

RESEARCH ARTICLE

Global Tourism and Carbon Emissions across the Pre-, During-, and Post-COVID-19 Periods: A Meta-synthesis of Qualitative Studies

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Abstract

The rapid development of the tourism industry stimulates economic growth across the world. However, tourism development is accompanied by an increase in CO₂ emissions. In 2003, the World Tourism Organization (WTO) provided a summary of the *Djerba Declaration on Tourism and Climate Change*, examining the impact of global tourism development on CO₂ emissions. This study employs a meta-synthesis approach to examine the relationship between global carbon emissions and international tourism across the pre-pandemic, pandemic, and post-pandemic periods of COVID-19 - the most disastrous event in terms of magnitude since World War II. This study synthesizes existing empirical evidence to provide a thorough understanding of the impact of tourism development on CO₂ emissions before, during, and after the epidemic. The results may serve as a reference for policymakers and authorities to develop sustainable tourism in the post-pandemic era.

Keywords: International Tourism, International Tourists, COVID-19, Carbon Emissions.

1. Introduction

The elimination of carbon emissions and climate change have become critical issues and challenges for all countries around the world. Consequently, everyone, including authorities, practitioners, and academics, must work quickly to reduce CO₂ emissions. This is a purpose and obligation that cannot be disregarded. In addition, Since the 1960s, improvements in living standards and the availability of more leisure time have fueled explosive growth in global tourism. As a result, tourism has become a key indicator of economic activity and emerged as a crucial sector in numerous nations (Min *et al.*, 2023). However, this rapid economic development has resulted in considerable environmental pollution, as tourism activities tend to utilize a great deal of energy and produce large amounts of CO₂ emissions (Duan *et al.*, 2022; Wang *et al.*, 2025).

This marked the first occasion in 2003 that the United Nations World Tourism Organization (UNWTO) presented a summary of the *Djerba Declaration*

on Tourism and Climate Change, highlighting the impacts, opportunities, and risks that CO₂ emissions pose to the global tourism industry. In addition, the recent COP 29 (Conference of Parties), which took place in 2024, was the first time that tourism and carbon emissions were discussed together as part of international climate talks. In formally recognizing the tourism industry's dual role as a contributor to and a possible mitigating factor of climate change, the conference marked a significant milestone. Moreover, it addresses the need to urgently develop a global plan coordinating with the tourism industry for the CO₂ elimination.

1.1 The Purposes of the Study

The tourism sector is extremely susceptible to unfavorable events, including natural or man-made disasters, as well as economic challenges (Ritchie & Jiang, 2019; Tülüce *et al.*, 2025). Sigala (2020) argues that tourism has become resilient in the face of such challenges due to a history of various environmental, political, socioeconomic risks that impact the

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industry. However, given the COVID-19 pandemic's unprecedented nature, there are arguments "that this crisis is not only different, but it can have profound and long-term structural and transformational changes to tourism both as a socio-economic activity and as an industry" (Sigala, 2020, p.312). It is therefore imperative to review the effects of the pandemics on global international tourism and carbon emissions. The current study adopts the meta synthesis approach examine the relationship between global carbon emissions and international tourism across the pre-pandemic, pandemic, and post-pandemic periods of COVID-19—the most disastrous event in terms of magnitude since World War II. This study synthesizes existing empirical evidence to provide a thorough understanding of the impact of tourism development on CO₂ emissions before, during, and after the epidemic. The results may serve as a reference for policymakers and authorities to develop sustainable tourism in the post-pandemic era.

2. Qualitative Meta-Synthesis

Theories generated by meta-synthesis play a critical role in settings where the application of standardized guidelines, protocols, and algorithms is increasing. It can assist service providers or managerial levels in personalizing standardized tools to enable the implementation of the most efficient evidence-based, yet tailored, interventions. In-depth meta-synthesis offers easily understandable instruction, including data collection, analysis, and theory generation in all stages of theory-generating meta-synthesis research.

