

Original Research

How do World-renowned Coffee Companies Manage Carbon Emissions? A Case Study of Starbucks

Yuyun Wang^{*}, Paul Dargusch, Genia Hill^{*}School of Earth and Environmental Sciences, University of Queensland, Australia; E-Mails: yuyun.wang@uqconnect.edu.au; p.dargusch@uq.edu.au; genia.hill@uq.edu.au^{*} **Correspondences:** Yuyun Wang and Genia Hill; E-Mails: yuyun.wang@uqconnect.edu.au; genia.hill@uq.edu.au**Academic Editor:** Zed Rengel**Special Issue:** [Case Studies of Carbon Management in Practice](#)*Adv Environ Eng Res*

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Abstract

Carbon emissions are a major factor influencing climate change. Climate change also has ecological impacts, such as loss of biodiversity and loss of ecosystem functions and services. Starbucks is a large multinational company which aims to reduce their environmental impact. Starbucks' carbon emissions in 2018 were 16,706 thousand metric tons, including 320 thousand metric tons of direct scope 1 emissions, 1,094 thousand metric tons of indirect scope 2 emissions and 14198 thousand metric tons of indirect scope 3 emissions. Huge carbon emissions and pressure from stakeholders forced Starbucks to launch a carbon management program in 2018. Therefore, this article focuses on the assessment of Starbucks' carbon management practices. The company's primary strategy for emissions reductions is to switch from single-use plastics to reusable and recyclable materials in the packaging of its products. Another measure is the development of regenerative agriculture, joining the effort to protect and restore forests and reduce the amount of water used in coffee processing and production. Starbucks' practices ensure that carbon emissions are avoided as much as possible while the company operates normally. Furthermore, as Starbucks itself has a significant carbon footprint and has the most emissions in its sector, the company should work to reduce their



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carbon footprint as well as strengthen its regulatory efforts and controls where it has not implemented measures to reduce emissions, such as the carbon footprint of Starbucks' transportation of ingredients.

Keywords

Starbucks; carbon emission; recyclable materials; regenerative agriculture; carbon management

1. Introduction

Climate change is important to various stakeholders given the global risks it poses to humans and ecosystems [1]. Climate change has become one of the most important ecological, economic and business issues in the 21st century. The main driver of climate change is the emission of greenhouse gases, particularly carbon dioxide [1]. The felling of trees also contributes to an increase in carbon dioxide. Large-scale development of agriculture has led to increased greenhouse gas emissions from disturbed vegetation sinks, contributing more than 10% of GHG emissions [2]. Therefore, the most important way to mitigate the effects of climate change is to directly reduce carbon emissions and develop agriculture [3]. Historically, coffee cultivation frequently involved agricultural development that converted natural forests into coffee trees [4]. If this is not avoided, coffee production can contribute directly to deforestation and increases carbon emissions.

As the market becomes increasingly important [5] and as business operations cause carbon emissions [6, 7], companies are beginning to manage the carbon emissions from their own activities [8]. Carbon management is a corporate strategy to reduce carbon emissions and associated risks [9]. Moreover, companies promote carbon management due to the pressure from regulations, public opinion, and stakeholders [5].

Starbucks, as a multinational company, aims to minimise its environmental impact [10], which mainly includes climate change and waste reduction [11]. It reduces emissions by employing a wide set of interventions such as resource use reduction and waste aversion [10]. According to Starbucks [10], in relation to reducing carbon emissions, Starbucks advocates the development of regenerative agriculture and the implementation of forest conservation and restoration programs, the expansion of renewable energy sources and plant-based menu options for customers. Additionally, in terms of water, Starbucks conserves or recycles water. Furthermore, Starbucks promotes the use of individual cups and reusable and recyclable cups and the move away from plastic.

