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Climate Justice Implications of Banning Air-Freighted Fresh Produce

Ebenezer Laryea [1,*], Amin Hosseinian-Far [2,*] and Simon Derrick [3]

[1] Department of Law, University of Northampton, Northampton NN1 5PH, UK
[2] Department of Business Systems & Operations, University of Northampton, Northampton NN1 5PH, UK
[3] Blue Skies Holding Ltd., Pitsford NN6 9AA, UK; simon.derrick@blueskies.com
* Correspondence: ebenezer.laryea@northampton.ac.uk (E.L.); amin.hosseinianfar@northampton.ac.uk (A.H.-F.)

Abstract: *Background*: Airfreight transport refers to the shipment of goods by air from one location to another and is often perceived as a contributor to global carbon emissions. The environmental impacts associated with airfreight are of notable and genuine concern. Such concerns have often led to calls for measures to ban or limit air freight as a mode of transportation for goods. Whilst the majority of these calls are perceived to be well placed, it is nevertheless essential to acknowledge the climate justice implications associated with such measures, particularly in the context of perishable products like fresh produce. *Methods*: The aim of this study is to thoroughly examine the socioeconomic implications of banning air-freighted fresh produce and to recommend practices that can minimize the environmental impacts. Utilizing Blue Skies Holdings Ltd., Pitsford, UK as a case study, this paper undertakes a comprehensive analysis of the potential climate justice ramifications associated with the prohibition of air-freighted fresh produce. *Results*: The analysis highlights the intricate interplay between the environmental and socioeconomic dimensions of the issue. By investigating the carbon emissions attributed to aviation and air logistics in particular and meticulously scrutinizing the possible consequences of an airfreight ban in relation to vulnerable communities within developing economies that are heavily reliant on fresh produce exports, the study contributes insights to guide policy discourse and the decision-making processes within commercial entities with respect to their carbon emissions reduction strategies. *Conclusions*: Accordingly, this study provides a number of recommendations for various actors, particularly commercial stakeholders, who deal with air-freighted fresh produce.

Keywords: aviation logistics; climate justice; carbon footprint; net zero; airfreight; fresh produce

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1. Introduction

In recent decades, there has been a substantial increase in aviation activity involving both passenger and cargo transportation. This surge has consequently led to a notable uptick in greenhouse gas emissions within the aviation sector [1]. The rise in global population numbers and its corresponding implications for demand in aviation, coupled with the high perishability of fresh produce, accentuates the significance of air freight as a means of speedy transportation [2]. In fact, emissions associated with international aviation were approximated to be 36.8 million tons of CO_2e in 2019 [3].

Several studies have attempted to establish a correlation between rising global aviation and ecological sustainability [4–6]. A study undertaken in 2021 [7] argues that both CO_2 and non-CO_2-greenhouse emissions from global aviation are significantly exacerbating the climate change emergency. With each passing year, the signs of the worsening climate crisis find ever more clear expression in extreme record-setting weather events across the globe. This has led some major retailers to rethink their business models and procurement practices with respect to air-freighted fresh produce [8].

Its climate change implications notwithstanding, aviation logistics plays an instrumental role in supporting businesses and the livelihood of individuals—particularly vulnerable

communities, along the supply chain. However, there is a gap in research in this area, which examines the socioeconomic consequences and climate justice implications of a significant reduction in the growth of the aviation sector with respect to air freight.

This study is therefore aimed at investigating the climate justice implications of limiting or banning fresh produce airfreight. It also seeks to offer essential recommendations to commercial actors and policymakers on how to better balance the need to pursue carbon emissions reduction policies whilst ensuring that those policies attain climate justice. Resultingly, the study aims to address the following research question: "How can commercial actors and policymakers effectively balance the socioeconomic benefits associated with air-freighted fresh produce within vulnerable local communities in developing countries with ecological sustainability considerations and concerns linked to air freight?". Accordingly, the study examines the outcomes, particularly from a climate justice perspective, and provides alternative strategies that can guide policymakers in crafting their net zero and carbon emissions reduction policies. The case study of a major fresh produce manufacturer that relies heavily on aviation logistics along its supply chain is employed to substantiate the arguments and support the discussion. It should be noted that this paper builds upon a previous study that examined the socioeconomic impacts of the Case Study organization's business model in the local communities in Ghana. However, as highlighted in Section 3 of this paper, specific quantitative and qualitative results of the previous study are not disclosed due to proprietary reasons. Within the context of Industry 4.0, the need to find a balance between the three pillars of Sustainability, i.e., Economy, Society, and ecology, is of very high importance [9]. This study, therefore, provides an argument that emphasizes the social and even economic contributions of business models that operate in local communities within developing countries and rely on air freight as a mode of transportation for fresh produce.

The key contributions of this study are as follows: The research presents a set of pertinent recommendations for both commercial and policymaking actors, making the case for the striking of a balance between the need to preserve the socioeconomic benefits that air-freighted fresh produce provides for vulnerable local communities in developing nations, and the need to pursue carbon emission reduction and Net Zero targets. Furthermore, this study introduces a fresh perspective, emphasizing the importance of incorporating social benefits into the analysis of comparable business models concerning economic and environmental aspects.

The paper is structured as follows: Section 2 provides a detailed background of the environmental impact of fresh produce airfreight and the underlying relevant notions of climate justice. Section 3 introduces the case study, which is adopted as part of the exploratory case study methodology. Section 4 entails a tailored investigation of climate justice constructs within the selected case study. Section 5 includes a discussion of the findings. Section 6 provides a list of recommendations that can support the policymakers' businesses, including retailers and farmers, when devising their fresh produce business model. The paper is concluded in Section 7.

2. Literature Review

2.1. Environmental Impact of Air-Freighted Fresh Produce

The main environmental concerns associated with aviation are climate change and stratospheric ozone reduction, which often leads to increased surface UV radiation and pollution. Aircraft engines emit carbon dioxide, oxides of nitrogen, oxides of sulfur, water vapor, hydrocarbons, and particles that consist of sulfur oxides and soot [10].

Whilst a proportion of aircraft emissions are absorbed by the Earth's vegetation and oceans, a significant amount ends up in the atmosphere, where it blends with other gases to create the quasi-blanket over the globe. Consequently, heat, which normally radiates through our atmosphere and into space, is reflected onto the earth, thus causing our planet to warm. In addition, Nitrogen Oxides (NOx) and H20 vapor from aircraft engines enhance

the formation of cirrus clouds and contrails, which are visible in a clear day's sky and serve as yet more clear evidence of the carbon emissions attributable to aircraft [10].

