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Carbon emission reduction and the Tokyo 2020 Olympics

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A R T I C L E I N F O

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1. Introduction

The 26th Conference of the Parties to the United Nations Framework Convention on Climate Change held in Glasgow (October–November 2021) amplified the looming climate crisis. The tourism sector, among others, is expected to be a significant player in the pursuit of net zero carbon emissions by 2050 (Higham, Font, & Wu, 2021). By implication, large scale sports events such as the Olympics must also demonstrate meaningful action. In systematically reviewing the environmental sustainability of sport tourism, Mascarenhas, Pereira, Rosado, and Martins (2021) highlight a dearth of attention on carbon emissions generated by this sector, particularly mega sports events.

Exceptions do exist (*see* Scott, Steiger, Rutty, & Johnson, 2015). After examining the potential consequences of climate change on the Winter Olympics, Scott et al. (2015, 2019) concluded that the climate suitability of former host cities/regions will be drawn increasingly into question, as evidenced by the Beijing 2022 Winter Olympics requiring entirely artificial snowmaking. Mitigating greenhouse gas emissions is pressing if future Winter Olympics are to be sustainable. In Scott et al.'s (2015) low-emission scenarios, ten of 19 former host locations would maintain reliable climate conditions, whereas in the high-emission scenarios, six former host locations would be climatically unsuitable by the 2080s. This focus on winter sports has not been meaningfully extended to address other mega sports events including the Summer Olympics.

Mega sports events attract a wide variety of attendees including athletes, spectators, and event-related personnel (officials and media) who collectively contribute a considerable carbon footprint. In the case of the Tokyo 2020 Olympics there were seven key attendee groups including: athletes and National Olympic Committee (team members), International Federation (e.g., technical personnel, referees), media (e.g., accredited press, television rights holders), Olympic family (e.g., International Olympic Committee, VIPs), marketing partners (e.g., sponsors), organising committee staff (e.g., employees, volunteers), and spectators (The Tokyo 2020 Organising Committee, 2017). Among these, five key groups, namely International Federation, media, Olympic family, and marketing partners are what we refer to as Olympics-related personnel.

The number of athletes participating in the Tokyo 2020 Olympics increased by 179 compared to the Rio 2016 Olympics (International Olympic Committee, 2022). Reducing the number of inbound attendees, particularly those who travel long-haul to attend (Klöwer, Hopkins, Allen, & Higham, 2020), is a key action to reduce the carbon footprint of mega sports events (Pereira, Filimonau, & Ribeiro, 2020). As a result of the COVID-19 pandemic, the Tokyo 2020 Olympics, subsequently held in 2021, went ahead in the almost complete absence of spectators. This being noted, the number of tourists also markedly decreased during the London 2012 Olympics, presumably because tourists for whom the event was of no interest, avoided visiting London (Japan Tourism Agency, 2014).

Therefore, reducing the number of inbound event-related personnel is an important avenue for climate action in regards to mega sports events. In estimating the carbon footprint of tourist accommodation