The research question in this paper is whether Starbucks' carbon management is capable of achieving the 2030 carbon neutrality target, which is halving carbon emissions. Previous articles exploring Starbucks' carbon emissions were not sufficient to support an assessment of Starbucks' carbon management, thus, the main purpose of this paper is to explore the effectiveness of Starbucks' carbon management to meet the 2030 target by reporting how Starbucks has reduced its greenhouse gas emissions as described in its most recent ESG reports. This case study will present an overview of Starbucks Corporation, mainly the channels through which greenhouse gas emissions are emitted. Secondly, the paper will use the Carbon Disclosure Project (CDP) and data from its official website to analyse Starbucks' GHG emission estimates for different ranges in 2020

and the company's GHG emission estimates for 2018 to 2020. Thirdly, the paper will outline the carbon management in place to reduce Starbucks' emissions and the contribution these activities make to meet the 2030 target. Finally, the paper will use the literature and the above data to conduct a performance assessment as well as to explain the limitations of the paper.

2. Overview of Starbucks

Starbucks is a famous American multinational coffee shop chain and the largest cafe chain in the world. Starbucks was founded in 1971 and is headquartered in Seattle, USA [12]. Starbucks is a food service retail shop that sells beverages such as whole bean coffee, tea and spices, as well as snack foods such as sandwiches and pastries [13]. Additionally, some of the shops are even aligned with other industries such as supermarkets and bookstores, operating as complex shops and selling peripheral design items, such as Starbucks cups [13]. Starbucks has its own shops as a producer and retailer in 83 countries, with more than 30,000 shops [13] and 349,000 employees [14]. Plus, Starbucks had a total net revenue of US\$23,518 million for 2020 [15]. For Starbucks itself, the dairy products such as whipped cream that Starbucks adds to beverages cause the emission of carbon dioxide, accelerating global warming [16]. Moreover, the introduction of heated food at Starbucks has meant the need for more ovens as well as refrigeration [17], creating more carbon. Furthermore, the use of disposable cups causes difficulties in waste disposal and also has a negative impact on the environment [18]. Furthermore, coffee production results in substantial greenhouse gas emissions. The production process impacts natural forests [19] and the long and complex process of transporting coffee beans to the country of sale results in substantial carbon emissions from international transport [4]. In turn, the warming climate has had an impact on the cultivation of Starbucks coffee beans, not only in terms of quality but also in terms of yield, to the extent that some regions are unable to continue growing coffee beans due to rising temperatures [20]. It is also worth noting that Starbucks' value chain is based on the collection of large quantities of unroasted coffee beans from coffee estates in Asia, Africa and Latin America, which are then sold through retail outlets, or through supermarket chains that sell beautifully packaged Starbucks peripherals [21, 22]. These products are not limited to packaged coffee, but also roasted coffee beans. The portion that Starbucks operates and sells is not nearly as large as the carbon emissions generated by coffee bean farming. Plus, the amount of environmental damage caused by coffee bean farming far outweighs the economic income generated by its application and consumption [23]. Therefore, Starbucks does not control a large part of the value chain. While, the coffee production unit, which is responsible for the largest part of the emissions, is owned by farmers.

3. Emissions Estimates

Data for the Starbucks study was obtained from its annual report [10], and from Starbucks' submission to the Carbon Disclosure Project (CDP) [24]. These total carbon emissions for the period 2018 to 2020 have been summarised as secondary data available for use.

In CDP, the GHG emissions are calculated using the emission factor method, which refers to the 108 activity data multiplied by an emission factor [24]. For example, for the activity that calculates the most carbon emissions, 'goods and services that Starbucks needs to purchase', such as coffee and packaging, the weight of the purchase is multiplied by the emission factor to calculate the final emissions. Plus, the emission factor is obtained according to Ecoinvent v3.3 [24].