Overall, aviation accounts for 2% of global CO_2 emissions. However, when non-CO_2 impacts on the world's climate are considered, aviation comes to account for 3.5% of global CO_2 emissions. The global aviation emission figure for greenhouse gas emissions (which includes all greenhouse gas emissions—not only CO_2 emissions is even lower at 1.9% [11]. Whilst these numbers may seem low, it is worth noting that aviation emissions have nevertheless doubled since the mid-1980s, and it is one of the most challenging sectors to decarbonize [11]. In a recent study, Lee et al. undertook a comprehensive year-by-year analysis of CO_2 emissions dating back to 1940 based on fuel consumption data from the International Energy Agency (IEA). From being well less than 100 million tons in 1940, aviation CO_2 emissions quickly quadrupled to being between 200 and 300 million tons in 1966. It then further doubled to just over 500 million tons in 1987 [7]. The financial crisis of 2008 saw a reduction in aviation, which resulted in a break in the sharp rise in aviation CO_2 emissions. Even then, the level of global CO_2 emissions caused by aviation (including airfreight) was recorded as being slightly over 700 million tons. A slow global economic recovery from the shocks of the 2008 financial crisis saw aviation activity pick up again in the 2010′s. As a result, an extremely sharp rise of 1.04 billion tons of CO_2 emissions from global aviation was recorded in 2018 [7].

The COVID-19 pandemic and its associated lockdowns exacted a heavy toll on the global economy. The suspension of conventional commercial activity and the movement of people across several countries across the world brought global aviation to a screeching halt, resulting in a sharp drop in CO_2 emissions. This meant that in 2022, aviation came to account for 2% of global CO_2 emissions, representing 80% of pre-pandemic levels [12].

What this analysis shows is that whilst CO_2 emissions from global aviation (including airfreight) have increased eightfold since the 1940′s, they still account for a relatively small proportion of overall global CO_2 emissions. Nevertheless, the levels of CO_2 emissions and their impact on the climate continue to remain a concern for many, resulting in political action across the world to progress the aviation industry towards carbon neutrality. The steps that have been taken by governments and political institutions in this regard have mostly found expression in the form of initiatives, fiscal and (or) regulatory policies intended to promote Sustainable Aviation Fuels (hereafter referred to as SAF) in major markets and thereby limit emissions reductions [12]. A notable example of this is the 'long-term global aspirational goal' (LTAG), which was adopted in 2022 by the 184 member countries of the International Civil Aviation Organization (ICAO). The goal behind LTAG is to achieve net carbon emissions from international aviation by 2050 [12]. Further to this initiative by ICAO, there are examples of direct fiscal policies and regulations by governments (mostly in the Western developed world) aimed at promoting sustainable aviation fuels in major markets to drive down aviation emissions. In 2022, the United States announced import tax credits and a grant program under its new Inflation Reduction Act to incentivize a pivot towards the use of SAF. The incentive package includes an allocation of $3.3 billion to scale up SAF production [12]. Similarly, the EU Parliament and Council reached a political agreement in early 2023 on a proposal called 'ReFuelEU Aviation' to decarbonize the aviation sector by requiring fuel suppliers to blend SAFs with kerosene in increasing amounts from 2025. On its own, this measure is projected to reduce CO_2 emissions by two-thirds. Other measures in the agreed 'REFueIEU Aviation' proposal include a requirement for airports to update their infrastructure to ensure that it can support SAF distribution [13]. The UK has taken a similar approach to the EU and unveiled the 'Jet Zero' pledge in 2022. 'Jet Zero' is a commitment by the UK government to support SAF projects with a £165 million investment. This investment will fund a plan to have at least five commercial SAF plants under construction by 2025. To support the achievement of this aim, the UK government set up the 'Advanced Fuels Fund' in July 2022 to competitively allocate the £165 million investment in grant funding to support UK advanced fuel projects until 31 March 2025 [14].

The commitment of governments and stakeholders in major markets, such as the UK, US, and EU, to support SAF production and advance the aviation industry's efforts to reduce CO_2 emissions is evident. Despite the aviation sector's relatively small contribution to global CO_2 emissions, the policy and fiscal measures discussed herein underscore the determination to reverse the significant increase in emissions from this sector. These measures highlight a collective drive to address environmental concerns and promote sustainable practices within the aviation industry.

2.1.1. Aviation and the Others

To gain a comprehensive understanding of aviation's impact on global greenhouse gas emissions, it is crucial to compare the emissions from the aviation sector with those of other major sectors. This comparative exercise enables us to assess and evaluate how aviation emissions fare in comparison to other significant contributors to global emissions. By considering aviation alongside other industries, we can gain insights into its relative environmental impact and better contextualize its role in the broader emissions landscape. Figures 1 and 2 provide breakdowns of the global emissions landscape by sector (Figure 1) and by field (Figure 2) as of 2020.

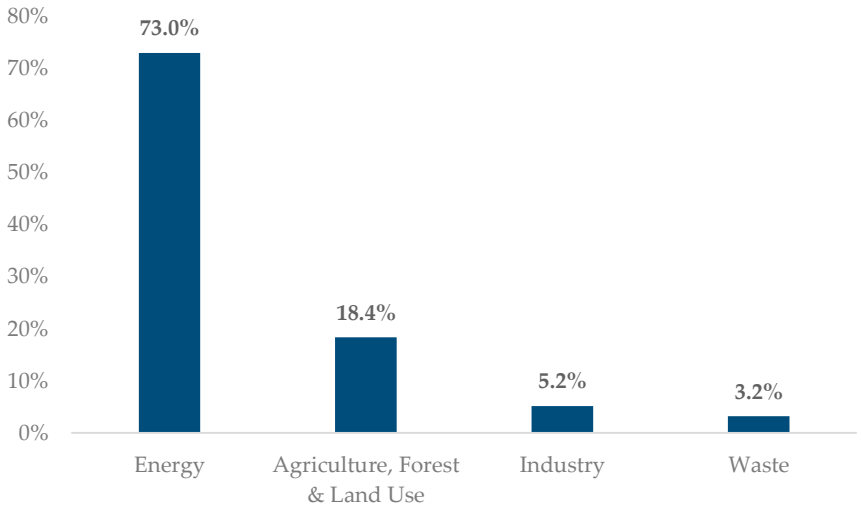

Figure 1. Global emissions by sector (adapted from [15]).