Through the extraction, analysis, and synthesis of qualitative findings from various published investigations, meta-synthesis of qualitative studies aims to produce evidence-based theory (Finfgeld-Connett, 2018). Thus, the current study adopts the meta-synthesis approach to review the influences of COVID-19 on the international tourism and carbon emissions.

3. Results

3.1 Overview of the International Tourism and COVID-19

Tourism has long been recognized as one of the world's largest and most diverse business industries. For many countries, tourism expenditures are key to economic growth, as they are an important source of business activity, income, employment, balance of payments, and foreign currency earnings, which exceed that of traditional sectors such as agriculture and manufacturing (Min *et al.*, 2019). In terms of regional tourism figures, Asia and the Pacific led notable growth in both arrivals and receipts. According to *Tourism Towards 2030* (WTO, 2025a), an assessment of the long-term outlook for tourism development from 2010 to 2030, international tourist arrivals are expected to increase by 3.3% a year worldwide, reaching 1.8 billion by 2030. The most notable growth is expected in Asia and the Pacific, and the increase is projected to increase by 331 million to 535 million in 2030, which represents 30% of global travelers, as presented in Figure 1.

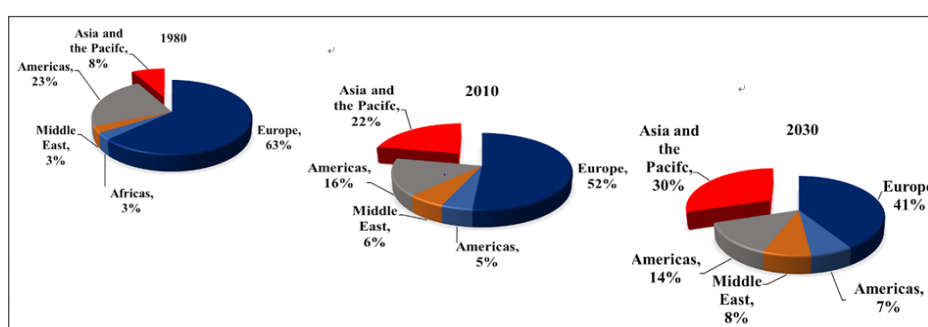


Figure 1. The share increase of the Asia and Pacific regions (WTO, 2025a, p. 16-17)

The COVID-19 pandemic has severely affected the global economy, with tourism being one of the most directly affected sectors. Prior to the COVID-19 pandemic, the tourism sector was responsible for creating 1 in 4 of all net new jobs across the world between 2014-2019. Moreover, GDP growth of the tourism and travel industry outpaced the global GDP for nine consecutive years, between 2011-2019. One report from World Travel and Tourism Council (WTTC) (2021) in 2020, due to global on-

and-off lockdowns and ongoing mobility restrictions caused by the COVID-19 pandemic, 62 million jobs were lost, leaving just 272 million employed across the sector globally, compared to 334 million jobs in 2019, decreasing 18%. Though proactive government retention schemes have helped the sector save millions of jobs and livelihoods, tourism's contribution to GDP saw a nearly 50% decline in 2020, which highlights the importance of support from public leaders. In addition, when we study some events in the historical

economic impact timeline, total GDP loss in 2020 from the industry was much higher than during the Global Financial Crisis, while the September 11 terrorist attack caused a slight drop during 2001-2003. The report indicated that the economic impact timeline of the tourism industry since 2000. In addition, the WTTC also indicated that global tourism had a loss of some US\$1.1 trillion in international tourism receipts.

