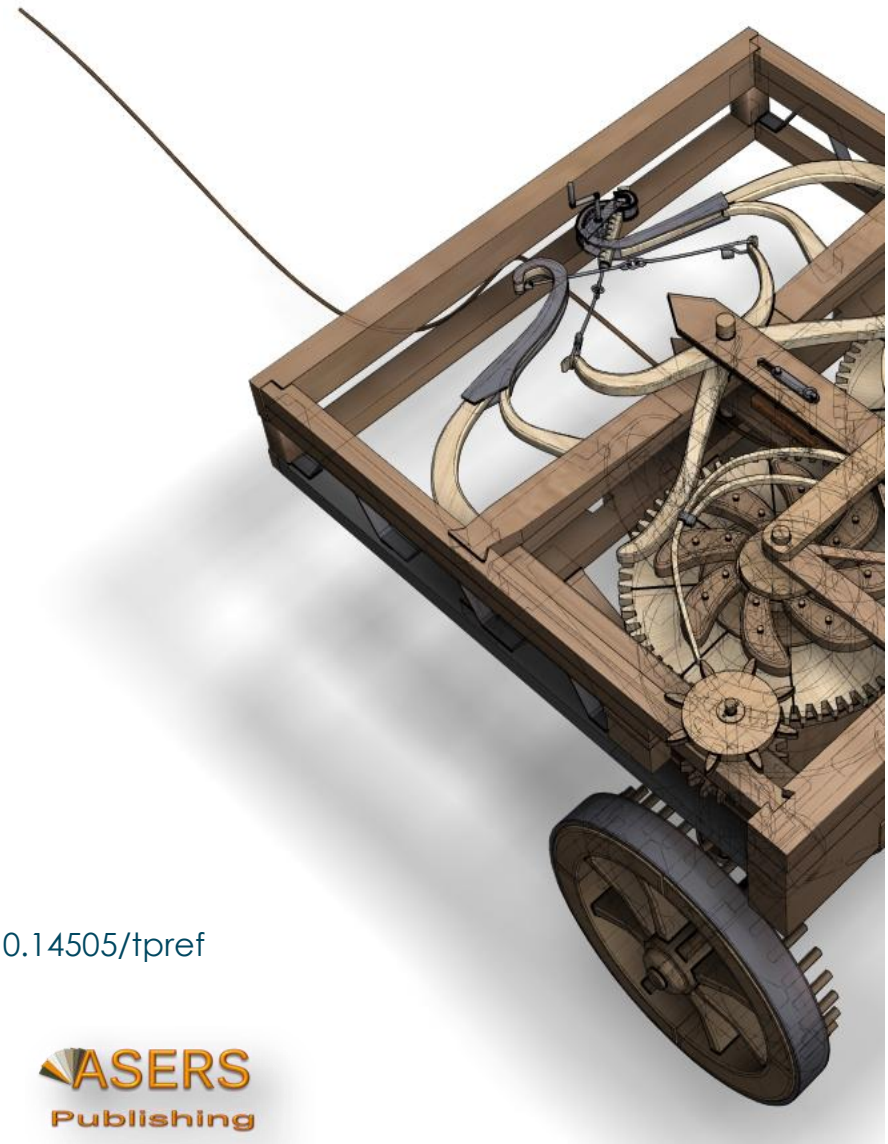
# Theoretical and Practical Research in Economic Fields



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# Macroeconomic Enablers of Sustainable Development in G20 Countries: The Role of Tourism

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**Abstract:** The G20 countries present a congenial macroeconomic environment in terms of per capita GDP, gross fixed capital formation, labour-force participation, inflation, cross-border trade, financial sector development, and human development for the growth of travel and tourism. These countries have a strong potential for the development of travel and tourism in terms of international tourist arrivals, international tourism expenditure and international tourism receipts. As appropriately recognised by the members of G20 in 2012 for the first time, and as identified during the India's Presidency in 2023, the potential of travel and tourism can optimally be utilized to make progress towards the SDGs by 2030. In this direction, this study is an attempt to empirically examine the impact of tourism development on sustainable development in G20 countries. The novelty of this study lies in estimating short-run and long-run effects of selected covariates on sustainable development in G20 nations in a panel framework. The results of the estimation of PMG based ARDL regression indicate a statistically significant positive contribution of the development of travel and tourism on sustainable development when macroeconomic indicators are the enablers. This finding contradicts the findings of a recent study by Destek & Aydin that tourism can be detrimental to sustainable development. Thus, the present study ushers a new direction for tourism-led sustainable development. The policy implication is that the effective and efficient implementation appropriate tourism development strategies in such a favourable macroeconomic environment can add to the progress of SDGs in G20 countries.

**Keywords:** economic growth; tourism development; SDGs; G20; Panel ARDL Model.

**JEL Classification:** C51; O18; Q01; Z32.

## Introduction

The G20, being the premier intergovernmental forum for international economic and financial cooperation, plays an important role in shaping and strengthening global architecture and governance on all major international economic issues such as financial stability, climate change mitigation and sustainable development[1]. The G20 members represent around 85 per cent of the global gross domestic product, over 75 per cent of the global trade,

[1] https://www.ipsnews.net/2015/09/g20-finance-ministers-committed-to-sustainable-development/

and about 2/3 of the world population[2]. By end of December 2024, the growth of GDP in G20 economies showcased a stable pace of acceleration, albeit some countries growing while others slowed down. Indonesia (1.2%), India (1.1%), and US (0.7%) recorded stable growth whereas growth accelerated significantly in Mexico (1.1%), China (0.9%), Germany (0.1%), South Korea (0.1%), and to a lesser extent in France (0.4%) and Australia (0.3%). However, the growth of macro-economies of Brazil (0.9%), UK (0.1%), Canada (0.3%), Japan (0.3%), Italy (0.0%), Turkiye (0.2%), and South Africa -0.3%) have been slowed down by end of December 2024[3]. Despite such a mixed macroeconomic scenario, the Brazil Presidency of G20 remain focused on fighting against hunger, poverty and inequality for sustainable development through necessary reforms in global governance framework. In this summit, investment on travel and tourism sector development projects was given a priority to enhance the importance of this sector in the attainment of SDGs.

Although G20 was founded in 1999, the leaders for the first time recognised the importance of travel and tourism as a driver of jobs, growth and economic recovery in 2012 in its annual meeting at Mexico[4]. It was observed that international tourism significantly contributed to the economies of the G20 nations in 2011. In this year, 656 million international tourists visited G20 countries which were 67 per cent of total international tourist arrivals. Such a large size of inbound tourism recorded an international tourism expenditure of about 830 billion USD and created about 78 million jobs in G20 nations[5]. Thus, travel and tourism were facilitated in G20 countries for the growth of local economy, raising national income, improving the balance of payments, and boosting economic growth. In this way, tourism was envisioned in 2012 to support job creation, quality work, poverty reduction and global growth. Since then, tourism in G20 nations was targeted for development in the strategic road maps. Recently, five tourism priority areas have been identified by India's G20 Presidency, viz., green tourism, digitalization, skills, tourism MSMEs, and destination management for transforming the tourism sector to meet the objectives of the SDGs and build an inclusive and sustainable future[6]. The development of tourism can be crucial for achieving the SDGs by generating economic growth, creating jobs, reducing inequalities and promoting cultural and environmental sustainability (UNWTO, 2023).