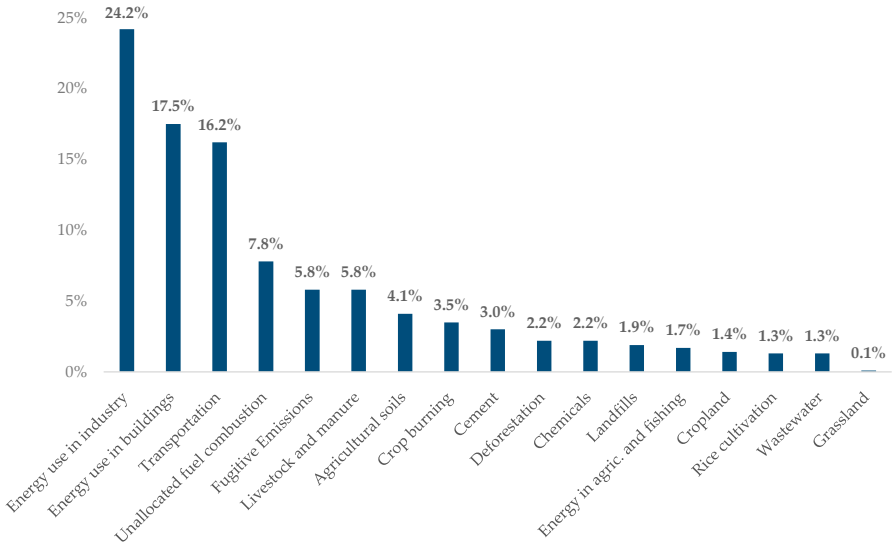

Figure 2. Subgroup rate of global emissions by sector (adapted from [15]).

As per Figures 1 and 2 above, the energy sector is the largest contributor to global emissions, accounting for 73% of total global emissions. The breakdown in Figure 2 shows that energy usage in industry and buildings is a significant contributor. Unallocated fuel combustion and fugitive emissions, though smaller in percentage, still play a notable role in contributing to overall global emissions. Energy-related activities in agriculture and fishing contribute a relatively smaller proportion.

Within transportation, road transport (including road freight) is by far the biggest contributor to emissions, accounting for 11.9%. By contrast, shipping contributes 1.7% whilst aviation accounts for 2% of transport emissions, as has already been highlighted in this paper. Rail and pipeline transports account for 0.4% and 0.3% respectively. As can be seen from this immediate data, aviation ranks amongst the least contributors to global emissions when compared to the emissions contributions from sectors within transport and other sectors within the wider Energy bracket [15].

Agriculture, forest, and land use contribute a total of 18.4% of global emissions. Livestock and manure are the most significant contributors within this sector, followed by emissions from agricultural soils and crop burning. Deforestation is also a notable contributor to emissions in this sector. It is worthy of note that when compared to the emissions contributed by aviation, only cropland and grassland activities contribute less, with all other agricultural activities contributing more than aviation to global emissions.

The industry processing sector contributes 5.2% of global emissions. Most emissions from this sector come from the production of chemicals and cement. When compared with aviation, this sector contributes more to global greenhouse gas emissions. This again demonstrates the fact that whilst the contribution to global emissions from aviation raises concern, they contribute relatively little to global emissions overall when compared with emissions from other commercial activities.

2.1.2. Banning or Limiting Air Freight—The Environmental Case

As this paper has established, aviation, including airfreight, contributes a relatively negligible amount to overall global emissions. This, therefore, raises the question: What is the environmental rationale for restricting or prohibiting air freight, and what potential advantages might such an approach offer?

An initial answer may well lie within the environmental impact per unit of airfreight. Although aviation's emissions may be small compared to other industries, the emissions intensity and global warming potential of air-freighted fresh produce can be between 20–26 times the global warming potential of locally sourced fresh produce. Airfreight produces a higher amount of emissions per kilogram of goods transported compared to other transportation modes like shipping or train freight. As a result, using airfreight to transport fresh produce has a more significant environmental impact [16]. However, recent studies have demonstrated that business models associated with air freight and air cargo have a positive impact on local communities, e.g., alleviating poverty in rural communities [17,18].

With many retailers having become increasingly aware of their environmental impact and the need to address climate change, some see limiting or banning air-freighted fresh produce as beneficial to reducing their carbon footprints [16]. This perceived benefit has led to a proliferation of environmentally conscious sourcing policies, which are viewed as being a positive step towards sustainability and are seen to resonate with environmentally conscious consumers as a means of boosting market reputation and customer loyalty [19]. In addition to this, carbon neutrality and emissions reduction goals are playing a major role in shaping the disposition most food retailers are taking to air-freighted fresh produce. Most retailers have set ambitious targets in this regard and have done so in a way that means there is public pressure to deliver on emissions reduction targets [20]. For example, the British Retail Consortium established the 'Better Retail Better World' initiative, under which thirty major food retailers have come together to set and pursue emissions reduction and other sustainability targets. The group of signatories under the initiative has expanded to

include big-name fashion brands as well [21]. Public commitments to emissions reduction targets, while necessary and appreciated, create consumer expectations that these targets will be achieved. In such scenarios, restricting or potentially banning airfreight may seem like a straightforward action to showcase a commitment to meeting climate emission reduction goals.

In addition to consumer pressure to reduce carbon emissions, retailers may also face regulatory and market pressures to reduce emissions. In such a situation, limiting or banning airfreight might appear to be a proactive measure to comply with existing or potential future environmental regulation—especially as the global economy draws ever closer to its Net Zero by 2050 target [22]. An example of this can be seen in the regulatory restrictions adopted by the EU parliament (Regulation (EU) 2021/1119) on centralized commercial refrigeration systems (including that of retailers and supermarkets) from 1 January 2022, which limits the global warming potential of the refrigerants [23]. Regulations such as this apply pressure to market actors and drive them towards changing their commercial behaviors and practices to meet future environmental targets.