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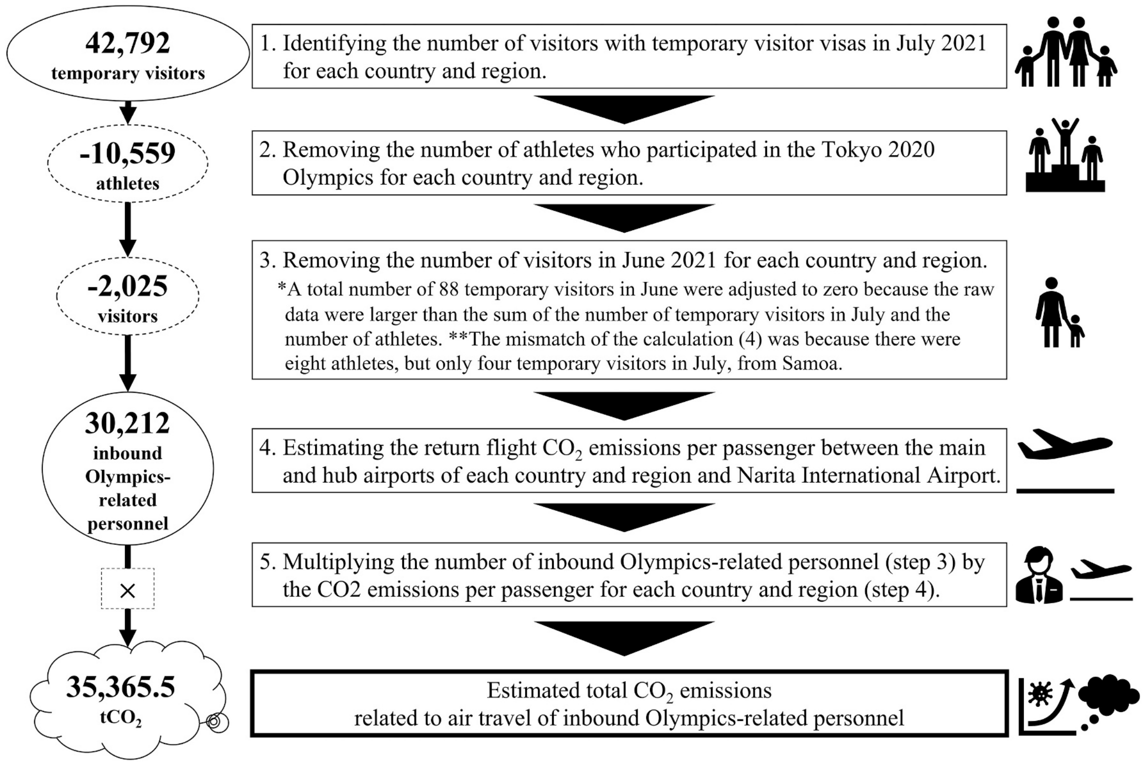

Fig. 1. A flow chart of the estimation process.

during the 2030 FIFA World Cup, Pereira et al. (2020, p. 6) reported that "FIFA staff have the largest individual carbon footprint, thus representing a group that should be more concerned with the carbon impacts arising from their actions and choices during a [FIFA World Cup]." The number of inbound event-related personnel who attended the Tokyo 2020 Olympics were significantly reduced due to the COVID-19 pandemic, from 141,000 to 41,000 (Nikkei, 2021). The reduction of CO_2 emissions resulting from this decision remains unclear. The underlying aim of this paper is to present an analysis of the CO_2 emissions related to air travel by inbound Olympics-related personnel during the Tokyo 2020 Olympics.

2. Methods

We estimated the CO_2 emissions produced by air travel that was consumed by inbound Olympics-related personnel (International Federation, media, Olympic family, and marketing partners) using immigration control statistics reported by the Immigration Services Agency of Japan (2021). Our analysis followed a five-step process (Fig. 1).

1. We identified that the number of visitors with temporary visitor visas in July totalled 42,792. This number significantly increased from May (1580) and June (2113), 2021. Some Olympics-related personnel who stayed over 90 days in Japan might have used a designated activities visa; however, the numbers of visitors with this visa were unremarkable - in April (444), May (798), and June (368). Thus, our data analysis focused on visitors on temporary visitor visas only to increase sampling robustness.
2. To exclude CO_2 emissions generated by athletes, we subtracted the known number of athletes (10,559) arriving from each country and region, from the total number of temporary visitors in July (Lane, 2021). Athletes including 552 Japanese, 29 refugee Olympic Team, and 99 whose regions were not recorded by the Immigration Services Agency of Japan were excluded from this analysis.
3. Because the number of temporary visitors in July included non-Olympics-related visitors, we deducted the number of visitors in June (2025) for each country and region. These steps provided an estimation of 30,212 inbound Olympics-related personnel. The mismatch of the calculation (4) was because there were eight athletes, but only four temporary visitors in July, from Samoa.

Table 1
Estimated total CO_2 emissions related to air travel of inbound Olympics-related personnel by region.

Region	Temporary Visitors in July	Athletes who Participated in the Tokyo 2020 Olympics	Temporary Visitors in June	Estimated Inbound Olympics-Related Personnel	Estimated Total CO_2 Emissions (kg)
Asia	6420	1544	504	4372	2,103,467
Europe	22,183	5062	798	16,323	19,098,610
Africa	2321	940	38	1343	2,070,152
North America	7343	1484	577	5282	7,361,907
South America	2298	757	49	1492	3,297,503
Oceania	2227	772	59	1400	1,421,152
Total	42,792	10,559	2025	30,212	35,365,543

Note. The number of estimated inbound Olympics-related personnel in Oceania did not match the calculation because there were eight athletes, but only four temporary visitors in July, from Samoa.

