to provide a critical review of Waypoint 2050, underlining why it is important for economists and policymakers to shift their understanding from pursuing endless growth toward Degrowth perspectives. We use the main arguments of Degrowth to interpret and analyse the air transport industry's climate strategy and reframe the discussions around sustainable aviation. Our goal is to show that Degrowth approaches can contribute to positively influencing the discourses of air transport by assessing the consequences of the sector and its reform strategy through diverse lenses. The discourse reflected in this paper would also be appropriate when applied to other top carbon producing industries and our assessment of air transport is not a directed criticism but rather an example on why business-as-usual scenarios need to be revisited.

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## 1. Introduction

In discourses around sustainability, concepts that promise to increase eco-efficiency through technological developments are highly popular. This popularity stems from the promise that humankind will be able to tackle the problems of climate change and environmental degradation while maintaining the impetus of current economic and social systems and continue business-as-usual. Dominant narratives and visions about the bioeconomy also fit into this line of thinking by giving a central role to

technological problem solving and decoupling, the opportunities of sustaining economic growth (Bugge et al., 2016; Bauer, 2018; Vivien et al., 2019) and advancing the extended use of renewable resources (McCormick and Kautto, 2013; Loeffler et al., 2017). Intervention measures supporting the developments in these technologies are popular with many policymakers but disregard important aspects of both environmental and social sustainability (Ramcilovic-Suominen and Pülzl, 2018). These solutions are also appealing to economic actors whose primary motivation is to continue the paths of economic growth. As we will establish in this paper, this also holds true to the air transport industry whose sustainability strategies strongly rely on bioeconomic solutions such as sustainable air fuels and renewable energy. The present paper aims to underline why it is important for economists and policy-

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makers to shift their understanding from pursuing endless growth toward Degrowth perspectives through providing a critical review of the air transport industry's climate strategy, Waypoint 2050, a good example of such growth-oriented sustainability strategies.

The concept of bioeconomy, in particular the way it is presented by official policy documents, has been criticised for presenting a technological fix and pre-empting alternative visions (McCormick and Kautto, 2013). Nevertheless, alternative narratives and visions of the bioeconomy do exist (Bugge et al., 2016; Bauer, 2018; Vivien et al., 2019) and are often advocated by citizens or environmental professionals ((Hausknost et al., 2017); Vainio et al., 2019). These alternative narratives revolve around ideas of strict ecological limits to growth, sufficiency and the bioeconomy not being an “endless frontier”. They appear as counter-expertise rather than an ongoing policy agenda (Vivien et al., 2019).

As ecological economists, we will argue that the concepts in which the dominant narratives of bioeconomy are rooted often revolve around the wrong questions. Bringing different perspectives such as Degrowth to the table may lead to more diverse and more sustainable solutions. By relying on the concepts of Degrowth, our stance resembles, but does not fully fit into existing bioeconomy narratives, such as the “bio-ecology vision” (Bugge et al., 2016) or the “type I bioeconomy” narrative (Vivien et al., 2019). This latter narrative can be explicitly linked to the ideas of Georgescu-Roegen (1975), who is not only considered to have been one of the first to use the notion of “bioeconomy”, but also one of founding fathers of ecological economics, and an early advocate of Degrowth. On the one hand, we intend to emphasise that the bioeconomy discourse - just like the broader debates around socio-ecological transformation or ecological modernization that it is part of - has taken a different path than proposed by Georgescu-Roegen and it is worthwhile to reflect on this. On the other hand, today's Degrowth thinking cannot be equated to his bioeconomy concept. Hence, this paper is meant to contribute to the discourses on the bioeconomy as an example of differences between mainstream approaches and their radical counterparts. The discourse reflected in this paper would be appropriate when applied to other top carbon producing industries and our assessment of air transport is not a directed criticism but rather an example on why business-as-usual scenarios are in need of critical scrutiny. This is especially important as Waypoint 2050 (ATAG, 2020a) claims that air transportation has been among the first industries to issue such a comprehensive strategy.

Among environmental activists and professionals, the air transport industry has been a prime object of criticism for a long time now. It has been a rapidly expanding sector, with a significant level of CO<sub>2</sub> emission. Its volume measured in the number of air passengers doubled between 2000 and 2020 (ATAG, 2020a); and almost doubled within just one decade, when measured in air passenger kilometres (RPKs) (IATA, 2020). Besides, the role of air transportation with regard to sustainability is also symbolic as it epitomises affluence and freedom at high ecological costs. It has been key in maintaining connectedness in the globalized world both in terms of business and private travels and tourism. This is also the reason why the industry was largely exposed to the consequences of the Covid-19 crisis. While the air cargo market has already recovered by 2021, and its volume in cargo tonne kilometres (CTKs) exceeds the January 2020 stage; the air passenger industry was severely hit. As of January 2021, the global passenger market reached only 50% of its January 2020 level of domestic RPKs and about 15% of international RPKs (IATA, 2021). It was in the midst of this economic turmoil, when the major actors of the industry, assembled under the frame of Air Transport Action Group (ATAG), issued Waypoint 2050, which is a global, sector wide strategy to tackle climate change and provide ways for a green recovery from the Covid-19

crisis (ATAG, 2020a). The document declares that aviation sees the response to the climate crisis as a continuation of its traditional way of doing business through collaborative effort.

Whether a sustainability transition is possible through simply reforming business-as-usual has been a bone of contention both in general (Hopwood et al., 2005; Sachs, 1993) and in connection with aviation (e.g. McManners, 2016; Walker and Cook, 2009). Recently, numerous scholars and activists have turned to the concept of Degrowth to reframe discussions around sustainability transitions (Kallis, 2011; Martínez-Alier et al., 2010). Degrowth contributions, in many respects, reach back to the origins of ecological economics. They draw attention to the embeddedness of economic processes in natural and social systems, and call for decolonizing imaginaries from presumptions on development, growth, and the good life (Latouche, 2009; Liegey and Nelson, 2020). Although Degrowth may not be considered a homogenous concept, especially due to the acceptance of pluralist approaches that are dependent on regional, developmental, and cultural diversities, in this paper we refer to Degrowth scholars or activists in general:

*“Degrowth is a new term that signifies radical political and economic reorganization leading to drastically reduced resource and energy throughput. Related scholarship critiques the ideology behind the dogma of economic growth; contributes to documentation of negative material, social, and ecological effects of growth; and assesses alternatives to growth-based development. Put simply, the degrowth hypothesis is that it is possible to organize a transition and live well under a different political-economic system that has a radically smaller resource throughput.” (Kallis et al., 2018, p. 291)*

In this paper we use some arguments often brought forward within the debates on Degrowth to interpret and analyse the air transport industry's climate strategy and reframe the discussions around sustainable aviation. The Waypoint 2050 concludes that “aviation can meet its ambitious 50% climate goal in 2050 and pursue net-zero emissions by 2060/65 at a global level” (p. 5). We, on the contrary, argue that the proposed endeavours of the sector are unsuited to meet the sustainability challenges and the document is centred around the wrong types of questions. Our aim is not to propose concrete recommendations for the air transport industry's sustainability challenges. This would be an impossible task not just due to the complex expertise needed to do that but also because we are introducing Degrowth perspectives on a general level also to readers who may not be fully familiar with its concepts. Our goal is to show that Degrowth approaches can contribute to positively influencing the discourses of air transport by assessing the consequences of the sector and its reform strategy through diverse lenses.

The paper is structured around six main sections. After this introduction, a short description of Degrowth perspectives frames our understanding of what sustainability is or should be and contextualises the criticisms that follow. The next section provides an overview of the Waypoint 2050 strategies, while the subsequent one analyses it from Degrowth perspectives in four main areas: the misplaced optimism around technological solutions; the overarching expectations around growth; the social sustainability of the strategy and finally the proposed financing of such technological fixes. Before drawing conclusions, the discussion section aspires to summarise why bringing Degrowth perspectives into such thinking may lead to more suitable – though clumsy – solutions to our wicked problems such as climate change.

## 2. Degrowth perspectives

This section serves as the framework to our analysis of the air transport industry's sustainability efforts. It is hardly surprising

that the ideas put forward in Waypoint 2050 rely on the concept of green growth (Dale et al., 2016) both as a policy and as a societal goal. Green growth is the dominant answer of our time to sustainability problems both in mainstream economic theories and in concrete industry strategies. However, our perspective of criticisms in this paper stems from Degrowth. While green growth and Degrowth follow two highly distinct paradigms, the incommensurability in this case can lead to the wider understanding of both approaches, a reflection on the importance of an industry's basic presumptions and hopefully to a dialogue that adds to the awareness of the limitations of green growth concepts and the appreciation of potential benefits of including Degrowth standpoints.