2.1.3. Banning or Limiting Air Freight—The Business Case

Having examined the environmental rationale for banning or limiting air freight, it is equally valid to explore the business advantages in order to gain a comprehensive understanding of how such an approach might align with the financial interests of retailers. Whilst airfreight offers speed and reliability, it is often more expensive than other modes of transportation. Retailers may, therefore, consider optimizing their supply chains to use more economical and environmentally friendly transport options [24]. In 2021, the cost of flying cargo reached unprecedented heights, with prices nearly doubling on vital air freight routes. This surge in costs can be attributed to supply chain shocks lingering from the aftermath of the COVID-19 pandemic, a reminder that the global economy is still on the path to complete recovery. In the face of these challenges, some food retailers are open to exploring alternatives to air-freighted fresh produce to cut costs amidst the turbulence of changing market dynamics [25]. Further to the cost-cutting benefits, limiting or banning airfreight might make business sense for the supply chain efficiency streamlining opportunities it offers. The adaptation of more eco-friendly modes of transportation could allow retailers to optimize inventory management, reduce lead times, and enhance overall efficiency to boost customer satisfaction. With airfreight, businesses often prioritize speed, leading to smaller, more frequent shipments. However, this can result in higher inventory carrying costs, as warehouses may need to accommodate smaller quantities of goods more frequently. By adopting more efficient transportation modes, retailers can consolidate shipments, reducing the need for frequent restocking [26].

The business case for limiting or banning air freight stretches to include risk mitigation as well. A heavy reliance on air freight can expose retailers to various shocks and risks caused by weather conditions, airport closures, or other logistical challenges. Set against this backdrop, diversifying transport options and limiting reliance on air freight can mitigate the risks of external political and economic shocks and ensure smoother operations [27,28]. In no recent example is the fragility of supply chains, which heavily rely on air freight, more evident than with the COVID-19 pandemic [29]. The pandemic placed unparalleled stress on food supply chains. Air freight, essential for fruits and vegetables especially, was severely disrupted by the decline in passenger air travel. To some extent, the legacies of this disruption continue to remain and affect the commercial operations of retailers and producers alike [30–32].

In sum, there is, *prima facie*, a strong environmental and business case that can be made for an approach to sourcing fresh produce that bans or limits the use of air freight. As has been already noted in this paper, whilst airfreight is known for its speed and reliability, it comes with a higher carbon footprint compared to other transportation modes like sea or rail freight. By shifting to more eco-friendly options, retailers can demonstrate their commitment to sustainability while also unlocking operational advantages. In addition

to this, limiting or banning airfreight can yield significant business benefits beyond cost-cutting, as has been highlighted in this paper.

However, retailers and other industry actors must approach decisions regarding banning or limiting air freight with careful consideration of various factors, such as product suitability. It is essential to acknowledge that certain products, like fresh-cut fruit, have unique characteristics that make them better suited for air freight due to their perishability and specific customer demands for freshness [33]. Fresh-cut fruit has a very limited shelf life, thus requiring swift transportation to maintain its quality and appeal to customers. Air freight's speed and efficiency make it the transportation mode of choice for such perishable goods—ensuring they reach their destination quickly and in good condition. This is especially crucial when serving markets where demand is high for fresh products, and time-sensitive deliveries can be a competitive advantage [33].

Retailers and other industry actors must, therefore, strike a balance between sustainability goals and meeting customer expectations. Whilst limiting or banning the use of air freight is essential for environmental reasons, it is equally vital to ensure that customers receive products of the expected quality and freshness. It is certainly the case, therefore, that exploring alternative solutions to enhance the overall sustainability of the fresh produce supply chain, such as using sustainable aviation fuels or optimizing inventory management, can be valuable strategies that help to balance the need for sustainability against other equally significant factors [34]. Careful thought must also be given to the socioeconomic consequences and impacts of limiting or banning air-freighted fresh produce at the point of source—which is often a geographical location in the developing world. Particularly, decisions to ban or limit air-freighted fresh produce may go against the principles of Climate Justice and can have far-reaching impacts on various stakeholders and communities involved in the supply chain. The subsequent sections delve into comprehensive discussions on these points.

2.2. Climate Justice Perspective

Climate Justice is a concept that seeks to address the unequal and disproportionate impacts of climate change on different communities and individuals. It represents a recognition that climate change is not just an environmental issue but also a social and economic one. At its core, climate justice advocates and emphasizes the need to address the underlying causes of climate change in a manner that ensures fair and equitable approaches to climate change policies that prioritize the most vulnerable communities [35]. A key characteristic of Climate Justice is the highlighting of historical and geographical differences in climate impacts and the role of systems such as colonization, capitalism, and globalization in perpetuating climate injustices. It acknowledges that marginalized communities—especially in developing countries—who have contributed the least to climate change often bear the greatest burden of its consequences and the unintended negative impacts of policies designed to tackle it. Climate justice, therefore, emphasizes the imperative of ensuring that approaches aimed at addressing climate change (including those undertaken by retailers and other commercial entities) are equitable and considerate of the well-being of vulnerable communities. It strives to confront and dismantle these oppressive systems, ultimately working towards a future that is both fair and sustainable [35].

Climate change and justice share an inextricable link because climate change is at the root of the issue of fairness in a finite world where resources and the capacity of our planet to absorb carbon emissions are limited. Therefore, the issue of climate change cannot be satisfactorily addressed without the promotion of justice being placed at the center of the crafting of climate policy. This means responding to climate change requires a commitment to fairness [36]. The importance of climate justice in achieving global climate targets has long been established and recognized. As a substantive starting point, the Paris Agreement allowed for voluntary cooperation between countries for sustainable development using market-based mechanisms in a manner that ensures that efforts to address climate change are supportive of the most vulnerable communities [37].

As a social institution, the market shares institutional philosophical underpinnings with the concept of justice, thus embedding them both, arguably, in a set of interconnected values and relations. The level of compatibility between the market and justice can vary depending on prevailing contextual factors. Nevertheless, engaging the shared institutional characteristics of both can support market-based approaches to achieve climate justice [35]. In part, this means that policymakers implementing market-based approaches to addressing the issue of climate change (such as the banning or limiting of air-freighted fresh produce) must ensure that their climate change policies take into account the rights of vulnerable communities within their supply chains, the risks to them vis-à-vis emissions reduction policies and the responsibilities owed them [38].

The interplay between rights, risks, and responsibilities makes for an effective framework for crafting and shaping equitable climate change policies so that they attain climate justice—ensuring the upholding of rights and responsibilities while addressing and mitigating risks, especially for marginalized and vulnerable communities. When these elements are balanced, it helps to make certain that the impact of market-based approaches toward addressing climate change is positive by ensuring that vulnerable individuals and communities receive equitable treatment, protection, and economic opportunity.