The figures presented in Table 1, Table 2, Table 3, Table 4 and Table 5 indicate the macroeconomic situations and that of the travel & tourism industry in G20 nations including that of European Union. It is observed from Table 1 that G20 countries present a congenial macroeconomic environment for the growth of travel and tourism. The growth rate of per capita GDP in G20 countries is favourable for financial sector development, human development, and thus for the tourism sector development. The percentage of gross fixed capital formation in GDP is the indication of favour infrastructure development in G20 nations which act as a promoter of travel and tourism. The labour-force participation rate is an encouraging factor in G20 countries. Similarly, the inflation rate indicates the stability of prices. Further, trade as a percentage of GDP is a good motivator for the development of G20 nations. The pre-COVID-19 data presented in Table 3 indicates that the tourism sector in G20 nations is able to attract foreign tourist arrivals and also able to activate the economy through significant spending by the tourists. The facts and figures presented in Table 4 indicate that the pre-COVID-19 contribution of travel and tourism is quite encouraging and that of post-COVID-19 contribution has already set in the path of rapid recovery in G20 nations. The financial development index presented in Table 2 indicates the depth, access, efficiency and stability of financial markets and institutions in G20 nations. The current financial development scenario is favourable for the development of travel and tourism in these nations.

Table 1. Selected Macroeconomic Indicators of G20 (2022, 2023)

| G20 Members | Per Capita GDP Growth (%) | | Gross Fixed Capital Formation (% of GDP) | | Labour Force Participation Rate (%) | | Inflation (%) | | Trade (% of GDP) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2022 | 2023 | 2022 | 2023 | 2022 | 2023 | 2022 | 2023 | 2022 | 2023 |
| Argentina | 5.04 | -1.89 | 17.57 | 18.57 | 61.48 | 62.28 | 69.87 | 135.37 | 31.55 | 26.64 |
| Australia | 2.92 | 0.94 | 23.18 | 23.29 | 66.70 | 66.78 | 7.17 | 6.51 | 45.82 | 49.22 |
| Brazil | 2.64 | 2.50 | 17.80 | 16.54 | 63.53 | 62.92 | 8.57 | 4.66 | 38.82 | 33.85 |

[2] https://web.archive.org/web/20140203221840/http://www.g20.org/about_g20/g20_members
[3] https://www.oecd.org/en/data/insights/statistical-releases/2024/12/g20-gdp-growth-third-quarter-2024.html
[4] https://webunwto.s3-eu-west-1.amazonaws.com/imported_images/36700/G20_Leaders_Declaration_2012.pdf
[5] http://www.g20.utoronto.ca/2012/2012-0516-tourism.html
[6] https://www.g20.org/content/dam/gtwenty/gtwenty_new/document/G20_Energy_Transitions_Ministers%E2%80%99_Meeting_Outcome_Document_and_Chair%E2%80%99s_Summary.pdf

| G20 Members | Per Capita GDP Growth (%) | | Gross Fixed Capital Formation (% of GDP) | | Labour Force Participation Rate (%) | | Inflation (%) | | Trade (% of GDP) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2022 | 2023 | 2022 | 2023 | 2022 | 2023 | 2022 | 2023 | 2022 | 2023 |
| Canada | 1.96 | -1.67 | 23.29 | 22.83 | 65.25 | 65.36 | 7.65 | 1.53 | 67.55 | 67.19 |
| China | 2.96 | 5.36 | 41.90 | 41.33 | 65.80 | 65.83 | 1.82 | -0.58 | 38.35 | 37.32 |
| France | 2.24 | 0.61 | 23.65 | 23.09 | 55.85 | 55.64 | 3.22 | 5.30 | 75.79 | 70.56 |
| Germany | 0.64 | 0.35 | 21.71 | 21.50 | 60.93 | 61.12 | 6.09 | 6.14 | 89.06 | 82.80 |
| India | 6.14 | 7.20 | 30.75 | 30.83 | 53.56 | 54.65 | 6.75 | 1.33 | 49.96 | 45.92 |
| Indonesia | 4.52 | 4.16 | 29.08 | 29.33 | 67.02 | 66.97 | 9.57 | 1.53 | 45.47 | 41.32 |
| Italy | 4.87 | 0.73 | 21.85 | 22.51 | 49.03 | 49.80 | 3.56 | 5.82 | 72.05 | 66.24 |
| Japan | 1.40 | 2.17 | 25.96 | 25.76 | 62.50 | 62.90 | 0.33 | 3.79 | 46.84 | 45.16 |
| Mexico | 2.91 | 2.30 | 22.46 | 24.25 | 60.95 | 61.74 | 6.49 | 4.46 | 88.39 | 73.16 |
| Russia | -1.73 | 3.89 | 20.40 | 21.86 | 61.94 | 61.69 | 16.72 | 7.07 | 43.26 | 41.83 |
| Saudi Arabia | 2.84 | -4.00 | 24.64 | 27.89 | 63.80 | 63.85 | 17.98 | -2.96 | 63.51 | 62.12 |
| South Africa | 0.48 | -0.63 | 14.06 | 14.93 | 56.94 | 58.53 | 4.99 | 4.80 | 64.778 | 65.18 |
| South Korea | 2.81 | 1.28 | 32.17 | 32.16 | 63.79 | 64.27 | 1.28 | 2.06 | 96.53 | 87.94 |
| Turkey | 4.50 | 4.68 | 29.16 | 31.86 | 53.05 | 53.31 | 96.04 | 68.23 | 81.17 | 66.28 |
| United Kingdom | 3.66 | -0.48 | 17.85 | 17.56 | 61.91 | 61.78 | 5.44 | 7.30 | 68.88 | 63.88 |
| United States | 2.13 | 2.38 | 21.37 | 21.39 | 61.79 | 62.08 | 7.13 | 3.60 | 26.89 | 24.89 |
| European Union | 3.20 | 0.21 | 22.09 | 22.05 | 57.49 | 57.65 | 6.69 | 6.41 | 103.57 | 95.69 |