Degrowth (D'Alisa et al., 2016; Hickel, 2020; Martínez-Alier et al., 2010; Kallis, 2011; Kallis et al., 2020; Latouche, 2009) is a research field and a social movement that strongly questions the supremacy of growth in economic and social decision-making. Its main questions revolve around how to keep human activities within ecological boundaries while ensuring social justice and providing a good life to all. Its main message is not to consciously pursue the shrinking of economies globally but to remove the centrality and absolute necessity of economic growth from societal systems, institutions, and imaginaries to achieve strong sustainability. Hence, research in Degrowth focuses on uncovering the relationships between economic growth and resource use; well-being; employment; technology; money and debt; democracy; culture. Moreover, it proposes ways to disengage these connections and reduce dependence on growth to be able to achieve lower economic throughput while rebalancing social, geographical, and intergenerational inequalities in our capabilities to achieve a good life.

To understand the difference between green growth and Degrowth, it is important to distinguish between weak and strong sustainability. Pearce et al. (1996) characterise three different capitals important to the sustainability debate: natural capital; human capital; and man-made (or manufactured) capital. While sustainable development concepts focus on leaving the overall stock of capital intact for future generations, mainstream approaches allow for the substitution of the different types of capital. For example, building an airport to advance air travel implies accepting the loss of natural capital (like the biodiversity of the land it is built on) which is made up for by gains in man-made capital (the airport itself that can serve future generations) and human capital (like the global connectedness of societies). This is called weak sustainability and, as we will show, is well reflected by Waypoint 2050. On the other hand, strong sustainability emphasises that any depletion of nature beyond its regenerative capacities is unacceptable regardless of potential gains in other forms of capitals or the aggregate capital stock (Hopwood et al., 2005). Natural and man-made capital are primarily complements and not substitutes (Daly, 2019). Hence, while sustainable development treats environmental, social, and economic sustainability as equally important pillars (Brundtland, 1987), following the logic of weak sustainability; Degrowth stresses the importance of the embeddedness (Polányi, 1944) of the economy into the social sphere and of human society into ecological systems. This hierarchical embeddedness signifies that when nature is damaged beyond its regenerative capacities, this will automatically impact society and the economy. It also implies that economic activities must remain within social and ecological limits. Hence, Degrowth follows strong sustainability principles.

Degrowth strongly criticises green growth concepts as the technological fixes promised by eco-modernisation are neither available in the timeframes needed for strong action (Hickel and Kallis, 2020), nor boost the need for deeper transformations not to reproduce current social and ecological injustices. However, Degrowth also offers alternative visions and narratives about the organisation of societies (Kallis et al., 2018, p. 308):

*“In future Degrowth societies...the economic is no longer at the center of everything; democracy is direct; surplus is expended for reproduction or fun; income and wealth are distributed according to egalitarian principles; vital resources, infrastructures, and spaces are shared and held in common; technology is convivial and serves social purposes; resource throughput is minimized; and working hours are reduced by cutting consumption, production, and wasteful expenditures.”*

It projects that – given adequate redistribution – transcending the growth paradigm and adapting Degrowth principles does not lead to human misery but to convivial lives where only part of the well-being is satisfied through consumption. Regardless, whether one perceives such directions desirable or not; achievable or not; realistic or not, – as this paper will try to establish – the questions Degrowth asks are relevant in all spheres of life, especially when sustainability is being claimed.

The problems in the centre of attention in this paper, the role of air transport in the climate crisis and its potential solutions are unquestionably complex. As we will see from the Waypoint 2050 report, – even without taking Degrowth perspectives into account – myriads of problems arise. The tasks, from choosing adequate technological pathways to maintaining global connectedness while substantially decreasing emissions without impacting employment in the tourism sector, are complicated enough. All this in times when many other industries are trying to adopt similar ventures, cannibalising financial, social, and ecological resources from each other. Bringing in Degrowth perspectives of ecological and social justice further raises the complexity. However, such wicked problems need clumsy solutions (Ney and Verwilj, 2015; Verwilj et al., 2006). Wicked problems (the term was originally introduced by Rittel and Webber in 1973) are persistent and complex situations where no clear alternative solutions exist, and their resolution requires significant resources and impacts various stakeholders with highly distinct interests (Ney and Verwilj, 2015). Clumsy solutions are interventions that take an alternative standpoint in finding ways out of a seemingly impossible situation by creatively manoeuvring between opposing perspectives. Clumsy solutions require the acceptance that no one scientific answer exists to the problem, and a dialogue between plural – often opposing – viewpoints is absolutely necessary in order to find them (Ney and Verwilj, 2015). Hence, bringing radically different stances to the table is crucial in orienting towards acceptable solutions. Degrowth most certainly offers such an alternative perspective to the green growth path, which seems to be the only one the air transport industry is ready to consider yet.

### 3. The air transport industry's approach to sustainability

The aim of this section is to provide an overview of the sustainability strategies of the air transport industry that occur in the Waypoint 2050 document (ATAG, 2020a). Waypoint 2050 was prepared as part of a project of the Air Transport Action Group. ATAG is a not-for-profit association funded by its members to deal with the long-term sustainability of the air transport industry, based in Geneva, Switzerland. The membership, which is spread across the aviation value chain, provides a “robust basis to speak with international decision-makers and represent a broad industry view.” Among other tasks, according to their mission ATAG “advocates for coordinated action on strategic issues ... that require cross-industry involvement.”<sup>1</sup> As ATAG claims to have a worldwide mandate to be a credible source of information in the air transport industry, even if they may not represent the opinions of all their

<sup>1</sup> <https://www.atag.org/about-us/what-we-do.html> retrieved on 9<sup>th</sup> of August 2021

members, their views are important in sustainability debates on the future of the industry. Waypoint 2050 was written amidst the Covid-19 crisis along with documents like *Aviation Beyond Borders (ATAG, 2020b)* that aims to justify the importance of air transport in the global economy.

Waypoint 2050 will serve as a basis for our critical assessment in the next section. In terms of sustainability, the document focuses on the reduction of global CO<sub>2</sub> emissions and only tangentially touches upon other sustainability elements. The emission reduction target used in the document is to halve emissions by 2050 using 2005 as a baseline. In terms of passenger volume, the document foresees a growth in air transport regardless of Covid-19 effects. Due to the coronavirus, the authors of the report have reduced their expectations for 2050 by 16% but in their central estimations see it plausible for 2024 to reach pre-Covid-19 levels and almost triple passenger transport by 2050. The report claims that this growth trend is necessary as aviation must “continue to serve global connectivity in all parts of the world” (p.7) and it would be highly unjust if the opportunities of flying would be unavailable for developing countries as the developed parts of the world have enjoyed unlimited travelling for decades. It also justifies growth in the vision of “supporting 180 million jobs and over \$8.8 trillion in economic activity” in 2050 (p.21).

In the document identifies four areas for improvement. Firstly, technological innovations should be encouraged to develop the wing body as well as the propulsion of the aircrafts (shifting towards electric and/or hydrogen). Secondly, operations and infrastructure should be improved e.g., by optimising flight routes, reducing emissions of ground handling equipment, improving taxi operations. Thirdly, liquid fuel from carbon neutral production (Sustainable Aviation Fuel - SAF) should be developed. And fourthly, offsetting, i.e., investing in emission reductions in sectors other than the aviation industry should be encouraged.

The document calculates with four different scenarios, all of which build on certain bioeconomy solutions, such as SAF or the development of the infrastructure and the value chains it requires. Scenario 0 is based on currently visible trends of reducing emissions, where the main emission-reducing element would be offsetting (50–72% of all reductions). Without this, emissions would gradually increase by 2050. The impact of the technological developments would not be visible, as the aircrafts currently on the market with present emission levels will have a lifespan of 20–25 years. Therefore, more advanced and efficient aircrafts within the fleets would only start appearing after 2035. Within the improvement of operational efficiency, increasing load capacity is considered one solution. Based on the current trends of sustainable fuel developments, in the lower share it would contribute only 4% to all reductions, while in the higher 26%. In Scenario 1 technological advances gain slightly more traction and electric or hybrid aircraft suitable for short-haul flights of less than 100 seats are introduced by 2035–2040. Focus also shifts towards SAF and offsetting, which altogether contribute 62% of all reductions. Scenario 2 is quite similar but drives this contribution up to 75%. Scenario 3 is the most optimistic in terms of technological innovations and believes that currently operating aircrafts can be replaced by more eco-friendly versions (in terms of emissions) earlier than in other scenarios and can contribute to 42% of all reductions, while SAF (and offsetting) accounts for half of emission reduction gains. In all scenarios, gains from more efficient operations and infrastructure are calculated between 8–12%.