2.3. Problem Domain

The global fresh produce industry is facing a critical dilemma centered around sustainability and socioeconomics, particularly in the context of air-freighted fresh produce products. On the one hand, there is an urgent need to address climate change, which has prompted discussions around the environmental impact of airfreight, instigating suggestions for restrictions or bans on the transportation of fresh produce by air due to its significant carbon footprint. Conversely, the fresh produce industry heavily relies on airfreight for the preservation of product quality, market reach, and substantial socioeconomic benefits, especially in regions with agricultural export economies, the majority of which are comprised of developing economies.

While the existing literature clearly highlights some of the environmental consequences of airfreight, there is a research gap in comprehensively analyzing and evaluating the trade-off between the environmental implications and the positive socioeconomic impacts of air-freighted fresh produce within local communities in developing nations. Economic growth, employment opportunities, and social development are only but a few of the benefits that developing countries derive from business models that add value to agricultural fresh produce at source and rely on air freight to transport the highly perishable products to international markets.

Given that the existing literature is heavily focused on the environmental impacts of shipments by air, this paper provides a fresh perspective that speaks to the socio-economic benefits of air-freighted fresh produce and the climate justice implications that arise for vulnerable communities in developing countries from commercial practices which ban or limit air-freighted fresh produce.

The relevance of this study, therefore, is in the understanding it provides of the nuances and complexities for commercial policymakers between the need to pursue carbon emissions reduction policies and the responsibility to ensure those policies attain climate justice for the most vulnerable communities within the supply chain—especially in developing nations.

3. Methodology—The Case Study of Blue Skies Ltd.

The research design adopted in this study is investigative, using a case study. The case study is utilized to support and substantiate the arguments made with respect to the socioeconomic benefits of aviation logistics for the communities that directly benefit from the fresh produce manufacturer's business model where the fresh produce is air-freighted to geographically distant markets.

To better contextualize this discussion within the core subject matter of this paper, it is pertinent to address the question of what the potential climate justice ramifications associated with the imposition of restrictions or bans on air-freighted fresh produce could be. This consideration is particularly relevant for vulnerable communities within the supply chain, particularly in developing nations where there exists a significant dependency on exports of fresh produce.

The case of Blue Skies Holdings Ltd. (also referred to as Blue Skies in this paper) provides a comprehensive case study for assessing what the potential climate justice impacts might be of climate policies, which are framed to ban or limit air freight as a way of attaining climate targets. A focus on Blue Skies as a case study for the purpose of this paper is justified as the business is one that embodies a real-world scenario that encapsulates the complexities and nuances of the subject matter of this paper.

This paper builds on the findings of an earlier project that attempted to understand the impacts of the Blue Skies business model [39]. In this study, a mixed methods research approach involving interviews, focus groups, and surveys was utilized to assess the socioeconomic effects of the Blue Skies business model. The research encompassed interviews with 192 employees, the facilitation of three focus groups involving farmers and local communities in Ghana, and a quantitative survey involving 322 respondents. This comprehensive investigation delved into various aspects, including pay, benefits, and other quantifiable parameters linked to the company's business model. Additionally, the project team employed a proprietary social impact assessment tool to quantify the social effects of the company's business model in monetary units.

Nonetheless, it should be noted that this paper does not aim to provide a detailed report of all the findings of the above-mentioned project due to proprietary reasons. Rather, the paper attempts to use those findings of the project, which are publicly available, to demonstrate its analysis of the case study and the insights drawn from it in relation to the socioeconomic benefits that are linked to business models that add value to fresh produce at source and rely on air freight as a main means of transportation for their viability.

Accordingly, the study is exploratory in nature, attempting to provide substantiated arguments to highlight the potential climate justice implications for vulnerable communities in the supply chain of an approach to emissions reduction target that limits or bans air freight. Furthermore, a meticulous analysis of this case study will make a substantial contribution to the broader discourse of the subject matter of this paper to support the framing of market-based approaches to emissions reduction so that they aim to attain climate justice.

Headquartered in Pitsford, Northamptonshire, Blue Skies is a multi-national fresh-cut fruit business that operates farms and processing facilities in Ghana, Bennin, Egypt, South Africa, Brazil, and the UK. The business was founded in 1998 and operates on an 'agro-processing for export' and 'value added at source model'. This means that freshly picked fruit (primarily pineapples, mangoes, and coconut) grown on local farms in countries like Ghana and Benin are processed in factories that are in close proximity to the farms. The processed fresh-cut fruit is then exported to the UK and EU markets, where it ends up on the shelves of the major food retailers [40].

Given that fresh-cut fruit is highly perishable with a typical, expected shelf-life of between 7 and 10 days, there is an urgent need to ensure that the processed fruit is transported with rapid speed so it is on shelves in the UK and EU in the shortest possible time [41]. Within its model, Blue Skies achieves the need for rapid speed transport from farm to shelf by using air freight. Using the operations at Blue Skies' processing Factory at Dobro in Ghana as an example, fresh fruit is processed in the factory throughout the day, and the finished fresh-cut fruit products are then transported to the main international airport in Accra, where they are loaded aboard departing passenger flights for the UK and the EU [42]. Figure 3 presents the Blue Skies business model.

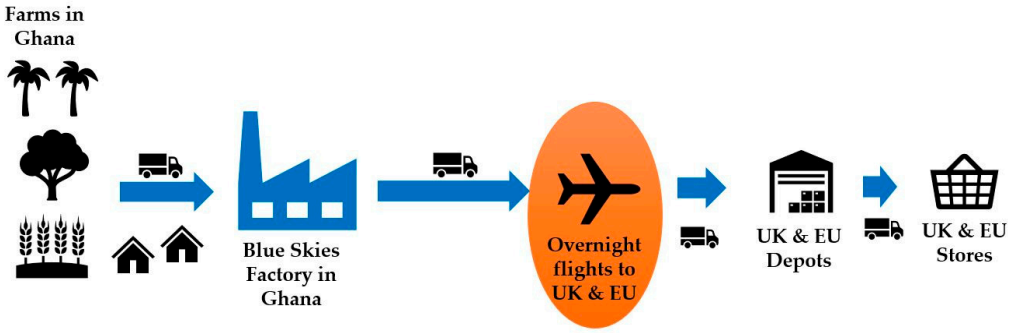

Figure 3. Blue Skies Business Model.