*Source*: WDI, World Bank, 2023; UK: United Kingdom; EU: European Union

Table 2. Selected Development Indices of G20 (2021)

| G20 Members | Financial Development Index | Human Development Index | Tourism Development Index | Sustainable Development Index |
|---|---|---|---|---|
| Argentina | 0.306 | 0.842 | 0.001 | 73.4 |
| Australia | 0.909 | 0.951 | 0.021 | 76.0 |
| Brazil | 0.662 | 0.754 | 0.009 | 73.4 |
| Canada | 0.874 | 0.936 | 0.026 | 78.3 |
| China | 0.634 | 0.768 | 0.147 | 72.0 |
| France | 0.815 | 0.903 | 0.094 | 82.0 |
| Germany | 0.702 | 0.942 | 0.089 | 83.3 |
| India | 0.534 | 0.633 | 0.027 | 62.8 |
| Indonesia | 0.364 | 0.705 | 0.000 | 70.0 |
| Italy | 0.767 | 0.895 | 0.049 | 78.7 |
| Japan | 0.888 | 0.925 | 0.008 | 79.5 |
| Mexico | 0.818 | 0.925 | 0.034 | 78.2 |
| Russia | 0.402 | 0.758 | 0.030 | 69.4 |
| Saudi Arabia | 0.530 | 0.822 | 0.018 | 74.1 |
| South Africa | 0.442 | 0.875 | 0.018 | 67.5 |
| South Korea | 0.546 | 0.713 | 0.003 | 63.9 |
| Turkey | 0.500 | 0.838 | 0.034 | 70.7 |
| United Kingdom | 0.836 | 0.929 | 0.664 | 81.7 |
| United States | 0.917 | 0.921 | 0.077 | 76.0 |
| European Union | 0.528 | 0.896 | 0.156 | 80.2 |

*Source*: IMF, UNDP, Authors' Own estimate, SDG-2023 Report

The levels of human development depicted in Table 2 indicate that the health, education and living standards of people in these nations also complementary to the growth of travel and tourism in G20 nations. The

current figures of sustainable development index indicate that these countries are moving towards the achievement of SDGs by 2030. Nonetheless, the composite tourism development index is relatively low in almost all countries except for UK as evidenced from Table 2. This is also implied from the travel and tourism development index of the World Economic Forum (refer to Table 3). This implies that although the travel and tourism industry have all potential to contribute to higher economic growth and sustainable development (as inferred from the selected tourism indicators and contribution to GDP for the years 2023 and 2024 in Table 4 and 5), effective implementation of appropriate strategies for tapping such potential are essential. But this needs empirical support. Thus, the crucial question is 'whether tourism development, especially international tourism, is supportive of sustainable development in G20 countries.'

Table 3. Travel and Tourism Development Index of G20 (2019, 2021 & 2024)

| G20 Members | 2019 | 2021 | 2024 |
|---|---|---|---|
| Argentina | 4.05 | 4.00 | 4.10 |
| Australia | 5.06 | 4.99 | 5.00 |
| Brazil | 4.09 | 4.19 | 4.41 |
| Canada | 4.99 | 4.89 | 4.81 |
| China | 4.80 | 4.92 | 4.94 |
| France | 5.14 | 5.13 | 5.07 |
| Germany | 5.16 | 5.06 | 5.00 |
| India | 4.23 | 4.12 | 4.25 |
| Indonesia | 4.24 | 4.39 | 4.46 |
| Italy | 4.89 | 4.93 | 4.90 |
| Japan | 5.21 | 5.25 | 5.09 |
| Mexico | 4.33 | 4.27 | 4.26 |
| Russia | - | - | - |
| Saudi Arabia | 4.25 | 4.35 | 4.23 |
| South Africa | 3.84 | 3.83 | 3.99 |
| South Korea | 4.74 | 4.83 | 4.74 |
| Turkey | 4.18 | 4.24 | 4.39 |
| United Kingdom | 5.20 | 4.97 | 4.96 |
| United States | 5.24 | 5.20 | 5.24 |
| European Union | - | - | - |

*Source*: Word Economic Forum, 2019, 2021, 2024; For Russia & EU, data not provided by WEF.

In order to address this research question, the methodological clue is taken from Destek & Aydin (2022), the only study most relevant to the present work. It suggests that the SDG index can be regressed on the indicators of travel and tourism while controlling the macroeconomic environment. Following this line of methodological application, we estimate the regression employing best suited PMG based panel ARDL framework. The results indicate a statistically significant positive contribution of tourism sector development to the sustainable development of G20 nations. This finding corroborates to the most recent agreement among the leaders of G20 during India's Presidency that travel, and tourism can be catalysed to accelerate the pace of socio-economic, cultural and environmental factors central to the achievement of SDGs by 2030.

Table 4. Selected Indicators of Tourism Industry in G20 (2019 & 2021)

| G20 Countries | International Tourist Arrivals (mn) | | International Tourism Expenditure (USD mn) | |
|---|---|---|---|---|
| | 2019 | 2021 | 2019 | 2021 |
| Argentina | 7.4 | 0.3 | 9845.0 | 1400.0 |
| Australia | 9.5 | 0.2 | 41345.0 | 1200.0 |
| Brazil | 6.4 | 0.7 | 21178.0 | 5200.0 |
| Canada | 32.4 | 4.3 | 33307.3 | 7900.0 |

| G20 Countries | International Tourist Arrivals (mn) | | International Tourism Expenditure (USD mn) | |
|---|---|---|---|---|
| | 2019 | 2021 | 2019 | 2021 |
| China | 162.5 | 5.7 | 292855.4 | 109400.0 |
| France | 217.9 | 141.3 | 59751.0 | 36000.0 |
| Germany | 39.6 | 11.7 | 101231.0 | 51000.0 |
| India | 17.9 | 7.0 | 25922.4 | 14300.0 |
| Indonesia | 16.1 | 1.6 | 14449.0 | 500.0 |
| Italy | 95.4 | 40.2 | 37908.0 | 15000.0 |
| Japan | 31.9 | 0.2 | 29146.0 | 2800.0 |
| Mexico | 17.5 | 1.0 | 35339.0 | 17800.0 |
| Russia | 97.4 | 55.3 | 12300.0 | 5100.0 |
| Saudi Arabia | 24.4 | 7.1 | 40611.0 | 11400.0 |
| South Africa | 20.3 | 3.9 | 16415.0 | 12200.0 |
| South Korea | 14.8 | 2.7 | 5866.0 | 1108.6 |
| Turkey | 51.7 | 30.0 | 5354.0 | 1700.0 |
| United Kingdom | 40.9 | 6.4 | 68884.9 | 30000.0 |
| United States | 165.5 | 66.6 | 186079.0 | 56700.0 |
| European Union | 968.9 | 222.3 | 375550.6 | 305107.2 |