There are three categories in greenhouse gas (GHG) emissions, direct scope 1 emissions and indirect scope 2 and 3 emissions. Scope 1 includes the combustion of fossil fuels, such as the carbon emitted from the combustion of fossil fuels when roasting coffee beans. Scope 2 refers to the energy efficiency of buildings and the electricity used, located in the latter part of the value chain, such as the lighting used in their retail shops. Specifically, the market-based method involves calculating emissions according to the electricity the company has purposefully chosen to purchase, usually detailed in contracts or energy attribute certificates (such as RECs) and supplier-specific emission rates and other default emission factor tools [25]. Plus, the location-based method refers to calculating average emissions intensity of the local grid area where electricity use occurs [25]. Scope 3 includes most of the emissions associated with the company's activities, the specific branches of which are shown in the following diagram (Figure 1).

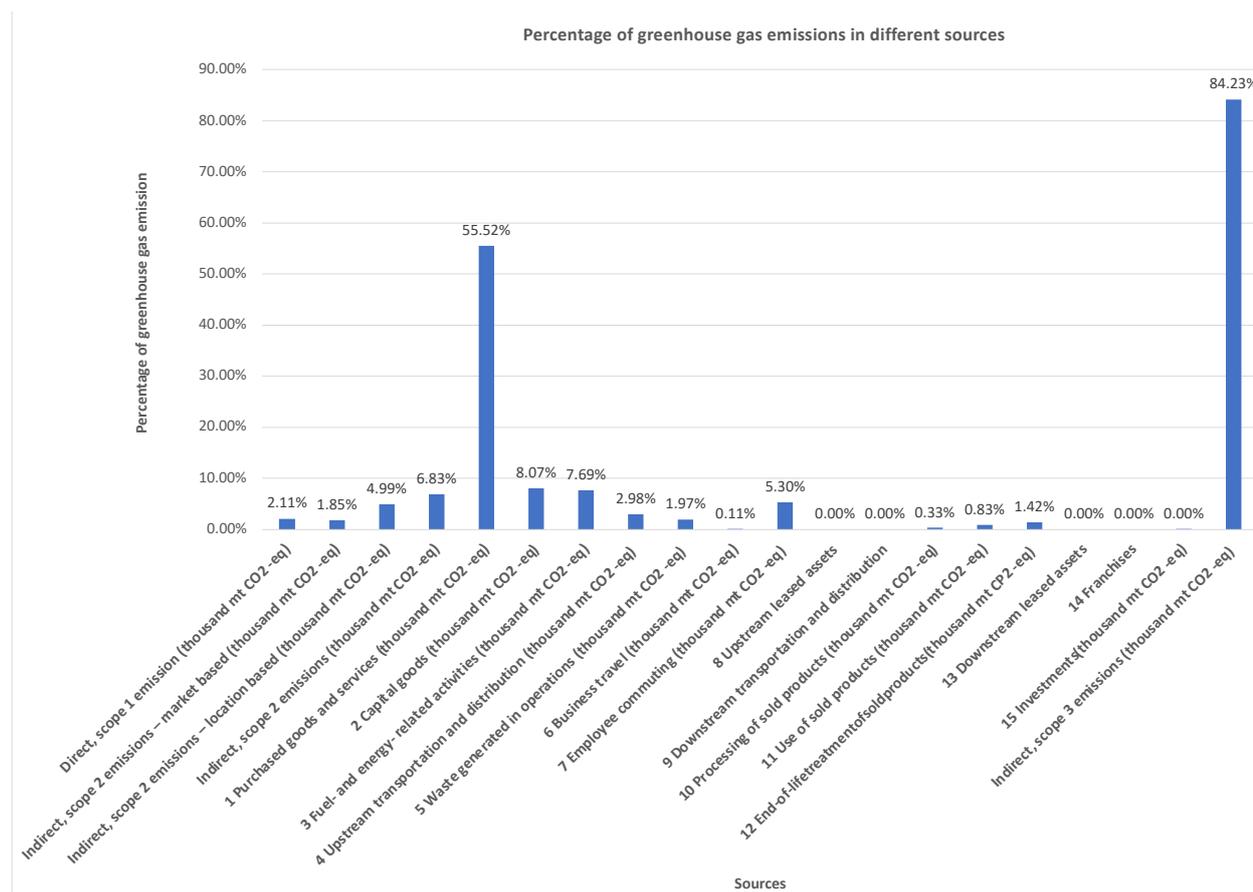


Figure 1 Percentage of greenhouse gas emissions in different scopes [10, 24].