As the orange-shaded area in the above diagram shows, air-freighting the finished fresh-cut product is an integral part of Blue Skies' model. There is no specific available data on how much carbon Blue Skies emits by air freighting its finished products to the UK and EU markets, where it is sold on the shelves of its food retail customers. Nevertheless, as has been discussed in this paper, currently available data on global carbon emissions suggest that the sector accounts for about 2% of all global carbon emissions [11].

Resultingly, any model that relies heavily on airfreight to transport highly perishable products to market is likely to raise environmental concerns. It may also draw the attention of commercial clients (especially those in the food retail sector) who are seeking ways to limit their carbon footprints through a set of net zero targets and policies that ban or significantly reduce the use of air-freighted fresh produce.

While the underlying objective of this cause is undoubtedly commendable, it is imperative for commercial policymakers, as previously highlighted in this paper, to strike a delicate balance. This balance must be achieved between the imperative of emissions reduction and the pursuit of net zero targets while simultaneously safeguarding the imperative of climate justice for the most vulnerable communities in their supply chains.

Blue Skies' model of adding value at the source allows it to make a positive socioeconomic impact on the local communities where it operates. According to a report published by the United Nations Conference on Trade and Development (UNCTAD), approximately 64% of developing countries are commodity-dependent. This means that out of the 187 developing nations on the globe, 87 of them rely heavily on non-value-added commodity exports for a significant proportion of their foreign exchange earnings [43]. This indicates that many developing nations (about two-thirds) are dependent on the export of raw materials for their economic growth and development. The implications of this can be dire, seeing as commodity dependency has a substantially negative impact on the growth of developing nations. When more than 60% of a nation's total exports are composed of commodities, it hinders the diversification of the economy, thus making the country vulnerable to price fluctuations in the global commodity market [43]. UNCTAD's report lists 45 of the 54 countries in Africa as being commodity-dependent. Ghana, a West African nation where Blue Skies has its largest processing factory, is listed by the report as being one of 45 countries in Africa that is commodity-dependent with a heavy reliance on agricultural exports [43]. Ghana and other commodity-dependent nations need to diversify their economic outputs by exporting more value-added items to increase their foreign exchange earnings, invest more in public services, and improve the livelihoods of their citizens [44].

Accordingly, business models that add value at source, like the one operated by Blue Skies, are essential to the economic growth of developing countries and the livelihoods of the vulnerable populations that reside in those countries. It is worth highlighting that this model only works because Blue Skies is able to air freight the value-added and highly perishable fresh-cut fruit products to European markets within 24 h of their being made. Take the ability to air freight away, and the model will no longer be viable. This would mean not only the loss of the business but also the loss of the economic and social benefits the model provides to vulnerable communities in developing countries like Ghana.

4. Analysis and Results—Socioeconomic Impact & Climate Justice Implications

Whilst there is no readily available economic data on exactly how much value-added fresh produce exports contribute to the total GDP of a country like Ghana, the socioeconomic impact that Blue Skies' business model has made on the local community was the subject of a recent research project. Accordingly, the analysis made in this section draws upon evidence found within the commissioned report by Blue Skies, which was independently undertaken by researchers at the University of Northampton [39].

The study measured the socioeconomic impact of Blue Skies' operational activities on the local community in Ghana [45]. The study also measured the impact of the Blue Skies Foundation model on local communities in Ghana, where the Foundation operates to deliver infrastructure projects that provide education, health, and sanitation facilities in disadvantaged communities. Drawing on several primary and secondary data sets, the study showed a combined monetized social value generated in 2021 in Ghana of US$11.5 m. This figure represents the impact of Blue Skies' operations on local communities and the benefit to several vulnerable communities of the business model and Foundation activities—serving as a clear example of how its model benefits vulnerable communities in a developing nation that is very reliant on commodity exports. In relation to UNSDG1 (No poverty), the researchers found that Blue Skies' business and Foundation models generated a social value for local communities in Ghana of $2.4 million in 2021 alone—whilst the social value generated in relation UNSDG's 3 and 4 was measured at $695,000 and $247,000, respectively [39].

By adding value at source and exporting the finished product by airfreight, Blue Skies has created a significant number of employment opportunities for locals in Ghana. It employs 3000 people in Ghana alone and employs a total of 5000 people across all of its processing factories (Ghana, Egypt, Bennin, South Africa, and Brazil) [46]. Over the years, Blue Skies has earned itself the reputation of being one of the biggest private-sector employers, providing thousands of people in Ghana with an economic livelihood through which they are able to provide for themselves and their families [47].

Given the reliance of the Blue Skies model on air freight, the climate justice implications for vulnerable communities in Ghana of an approach to net zero, which entails banning or limiting air-freighted fresh produce, will be substantial and severely felt.

The first and clear climate justice impact would be on the local economy in Ghana, where the employment opportunities, support to local farmers, and the economic livelihoods linked to the Blue Skies model would all be put at risk. This would have significant unintended economic consequences for vulnerable communities and affect their socioeconomic well-being at a time when climate change has already put the livelihoods of millions of people in developing nations at risk [48].

The Blue Skies Foundation, with its focus on education, health, and sanitation initiatives, makes a significant contribution to sustainable development goals that improve the quality of life for local communities. In the event there were operational changes prompted by airfreight limitations or bans, the funding capacity for such projects might be compromised, thereby affecting the overall well-being and development trajectory of these communities.

In considering the broader climate justice implications for vulnerable communities in Ghana of a ban or limit on air-freighted fresh produce, it is essential to recognize the multifaceted nature of their dependence on Blue Skies' activities. The model's impact spans areas such as income generation, education, access to health care, and community resilience. Any shift away from this operational model could potentially result in the loss of income opportunities for vulnerable individuals and families, thus affecting their socioeconomic conditions.

Ultimately, these climate justice implications of a potential scenario where the Blue Skies model is no longer operable or significantly impaired in its operation due to limitations or bans on air-freighted fresh produce demonstrates the need for an intricate balance

between emissions reduction initiatives and the imperative to ensure climate justice for the most vulnerable communities within supply chains in developing nations like Ghana.