*Source*: WDI, World Bank, 2023

Table 5. Contribution of Travel & Tourism to GDP in G20 (2019 to 2024)

| G20 Countries | Contribution of Travel & Tourism to GDP (%) | | | | | |
|---|---|---|---|---|---|---|
| | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
| Argentina | 9.4 | 6.5 | 7.0 | 8.0 | 8.8 | 9.6 |
| Australia | 10.7 | 6.0 | 4.7 | 6.9 | 9.8 | 10.2 |
| Brazil | 7,7 | 5.5 | 6.4 | 7.6 | 7.7 | 7.8 |
| Canada | 6.4 | 3.2 | 4.4 | 5.0 | 6.0 | 6.4 |
| China | 11.6 | 4.5 | 4.6 | 3.3 | 7.3 | 9.6 |
| France | 8.5 | 4.7 | 6.5 | 8.2 | 8.8 | 9.0 |
| Germany | 9.8 | 5.5 | 6.4 | 8.8 | 11.0 | 11.4 |
| India | 6.9 | 4.7 | 5.8 | 5.9 | 6.5 | 6.8 |
| Indonesia | 5.9 | 3.2 | 2.4 | 3.9 | 4.8 | 5.1 |
| Italy | 13.1 | 7.0 | 9.1 | 10.2 | 10.5 | 10.8 |
| Japan | 7.1 | 4.7 | 4.2 | 6.2 | 7.1 | 7.5 |
| Mexico | 15.0 | 8.5 | 13.1 | 14.7 | 14.4 | 14.2 |
| Russia | 4.9 | 2.7 | 3.7 | 3.6 | 4.1 | 4.3 |
| Saudi Arabia | 9.8 | 7.1 | 6.5 | 8.4 | 11.5 | 12.3 |
| South Africa | 6.9 | 3.7 | 3.2 | 6.3 | 8.2 | 8.8 |
| South Korea | 4.4 | 2.4 | 2.7 | 3.6 | 3.8 | 4.3 |
| Turkey | 11.0 | 5.0 | 7.3 | 11.5 | 12.0 | 12.4 |
| United Kingdom | 10.1 | 4.2 | 5.7 | 9.5 | 8.8 | 10.3 |
| United States | 8.6 | 5.3 | 5.5 | 7.9 | 8.6 | 9.0 |
| European Union | 10.1 | - | - | - | 9.7 | 10.1 |
| G 20 | 9.4 | - | - | - | 8.1 | 9.0 |

*Source:* Economic Impact Report, WTTC (2021, 2022, 2023, 2024); All Figures shown for 2024 are estimates of WTTC

This research work is therefore important for planners and policy makers of G20 nations in reorienting the travel and tourism specific policies and strategies for making their economies resilient to domestic as well as

cross-border shocks and can trace a robust growth path towards sustainable development. This is the first study in the context of G20 nations in providing literature about the significance of tourism sector development for sustainable development, and hence, the study is original. The rest of the paper is organised as follows: Section 2 presents a review of relevant literature to identify the gaps of knowledge and to justify the research problem; Section 3 elaborates the data and methodology used in the study; Section 4 presents the results and discusses the findings; and Section 5 concludes.

## 1. Literature Review

Although the role of various sectors in the growth and development of an economy has occupied a great place in the literature since the era of classical economists, the importance of the smoke-less industry, travel and tourism, in the attainment of SGDs have discussed in the last decade only. But the origin of the concept of travel and tourism dates back to the growth of early civilization when people from one locality moved to another locality in search of living for themselves and their cattle. But the origin of the concept of modern tourism can be traced back to the 17$^{th}$ century when people in Europe started the 'Grand Tour'. However, the modern travel and tourism developed into an economic sector since 1850s when rail travel became cheaper and became a contributor to economic growth since 1950s when charter flights started worldwide (Chen, Zhang & Chen, 2023). Now, the global size of the tourism industry has risen to nearly 1.8 trillion USD in 2019 which after a temporary sluggishness during 2020-21 due to the unprecedented consequences of COVID-19 disease, reached over 1.6 trillion USD in 2022 (Chen, Zhang & Chen, 2023). According to report by UNWTO, the industry has been recovered 82 per cent as of July 2023.

This rapid growth in world tourism has happened due to the presence of rich cultures and traditions of different communities, colourful festivals of different places, scenic beauties, wonderful landscapes, bountiful nature, varieties of flora and fauna, the array of foods and beverages, and stunning heritage of monuments, scriptures etc. All these are catalyst in attracting large visitors worldwide every year which contributes to the development of inbound or international tourism. The extant literature acknowledges travel and tourism as a significant contributor to the economic growth and development of a nation by increasing foreign exchange reserves, creating new infrastructure and tourist attractions, enhancing the quality of human resources, creating new employment opportunities, increasing earnings, improving productivity, developing industries, reducing poverty and inequality, balancing the regional development, and in ensuring sustainable development (McKinnon, 1964; Croes, 2006; Lee & Chang, 2008; Lemmetyinen & Go, 2009; Cernat & Gourdon, 2012; Li *et al.* 2018; OECD, 2018; Khan *et al.* 2020; Mishra *et al.* 2020, 2021, 2022; Khan *et al.* 2023; Colacchio *et al.* 2023; Zhao *et al.* 2023). Therefore, tourism plays a critical role in resolving macroeconomic problems including low income and output, high unemployment, capital deficiency, shortage of foreign exchange, fiscal deficit, and balance of payments disequilibrium (Belke *et al.* 2021). Besides, travel and tourism is well known for its support to handicrafts and fine arts which not only contribute to preservation of tradition and culture of a country but also strengthens the process of national integration and universal brotherhood (Thommandru *et al.* 2023). Therefore, travel and tourism is a significant economic activity, and the most important sources of economic growth and development across the globe (Sana, 2021; Huseyn, 2023).

Thus, tourism sector development can be an important strategy for creating jobs, building capital, increasing economic growth, alleviating poverty, creating jobs, improving food security, and promote global trade (Richardson, 2021; Manzoor *et al.* 2019; Usmani *et al.* 2021). Therefore, tourism can be an important strategy to achieve some specific sustainable development goals such as no poverty (SDG-1), zero hunger (SDG-2), good health and well-being (SDG-3), quality education (SDG-4), clean water and sanitation (SDG-6), affordable and clean energy (SDG-7), decent work and economic growth (SDG-8), promoting industry, innovation and infrastructure (SDG-9), reduced inequalities (SDG-10), and sustainable cities and communities (SDG-11). In other words, tourism development can contribute to improved quality of life and country's sustainable economic growth (Sana, 2021). In this context, Destek & Aydin (2022) empirically checked the nexus between tourism and sustainable development for 10 most visited countries viz., China, France, Germany, Italy, Mexico, Spain, Thailand, Turkey, UK and USA, and the results indicate that tourism is detrimental to sustainable development in these countries primarily due to environmental degradation caused by tourists' arrivals, excessive consumption in touristic facilities, increase in the volume of transportation, etc. Although the arguments developed Destek & Aydin (2022) are justified, further investigations are also required.

It is inferred from the theoretical literature that tourism is helpful for achieving sustainable development of a country, but the empirical observation is just opposite to it and also limited. Further, studies in the context of

G20 countries as a whole in also scanty. Therefore, this study intends to fill this gap by examining the impact of tourism on sustainable development in the context of G20 members.

## 2. Materials and Methods

The key research question in this paper is 'does tourism sector development contribute to sustainable development in G20 countries?' and, to address this research question, all the G20 members have been included in the study. These members are: Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Korea Republic, Mexico, Russian Federation, Saudi Arabia, South Africa, Turkey, United Kingdom, United States and European Union. This study has been conducted in a panel data framework consisting of 20 countries, 09 variables and 20 years (from 2002 to 2021).