Scope 1 emissions account for the lowest percentage (2.11%), while the highest proportion of GHG emissions is in scope 3 (84.23%), with purchased goods and services being the activity that emits the most GHG, accounting for more than half of total emissions (Figure 1). Consequently, Starbucks' greenhouse gas emissions are primarily due to this activity, which includes the total amount of greenhouse gas emissions from all the goods and services the company needs to purchase, such as the top categories of coffee, dairy, food, beverage ingredients, packaging, and other materials. Additionally, Starbucks' total GHG emissions have been on a downward trend since FY18, with scope 3 emissions decreasing the most (Figure 2). However, there is a slight trend of increasing carbon emissions in scope 2 from 2018 (Figure 2).

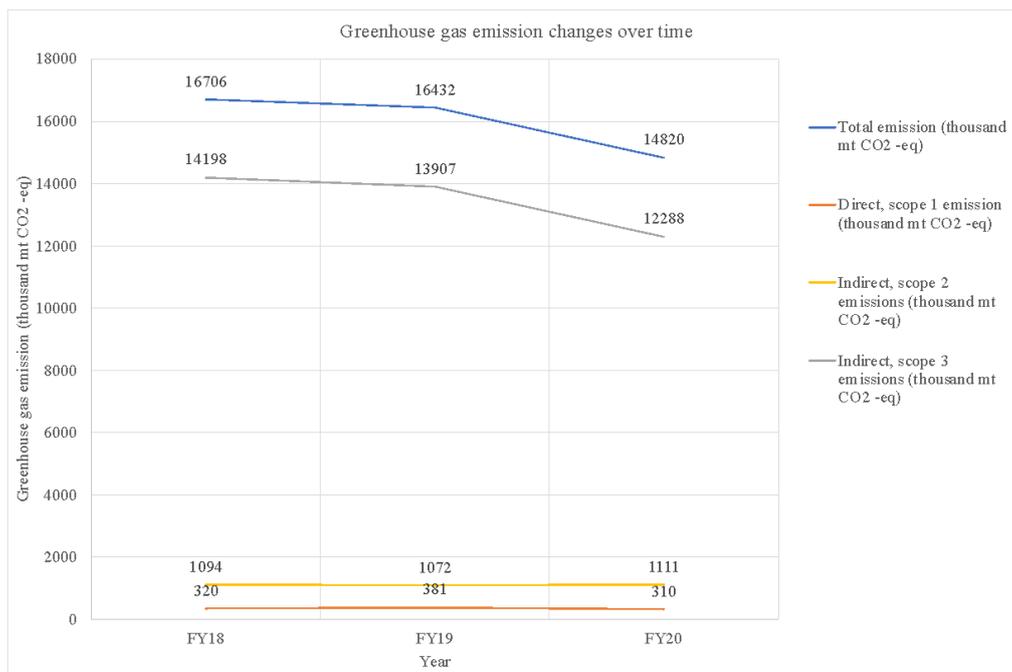


Figure 2 Greenhouse gas emission changes over time [10, 24].

However, as the percentage result is rounded to two decimal places in the calculation process, the result is inaccurate and the sum of scope 1, 2 and 3 does not equal 100%.