As the case of Blue Skies Holding Ltd. shows, striking this balance is vital to ensure that policy decisions on emission reduction and operational changes on the same are sensitive to climate justice implications and are kind to vulnerable local communities within the supply chain who are amongst the most exposed to the social and economic effects of climate change. The complexity of these implications highlights the importance for commercial actors to adopt a comprehensive and nuanced approach in crafting carbon emission policies and strategies that attain climate justice whilst addressing the need for a reduction in carbon emissions.

5. Discussion

Exploring the potential climate justice implications of a ban or limit on air-freighted fresh produce entails a deep dive into the intricate interplay between environmental, social, and economic factors. This examination revolves around the intricate relationship between aviation and its environmental consequences, particularly its role in climate change, ozone reduction, and pollution.

Aviation's direct contribution to global CO_2 emissions is approximately 2%, and accounting for non-CO_2 impacts elevates this figure to 3.5%. When considering all greenhouse gas emissions, including CO_2, the aviation sector's share further drops to 1.9% [11]. Despite these seemingly low figures, it is essential to acknowledge that aviation emissions have doubled since the mid-1980s [11], making it one of the most difficult sectors to decarbonize. Historical data reveals a rapid escalation in CO_2 emissions from aviation over the decades, emphasizing the need for proactive interventions [7].

The occurrence of events such as the 2008 financial crisis, the COVID-19 pandemic, and the associated lockdowns have demonstrated how external factors can temporarily influence aviation's carbon footprint [3]. The sharp decline in commercial activity during these times resulted in a noticeable reduction in CO_2 emissions. However, the rebounding of aviation post-pandemic showcases how the sector is generating emissions once again, albeit with a partial reduction compared to pre-pandemic levels [12].

On the whole, the analysis of this paper in this respect has shown the relatively minor portion of global CO_2 emissions that are attributable to aviation despite its substantial growth over the years. Nonetheless, the impact on our climate remains a cause for concern, prompting global efforts to align the aviation industry with carbon neutrality goals [49]. Governments and institutions have initiated measures to enhance the availability and use of sustainable aviation fuels (SAF) within the aviation sector. Initiatives like the 'long-term global aspirational goal' (LTAG) and national programs, such as those in the US, EU, and UK, demonstrate a collective commitment to advancing SAF production, reducing emissions, and promoting sustainable practices within the aviation industry [13].

The question of whether to limit or ban air freight prompts an assessment of its environmental implications and potential benefits. This paper has demonstrated that the environmental case against airfreighting fresh produce is rooted in its emissions intensity per unit. While aviation's contribution to overall emissions is relatively small, the emissions intensity and global warming potential of air-freighted produce can be significantly higher compared to locally sourced alternatives. The environmental impact of airfreight is further compounded by its higher emissions per kilogram of transported goods, making it even less environmentally friendly than other transportation modes like shipping or train freight [16].

The potential business benefits of limiting or banning airfreight in the fresh produce supply chain are multifaceted. While airfreight offers speed, it is often more costly, prompting retailers to explore more economical transport options. Skyrocketing air cargo costs in 2021, influenced by post-pandemic supply chain shocks, have motivated some food retailers to consider alternatives to air-freighted produce to navigate fast-evolving market dynamics [25].

In addition to cost-cutting advantages, limiting or banning airfreight can streamline supply chain efficiency. Embracing eco-friendly transportation methods can optimize inventory management, reduce lead times, and enhance overall efficiency, improving customer satisfaction. Diversifying transport options can also mitigate risks tied to weather, airport closures, and logistical challenges. The fragility of supply chains heavily reliant on airfreight was vividly demonstrated during the COVID-19 pandemic when commercial actors whose business models rely heavily on airfreight experienced severe disruption to their commercial operations [50].

Nevertheless, this paper has demonstrated that whilst the environmental and business cases for limiting or banning airfreight are strong, such decisions must be balanced, considering factors like product characteristics. Perishable items such as fresh-cut fruit often necessitate airfreight due to their short shelf life and customer demand for freshness [2]. This approach balances sustainability goals with meeting customer expectations.

Furthermore, and perhaps more crucially, measures to ban or limit air-freighted fresh produce must be balanced with a consideration of the socioeconomic implications, especially in developing countries. Decisions to limit or ban air-freighted produce could potentially have severe Climate Justice implications and affect vulnerable stakeholders and communities within the supply chain. Striking a balance between the need for sustainability, customer satisfaction, and the socioeconomic climate justice implications is therefore essential. This paper has shown that exploring alternative strategies like sustainable aviation fuels and optimized inventory management can help achieve this delicate balancing act.

At a general level, the significance of climate justice in achieving global climate objectives has been long established, as demonstrated by this paper. The Paris Agreement established a foundation for nations to collaboratively pursue sustainable development through market-based mechanisms while safeguarding the interests of vulnerable communities [37]. With inherent connections to the concept of justice, the market operates within a framework of shared values and relationships. The degree of alignment between the market and justice depends on contextual factors. Nevertheless, leveraging their shared institutional characteristics can facilitate market-driven strategies for achieving climate justice [35].

In practice, this implies that the use of market-oriented strategies to address climate change, such as limiting or banning air-freighted fresh produce, must integrate considerations of the rights, risks, and responsibilities pertaining to vulnerable communities within the supply chain. The intricate interplay among these elements offers an effective framework for designing equitable climate policies that promote climate justice. Balancing the preservation of rights and responsibilities while addressing and mitigating risks, particularly for marginalized groups, is essential. This equilibrium ensures that market-driven efforts to combat climate change yield fully positive outcomes by ensuring equitable treatment, protection, and economic opportunities for vulnerable individuals and communities.

This paper has used the case of Blue Skies Holdings Ltd. to demonstrate the importance of striking this equilibrium and has highlighted the potential climate justice implications for vulnerable communities in Ghana if commercial actors were to pursue an approach to carbon emissions reductions that had at its heart, the banning or limiting air-freighted fresh produce. Such limits or bans on air freight could potentially jeopardize the local economy, employment opportunities, and the livelihoods tied to the Blue Skies model, thus amplifying already weak socioeconomic conditions at a time when extreme weather events driven by climate change are already threatening economic livelihoods in vulnerable communities in developing nations. The positive impact of Blue Skies' operations on local communities in Ghana, as highlighted in this paper, would potentially be compromised, thus affecting education, health, and sanitation initiatives for vulnerable communities.