As mentioned, the tourism industry is highly vulnerable to adverse impacts such as natural disasters, man-induced disasters, or economic factors, and the effects of disasters on the tourism industry have been devastating and inevitable (Min *et al.*, 2019). However, the pandemic has been the most damaging, as it has led to an unprecedented global healthcare crisis, social emergencies, and a sharp blow to the global economy (Gössling *et al.*, 2021). Figure 2 shows the international arrivals from 2019 to 2024 by regions. After the unprecedented 72% drop in international tourism in 2020, demand for international travel remained very weak in 2021 due to the effects of the COVID-19 pandemic. There are still difficulties for the international tourism industry

in turns of travel demand, with decreasing 70%. In 2022, international tourism saw a strong rebound 66% of pre-pandemic visitors recovering, although the high uncertainty resulting from Russian military offensive on Ukraine, combined with economic challenges and lingering travel restrictions from the pandemic, could dampen overall confidence and the upward trend seen in tourism. The figure indicates that the number of arrivals in 2023 plunged to 11% worldwide compared with the pre-pandemic year of 2019, with Asia and the Pacific suffering the largest decline, by regions, with a 34% drop in international arrivals in 2023. However, international tourism returned to nearly 90% of its pre-pandemic levels (WTO, 2024).

In 2024, international tourists nearly fully recovered to 99% of pre-pandemic levels, reaching around 1.4 billion, according to the latest WTO Barometer (2025b). Compared to 2023, this number represents an 11% increase, or 140 million more travelers. Strong performance from major regions, the ongoing recovery of Asia-Pacific destinations, and sustained post-pandemic demand all contributed significantly to the growth.

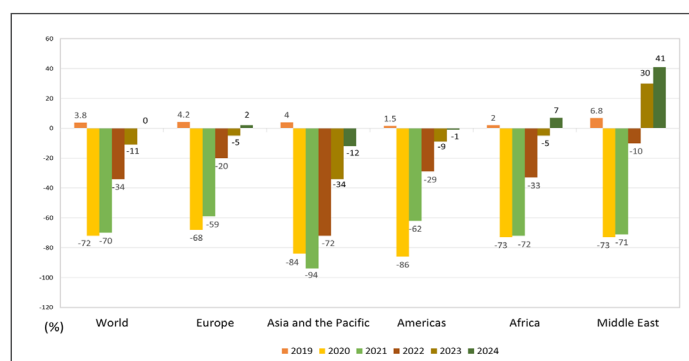


Figure 2. International tourist arrivals (% change over 2019). (Data Source by WTO, 2024 and 2025b)

According to the WTO (2025b), international tourism is expected to continue its growth trend through 2025, bolstered by ongoing demand that plays a vital role in the socio-economic advancement of both well-established and emerging destinations. After fully recovering to pre-pandemic figures in 2024, the number of international tourist arrivals rose by 5% in the first quarter of 2025 compared to the same time frame in 2024, exceeding 2019 figures by 3%. From January to March 2025, there were over 300 million international tourists documented - an increase of around 14 million from the same months the previous year.

3.2 The Impact of COVID-19 on Global Carbon Emissions and International Tourism

In the latest report of the WTO (2019) estimate,

the transportation (Car: 32% and Aviation: 40%) associated with tourism accounts for approximately 75% of projected CO₂ emissions, compared with accommodation/catering (approximately 21%) and other activities related the tourism (approximately 4%) among these tourism activities. This indicates that transportation contributes approximately three-quarters of tourism-related carbon emissions. During the COVID-19 pandemic, government enforced lockdowns worldwide significantly disrupted travel and transportation sectors. However, the International Civil Aviation Organization (ICAO, 2023) argues that a strong post-COVID rebound in air travel was anticipated, with longer-term developments expected to accelerate following the end of the pandemic. A report published by the International

Air Transport Association (IATA) on January 30, 2025, highlighted that global demand for air travel hit a record high in 2024. The total volume of air traffic, measured in revenue passenger kilometers, rose by 10.4% from 2023, exceeding pre-pandemic figures from 2019 by 3.8%. International flights saw a 13.6% increase throughout the year, while domestic air travel grew by 5.7%. Moreover, Ibrahim and Mohammed (2023) provide evidence that tourism and transportation services undermine environmental sustainability, providing the above findings. However, these consequences may differ because of global lockdowns and mobility restrictions during the COVID-19 pandemic. Similar to this, Cui (2025) highlights the detrimental consequences of tourism on the environment by demonstrating how rising tourism in developing countries is associated with increased CO₂ emissions and environmental degradation. Both studies stress the importance of implementing sustainable practices and legislation to reduce the adverse environmental effects of tourism and transportation services.