From the scenarios, the primary strategy for meeting sustainability goals is the improvement of fuel efficiency, whereby fuel consumption and the resulting emissions can be decoupled from increasing passenger volume. Efficiency per passenger kilometre has increased by 54.3% between 1990 and 2019. However, due to the increases in volumes, CO<sub>2</sub> emissions have almost doubled in

these years. This reduction due to technological developments over the last 30 years is considerable. Nonetheless, given the trends described above, using jet engines burning conventional fossil fuels (kerosene) is unlikely to lead to radical efficiency gains over the next 30 years. The document itself notes that “aviation is already remarkably efficient” (p. 13) and therefore solutions must be sought beyond the types of efficiency gains produced in the past decades.

In the vision it is stated that “SAF is up from around 0.04 million tonnes today to around 500 million tonnes per year by 2050” (p. 21) and while admitting that out-of-sector carbon reduction (offsetting) should not be the primary means of meeting long-term goals, it nonetheless plays a major part in the strategy. The authors of the report assure us that producing SAF in the amount necessary to satisfy the radically growing need of the air transport sector will not have adverse effects on agriculture, land use, water availability or biodiversity.

According to the report, this immense technological innovation should be the result of extensive cooperation between the air transport sector, governments, research- and financing institutions as well as the energy sector. The collaboration the document suggests is aimed at involving a) governments for example in “prioritising aviation (and other hard-to-abate sectors) as a user of alternative fuel” (p.79); b) financial institutions (together with governments) to invest in finding solutions; c) research institutes to come up with the necessary technological solutions; and d) the energy industry to lower the CO<sub>2</sub> content of energy. Sustainability improvements in the energy sector have a direct influence on air transport targets, as using electric propulsion can only mean carbon reduction if and when the energy produced comes from renewable sources.

In terms of identified problems, the report admits that there is no clear direction in the development of useful technologies when it comes to aviation. Many different paths may yield success in the long run but following all hopeful ventures seems extremely costly. “There are always trade-offs given the constraints in realistic scenarios. Accelerating the development of new technology comes with a significant price tag that will need to be borne by players across the aviation system” (p.29). It is admitted that all levers cannot be pushed at the same time and solutions need to rely on the performance of other sectors such as the energy industry. Moreover, these challenges are undoubtedly costly and even according to the report it remains ambiguous who picks up the price tag of these relatively risky ventures.

The report is adamant, that given adequate cooperation on behalf of other sectors, CO<sub>2</sub> emission targets can be met by 2050. However, in all their foreseen scenarios it must be accepted that emissions will rise until the mid-2030s. While offsetting is to play a substantial part in aviation’s climate strategies in the short-term, in the long run carbon capturing is also presented a way forward. Given sufficient technological advances, carbon-neutral aviation is assumed to become possible around the 2060s, but it could also be accelerated: “With enough money, anything can be sped up, but only as far as technology, materials and politics allow. At the same time as aviation is trying to decarbonize its energy system and develop radical new technologies, the rest of the world is also tasked with decarbonising other sectors in the economy” (p.6).

#### 4. Critical assessment of waypoint 2050

In the present section we use the perspective of Degrowth to interpret, and critically assess the air transport industry’s approach to sustainability. We attempt to reframe discussions around the sustainability transition by drawing attention to the presumptions and hidden beliefs behind Waypoint 2050 and by making counter-arguments based on the radically different narrative of Degrowth.

We focus on four main issues: 1) the limitations of technological fixes; 2) the contradictory nature of the pursuit of growth at all costs; 3) the relationship with social sustainability; 4) the financing of such transitions based on eco-modernisation.

#### 4.1 Technological fixes and eco-modernisation

The concept of ecological modernisation stems from the 1980s, but the idea gained significant traction in the 1990s. Its emergence may be traced back to German authors such as Huber (2000) and Jänicke & Klaus (2004), as well as Dutch scientists such as Mol (1997, 2000, and 2002) and (Spargaaren, 2000). Huber's description perfectly captures the essence of ecological modernisation: "...the dirty and ugly industrial caterpillar will transform into an ecological butterfly...". In other words, instead of producing environmental harm, the evolution of industry will, out of its own logic, lead to the establishment of an ecologically sustainable society without the need for socio-political transformations. There is hardly a need to intervene in the process, as science, business, governmental institutions, and consumers will progress toward being "green" as a natural course of development, mediated by the coordinating capacity of the market. On both theoretical and practical levels, the message of ecological modernisation is extremely optimistic: there is no need to choose between economic growth and environmental sustainability because green growth can address both.

According to Degrowth, the idea that today's wicked environmental and social problems could be fixed merely by technological solutions is absurd. Such technological fixes misunderstand both the nature of the sustainability challenge and the features of technological change. Nevertheless, the dominant business narrative on sustainability transitions, - which also heavily influences political and even scientific discourses -, is centred around technological solutions (Porter and Linde, 1995; Springett, 2003). Eco-modernisation was found to be the dominant narrative also regarding aviation (Walker and Cook, 2009). Waypoint 2050, not surprisingly, fits into this dominant business narrative:

*"Aviation has a strong history of solving challenges through technological innovation. From the first forays into powered flight, to the jet engine, use of composites and 3D printing, constant improvements are part of the sector's DNA. Responding to the climate change challenge is no different".*

(ATAG 2020, p. 40)

The document introduces four scenarios, the components of which are all related to technological solutions, i.e., gains in eco-efficiency (increasing the ratio of added value and the impact on the biosphere). The components of the four scenarios are different partial strategies for achieving eco-efficiency gains in aviation: (1) increased efficiency of aircrafts; (2) increased efficiency of operations and infrastructure; (3) increased efficiency by substituting fossil with non-fossil fuels; and (4) increased efficiency in other sectors allowing for off-setting. This exclusive focus on efficiency gain is especially telling since the document itself admits the difficulty of this strategy: two of the main challenges emphasized by the document are that "aviation is already remarkably efficient" and that "the cost of transition is high, and the technology is not available yet" (ATAG 2020, p. 13).

Searching for solutions in technological advancements is typical to the dominant (eco-modernisation) narrative. One of the main limitations of this narrative is blurring the differences between the micro- and the macro perspective. It suggests that efficiency gains on the corporate level will result in efficiency gains on the macro level as well. On the one hand, eco-innovations thus appear as key to sustainability (and corporate responsibility), implying that actors implementing eco-innovations are key and should even be

subsidised. On the other hand, it is suggested that, with sufficient pace of technological change, growth can be limitless.

This stance of eco-modernisation has been widely criticised in ecological economics. One of the main criticisms points out that the macro-level efficiency gains are not direct concomitants of micro level eco-innovations. In fact, several mechanisms may lead to the increased use of natural resources despite (or due to) their more efficient use (Alcott, 2005; York, 2006). This also means that the expectation of decoupling economic growth from human impact on the biosphere cannot be met. In fact, empirical evidence rather suggests the opposite of decoupling (Parrique et al., 2019; Stern, 2004). The perspective of Degrowth can clarify and supplement this criticism - as summarized by Kallis (2021, p. 3.):

*"My problem with ecomodernism is not its insistence on certain technologies (debatable as they may be), but its emphatic rejection of the need for limits. To stop climate change we need to limit some production/consumption, manage economic slowdowns and apply new technologies - from clean energy, to removing carbon to stabilizing icebergs. More, we also need to live, consume and produce differently- with new limits and new possibilities."*

Degrowth emphasizes that eco-modernism pursues efficiency to maintain the ability to grow, and not to be able to decrease human impact on the biosphere. The core idea of modernisation is that humanity can control the environment and manage its impact. Eco-innovations would help economic actors maintain the highest possible growth rate while just aiming to remain within the carrying capacity of the biosphere. (Robra et al., 2020) In Degrowth, the idea of technological change serving such purposes is considered futile and alarming. Philosophers who analysed how modern technologies unfolded oppression and jeopardized conviviality heavily influenced Degrowth (Ellul, 1980; Illich, 1973; Latouche, 2009). Recently, we can witness a departure from this overwhelmingly sceptical stance towards depicting the features of technologies and technological systems that may fit the Degrowth transition (Kerschner et al., 2018; Vetter, 2018).

For Degrowth the need for *different* technologies and technological systems is evident. According to critical theories of technology (e.g., Feenberg, 1999), social relations are to a large extent mediated by technological systems. Current structures and hierarchies affect new technologies, which in turn create a new social reality that influences actors, their relations, and the future direction of change. As Feenberg (1999) argues, new technologies may reinforce current hierarchies and hegemonies. But these technologies may also be used to challenge the current structures by making new visions, values, relations be part of the new social reality.