The variables included in the study are: Sustainable Development measured by SDG Index (*sdgi*), economic growth measured by GDP Per Capita growth (*gdpc*), capital measured by Gross Fixed Capital Formation as percentage of GDP (*gfcf*), labour as measured by Labour force participation rate as a percentage of total population ages 15+ (*lfpr*), human development as measured by Human Development Index (*hdi*), trade as a channel of tourism sector development across nations as measured by Trade as percentage of GDP (*trade*), depth, access, efficiency and stability of financial markets and institutions as measured by Financial Development Index (*fndi*), inflation as measured by Annual Rate of GDP deflator-based Inflation (*inf*), and tourism sector development (*tdi*) measured by a composite index computed based on three key indicators of tourism development, viz., international tourist arrivals, international tourism expenditure, and international tourism receipts. The data on these variables have been compiled from the World Development Indicator, World Bank, International Monetary Fund, UN Sustainable Development Report-2023, and UNDP Human Development Reports. Wherever data were missing, the same either have been taken from CEIC database or have been interpolated or extrapolated.

*Construction of Composite Tourism Sector Development Index (tdi)*: The rationale behind the construction of a composite tourism sector development index is that individual indicators of tourism development such as international tourist arrivals, international tourism expenditure, and international tourism receipts reflect only a partial linkage with the economic growth of a nation. Secondly, these indicators portray a strong linear correlation among themselves as the larger arrival of international tourists means greater volume of expenditure and bigger size of national receipts thereby leading to the problems of multicollinearity (Shahzad *et al.* 2017). Besides, extant literature also supports the construction of a composite index of tourism sector development for its better representation and interpretation in empirical studies (Shahzad *et al.* 2017; Shahbaz *et al.* 2018; Al-Mulali *et al.* 2020; Mishra *et al.* 2023). Thus, it is justified to construct a composite tourism sector development index which is detailed below:

If the set of values of the 3-selected tourism indicators for the $i^{th}$ G20 member are $T_{i1}, T_{i2}, T_{i3}$, then the composite indices obtained for each of the G20 country by using the first principal component is given by the linear combination of the variables: $ctsd_i = w_{11}T_{i1} + w_{12}T_{i2} + w_{13}T_{i3}$, where $w_{11}, w_{12}, w_{13}$ are weights of each indicator such that their sum of squares is one, and *ctsd* is the composite tourism sector development index. The first principal component is calculated such that it accounts for the greatest possible variance in the dataset (Mishra *et al.* 2023). Finally, the obtained composite index is normalized by the max-min method to obtain the tourism sector development index for G20 as given by:

$$tdi = \frac{ctsd_i - \min\{ctsd_i\}}{\max\{ctsd_i\} - \min\{ctsd_i\}}.$$

Theoretically, it is argued that tourism sector development contributes to sustainable development in G20 countries through its contribution to GDP, capital formation, employment, human development, trade, financial sector development, and inflation. Tourism sector development raises arrivals of tourists, increases their spending, and makes revenue contributions. All these directly and indirectly contribute to national income thereby favourably influencing sustainable development of a country. *Second*, tourism sector development is both a pre-condition for and a post-realization of capital formation in an economy which in turn positively influences sustainable development of a nation. *Third*, tourism sector development makes direct and indirect contributions to the creation of employment opportunities in a country thereby positively adding to sustainable development of a country. *Fourth*, tourism sector development via its income and employment contributions raises the level of human development and thus, positively impacts the sustainable development of a nation. *Fifth*, tourism sector development via increased number of tourists' arrivals and their spending, positively contribute to exports and imports which in turn favourably add to the sustainable development of a nation. *Sixth*, tourism sector

development via increased number of tourists' arrivals and their spending, maintains a balance between demand and supply of money thereby contributing to the sustainable development of an economy by stabilizing prices. *Seventh*, tourism sector development adds to financial sector development by favourably influencing depth, access, efficiency and stability of financial markets and institutions which in turn positively contributes to sustainable development of a country.

Based on the above stated theoretical underpinning, it is assumed that sustainable development in G20 countries is a function of tourism sector development through its contribution to increased volume of income, employment, and capital formation, improved human development, increased volume of trade, greater financial development, and lower inflation. Symbolically, $sdgi = f\left(gdpc, gfcf, lfpr, hdi, trade, fndi, inf, tdi\right)$ (1)

The estimated form of this theoretical model (1) is:

$$sdgi_{it} = \gamma_{i0} + \gamma_{i1} gdpc_{it} + \gamma_{i2} gfcf_{it} + \gamma_{i3} lfpr_{it} + \gamma_{i4} hdi_{it} + \gamma_{i5} trade_{it} + \gamma_{i6} fndi_{it} + \gamma_{i7} inf_{it} + \gamma_{i8} tdi_{it} + \varepsilon_{it} \quad (2)$$

Here, $\gamma_{i0}$ is the intercept term, $\gamma_{ij}$ is the coefficient measuring the extent and direction of each of the explanatory variables, and $\varepsilon_{it}$ is the random error. The anticipated sign of $\gamma_{ij}$ depends on the direction of relationship of the relevant regressor with the dependent variable. Specifically, the coefficients of *gdpc*, *gfcf*, *lfpr, hdi, trade, fndi,* and *tdi* are expected to be positive as these factors have positive impacts on sustainable development. But the coefficient of *inf* is expected to be negative as it is having an inverse relationship with the degree of sustainable development.

Prior to the estimation of this empirical equation (2), descriptive statistics have been observed in terms of mean and standard deviation, cross-section dependency has been tested by using CD test of Pesaran (2004), and stationarity of variables checked by using Cross-sectional Augmented Dickey-Fuller (CADF) unit root test of Pesaran (2007).

In the literature, it is argued that the panel datasets may be subject to cross-sectional dependency due to the present of spatial or spillover effect or may be due to unobserved common errors (Baltagi & Pesaran, 2007). Therefore, it is important to check the cross-section dependence of the panel dataset used in the study by using CD test statistic as proposed by Pesaran (2004). Moscone & Tosetti (2009) found the strength of CD test over other tests in the literature. Therefore, the CD test is used in this study. The CD test statistic is stated as follows:

$CD = \sqrt{\frac{2t}{n(n-1)} \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} \hat{\theta}_{ij}}$ where $\hat{\theta}_{ij}$ is the mean value of the pair-wise association of coefficients of Ordinary Least Square (OLS) residuals in fixed effect or random effect regressions. This test checks the likely validity of the null hypothesis that 'panel dataset has cross-sectional independence' against the alternative hypothesis that 'panel dataset has cross-sectional dependence'.

It will be seen in the next section that the null is rejected for the panel dataset used in this study, and thus, infer that there is cross-sectional dependence which warrants use of use of CADF unit root test for observing the stationary properties of variables under the study. This test is based on the regression equation that:

$$\Delta Y_{it} = \psi_i + \vartheta_i Y_{i,t-1} + \xi_i \bar{Y}_{t-1} + \phi_i \Delta \bar{Y}_t + \upsilon_{it} \quad (3)$$

This CADF unit root test is based on the OLS results of regression equation (3), and the test statistic is stated as: $CADF = \frac{\Delta Y_i \bar{M}_w Y_{i-1}}{\hat{\eta}\sqrt{\left(Y_{i-1}^{'} \bar{M}_w Y_{i-1}\right)}}$. In this test, the null hypothesis is 'the variable is not stationary'. It would be seen in the next section that variables of this study are either level stationary or first difference stationary.