4. We estimated the return flight distance (miles) and CO_2 emissions (kg) per passenger between the main and hub airports of each country and region and Narita International Airport using a flight carbon calculator website (Flight CO2 Calculator, 2020). Given differences in CO_2 emissions between classes of travel (Gössling & Humpe, 2020), economy seat class was selected for the calculation for conservative purposes. For six countries that do not have airports (e.g., Monaco), we selected the closest alternative international airport to each country.
5. The total CO_2 emissions were calculated by multiplying the number of inbound Olympics-related personnel (30,212; Fig. 1 step 3) by the CO_2 emissions per passenger for each country and region (Fig. 1 step 4).

3. Results

Table 1 displays the results of our regional estimates, which calculated 35,365.5 tCO_2 emissions related to inbound Olympics-related personnel. Detailed information on the estimates is presented in Appendix A. If 141,000 inbound Olympics-related personnel came to Japan as scheduled (Nikkei, 2021), their carbon footprint would have been 165,051.5 tCO_2 (35,365.5 × 141,000 ÷ 30,212). Thus, the COVID-19 pandemic effectively reduced the carbon footprint of inbound Olympics-related personnel by 129,686.0 tCO_2.

4. Discussion and conclusion

Our estimations indicate that a reduction in the number of Olympics-related personnel reduced the CO_2 emissions of the Tokyo 2020 Olympics by 129,686.0 tCO_2. These CO_2 emissions only relate to air travel, and equate to approximately 40% of the reduced amount of CO_2 emissions that would have been caused by the travel and accommodation of overseas spectators (i.e., 340,000 tCO_2; The Tokyo 2020 Organising Committee, 2021). Our results, when set alongside Pereira et al.'s (2020) findings of CO_2 emissions generated by accommodation of event-related personnel, indicate that acting to minimise the number of event-related personnel attending the Olympics is an important strategy that aims to mitigate the carbon footprint of mega sports events.

Based on these findings and the known link between distance of air travel and carbon emissions (Klöwer et al., 2020) we propose three potential actions for each attendee group. First, while International Federation officials are critical for the successful delivery of a sports event, local/regional officials should be prioritised to reduce distance of travel. Second, in terms of media personnel, Olympic event organising committees should use remote media by offering opportunities for live virtual reality streaming and online press conferences. The same virtual media options should be extended to Olympic family and marketing partners to allow remote attendance. Third, for all stakeholders, organising committees may consider charging a carbon tax for all event-related personnel, which may be graded by distance and class of air travel. The carbon cost levied upon event-related personnel must be ringfenced to be invested independently in approved carbon offsetting programs such as tree planting and priority low-carbon transport infrastructure.

These three actions are hypothetical; however, online meetings and press conferences were utilised and the introduction of carbon pricing was discussed in the Tokyo 2020 Olympics (The Tokyo 2020 Organising Committee, 2021). These actions also have the potential to contribute to reduced CO_2 emissions arising from event personnel accommodation, alongside wider responses toward net zero emissions that in the long run, can protect the climatic integrity of sports, destinations and host cities (Scott et al., 2015; Scott, Steiger, Rutty, & Fang, 2019).

Notwithstanding, this study has some limitations. We estimated CO_2 emissions based on direct flights between Narita International Airport and the points of origin of Olympics-related personnel; some would no doubt have had multiple flights and transit stopovers en route to Japan. Additionally, although some countries (e.g., USA) have multiple international airports, we estimated CO_2 emissions based on a reference airport for each country. Our estimation would be more accurate if the official travel statistics of Olympic visitors, including class of air travel, were made publicly available. Similarly, by comparing the CO_2 emissions related to inbound Olympics-related personnel in previous Olympics, future research could examine the effect of COVID-19 on the sustainability credentials of the Tokyo 2020 Olympics.

Due to the pandemic, the Tokyo 2020 Olympics was postponed for a year, with the event eventually held largely without spectators. The pandemic also transformed the Games into a more climatically responsible and sustainable mega sports event in terms of reduced CO_2 emissions, than would have otherwise been the case. Our estimates indicate a reduction of 129,686.0 tCO_2 emissions by restricting official inbound Olympics-related personnel. The International Olympic Committee and event organising committees should, in future, work to minimise the number of inbound event-related personnel by utilising the three approaches proposed earlier. The Tokyo 2020 Olympics demonstrated that these are viable and effective ways to significantly reduce the carbon footprint of mega sports events.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.annale.2022.100056.

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