Degrowth argues that current economic and social structures need to be challenged to tackle our wicked problems. However, leaving the context in which innovations occur and the way they emerge unchanged will probably maintain current (unsustainable) structures and institutions. Therefore, Degrowth does not expect eco-innovations to be able to further sustainability transitions. What seems to be missing from eco-modernisation is a quest for *different* technologies and technological systems. New technologies, which challenge the current structures in line with a Degrowth transition should enhance autonomy and bottom-up problem solving; should be more democratic regarding both production and use; and should be considered as means and not ends. Moreover, their core guiding logic ought to be one of sufficiency, rather than increasing efficiency. Degrowth concentrates on ecological sufficiency instead of efficiency (Harangozo et al., 2018; Robra et al., 2020; Sekulova et al., 2013). Sufficiency focuses on what is enough to produce and consume to provide a good life to all while respecting ecological boundaries. Instead of aiming just to come up with technologies that reduce the use of environmental resources and energy per unit of output, the aim of technology moves beyond

this objective and – coupled with efficiency – focuses on delivering sufficient amounts of goods and services with the fairest distribution while not increasing overall output (Robra et al., 2020).

The adherence to the idea of eco-modernisation makes Waypoint 2050 a vision of sustaining growth. In this view, the problem with sustainability challenges is that they may limit the economy's ability to grow. Accordingly, the purpose of technological developments is to eliminate these barriers and ensure the maintenance of business-as-usual. On the contrary, Degrowth does not warn of limits to growth, but rather expresses a desire to limit growth and open alternatives (Kallis, 2021). Here, technological change is a means to create these alternatives.

#### 4.2 Expectations of growth

According to Degrowth, economic growth as a point of reference for economic and social change is incongruous. It is neither possible nor desirable. Without considering the physical limits (and embeddedness) of economic activities, society cannot come up with real solutions to our 'grand challenges'. Even in less radical sustainable development approaches, economic sustainability is only one of the three pillars on par with environmental and social sustainability. However, Waypoint 2050 never questions the supremacy of economic growth, neither as an industrial objective (this part is understandable), nor as a social aim. None of the depicted scenarios give up the growth perspective. For example, a strong cut-back on short-haul flights under 1000 km could bring a 17.5% reduction (p. 39) immediately. This being an option is well illustrated by the French government's move in April 2021 to ban short haul flights that can be covered by rail in less than 2.5 h.

The reluctance to face potential slowing of growth rates is well emulated in the way the document treats the potential long-term impacts of Covid-19 (ATAG, 2020a, p. 17):

*“Post-Covid-19 revision of long-term growth suggests that the central traffic forecast used for Waypoint 2050 is around 16% lower in 2050 than it was in a pre-Covid world. This is due to: a slow recovery from a severe drop-off in traffic in the 2020 year, likely to not recover to 2019 levels until 2024, and completely re-baselining the growth of air travel; a longer-term impact on GDP growth in economies around the world; a reduction in the propensity to travel due to concerns over health situation at destinations and the potential for quarantine inconvenience – this will recover as the world eases out of the Covid-19 crisis, but there may be a long tail of concern, particularly amongst older travellers; a reduction in business travel in the medium-term, due to a soft corporate financial situation and the reliance on video conferencing and remote working during the shutdown leading to a change in behaviour amongst corporate travellers.”*

This reflects well the one-sided worldview of Waypoint 2050. Only two things can influence growth rates: lack of money (constrained GDP growth and soft corporate financial situation) and inconvenience (fear of getting ill or being quarantined). The world is assumed to return to business-as-usual by 2024, and no long-term changes in trends, tendencies, and perspectives are truly considered. While the quote mentions the possible technological shift towards virtual spaces that can replace business travel, its impact is considered only mid-term. At the same time, if environmental sustainability concerns were to be taken equally seriously, this option would be encouraged (Guerin, 2017; Poom et al., 2017) and the impact of Covid-19 on travel (e.g., Becken and Hughey, 2021; Hiselius and Arnfalk, 2021) would not be nullified but exploited.

Three possible limits to growth are acknowledged in the document for the long run: 1) environmental concerns from consumers; 2) governments moving to reduce growth; 3) shifts to other modes

of transport (such as rail). All three of them are immediately dismissed. By dismissing the first one, the report chooses to ignore both the moral responsibility (Ha-Brookshire, 2017) of raising social awareness to sustainability issues or being sustainable nonetheless, and tendencies that show that movements have already started to change attitudes (Pereira and Larsen, 2020). While Flygskam is mentioned, it is labelled as a Western European peripheral phenomenon and presumed that societal acceptability of air travel remains unchanged. At the same time, it is important to note that avoiding air travel makes a greater difference for environmental impact than almost any other personal decision one can make (Moriarty and Honnery, 2020; Wynes and Nicholas, 2018).

The report's mentioning of governments moving to reduce growth may sound like music to Degrowth researchers' ears, but the report only mentions “protectionism deepening along with a reduction in mobility on top of Covid-19 impact” (ATAG, 2020a, p.31) as a possible undesirable intervention. However, relocalisation both as a strategy for a more sustainable *modus operandi* (Douthwaite, 2004); Jackson, 2012) or as a tool to improve the resilience of economic and social systems (Ivanov, 2020; Sarkis, 2020), is not considered. While demanding governmental financial support for aviation, the report disregards the possibility of prioritising rail options when deciding on funding preferences, especially accounting for the greener possibility of switching between the two (Dobruszkes et al., 2014; Jimenes and Betancor, 2012).

The authors of the report debate the fact that green taxes on aviation fuel would have a beneficial sustainability impact, arguing that based on past experiences even high aviation taxes (such as those imposed in the UK) have only slowed down growth, but not stopped it. Using this inelasticity in demand as an analogy, they also argue that rising prices due to the massive investment costs of the sustainability transition will have no considerable effect on consumer demand, as rising demand for aviation in developing countries is expected to offset this possibility. Moreover, the report claims that “airline ticket prices comprise a range of costs and the price to the public doesn't always reflect the underlying costs of things such as fuel or aircraft purchases... Based on today's estimates, it is likely the cost of energy for aviation may be higher in the future, but this could also be partially offset by an increase in efficiency with new technologies and improvements in operational performance” (ATAG 2020a, p. 7). However, if we accept that this inelasticity in demand really exists in air transport, it is even more important to find non-mainstream solutions to curb consumption levels.

The supremacy of the growth perspective leaves the *telos* of flying wide open even at the declared cost of aggravating the climate problems for at least the next 15 years. The justice issue of who benefits from increasing air travel and who pays the price of hindered sustainability efforts remains unaddressed throughout the document.

#### 4.3 Social aspects of sustainability

Considering climate change as a challenge that could be handled within existing institutional arrangements and social structures diverts attention from the social aspects of sustainability. For strong sustainability, and for Degrowth in particular, the problem is inherently social in nature. Accordingly, problem solving is considered social learning and change, and not a mere technical exercise.

Waypoint 2050 takes the fundamental institutional arrangements of the present globalized economy as given. The document finds justification for its vision and the need for being supported and subsidised in the industry's contribution to growth, employment and connectivity.

*“Air transport has connected the world for more than a century [...]. It is a system relied on by millions of people for connectivity to their loved ones; by businesses to engage in trade, development and innovations, by governments to encourage economic benefits of tourism, and to support nearly 88 million jobs worldwide”.*

(ATAG 2020, p. 12)

Furthermore, it connects the idea of growth to justice, and claims that it is precisely future growth that will widen access to the services of the air transport industry and thus enhance global justice. This “trickle-down” argument finds its root in a very simplistic understanding of utilitarianism and neoclassical economics, and has been widely criticised (e.g., [Piketty, 2018](#); [Sen, 1999a](#); [Stiglitz, 2002](#)).

*“Much of the growth out to 2050 will have taken place in Asia-Pacific, the Middle East, Africa and Latin America, allowing the citizens of those societies to benefit from the social, family, cultural and business connectivity that was a century earlier the reserve of the wealthy in Europe and North America”.*

(ATAG 2020, p. 21)

From the perspective of Degrowth, the air transport industry, including its future vision, is largely captured by the present structures and institutions of globalized market capitalism, and is destined to grow. If we take a closer look at the arguments of the document, we can identify that it fails to provide further justification for its claims to job creation, or any further discussion on justice.

The air travel industry’s growth went along with a huge rise in labour productivity. Despite the tremendous growth in the last two decades the employment levels are similar to their levels in the early 1990s; and lower than two decades ago ([DG MOVE, 2015](#)). In other words, continuous (and rapid) growth is required to be able to maintain a constant employment level. On top of this, in times of crisis the industry is highly vulnerable to rapid and significant employment loss as experienced in 2020 and early 2021.