4. Pledges

The continued growth of carbon emissions is accelerating climate change, and carbon emissions and their impacts are difficult and costly to eliminate [26]. Plus, people now prefer to have the option of a carbon management company [27]. Therefore, carbon management is necessary for Starbucks in order to attract more customers. Therefore, Starbucks has set a goal to be carbon neutral by 2030 within the next decade [28]. During this period, Starbucks envisions becoming a resource positive company, which means that the company looks to give more than it takes from the planet [18], being the foundation for developing the company's long-term economic, social, and global values and stakeholders [29]. In addition, joining the net zero plan is a guarantee of its company's commitment to a sustainable future [30]. As such, using 2018 emissions as a baseline, the company commits to reducing GHG emissions to half by 2030, including scopes 1, 2 and 3 for operation and its valued chain. It is worth noting that the target is under the Science Based Targets initiative (SBTi) criteria [10]. SBTi is about setting optimal emission reduction targets for companies based on climate science definitions and thus achieving net zero [31]. Another long-term corporate goal is to achieve net zero emissions by 2050, accelerating the transition to a net zero global economy [10].

In addition, Starbucks has made a commitment to reduce its carbon emissions by halving its water use¹ and waste generation, increasing the use of recyclable cups by 20%, eliminating plastic and investing in 100% renewable energy [10, 32].

¹ While water [use, or other word from their report] does not contribute directly to their emissions profile, Starbucks includes this in their sustainability reporting due to the transportation, refrigeration, and other emissions-intensive activities directly connected to water use.

5. Emissions Reduction Strategies Implementation

Starbucks has been working to reduce carbon emissions. The programme adopted by Starbucks until 2018 is the Coffee and Farmers' Equity (C.A.F.E.) practice, launched in 2004 in partnership with Conservation International and overseen by SCS Global Services [33]. In addition, the practice thus makes it possible to determine how the greenest and best quality coffee is produced, consequently, reducing the damage to society and the environment. In detail, the program enforces measures to enhance environmental protection in the coffee production process, such as waste management, protection of water quality, conservation of water and energy use, protection of biodiversity and reduction of agrochemical use [34]. On the other hand, the reduction of emissions is promoted through the elimination of deforestation, the avoidance of forest conversion and the use of banned pesticides [33]. The last aspect is to increase resilience to climate change, for example by maintaining shade trees and ground cover, which contributes to reduce soil erosion during heavy rains [33] and increasing resistance. After 2018, Starbucks published its first global environmental impact report. Based on the report the standards set by STBi, Starbucks has developed a strategic plan to achieve its 2030 goal to reduce emissions on several fronts simultaneously, including increasing recyclability and developing regenerative agriculture [10]. The process is done under the supervision of the Global Environment Council [10].

Firstly, for most coffee companies, their coffee value chain accounts for a very high proportion of their total carbon emissions. Whereas for Starbucks, the large chain of retail store, the coffee value chain accounts for simply 19% of their total carbon emissions, and therefore has far more emissions on the sales side than the coffee value supply chain itself (Figure 1). Therefore, as a seller, Starbucks is committed to changing their packaging and eliminating waste to reduce the company's carbon footprint. Starbucks has revamped its essential coffee cups, using recycled materials in packaging instead of single-use plastic and increasing the number of reusable cups [10]. Instead of drinking coffee through a straw, Starbucks is now using strawless lids or straws made from biodegradable materials (including paper and compostable plastic), and thus cups can be recycled, facilitating the recycling of materials [35]. This practice avoids the generation of waste from plastic straws as well as the increase of carbon footprint. In North America, where Starbucks is rapidly growing, a 70% recyclability rate can essentially be achieved [35]. Additionally, Starbucks' hot cups contain 10% post-consumer fiber [10], which saves over 75,000 trees per year [36], increasing carbon sequestration and enhancing carbon management.

Moreover, the company has introduced a 'borrow a cup' programme to increase the frequency of reuse of cups by customers [10]. This approach helps to reduce the use of disposable cups and promotes a circular economy [37], thereby reducing the carbon footprint of the cup manufacturing process and the waste disposal process. It is estimated that Starbucks will eliminate a total of over 500 tonnes of plastic and 350 tonnes of waste per year after implementation [38].