The multifaceted dependence of local communities in Ghana on Blue Skies' activities could mean that a ban or limit on air-freighted produce by commercial actors would also

lead to loss of income and diminished community resilience. This again underscores the need for a delicate balance to be struck between emissions reduction measures and the need to ensure that those measures attain climate justice, particularly for vulnerable communities in supply chains within developing countries like Ghana. Through this analysis, the paper has highlighted the necessity for comprehensive carbon emission policies that prioritize climate justice and acknowledge the challenges faced by communities that are themselves highly susceptible to climate change's socioeconomic effects.

As a result of this analysis, this paper suggests that commercial actors undertake a comprehensive approach in crafting their emissions reduction policies and strategies, which encompasses a risk assessment for adverse climate justice implications, secures community rights, and meets the responsibilities of care commercial actors have to vulnerable communities in their supply chains.

Commercial actors must understand the socioeconomic rights of these communities and acknowledge their responsibility to adopt emissions reduction strategies that ensure their protection from adverse socioeconomic implications. This involves mitigating potential disparities in climate impacts and considering the broader well-being of vulnerable groups. Balancing climate targets with long-term community well-being requires nuanced evaluations of both direct and indirect impacts.

Furthermore, supporting efforts to decarbonize air freight is essential. The aviation industry's ambitions to improve fuel efficiency, cap emissions, and reduce them by 50% by 2050 [51] offer a pathway to address the environmental concerns linked to air-freighted fresh produce. Commercial investment in sustainable aviation fuel and new aircraft technology has strong potential to drive innovation and minimize the sector's carbon footprint.

Such a proactive approach aligns emissions reduction goals with the socioeconomic interests of vulnerable communities within supply chains and demonstrates a commitment to climate justice. By supporting responsible emissions reduction practices, commercial entities can create a positive trajectory that benefits both their operations and the well-being of communities in developing nations.

6. Recommendations

The operational practices of commercial actors, such as food retailers, play a pivotal role in ensuring that emissions reduction policies attain climate justice for vulnerable communities within supply chains. By adopting a comprehensive approach that evaluates the potential risks of adverse climate justice implications for these communities, commercial actors are better able to respond to the need to secure their rights and meet the responsibilities owed them. Such an approach can contribute to a more equitable and sustainable effort in our collective journey towards achieving net zero.

One essential aspect of this approach involves recognizing the interconnectedness between business operations and the broader socioeconomic fabric of vulnerable communities within supply chains. As the case of Blue Skies shows, the reliance on airfreight for transporting fresh-cut fruit products highlights the intricate balance between economic activities and environmental considerations. However, a sudden limitation or ban on airfreight could disrupt the established equilibrium and, in turn, impact vulnerable communities that are deeply integrated into the supply chain.

Commercial actors can employ a proactive strategy by understanding the socioeconomic rights of these communities within the supply chain. Beyond the immediate economic transactions, a deeper comprehension of the communities' rights to decent work, fair wages, and overall well-being is essential. By recognizing these rights, commercial actors can ensure that their emissions reduction and net zero policies align with principles of fairness, justice, and dignity, regardless of geographic location.

In conjunction with understanding socioeconomic rights, commercial actors must also understand that they carry a responsibility to adopt emissions reduction strategies and policies that safeguard the most vulnerable communities within developing countries. This involves acknowledging the potential disparities in climate impacts that these communities

face and actively working to mitigate any negative consequences of emissions reduction policies and strategies.

The adoption of equitable emissions reduction strategies entails balancing the need to attain climate targets with the long-term well-being of vulnerable communities within the supply chain. This approach necessitates a nuanced evaluation of both immediate and indirect impacts, which may disproportionately affect vulnerable groups. By considering the broader socioeconomic context and the responsibilities toward these communities, commercial actors can avoid inadvertently exacerbating existing inequalities.

A balanced approach to crafting climate emissions reduction strategies that attain net zero must also mean looking to support and advance efforts to decarbonize air freight. The aviation industry has set ambitious targets to address climate change. These targets include an average improvement in fuel efficiency, a cap on net aviation CO_2 emissions, and a reduction in net aviation CO_2 emissions by 50% by 2050, relative to 2005 levels [51]. The air cargo sector has identified several actionable priorities to decarbonize the industry. These include the usage of sustainable aviation fuel, investment in new aircraft technology, adoption of zero or low-emission vehicles, and the implementation of negative emission technologies [51].

Commercial investment to advance research into the usage of sustainable aviation fuel and new aircraft technology can play a central role in addressing the environmental concerns surrounding air-freighted fresh produce. By fostering innovation in aviation technology and promoting the development of sustainable fuel alternatives, commercial actors can actively work towards mitigating the environmental impact of air freight. This proactive approach not only aligns with the broader objectives of emissions reduction strategies but also demonstrates a commitment to balancing those interests with the need to attain climate justice by protecting the well-being of vulnerable communities within the supply chain. Moreover, such initiatives could establish a positive trajectory, encouraging responsible emissions reduction practices that can safeguard the interests of both commercial entities in developed nations and communities in developing countries.

7. Conclusions

This paper has sought to explore the climate justice implications that a ban on air-freighted fresh produce could have on climate justice, delving deeply into the intricate relationships between environmental, social, and economic factors. Through a comprehensive exploration, this paper has examined the carbon emissions intricately tied to air freight within the global carbon emissions landscape. Additionally, this paper has used the case of Blue Skies Holdings Ltd. to scrutinize the potential outcomes and impacts of a ban or limit on air-freighted fresh produce on vulnerable communities, with a specific focus on developing countries heavily dependent on the export of fresh produce. The analysis of the case study highlights the need to pay attention to the socioeconomic benefits of air-freighted fresh produce for vulnerable communities in developing nations and the adverse climate justice implications that arise from an approach to carbon emissions reductions that ban or limit air-freighted fresh produce. The study also provides a set of key recommendations that can guide commercial and policymaking actors in this area.

A limitation of the study is related to the examination of a single case. However, future work on similar case studies can contribute to a richer debate about the ecological impacts of aviation logistics and the socioeconomic implications of its ban. Additionally, as future work, a quantitative comparison between the negative ecological impacts of aviation logistics within selected fresh produce sectors and the positive socioeconomic contributions of the business model can make a stronger case for informing pertinent policies and devising interventions.

Future work could also potentially broaden the discussions and arguments in this paper by conducting quantitative economic analysis on the limiting or banning of air-freighted fresh produce, taking into account the resulting socioeconomic effects for affected local communities, with a monetized assessment that utilizes appropriate benchmarks.

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