In terms of access to the services of the air transport industry, evidence does not support the industry’s “trickle down” expectations. We can witness huge inequalities in flying both within and between countries ([Hopkinson and Cairns, 2020](#)). Actually, a very small proportion of frequent flyers account for most of the travels and the CO<sub>2</sub> emissions in all countries. In terms of justice this has at least two vital implications. First, the benefits and burdens of aviation are not allocated in a just way. Second, injustice may also occur in terms of setting objectives and priorities for communities and societies. Opting for the expansion of the air travel industry (allocating investments, research efforts, government support, off-setting opportunities to this sector and not somewhere else), is most likely to reinforce the position of those benefiting from the status quo. Imbalances of power over and within the discourses around air transportation are striking. Certain actors (e.g., members of the Air Transport Action Group) have strong influence on how global challenges around air transportation are interpreted, and in which direction solutions are searched for.

Waypoint finds its point of reference in growth even in topics that relate to the social aspects of sustainability. Its narrative about the role of the air transport industry, justice issues around air travel and the employment effects of the sector is heavily biased by this stance. The Degrowth standpoint is not about reducing access to air travel by making the industry contract in a way that effectively renders flying a privilege of the rich. It is about finding justice by weighing the social costs produced by climate problems and the inequality of access to services at the same time. Hence, reductions in air traffic needs to be accompanied by a convergence towards fair access.

#### 4.4 Financing technological climate solutions

The document is blatantly open about the fact that such sustainability transitions based on eco-modernisation have immense price tags, as investing in new – currently unavailable – technological solutions is not only risky in terms of returns but also demands enormous amounts of knowledge and intangible resources. Even if hopeful technologies are being developed and become available, their application requires costly changes in fleets and infrastructure. How is the financing of such a transition possible in a sector that is in a “severe financial state” ([ATAG, 2020a, p.7](#)) already due to Covid-19 and is expected to be in years to come?

Four options and their combinations seem viable according to Waypoint 2050: 1) the airline industry takes up loans from financing institutions; 2) governments pick up the bills; 3) passengers pay an increased price for flying; and 4) society needs to accept that the air travel industry is not capable to transit to a sustainable state and hope that other sectors are in better positions in the race to sustainability and the industry buys carbon quotas. However, all four options include the following rather controversial elements when analysed from a Degrowth perspective.

If the sustainability transition of air transport is financed by regular investment means, the risks on returns are likely to be mitigated through higher interests. Even if – through governmental interventions – these interests would be kept to a minimum, satisfying investors would require economic interests to override ecological interests. Therefore, no decisions could be taken that jeopardise growth, for example giving up on short haul flights to accelerate CO<sub>2</sub> emission reduction. Financial investments based on interests drive growth regardless of ecological and social limits ([Douthwaite, 2000](#); [Farley et al., 2013](#)).

The financing of technological innovations by governments is commonplace. So much so that, as [Mazzucato \(2013\)](#) argues, this has especially been true in case of high-risk innovations and, this being one, it would make leading, and financing change an obvious choice to governments. The moral dilemma that arose after the bail-out of banks after the 2008 economic crash ([Sandel, 2010](#)) applies to this case as well: why finance privately owned enterprises from public funds and not receive community control over them in exchange? In the face of the climate crisis – following the eco-modernisation path at all costs – governments face similar demands not just from the air transport industry but from many other industries expecting similar support. Even if we leave behind more fiscally restrictive economics and turn our attention to Modern Monetary Theories ([Ehnts, 2017](#); [Kelton, 2020](#)) and the theory of endogenous money ([Cahen-Fourot and Lavoie, 2016](#)) that propagate that given the right reasons and circumstances, the state can and should issue money to finance projects important to societies, the question remains whether supporting the air transport industry should be prioritised or supported at all. Therefore, demanding governmental support can be a double-edged sword: it can continue to support private corporations or public opinion could shift towards community ownership where ecological interests can one day outweigh the business-as-usual scenarios. In that case, Degrowth perspectives may start playing a role in these decisions.

The third option is to transfer increased costs to passengers. However, Waypoint 2050 omits this option altogether: “By way of example, the price of a ticket from Boston to Los Angeles fell by 89% in real terms between 1941 and 2012 – a downward trend in the real cost of air travel is expected to resume in the future, mainly reflecting new technologies and efficiencies being realised.” ([ATAG, 2020a, p.37](#)). It underlines that in the sustainability scenarios of the document, no compromise is made when it comes to cheap flying, even though including the costs of environmental impact in the forms of carbon taxes or green taxes has been long considered a possible scenario ([Larsson et al., 2019](#)). This

option is only left open to environmentally conscious passengers who might be able to purchase tickets for electric, hybrid-electric or hydrogen flights in the future. It is beyond the scope of this paper to investigate this in more depth, but the demand inelasticity ATAG claims is a controversial issue (see [Seetaram et al., 2020](#)) and the increase in the price of tickets due to expensive sustainability investments or carbon taxes can in fact impact demand and defuse the growth narratives Waypoint 2050 relies on. It also further undermines social sustainability elements discussed earlier.

The fourth element in the financial portfolio is carbon trading ([ATAG, 2020a](#), p. 82): “Carbon credit products are also evolving and developing especially under the Paris Agreement. An important distinction is between projects in the voluntary (or non-regulated) markets and projects in the Kyoto (or regulated) market, which generate offsets called CERs (Certified Emission Reductions).” Carbon trading is a way of putting a cap on pollution (in this case CO<sub>2</sub>) but enabling market actors who cannot adhere immediately to pollution cutbacks trade with those who can reduce their emissions. However, carbon trading is more of a justification for harmful behaviour than a remedy to the problem as people and companies believe that they are compensating for polluting activities simply by their willingness to pay for them ([Sörqvist and Langeborg, 2019](#)). This results in an abstention of seeking alternatives among those who have the financial means to counterweigh irresponsible behaviour, similarly to medieval moral sin offsets ([Goodin, 1994](#)). Carbon trading has long been criticised by Degrowth scholars for its inherent ethical misconceptions, its incapability of actually reducing emissions, and for diverting attention away from the importance of behavioural change ([Spash, 2010](#); [Stuart et al., 2019](#)). For a highly complex problem, carbon trading offers a simplified monetised solution that also incurs non-monetary damages while unequally impacting different social groups. The richer are more likely to be able to pay for pollution, while the less fortunate are likely to face its impacts. At the same time, voluntary behaviour change is crowded out by replacing intrinsic motivations with cost-benefit analysis. ([Spash, 2010](#))

## 5. Discussion

Accepting climate change (and more broadly environmental degradation due to human activities) as a ‘wicked problem’, the need for clumsy solutions occurs. Therefore, using many different viewpoints to address the same issue is of vital importance. It might be argued that a document like Waypoint 2050 cannot take a stance that transcends the dominant logic of the market, but it is crucial to see that this is only one perspective, and leaving prevailing narratives behind as well as opening avenues for dialogue of alternatives is of upmost priority.

According to the Waypoint 2050 document, the air transport industry pays intense attention to bioeconomy solutions, including the extensive use of biofuels, the creation of the infrastructure and value chains it necessitates, and the overcoming of technological challenges this path implies. While not all the proposed solutions of Waypoint 2050 rely on the bioeconomy, we found, that the overall approach of the document corresponds strongly to narratives that dominate bioeconomy discussions. A call for a more extensive use of biofuels in aviation and the challenges this implies (e.g., technological problems yet to be solved in production, high costs, feedstock availability, compatibility with conventional fuels, thermal and storage stability) are well established in the literature ([Hari et al., 2015](#); [Prussi et al., 2019](#); [Wydra et al., 2021](#)). However, the focus on technological problem solving, the innovation activities of enterprises, and the reliance on the concepts of

weak sustainability and “green growth” has also been criticised regarding both aviation ([Wydra et al., 2021](#)) and the bioeconomy in general ([Hauknost et al., 2017](#); [Vivien et al., 2019](#)).

A Degrowth stance helps to bring forward highly relevant arguments both to the discourses on strong sustainability and to alternative bioeconomy narratives. Degrowth claims that society should not wait for the market to fix something that it is unsuited to fix. Moreover, since technology is developed based on the visions and narratives humans create, it makes sense to put forward arguments on alternative narratives and question the telos of a human activity. In this vein, we suggest three Degrowth-inspired questions that society and the air transport industry should be asking themselves.