Furthermore, it will cost \$230.21 million to achieve sustainable packaging [39]. By completely moving away from plastic, Starbucks will save \$100,000 in annual operating costs, and the company estimates that it will save around \$50 million over the next ten years in terms of the cost of utilities [40]. Additionally, Starbucks' carbon footprint on packaging accounts for 6% of its total carbon footprint in 2018 [41], it is worth noting that in 2020 Starbucks has achieved a 72% to renewable conversion [38]. Besides, Starbucks gets rid of plastic to achieve fully recyclable materials the long term environmental and social value achieved far outweighs the monetary loss.

On the other side, the quality of coffee is key to Starbucks' profitability as a roaster. Therefore, given the potential impact of coffee on climate change, Starbucks has developed a number of initiatives to maintain and improve coffee quality. This, coupled with the fact that growing coffee for long periods of time can lead to threats to biodiversity and damage to ecosystems [42]. Plus, coffee production is responsible for 11% of Starbucks' total carbon emissions, with transportation, roasting and packaging accounting for 8% [41]. Therefore, Starbucks needs to focus on developing agriculture to reduce carbon emissions. As high-quality products are often produced in good agricultural systems, Starbucks invests heavily in regenerative agriculture to support the development of the company's chain to ensure the quality of its own products [10]. Regenerative agriculture centred on improving soil structure and soil health, soil fertility and crop yields, and water recharge, thereby restoring degraded soils [43]. In addition, regenerative agriculture has the effect of extracting carbon from the atmosphere. Therefore, Starbucks has joined forces with farmers and experts to develop a detailed plan for developing agriculture [10, 44]. More specifically, Starbucks' own food waste can be processed into low carbon fertiliser for irrigation in its supply chain [10]. This not only protects the environment, reduces carbon emissions and improves water quality contaminated by fertilisers, but also allows food waste to be disposed of and recycled, avoiding the additional greenhouse gases that may be generated during its own disposal process and working towards the goal of net zero GHG emissions [18]. Additionally, not only can Starbucks provide fertilizers, but it also helps farmers identify and understand the specific nutrients and fertilizers needed for agricultural productivity by collecting and analysing different soil and leaf samples [28]. Starbucks can reduce the total carbon footprint of their farms and increase farm productivity and safeguard the environment around their farms by allowing farmers to reduce the amount of fertilizer they use [28]. Therefore, the efficiency of productivity is improved in terms of both fertiliser and soil, thereby reducing carbon emissions as well as reducing farmers' deforestation activities, leading to recycling of farms, thus achieving longer-term carbon neutrality.

Moreover, land-use change and deforestation are affecting climate change and therefore coffee production and quality, thus Starbucks is investing in forest conservation and restoration programmes to promote reforestation [10]. This activity not only reduces carbon emissions but also increases carbon sequestration in an effort to achieve carbon neutrality. Therefore, along with the C.A.F.E. Practices program, Starbucks eliminates the cutting of natural forests. Since 2014, Starbucks has guaranteed no conversion of natural forests [38]. By 2025, Starbucks is committed to providing 100 million healthy coffee trees to replace degraded trees [38]. Between 2015 and 2020, Starbucks has already provided 50 million trees to farmers [38]. These healthy coffee trees increase resistance to climate change, producing improved coffee quality for farmers as well as being able to increase coffee production [38, 45]. Furthermore, after two years of action, carbon emissions have been reduced by 14.3% [38].

Additionally, \$987.21million was used to support agroforestry [39], which will reduce the impact of climate change on coffee and ensure coffee quality and yield. The cost is considered worthwhile as the campaign not only ensures the availability of raw materials for Starbucks, but also has a protective effect on the environment. The environmental impact of the campaign is reflected in the effective control of carbon emissions and the protection of land and forest resources.