Thus, the Autoregressive Distributive Lag (ARDL) framework based on the Pooled Mean Group (PMG) estimators (Pesaran *et al.* 1999) has been used to estimate the equation (2). The selection of this estimation technique has been made based on the outcome of the Hausman (1978) test in which the chi-square test statistic at 5 degrees of freedom having a p-value of 0.9995 > 0.05 fails to reject the null hypothesis that 'PMG based panel ARDL estimation is appropriate over MG based panel ARDL estimation'.

This panel ARDL model based on PMG estimators is preferred when the variables of interest are a mix of I(0) and (1), and in no case any variable is I(2) (Pesaran & Shin, 1999). Using this estimation technique, both long-run and short-run relationships can be studied (Pesaran *et al.* 1997, 1999) in which the lags both for

dependent and independent variables are chosen based on Akaike Information Criterion, and the following estimated form of regression equation is used:

$$\Delta sdgi_{i.t} = \zeta_i ect_{i,t} + \sum_{j=1}^{p-1} \tau_{i,j^*} \Delta sdgi_{i,t-j} + \sum_{j=0}^{q-1} \zeta_{1i,j} \Delta gdpc_{i,t-j'} + \sum_{j=0}^{r-1} \zeta_{2i,j} \Delta gfcf_{i,t-j'} + \sum_{j=0}^{s-1} \zeta_{3i,j} \Delta lfpr_{i,t-j''} + \sum_{j=0}^{u-1} \zeta_{4i,j} \Delta hdi_{i,t-j^{iv}} + \sum_{j=0}^{v-1} \zeta_{5i,j} \Delta trade_{i,t-j^{v}} + \sum_{j=0}^{x-1} \zeta_{6i,j} \Delta inf_{i,t-j^{vi}} + \sum_{j=0}^{y-1} \zeta_{7i,j} \Delta fndi_{i,t-j^{vii}} + \sum_{j=0}^{z-1} \zeta_{8i,j} \Delta tdi_{i,t-j^{viii}} + \omega_{i,t} \quad (4)$$

In this panel ARDL equation (4), the term *ect* stands for error correction indicating thereby the deviation from long-run equilibrium relationship in the short-run, and if it has a statistically significant negative coefficient, then a periodic adjustment towards the long-run equilibrium relationship is indicated implying the stability of the long-run equilibrium relationship. The results of this panel ARDL estimation are presented and discussed in the next section.

## 3. Research Results

Table 6 summarizes the descriptive statistics of variables of the study. The annual average sustainable development index across cross-sections of G20 is 71.03 which is less than one. It means, on average, there is yet many miles to go to achieve the targets of SDGs in G20 countries. The annual average growth rate of the economy is 1.95 per cent which indicates a low level of growth of per capita income across the cross-sections of G20 countries.

Table 6. Descriptive Statistics of Covariates

| Statistics | *sdgi* | *gdpc* | *gfcf* | *lfpr* | *hdi* | *trade* | *fndi* | *tdi* | *inf* |
|---|---|---|---|---|---|---|---|---|---|
| Mean | 71.03 | 1.95 | 23.43 | 59.99 | 0.81 | 53.74 | 0.62 | 0.11 | 5.45 |
| Median | 72.22 | 1.79 | 21.98 | 60.65 | 0.85 | 53.47 | 0.60 | 0.05 | 3.10 |
| Maximum | 83.28 | 13.63 | 44.51 | 75.71 | 0.95 | 105.56 | 0.97 | 1.00 | 54.15 |
| Minimum | 51.69 | -11.84 | 11.96 | 45.52 | 0.50 | 20.44 | 0.26 | 0.00 | -16.58 |
| Std. Dev. | 7.07 | 3.66 | 6.23 | 5.77 | 0.10 | 18.26 | 0.20 | 0.17 | 7.65 |
| Observations | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 |

*Source*: Authors' Estimation

The annual growth of gross fixed capital is 23.43 per cent which indicates low level of capital accumulation across the cross-sections of G20 countries. The average labour force participation rate is 59.99 per cent which indicates a moderate level of total labour force participation across the cross-sections of G20 countries. The average level of human development is 0.81 across the cross-sections of G20 countries. The average total trade as a proportion of GDP is 53.74 per cent which indicates a moderate volume of total trade (exports + imports) across the cross-sections of G20 countries. The average inflation rate is 5.45 per cent which indicates a bit high rate of prices across the cross-sections of G20 countries. The average value of financial development index is 0.62 which indicates a moderate level of depth, access, efficiency and stability of financial markets and institutions across the cross-sections of G20 countries. The average level of tourism sector development is 0.11 which is considerably low across the cross-sections of G20 countries. This observation is crucial when the extant literature recognizes the contribution of travel and tourism to income and employment for growth and development of nations. Therefore, in this study, an attempt has been made to investigate whether tourism sector development can really be catalyzed for sustainable development of G20 nations as envisaged in G20 summits since 2012.

Table 7. Results of Cross-sectional Dependence Test

| Panel Data Model | CD test stat. | p-value |
|---|---|---|
| Fixed Effect | 18.085 | 0.000* |
| Random Effect | 18.807 | 0.000* |

Source: Authors' Estimation; *$H_0$: No Cross-Sectional Dependence; * sig. at 0.01 level*

Next, the cross-sectional dependence on the panel dataset has been tested by the CD test and its results are presented in Table 7. It is observed that the null hypothesis of 'no cross-sectional dependence' is rejected at the 0.01 level of significance. This means cross-sectional dependency is present in the panel dataset considered in this study. So, the cross-sectional ADF unit root test is appropriate to observe the stationary properties of the variables under study. The findings are presented in Table 8. It is observed that variables of the study are a mix of I(0) and I(1). And it is ensured that none of the variables is integrated in order two.

Table 8. Results of Cross-Sectional ADF Unit Root Test

| Variables | CADF at Level | | CADF at 1st diff. | | Decision |
|---|---|---|---|---|---|
| | With Intercept only | | | | |
| | t-bar | p-value | t-bar | p-value | |
| *sdgi* | -2.201 | 0.019** | - | - | I(0) |
| *gdpc* | -1.648 | 0.640 | -2.935 | 0.000* | I(1) |
| *gfcf* | -2.234 | 0.014** | - | - | I(0) |
| *lfpr* | -1.117 | 0.996 | -2.375 | 0.002* | I(1) |
| *hdi* | -2.523 | 0.000* | - | - | I(0) |
| *trade* | -1.114 | 0.997 | -2.448 | 0.001* | I(1) |
| *fndi* | -1.817 | 0.351 | -3.512 | 0.000* | I(1) |
| *inf* | -2.093 | 0.056*** | - | - | I(0) |
| *tdi* | -2.523 | 0.000* | - | - | I(0) |

*Source*: Authors' Estimation; *Note: *sig. at 0.01 level; **sig. at 0.05 level; ***sig. at 0.10 level*

Therefore, the impact of tourism sector development on sustainable development in G20 countries can appropriately be estimated in the panel ARDL framework. Before the estimation is performed, the correlation between the regressors is checked by employing Person's correlation test and the results are presented in Table-9. It is observed that no pair-wise correlation coefficient of explanatory variables is more than 0.80. This means there is no problems of exact linear correlation or multi-collinearity in the model specification in this study.