Firstly, what is the telos of flying? What values does it create for the whole of society and what does it destruct? Degrowth does not focus on the issue of maintaining an industry but on what humanity wants to achieve by maintaining this industry and what it is prepared to give up for its success in doing it. Once the basic presumption of ecological economics and Degrowth is accepted that the economy is embedded in society, which in turn is embedded in the natural environment, we cannot forego the issue of social and environmental roles of an economic actor or an industry as a whole. Mainstream economics’ reductionist attitude and its supposition that these actors can be examined in abstraction from their embeddedness is one of the most important criticisms when it comes to sustainability ([Daly, 1999](#); [Granovetter, 1985](#)). As soon as economic actors are not seen as operating in a vacuum, their motivations and roles can also change. Instead of mere profit-maximisation arises the need to define what social issues their existence serves. It makes a huge difference whether a company just wants to sell as many air flights as possible, or whether it identifies as an organization whose purpose is to, for example, serve global connectivity. The first can only be achieved by making people fly, while the latter may involve many different broader and creative options. And this may just be the key to their survival. Sustainability is a concept with a macro perspective. The micro perspective of whether an industry or a bunch of companies survive is somewhat important regarding the social limits and largely unimportant regarding the physical limits, but not a central issue in any way. Switching these perspectives – even just for brief considerations – can uncover new dimensions and drive the understanding that Waypoint 2050’s vision of growth reflects merely the perspectives of capital investments. It could be argued by ATAG that the air transport industry’s primary purpose is to serve global connectivity and to employ more people but, in that case, other – maybe less environmentally harmful – options might be considered to fulfil this role.

In Degrowth, when posing the question of what values the air transport industry creates for the whole of society and what it destructs, it is important to transcend the utilitarian logic of weighing and aggregating positive and negative effects, and then picking the option that maximises utility. Positive and negative effects cannot be simply brought to a common denominator. Rejecting maximization as a decision-making rule, or including considerations that are not present in a utilitarian space of evaluation (e.g. distribution of gains and losses, justice, the freedom to live a valuable life) may both be relevant ([Sen 1999a](#)). Furthermore, any kind of change in the social arrangements requires adaptation from social actors, for which they can be equipped to varying extents. Therefore, the time frame of transitions is also highly significant ([Polányi, 1944](#)). While going beyond utilitarian considerations may result in complex social decision-making situations, this does not imply the impossibility of arriving at coherent results. On the contrary, widening the set of information considered during a complex evaluative exercise is precisely what helps to arrive to coherent solutions ([Sen, 1999b](#)).

The second question is whether there is such a thing as the ideal size of an industry. Different social actors might find a vast number of reasons (especially after assessing the values created and diminished) why the industry should shrink rather than grow. It follows that the industry should not become more eco-efficient to grow but should become more eco-efficient to degrow. The mainstream tends to consider pressing environmental issues as limits rather than just circumstances (Kallis, 2021). When we look beyond questions concerning the sustainability of companies or industries to take a broader ethical and citizen perspective, we find that embeddedness is no longer a limitation but something that influences the way we all live and think. The 'optimum' size of the industry from a Degrowth perspective is not necessarily a balance where it just fits exactly within ecological boundaries so that humankind will sadly have to renounce anything additional. It is about transforming it to be in line with its telos and increase its justice perspectives as much as possible.

And this is where the third question comes in: Who decides? Waypoint 2050 (p.12) says "the world with modern, rapid, air transport is a rich and rewarding one." According to whom, and who decides on these values? Is this really the view of humankind or just a certain geographical and social segment of human society? Who decides on the telos of an industry or the optimal size of an industry and who will be involved in these decisions? Currently, in mainstream narratives we expect consumers to decide whether they support an industry by buying into it. However, in Degrowth it is not considered a market problem but a community, ethical and political issue that we can only decide on as citizens and not as consumers. In a world of vast power asymmetries, it seems acceptable that Waypoint 2050 assigns tasks to governments, research organisations, or the energy sector stating that their support is the one and only way to achieve any kind of sustainability. But while community stakes are high with these partners, there is no concern for social dialogue or any kind of community control. It comes as no surprise that an industry does not propose anything that goes against their money-making purposes (e.g., completely giving up short-haul flights), but when it comes to meeting their demands in cooperation, the least that should happen is to introduce some form of community control. And that means including other narratives and visions in deciding on the sustainable future of the air transport industry. It is understandable that Waypoint 2050 is a vision of one particular standpoint, but it would be absurd if it was the industry alone deciding how to turn themselves sustainable when all others are involved and also at stake. Proactively thematising dilemmas and concerns around the air transport industry (for example the rail vs. air development) is crucial as these will soon become highly political issues, especially when other industries are likely to follow similar patterns. The rest of the world is also tasked with decarbonising their own sectors, and if most actors follow the same eco-modernisation strategies based on governmental support, bottlenecks are likely to occur, and solutions can crowd each other out. And in such a case someone will have to prioritise and decide. At the end of the day this problem is about democratising the economy, and in this specific case the air transport industry.

Waypoint 2050 claims to be among the first industries to issue such a document. All the more important to point to problems that are likely to arise in many other industries, as the difficulties are inherent to the economic system itself. This document only covers passenger air travel and not military and commercial logistics, so when it is admitted that in the next twenty years, the situation will become even graver and only then – if all goes well – will the industry start turning green and perhaps meeting climate targets, it is imperative to start putting different perspectives on the table.

The authors of this article are themselves not free from the cognitive dissonance sustainability scientists face when deciding on

flying (Schrems and Upham, 2020). We have been raised in an era and a region where flying was a sign of freedom and prosperity, and we have personally enjoyed this freedom and prosperity. We have also made a lot of personal and professional contacts all over the world and fear losing them. However, we would not mind getting rid of this cognitive dissonance not just through rationalising our flying or no flying options, but through building a future where it is not swimming against the tide when you opt out and not fighting your conscience to opt in. For that we certainly need clumsy solutions, and Degrowth perspectives have a lot to add to them.

## 6. Conclusion

The air transport industry has devotedly bought into concepts that fit into the dominant narratives of the bioeconomy and rely heavily on technological fixes through promoting developments in sustainable air fuels, offsetting and electric solutions using renewable energy. However, following these concepts alone will not necessarily lead to strong sustainability in aviation. As we tried to establish in this paper, the problem is confusing the purpose and the means. Are we using bioeconomic and related concepts and suggested technological solutions as adequate means to continue growing the economy? The air transport sector's Waypoint 2050 strategy suggests so.

In this paper we argued that this logic raises several significant issues that are not addressed by a vision based solely on bioeconomic solutions, especially if they are understood as a quest to maintain business-as-usual under certain environmental and social constraints. We propose that Degrowth perspectives have a significant role to play here. Questions on what social purpose an industry serves; whether this purpose justifies the social and environmental costs; how these benefits and costs are distributed geographically, temporally, and socially; whether there is an "optimal" size of an industry and finally who is invited to decide on this, are crucial in sustainability transitions.

In Waypoint 2050, the air transport industry pleads for cooperation with many other stakeholders such as governments, academia, the energy sector, stakeholders involved in offsetting initiatives. Many of these stakeholders are or are supposed to be representing public and community interests and will face similar demands from many different industries. To be able to prioritise and decide on real transformational interventions, it is of utmost importance for them to seek answers to such questions through participatory means in a dialogue with key stakeholders as well as the wider public. Participation is crucial in strong sustainability consumption governance as highly diverse interests, needs and wants must be mitigated (Lorek and Fuchs, 2013). Also, "radical restructuring of economic processes... (can only be performed)...through collective deliberation about their scope, functions, and structure" (Kallis et al., 2020, p. 307).

It is obvious why the industry itself may not want to move beyond shareholder value perspectives. Under current circumstances promoting anything other than economic growth may lead to financial losses, layoffs, hostile takeovers. However, if that is the case, society must be fully aware that these sustainability strategies prioritise profit over environmental and social interests. The perspective of Degrowth is so radically different from that found in the air transport industry's strategy that it may seem a futile effort to convince representatives of the necessity to include such profoundly distinct viewpoints. Nonetheless, we must find societal actors capable of enacting alternative strategies. Presenting fundamentally different stances and initiating social and scientific dialogue can help all relevant stakeholders (including industry representatives) understand the road ahead and find adequate "clumsy solutions".

At the same time, it is the continuing work of Degrowth researchers as part of their challenges to apply, refine, and further transition scenario arguments in the frame of Degrowth for other “wicked problem” sectors, as opposed to just being critical of them. This opinion paper is supposed to serve as an example of a more refined take on a complicated problem in a complex industry.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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### References

Alcott, B., 2005. “Jevons' Paradox”. *Ecol. Econ.* 54 (1), 9–21.

ATAG, 2020a. Waypoint 2050: An Air Transport Action Group Project. <https://aviationbenefits.org/environmental-efficiency/climate-action/waypoint-2050/> retrieved on the 9th August 2021.