Besides, Starbucks should focus on reducing carbon emissions in the dairy, which accounts for 21% of Starbucks' environmental baseline report in 2018 [41]. The company has therefore introduced plant-based menu options, such as oat milk [10], in its shops around the world. This oat-

based drink is based on a water-soluble substance derived from pulses, oilseeds, grains or nuts [46]. In comparison, the supply of milk requires land to raise the cows and to grow the grains they need. In addition to this, cows emit large amounts of GHG through their digestive system and manure [47]. Therefore, the choice of oat milk as an alternative not only maintains similar features to milk, but also helps to reduce carbon emissions caused by animal and feed production [46]. Starbucks [38] states that customer demand for plant-based milk has increased by 29% in the last two years.

Furthermore, water is an essential resource of coffee production. To ensure the sustainable use of freshwater, Starbucks has partnered with the World Wildlife Fund (WWF) to use their Water Risk Tool to gain a clear understanding of the challenges in coffee growing regions [10]. The practice helps Starbucks to optimise the replenishment and sustainable use of water in its supply chain and reduce its carbon footprint [32] to achieve its goal of halving carbon emissions by 2030.

6. Discussion

Good carbon management is required to meet the following conditions. Firstly, project emissions reductions need to be monitored by project developers. Monitoring risk assessments and reporting need to have a cycle [9, 48]. Starbucks' annual report specifies that the Global Environmental Committee, made up of senior leaders of Starbucks, monitors the management of commitments made by the company and that the company's duration is once a year [10]. As a result, the company has laid a good foundation for carbon management under external conditions. Starbucks complies with public disclosure requirements and provides training to its employees and partners [9] in order to raise their awareness and to strengthen their monitoring of environmental practices, thereby promoting good carbon management. Plus, Hsu et al. [27] and Tang and Luo [9] note that this approach facilitates the global evaluation of the company's approach to reducing emissions. On the other hand, carbon targets, implementation and control in good carbon management should be considered in a holistic manner [9, 49]. Starbucks' emissions reduction practices can be described as best practice in this regard. This is because Starbucks' emissions reduction targets are set in strict accordance with the STBi standards. In addition, the greenhouse gas emissions emitted during the implementation phase are publicly disclosed and the information is derived from CDP reports and Starbucks' annual reports. As the current CDP is considered the most effective rating for evaluating a good carbon management performance [50], Starbucks Corporation data is compared across multiple sources to ensure that it is provided with accuracy, credibility and comprehensiveness. Therefore, the company's approach is considered good in terms of the development of carbon management and reporting as described above.

In addition, carbon management performance is targeted to produce different outcomes for different stakeholders in carbon disclosure activities related to climate change mitigation [50]. Specifically, carbon management performance is assessed for the quantity and quality of a company's carbon emissions. Not only can performance be assessed in terms of economic costs and carbon emissions, but also in terms of the environmental value generated by the resulting carbon management programme [51]. Starbucks has completed 98.6% of its recycled agriculture, reduced its plastic use by 9% and purchased renewable energy to power 72% of the company's operating sites worldwide [10]. Consequently, Starbucks' output in terms of environmental value is steadily on track. Besides, in the CDP carbon management performance assessment, Starbucks Corporation received ratings of C and D for 2018 and 2019 respectively [24]. Besides, the results of the CDP [24]

ratings compared to the above emission estimates (Figure 2) show that the results are consistent for Starbucks and thus the emission estimates are reliable and can be accepted and trusted by the public. The carbon performance ratings make it clear that Starbucks Corporation is in a poor position in terms of its carbon emission practices. This result could be attributable to the fact that Starbucks' burning of fossil fuels during the transportation and roasting processes of coffee beans results in significant carbon emissions. This idea is also confirmed in the CDP [24]. Plus, coupled with poor control over this in the implementation of carbon management measures, is what led to its poor carbon management performance rating. Therefore, Starbucks needs to control its practices when implementing its carbon management programme, such as continuing to grow its use of wind and solar energy to replace fossil fuel combustion, thereby reducing the use of fossil fuels, in order to control the reduction of its carbon emissions.