Now, the panel ARDL estimation is performed by including one lag of the dependent variable, and one lag of each dynamic regressor as suggested by Akaike info criterion (AIC). The estimation outcomes are presented in Table 10. It is observed that the tourism sector's development has a statistically significant positive impact on the sustainable development in G20 countries in the long-run. In addition, the contributions of per capita GDP growth, gross fixed capital formation, labour-force participation, human development, and trade on sustainable development in G20 countries in the long-run are positive and statistically significant. As expected, inflation is inversely related to sustainable development in G20 countries in the long-run. But the finding that financial development has a statistically significant negative impact on the sustainable development in G20 countries in the long-run was not expected.

Table 9. Results of Pearson's Correlation Test

| *Variables* | *gdpc* | *gfcf* | *lfpr* | *hdi* | *trade* | *fndi* | *inf* |
|---|---|---|---|---|---|---|---|
| *gfcf* | 0.446 | - | - | - | - | - | - |
| *lfpr* | 0.169 | 0.269 | - | - | - | - | - |
| *hdi* | -0.352 | -0.295 | 0.047 | - | - | - | - |
| *trade* | 0.011 | 0.010 | -0.172 | 0.207 | - | - | - |
| *fndi* | -0.207 | -0.033 | 0.162 | 0.727 | -0.012 | - | - |
| *inf* | 0.097 | -0.218 | -0.078 | -0.260 | -0.196 | -0.527 | - |
| *tdi* | -0.037 | -0.013 | -0.030 | 0.284 | 0.251 | 0.164 | -0.224 |

*Source*: Authors' Estimation

Furthermore, understanding that the long-run relationship can be disturbed in the short-run, it is found that the short-run deviations are primarily due to labour-force participation and inflation which are statistically significant. However, such short-run deviation has a convergence tendency towards long-run equilibrium as indicated by the negative and statistically significant coefficient of the error correction term ($\phi$) and thus, the long-run equilibrium relationship can subsequently be restored. It is noticed that the short-run deviation is corrected

towards long-run equilibrium at a speed of 55.62 per cent per annum. This means G20 countries would benefit from the tourism sector development in the long-run.

## 4. Discussions

Based on the results of PMG based panel regression estimation as shown in table-10 above, the following are the points of discussions:

*Per Capita GDP Growth*: It is observed from Table 10 that the per capita GDP growth has a positive and statistically significant impact on sustainable development of G20 countries in the long-run. The estimated coefficient of *gdpc* indicates that 1 per cent increase in it can increase the sustainable development index by 0.0226 points G20 countries in the long-run, assuming all other factors remaining unchanged. This finding implies the importance of higher economic growth as an enabler for a positive contribution of tourism sector to sustainable development in G20 countries.

Table 10. Results of Panel ARDL Model (PMG Estimates of Short-Run Long-Run Relationships)

| *Dependent Variable:* $\Delta sdgi$ : | Dependent Lag: 1 | Dynamic Regressors Lag: 1 | | |
|---|---|---|---|---|
| **Regressors** | **Coefficient** | **Std. Error** | **t-statistic** | **p-value** |
| **LONG-RUN RELATIONSHIP** | | | | |
| *gdpc* | 0.0226*** | 0.013 | 1.668 | 0.097 |
| *gfcf* | 0.0179*** | 0.010 | 1.757 | 0.081 |
| *lfpr* | 0.1048* | 0.013 | 7.734 | 0.000 |
| *hdi* | 14.1833* | 1.446 | 9.808 | 0.000 |
| *trade* | 0.0131* | 0.003 | 5.087 | 0.000 |
| *inf* | -0.0239*** | 0.013 | -1.779 | 0.077 |
| *fndi* | -6.4816* | 0.527 | -12.297 | 0.000 |
| *tdi* | 0.8571* | 0.320 | 2.678 | 0.008 |
| **ERROR CORRECTION TERM** | | | | |
| $\phi$ | -0.5562* | 0.119 | -4.650 | 0.000 |
| **SHORT-RUN RELATIONSHIP** | | | | |
| $\Delta$(*gdpc*) | 0.0032 | 0.007 | 0.455 | 0.649 |
| $\Delta$ (*gfcf*) | -0.0341 | 0.044 | -0.774 | 0.439 |
| $\Delta$ (*lfpr*) | -0.0970*** | 0.049 | -1.960 | 0.051 |
| $\Delta$ (*hdi*) | -7.1270 | 10.643 | -0.669 | 0.504 |
| $\Delta$ (*trade*) | -0.0159 | 0.011 | -1.494 | 0.136 |
| $\Delta$ (*inf*) | 0.0395** | 0.019 | 2.053 | 0.041 |
| $\Delta$ (*fndi*) | -0.1001 | 0.831 | -0.120 | 0.904 |
| $\Delta$ (*tdi*) | 2.7186 | 3.764 | 0.722 | 0.471 |
| C | 30.1593* | 6.092 | 4.950 | 0.000 |
| *@trend* | 0.1628* | 0.032 | 5.116 | 0.000 |

*Note: *, ** , *** sig. at 0.01, 0.05 and 0.10 levels respectively; Lag order selection by AIC value of 0.199*
*Source*: Authors' Estimation

*Gross Fixed Capital Formation*: It is observed from Table 10 that the gross fixed capital formation has a positive and statistically significant impact on sustainable development of G20 countries in the long-run. The estimated coefficient of *gfcf* indicates that 1 per cent increase in it can increase the sustainable development index by 0.0179 points G20 countries in the long-run, assuming all other factors remain unchanged. This finding implies the importance of higher capital availability as an enabler for a positive contribution of tourism sector to sustainable development in G20 countries.

*Labour-Force Participation Rate*: It is observed from Table 10 that the labour-force participation rate has a positive and statistically significant impact on sustainable development of G20 countries in the long-run. The estimated coefficient of *lfpr* indicates that 1 per cent increase in it can increase the sustainable development index by 0.1048 points G20 countries in the long-run, assuming all other factors remain unchanged. This finding

implies the importance of higher labour-force participation as an enabler for a positive contribution of tourism sector to the sustainable development in G20 countries.

*Human Development*: It is observed from Table 10 that the human development index has a positive and statistically significant impact on sustainable development of G20 countries in the long-run. The estimated coefficient of *hdi* indicates that 1 per cent increase in it can increase the sustainable development index by 14.18 points G20 countries in the long-run, assuming all other factors remain unchanged. This finding implies the importance of higher level of human development as an enabler for a positive contribution of tourism sector to the sustainable development in G20 countries.