ATAG, 2020b. Aviation Beyond Borders. [https://aviationbenefits.org/media/167186/abb2020\\_full.pdf](https://aviationbenefits.org/media/167186/abb2020_full.pdf) retrieved on the 9th August 2021

Bauer, F., 2018. Narratives of biorefinery innovation for the bioeconomy—conflict, consensus, or confusion? *Environ. Innov. Soc. Trans.* 28, 96–107.

Becken, S., Hughey, K.F., 2021. Impacts of changes to business travel practices in response to the COVID-19 lockdown in New Zealand. *J. Sustain. Tour.* 0, 1–19. doi:10.1080/09669582.2021.1894160.

Brundtland, G., 1987. Report of the World Commission on Environment and Development: Our Common Future. United Nations General Assembly document A/42/427.

Bugge, M.M., Hansen, T., Klitkou, A., 2016. What is the bioeconomy? A review of the literature. *Sustainability* 8 (7), 691.

Cahen-Fourot, L., Lavoie, M., 2016. Ecological monetary economics: a post-Keynesian critique. *Ecol. Econ.* 126, 163–168. doi:10.1016/j.ecolecon.2016.03.007.

Dale, G., Mathai, M.V., Puppim de Oliveira, J.A., 2016. Green Growth: Ideology, Political Economy and the Alternatives. Zed Books.

Daly, H.E., 1999. Uneconomic growth: in theory, in fact, in history, and in relation to globalization. In: Daly, H.E. (Ed.), *Ecological Economics and the Ecology of Economics: Essays in Criticism*. Edward Elgar Publishing Inc., Cheltenham, pp. 8–24 1999.

Daly, H., 2019. Some overlaps between the first and second thirty years of ecological economics. *Ecol. Econ.* 164, 106372.

D'Alisa, G., Demaria, F., Kallis, G., 2016. *Degrowth – a vocabulary for a New Era*. Routledge.

DG MOVE, 2015. Study on employment and working conditions in air transport and airports. Final Report. <https://ec.europa.eu/transport/sites/default/files/modes/air/studies/doc/2015-10-employment-and-working-conditions-in-air-transport-and-airports.pdf>.

Dobruszkes, F., Dehon, C., Givoni, M., 2014. Does European high-speed rail affect the current level of air services? An EU-wide analysis. *Transp. Res. Part A Policy Pract.* 69, 461–475. doi:10.1016/j.tra.2014.09.004.

Douthwaite, R., 2000. *Commercially-Produced Money. The Ecology of Money*. Green Books.

Douthwaite, Richard, 2004. Why localisation is essential for sustainability. *Feasta Review* 2.

Ehnts, D.H., 2017. *Modern Monetary Theory and European Macroeconomics*. Routledge.

Ellul, J., 1980. *The Technological System*. Continuum Publishing Corporation, New York.

Farley, J., Burke, M., Flomenhoft, G., Kelly, B., Murray, D., Posner, S., Putnam, M., Scanlan, A., Witham, A., 2013. Monetary and fiscal policies for a finite planet. *Sustainability* 5, 2802–2826. doi:10.3390/su5062802.

Feenberg, A., 1999. *Questioning Technology*. Routledge.

Georgescu-Roegen, N., 1975. Bio-economics aspects of entropy. In: Kubat, L., Zeman, J. (Eds.), *Entropy and Information in Science and Philosophy*. Elsevier, Amsterdam, pp. 125–142 1975.

Guerin, T.F.T.F., 2017. A demonstration of how virtual meetings can enhance sustainability in a corporate context: quantified benefits of virtual meetings through video conferencing. *Environ. Qual. Manag.* 27, 75–81. doi:10.1002/tqem.21515.

Goodin, R.E., 1994. Selling environmental indulgences. *Kyklos* 47 (4), 573–596.

Granovetter, M., 1985. Economic action and social structure: the problem of embeddedness. *Am. J. Sociol.* 91 (3), 481–510.

Ha-Brookshire, J., 2017. Toward moral responsibility theories of corporate sustainability and sustainable supply chain. *J. Bus. Ethics* 145, 227–237. doi:10.1007/s10551-015-2847-2.

Harangozo, G., Csutora, M., Kocsis, T., 2018. How big is big enough? Toward a sustainable future by examining alternatives to the conventional economic growth paradigm. *Sustain. Dev.* 26, 172–181. doi:10.1002/sd.1728.

Hari, T.K., Yaakob, Z., Biniha, N.N., 2015. Aviation biofuel from renewable resources: routes, opportunities and challenges. *Renew. Sustain. Energy Rev.* 42, 1234–1244.

Hausknost, Daniel, Schriebl, Ernst, Lauk, Christian, Kalt, Gerald, 2017. A Transition to Which Bioeconomy? An Exploration of Diverging Techno-Political Choices. *Sustainability* 9 (4), 669–691. doi:10.3390/su9040669.

Hickel, J., 2020. What does degrowth mean? A few points of clarification. *Globalizations* 1–7. doi:10.1080/14747731.2020.1812222.

Hickel, J., Kallis, G., 2020. Is green growth possible? *New Polit. Econ.* 25, 469–486. doi:10.1080/13563467.2019.1598964.

Hiselius, L.W., Arnfalk, P., 2021. When the impossible becomes possible: COVID-19's impact on work and travel patterns in Swedish public agencies. *Eur. Transp. Res. Rev.* 13. doi:10.1186/s12544-021-00471-9.

Hopkinson, L., Cairns, S., 2020. *Elite Status: Global Inequalities in Flying. Report for Possible, London, UK*.

Hopwood, B., Mellor, M., O'Brien, G., 2005. Sustainable development: mapping different approaches. *Sustain. Dev.* 13, 38–52. doi:10.1002/sd.244.

Huber, J., 2000. Towards industrial ecology: sustainable development as a concept of ecological modernization. *J. Environ. Policy Plann.* 2, 269–285. doi:10.1002/1522-7200(200010)12)2.

IATA, 2020. Air passenger market analysis January 2021. IATA Econ. Anal. <https://www.iata.org/en/publications/economics/>.

IATA, 2021. COVID 19. Passenger market remains weak while air cargo strengthens. IATA Econ. Present. <https://www.iata.org/en/publications/economics/>.

Illich, I., 1973. *Tools for Conviviality*. Calder and Boyals.

Ivanov, D., 2020. Viable supply chain model: integrating agility, resilience and sustainability perspectives—Lessons from and thinking beyond the COVID-19 pandemic. *Ann. Oper. Res.* doi:10.1007/s10479-020-03640-6.

Jackson, T., 2012. Prosperity without growth. In: Hinterberger, F., Freytag, E., Pirgmaier, E., Schuster, M. (Eds.), *Growth in Transition*. Earthscan/Routledge, pp. 2–65.

Jänicke, M., Klaus, J., 2004. Lead markets for environmental innovations: a new role for the nation state. *Global Environ. Polit.* 4 (1), 29–46. doi:10.1162/152638004773730202.

Jiménez, J.L., Betancor, O., 2012. When trains go faster than planes: the strategic reaction of airlines in Spain. *Transp. Policy* 23, 34–41. doi:10.1016/j.tranpol.2012.06.003.

Kallis, G., 2011. In defence of Degrowth. *Ecol. Econ.*, 705, 873–880.

Kallis, G., Kostakis, V., Lange, S., Muraca, B., Paulson, S., Schmeller, M., 2018. Research on degrowth. *Annu. Rev. Environ. Resour.* 43, 291–316. doi:10.1146/annurev-environ-102017-025941.

Kallis, G., Paulson, S., D'Alisa, G., Demaria, F., 2020. *The Case For Degrowth*. Polity Press.

Kallis, G., 2021. Limits, ecomodernism and Degrowth. *Polit. Geography*, 102367.

Kelton, Stephanie, 2020. *The Deficit Myth*. John Murray Press, London.

Kerschner, C., Wächter, P., Nierling, L., Ehlers, M.H.M.H., 2018. Degrowth and Technology: towards feasible, viable, appropriate and convivial imaginaries. *J. Clean. Product.* 197, 1619–1636.

Larsson, J., Elofsson, A., Sterner, T., Åkerman, J., 2019. International and national climate policies for aviation: a review. *Clim. Policy* 19, 787–799. doi:10.1080/14693062.2018.1562871.

Latouche, S., 2009. *Farewell to growth*. Polity.

Liegy, V., Nelson, A., 2020. *Exploring Degrowth. A critical Guide*. Pluto Press.

Loeffler, M., Hinrichs, J., Moß, K., Henkel, M., Hausmann, R., Kruse, A., Dahmen, N., Sauer, J., Wodarz, S., 2017. Processing of biobased resources, Bioeconomy: shaping the Transition to a Sustainable. *Biobased Econ.* doi:10.1007/978-3-319-68152-8\_7.