3.3 International Tourism and Global Carbon Emissions Before, during, and after the COVID-19 Pandemic

In terms of global CO₂ emissions, it has grown significantly since 2000, reaching a record high of 36.3 billion metric tons of CO₂ in 2019 before the pandemic. During this period, there were two notable declines. The first occurred in 2009, when emissions

dropped by 1.3% due to the global financial crisis. However, emissions rebounded sharply the following year, increasing by 6.2% in 2010. Undoubtedly, the global lockdowns and international travel restrictions caused by the COVID-19 pandemic led to a 5% reduction in global emissions in 2020. Although this reduction was insufficient to significantly impact the accumulation of CO₂ in the atmosphere, it represented the largest annual decrease in several decades. With global lockdowns easing, the CO₂ emissions jumped by an estimated 5.7% in 2021 as compared to 2020, reaching pre-pandemic levels with an estimation of 2019. Figure 3 illustrates the number of international tourist arrivals and global carbon dioxide emissions from 1995 to 2024.

Global tourism suffered the worst year in the historical series on record in 2020, and it has never experienced a rapid and sharp drop in demand like that caused by the COVID-19 pandemic. In comparison, international tourist arrivals declined 1.8% during the SARS outbreak and 3.7% during the global financial crisis. The number of international arrivals plunged under 1995 levels, representing that the lowest figure recorded during two decades after peaking at 1.46 billion in 2019. Although the number of tourists in 2022 had only recovered to about 63–66% of 2019 figures, global carbon emissions were already slightly more than 1% higher compared to 2019. With the easing and eventual end of the pandemic, global tourist arrivals have gradually increased, reaching pre-pandemic levels by 2024.

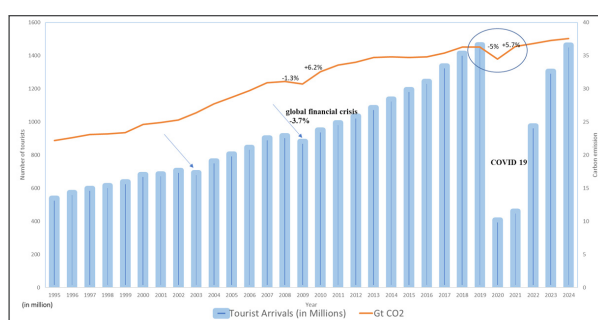


Figure 3. International tourist arrivals and global carbon dioxide emissions (1995-2024)

4. Conclusion

This study adopts meta synthesis approach to review the effects of international tourism and the carbon emissions pre, during and after COVID-19, the most disastrous event in terms of magnitude since World War II. Understanding the association of tourism-CO₂ under the pandemic are of particular importance to governmental authorities and policymakers for planning an appropriate strategy to reach CO₂ removal goals while developing tourism.

Recently, WTO (2025c) emphasized that sustainable tourism development guidelines and management practices apply to all tourism forms and destination types, including both mass tourism and various niche tourism segments. Achieving the long-term viability of tourism necessitates creating a well-adjusted equilibrium among the environmental, economic, and sociocultural aspects of tourism growth. The results can provide valuable insights and provide a basis for further research in assessing the influences of

disastrous events. The results thus can also be used as an important reference for the authorities to activate developing mitigation policies and more sustainable plans, thereby achieving net-zero emission goals much more effectively and efficiently.

Acknowledgments

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