*International Trade*: It is observed from Table 10 that international trade (exports + imports) has a positive and statistically significant impact on sustainable development of G20 countries in the long-run. The estimated coefficient of *trade* indicates that a 1 per cent increase in it can increase the sustainable development index by 0.0131 points G20 countries in the long-run, assuming all other factors remain unchanged. This finding implies the importance of a higher volume of trade as an enabler for a positive contribution of the tourism sector to the sustainable development in G20 countries.

*Inflation*: It is observed from Table 10 that inflation has a negative and statistically significant impact on sustainable development of G20 countries in the long-run. The estimated coefficient of *inf* indicates that 1 per cent decrease in it can increase the sustainable development index by 0.0239 points G20 countries in the long-run, assuming all other factors remain unchanged. This finding implies the importance of lower level of inflation as an enabler for a positive contribution of tourism sector to sustainable development in G20 countries.

*Tourism Sector Development*: It is observed from the Table 10 that the tourism sector development has a positive and statistically significant impact on sustainable development of G20 countries in the long-run. The estimated coefficient of *tdi* indicates that 1 per cent increase in it can increase the sustainable development index by 0.8571 points G20 countries in the long-run, assuming all other factors remain unchanged. This finding implies the role of travel and tourism towards achieving sustainable development goals in G20 countries. This finding contradicts the findings of a recent study by Destek & Aydin in 2022 that tourism can be detrimental to sustainable development and establishes a new direction for further research that travel, and tourism can have significant contributions towards attainment of SDGs.

## Conclusions and Scope for Further Research

This study empirically examined the impact of the development of travel and tourism on sustainable development in the G20 nations. In this study, important macroeconomic variables have been used as control variables. The results lend support to the G20 members' consideration that travel, and tourism can drive the economies to achieve SDGs by 2030. Making travel and tourism one of the critical economic sectors for accelerating the pace of sustainable development necessitates the implementation of appropriate strategies for effective and efficient growth and development of this industry. The recently identified priorities include greening the tourism sector, harnessing the power of digitization, skilling the youth, nurturing tourism MSMEs and strategic management of destinations during the India's Presidency in 2023, can certainly accelerate the progress on SDGs in G20 countries. Despite the simplicity of this study, the limitations include non-incorporation of domestic tourism development and ignoring the importance of institutional factors that are likely to play a crucial role in the development process. Furthermore, country-specific factors need to be identified may be through time-series analyses for designing relevant tourism development policies for accelerating the advancements on SDGs. In all these directions, future works can be planned.

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## Credit Authorship Contribution Statement

**P. K. Mishra**: Conceptualization, Investigation, Methodology, Software use, Formal analysis, Supervision, Data curation, Validation, Writing – review and editing, Visualization.
**Himanshu B. Rout**: Investigation, Formal analysis, Writing – original draft, Writing – review.
**Pradip Kumar**: Investigation, Data curation, Validation, review and editing, Visualization.
**Sanjeev Kumar Saxena**: Investigation, Validation, Writing – review.

## Declaration of Competing Interest

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

## Declaration of Use of Generative AI and AI-assisted Technologies

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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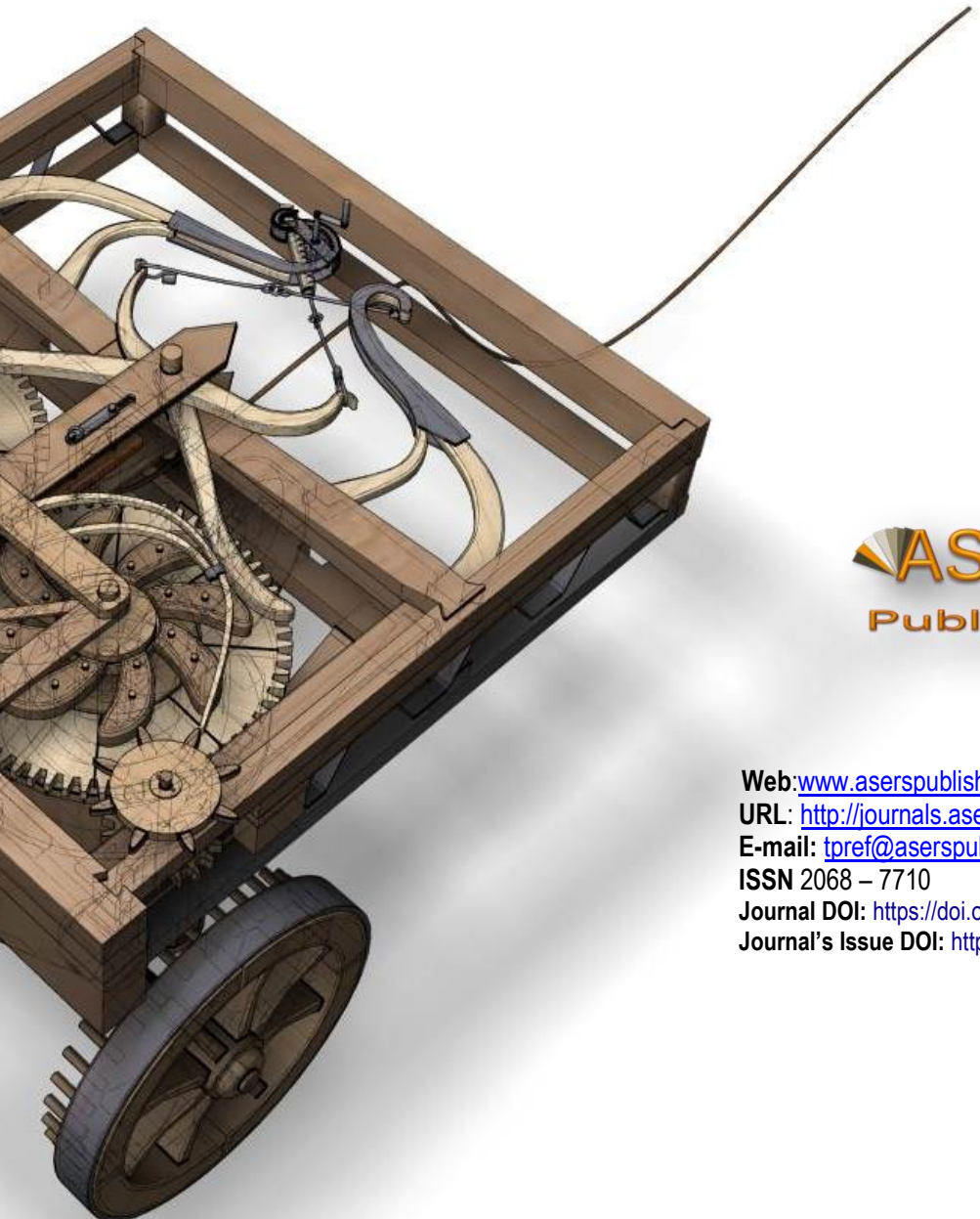

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