Lorek, S., Fuchs, D., 2013. Strong sustainable consumption governance – precondition for a degrowth path? *J. Clean. Product.* 38, 36–43. doi:10.1016/j.jclepro.2011.08.008.

Martínez-Alier, J., Pascual, U., Vivien, F.D.F.D., Zaccai, E., 2010. Sustainable degrowth: mapping the context, criticisms and future prospects of an emergent paradigm. *Ecol. Econ.* 699, 1741–1747.

Mazzucato, M., 2013. *The Entrepreneurial State: Debunking Public vs. Private Sector Myths*. Anthem Press.

McCormick, K., Kautto, N., 2013. The Bioeconomy in Europe: an Overview. *Sustain* 5, 2589–2608. doi:10.3390/su5062589.

- McManners, P.J., 2016. Developing policy integrating sustainability: a case study into aviation. *Environ. Sci. Policy* 57, 86–92.
- Mol, A.P.J., 1997. Ecological modernization: industrial transformations and environmental reform. In: Redclift, M. (Ed.), *The International Handbook of Environmental Sociology*. Edward Elgar, Cheltenham, pp. 138–149.
- Mol, A.P.J., 2000. The environmental movement in an era of ecological modernisation. *Geoforum* 31, 45–56.
- Mol, A.P.J., 2002. Ecological modernization and the global economy. *Global Environ. Polit.* 2 (2), 92–115.
- Moriarty, P., Honnery, D., 2020. New approaches for ecological and social sustainability in a post-pandemic world. *World* 1, 191–204. doi:10.3390/world1030014.
- Ney, S., Verweij, M., 2015. Messy institutions for wicked problems: how to generate clumsy solutions? *Environ. Plan. C Gov. Policy* 33, 1679–1696. doi:10.1177/0263774X15614450.
- Parrique, T., Barth, J., Briens, F., Kerschner, C., Kraus-Polk, A., Kuokkanen, A., Spangenberg, J.H., 2019. Decoupling debunked: evidence and arguments against green growth as a sole strategy for sustainability. *Eur. Environ. Bureau*.
- Pearce, D., Hamilton, K., Atkinson, G., 1996. Measuring sustainable development: progress on indicators. *Environ. Dev. Econ.* 1, 85–101.
- Pereira, G.F.J., Larsen, L.S., 2020. *The Role of Flight Shame in Air Travel Behaviour*. Copenhagen Business School.
- Piketetty, T., 2018. *Capital in the Twenty-First Century*. Harvard University Press.
- Polanyi, K., 1944. *The Great Transformation: The Political and Economic Origins of Our Time*. Beacon Press.
- Poom, A., Orru, K., Ahas, R., 2017. The carbon footprint of business travel in the knowledge-intensive service sector. *Transp. Res. Part D Transp. Environ.* 50, 292–304. doi:10.1016/j.trd.2016.11.014.
- Porter, M.E.M.E., van der Linde, C., 1995. Toward a new conception of the environment-competitiveness relationship. *J. Econ. Perspect.* 9 (4), 97–118.
- Prussi, M., O'connell, A., Lonza, L., 2019. Analysis of current aviation biofuel technical production potential in EU28. *Biomass Bioenergy* 130, 105371.
- Ramcilovic-Suominen, S., Püzl, H., 2018. Sustainable development – A 'selling point' of the emerging EU bioeconomy policy framework? *J. Clean. Prod.* 172, 4170–4180. doi:10.1016/j.jclepro.2016.12.157.
- Rittel, H., Webber, M., 1973. Dilemmas in a general theory of planning. *Policy Sci.* 4, 155–169. [http://urbanpolicy.net/wp-content/uploads/2012/11/Rittel+Webber\\_1973\\_PolicySciences4-2.pdf](http://urbanpolicy.net/wp-content/uploads/2012/11/Rittel+Webber_1973_PolicySciences4-2.pdf).
- Robra, B., Heikkurinen, P., Nesterova, I., 2020. Commons-based peer production for degrowth? - The case for eco-sufficiency in economic organisations. *Sustain. Future* 2, 100035. doi:10.1016/j.sfr.2020.100035.
- Sachs, W., 1993. Global ecology and the shadow of development. In: *Global Ecology: A New Arena of Political Conflict*. Zed Books, pp. 3–21.
- Sandel, M., 2010. *Justice: What's the Right Thing to do*. Straus and Giroux, Farrar.
- Sarkis, J., 2020. Supply chain sustainability: learning from the COVID-19 pandemic. *Int. J. Oper. Prod. Manag.* 41, 63–73. doi:10.1108/IJOPM-08-2020-0568.
- Seetaram, N., Adedoyin, F.F., Ye, S., 2020. The impact of passenger taxes. The UK air passenger duty case. In: Graham, A., Adler, N., Niemeier, H.-M., Betancor, O., Antunes, A.P., Bilotkach, V., Calderón, E.J., Martini, G. (Eds.), *Air Transport and Regional Development Policies*. Routledge, pp. 267–280.
- Sekulova, F., Kallis, G., Rodríguez-Labajos, B., Schneider, F., 2013. Degrowth: from theory to practice. *J. Clean. Prod.* 38, 1–6. doi:10.1016/j.jclepro.2012.06.022.
- Sen, A.K., 1999a. *Development As Freedom*. Oxford University Press.
- Sen, A.K., 1999b. The possibility of social choice. *Am. Econ. Rev.* 89 (3), 349–378.
- Schrems, I., Upham, P., 2020. Cognitive dissonance in sustainability scientists regarding air travel for academic purposes: a qualitative study. *Sustain* 12, 1–14. doi:10.3390/su12051837.
- Sörqvist, P., Langeborg, L., 2019. Why people harm the environment although they try to treat it well: an evolutionary-cognitive perspective on climate compensation. *Front. Psychol.* 10, 1–5. doi:10.3389/fpsyg.2019.00348.
- Spargaaren, G., 2000. Ecological modernization theory and domestic consumption. *J. Environ. Policy Plan.* 2, 323–335. doi:10.1002/1522-7200(200010)12:2:4(323::AID-JEPP61)3.0.CO;2-W.
- Spash, C.L., 2010. The brave new world of carbon trading. *New Polit. Econ.* 15, 169–195. doi:10.1080/13563460903556049.
- Springett, D., 2003. Business conceptions on sustainable development: a perspective from critical theory. *Bus. Strategy Environ.* 12 (2), 71–86.
- Stern, D.I., 2004. The rise and fall of the environmental kuznets curve. *World Dev.* 32 (8), 1419–1439.
- Stiglitz, J.E., 2002. *Globalization and Its Discontents*. Norton.
- Stuart, D., Gunderson, R., Petersen, B., 2019. Climate change and the polanyian counter-movement: carbon markets or degrowth? *New Polit. Econ.* 24, 89–102. doi:10.1080/13563467.2017.1417364.
- Vainio, A., Ovaska, U., Varho, V., 2019. Not so sustainable? Images of bioeconomy by future environmental professionals and citizens. *J. Clean. Prod.* 210, 1396–1405.
- Verweij, M., Douglas, M., Ellis, R., Engel, C., Hendriks, F., Lohmann, S., Ney, S., Rayner, S., Thompson, M., 2006. Clumsy solutions for a complex world: the case of climate change. *Public Adm* 84, 817–843. doi:10.1111/j.1540-8159.2005.09566.x-11.
- Vetter, A., 2018. The matrix of convivial technology—assessing technologies for Degrowth. *J. Clean. Prod.* 197, 1778–1786.
- Viski, István, 2021. *A légiközlekedés jövőjének kritikai olvasata az erős fenntarthatóság szemszögéből (Critical review of the air transport industry's future from the perspective of strong sustainability) - Master Thesis*. Corvinus University of Budapest, Budapest.
- Vivien, F.D., Nieddu, M., Befort, N., Debref, R., Giampietro, M., 2019. The Hijacking of the Bioeconomy. *Ecol. Econ.* 159, 189–197. doi:10.1016/j.ecolecon.2019.01.027.
- Walker, S., Cook, M., 2009. The contested concept of sustainable aviation. *Sustain. Dev.* 176, 378–390.
- Wydra, S., Hüsing, B., Köhler, J., Schwarz, A., Schirrmeyer, E., Voglhuber-Slavinsky, A., 2021. Transition to the bioeconomy—Analysis and scenarios for selected niches. *J. Clean. Prod.* 294, 126092.
- Wynes, S., Nicholas, K.A., 2018. Reply to Second comment on “The climate mitigation gap: education and government recommendations miss the most effective individual actions. *Environ. Res. Lett.* 13. doi:10.1088/1748-9326/aac9cf.
- York, R., 2006. Ecological paradoxes: william stanley Jevons and the paperless office. *Hum. Ecol. Rev.* 13 (2), 143–147.