Moreover, carbon emissions show an overall continuous trend of reduction over two years from 2018 to 2020, with Starbucks already reducing its carbon emissions by 11% by 2020 (Figure 2) and therefore on track to reach 50% of its 2018 carbon emissions by 2030. However, where carbon emissions scope 2 is trending upwards. This is unscientific as Starbucks commercial activity decreases due to COVID-19 in 2020 [10], whereas market-based carbon emissions should decrease, the increase could be due to Starbucks improving its environmental impact measurement process [10], resulting in a more accurate calculation. It is worth noting that the activity hardly affects the results for total carbon emissions. Plus, this activity, where Starbucks needs to control for the most emitting purchased goods and services in scope 3, could effectively avoid an increase in carbon emissions due to its increase, which would fall short of Starbucks' pledged targets. Additionally, Starbucks should work with put pressure on its suppliers and work with them to move away from a carbon-intensive supply chain in order to control the highest emission in scope 3. Furthermore, Starbucks' initiatives to reduce emissions through regenerative agriculture and the elimination of plastic are both beneficial in reducing carbon emissions and increasing carbon sequestration, and the reduction in carbon emissions can be minimised to avoid causing climate change [1]. On the other hand, the development of regenerative agriculture will ensure that coffee production is protected from climate change to the greatest extent possible [10]. Therefore, Starbucks can effectively combat climate change with the implementation of carbon management.

Furthermore, it is noteworthy that Starbucks' carbon emissions fall significantly in 2020. COVID-19 leads to impacts that demonstrate the effectiveness of Starbucks' carbon management initiatives. Starbucks Fiscal 2020 Annual Report [15] proves that COVID-19 in 2020 led to the temporary closure of half of Starbucks' shops during the second and third quarters, however by the end of the third quarter, most of Starbucks' shops had returned to normal. Furthermore, in the two years before and after COVID-19, the difference between total operating expenses and net revenue was not significant, whereas operating income decreased by 2/3. Therefore, the significant reduction in Starbucks' carbon emissions in 2020 could indicate the effectiveness of the company's carbon management measures, the COVID-19-induced the reasons for the reduction in customer traffic cannot be ignored.

7. Conclusion

Starbucks' carbon management needs to continue to improve. Although the company's carbon emissions have decreased in two years, its carbon performance is decreasing. Consequently, it still

needs to control its carbon emissions scope 2 as well as needs to pay attention to controlling the highest emissions of purchased goods and services in scope 3. This monitoring and control will enable Starbucks to achieve its desired goal, which is to halve its carbon emissions by 2030. Furthermore, Starbucks has implemented a carbon emissions practice that is conducive to reducing carbon emissions, increasing carbon sequestration, reducing the company's impact on the environment, and contributing to environmental sustainability.

However, this paper still has limitations. Starbucks introduced its carbon emissions reduction policy from 2018 and the two years between 2019 and 2020 do not fully ensure that his carbon management is in good control. Additionally, because of COVID-19, Starbucks does not operate as many shops as it did before, thus the carbon emissions will be lower than before. Therefore, the impact of COVID-19 cannot be ignored. Therefore, Starbucks still needs to reduce carbon emissions from purchased goods and services in its carbon management by enhancing the efficiency of alternative coffee. A further improvement in Starbucks' carbon reduction efforts is to improve the carbon emissions generated during the transportation of ingredients in order to achieve carbon neutrality as soon as possible.

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Author Contributions

Yuyun Wang did the research work of the study and wrote the manuscript. Paul Dargusch and Genia Hill reviewed and professionally optimized the paper.

Competing Interests

The authors have declared that no competing interests exist.

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