

QUANTITATIVE ASSESSMENT OF SAUDI TOURISM GROWTH DYNAMICS (2015–2020) AND ITS ALIGNMENT WITH SDG 8 AND SDG 12: INSIGHTS FOR VISION 2030 AND GLOBAL SUSTAINABLE DEVELOPMENT PRACTICES

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ARTICLE INFO	ABSTRACT
<p>Article History:</p> <p>Received 15.11.2025 Accepted 15.03.2026 Published 25.04.2026</p> <p>Keywords:</p> <p>Saudi Arabia, Vision 2030, SDG 8, SDG 12, sustainable tourism, tourism economics, data analytics, Python, time-series analysis, policy monitoring</p>	<p><i>This paper assesses the growth dynamics of the Saudi Arabian tourism industry using Tourism Demand Statistics 2015-2020 data, including key variables such as total tourist trips, nights, total expenditures, and average spending. The analysis specifically covers the period from 2015 to 2019, excluding 2020 data due to the massive disruptions caused by the COVID-19 pandemic. This omission would mean the study is centered on trends before the pandemic, and it would provide a better perspective on how Vision 2030 will affect the growth and sustainability of tourism. The study evaluates how Saudi tourism aligns with the Sustainable Development Goals (SDGs), especially SDG 8 (Decent Work and Economic Growth) and SDG 12 (Responsible Consumption and Production). The results show that tourism is growing strongly up to 2018, and the number of tourist trips and spending will continue to increase, supporting SDG 8 economic goals. Nevertheless, SDG 12 alignment is inconsistent, with the increase in per-night expenditure indicating that resource consumption is growing, while there are no substantial improvements in sustainability. The 2019 recession is an indicator of the sector's susceptibility to exogenous shocks and underscores the need to implement policies that promote resilience and sustainable growth. The paper presents practical suggestions for policymakers and underscores the need for real-time surveillance of tourism and enhanced sustainable practices to facilitate its long-term development in line with the objectives of Vision 2030.</i></p>

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1. Introduction

Vision 2030 is a transformative national vision for Saudi Arabia that aims to reduce the Kingdom's reliance on oil and accelerate economic diversification. Tourism is one of the most strategically flagged sectors in this plan. It has been categorised as a leading factor in creating employment opportunities, investment promotion, and global cultural exposure in the country (Ashley et al., 2007). This has been contributed to by the number of government-sponsored

mega projects (including the Red Sea Project, Qiddiya, Al-Ula development, and the introduction of tourist visas) (Almakaty, 2025). The initiative aims to attract international tourists, create sustainable jobs, involve more people locally in tourism services, and modernize the country's tourism infrastructure.

The need for tourism as a sustainable development means is globally contextualized through the initiative of the United Nations Sustainable Development Goals (SDGs), specifically SDG 8 (Decent Work and Economic Growth) and SDG 12 (Responsible Consumption and Production) (Boluk et al., 2019). SDG 8 promotes inclusive economic growth and productive employment that is not only inclusive but also focused on job productivity (Frey, 2018), whereas SDG 12 is focused on the reduction of environmental footprints and the development of sustainable infrastructure and consumption (Gasper et al., 2019). In tourism, such objectives rest on a dual tenet: the capacity to generate economic impacts without causing economic or social effects beyond the imaginable limits.

Nevertheless, as Vision 2030 proposes aspirational policy frameworks, existing research on tourism development in Saudi Arabia and these two SDGs has been lacking, especially in empirical, replicable studies examining the compatibility of tourism growth in the state with these two SDGs. Most of the previous evaluation mostly depends on the macroeconomic forecasts or qualitative observations without considering longitudinal climatological data trends or a proxy of sustainability (Ali et al., 2025; Saleem et al., 2025). In addition, the Gulf region is deprived of free-to-use, good-to-copy analytics frameworks to oversee the tourism development in a real-time or near-real-time (Ditta et al., 2025). This does not provide policymakers and analysts with fine-grained information on trade-offs between growth and sustainability.

In response to this gap, this paper will conduct research that will ask three research questions: (1) What are the trends in tourism growth in Saudi Arabia from 2015 to 2020? (2) To what extent are these trends aligned with SDG 8 and SDG 12 targets? (3) How useful has Vision 2030 been in making the tourism sector follow a more sustainable and resilient pathway? This will be addressed by providing answers using a Python-based time-series analysis of official tourism indicators.

2. Literature Review

Tourism is an age-old industry that has been credited with fostering economic growth, especially in emerging economies that have sought to diversify revenue sources and create jobs. According to Sustainable Development Goal 8 (Decent Work and Economic Growth), most studies have stressed the fact that tourism is positively linked to the creation of jobs, growth of domestic product, and economic growth at the regional level (Kreinin & Aigner, 2022; Stoian et al., 2019). According to research by the World Tourism Organisation (UNWTO) and other development agencies, tourism significantly creates jobs in both skilled and unskilled labor markets (Telfer & Sharpley, 2015). In the case of Saudi Arabia, literature preceding Vision 2030 essentially positioned tourism in the context of religious pilgrimage, and post-2016 events have enabled tourism to broaden the scope in cultural and leisure tourism as well as in entertainment tourism, and this has helped in diversifying occupations and create higher revenue potential (Abuhjeeleh, 2019).

At the same time, the topic of tourism's contribution to environmental sustainability, as reflected in the title of SDG 12 (Responsible Consumption and Production), has been increasingly discussed. Among the primary issues are the pressure on the environment that such large-scale infrastructure projects place, the over-exploitation of natural resources, and the increasing amount of energy used by each person (Jaber, 2025). Some trends in accommodation, such as hotel capacity growth and occupancy levels, are commonly considered proxy measures of tourism demand but also serve as indicators of resource intensity and environmental pressure. According to Khater et al. (2024), the development of the tourism infrastructure may hamper the prospects of conserving the environment without any form of sustainable planning and regulation (Khater et al., 2024). Different world experiences have identified interventions to mitigate the environmental impact of tourism, including eco-certification schemes, green hotel rooms, and contiguity spheres in the provision of hospitality services.

Top-down, policy-based initiatives heavily supported by governments have driven tourism development in the Gulf. The importance of religious tourism, more so Hajj and Umrah, has been the most significant factor in the tourism industry of Saudi Arabia (Bokhari, 2018). Nevertheless, the Vision 2030 is indicative of an interest in entertainment, nature-based, and international cultural tourism (Ibrahim et al., 2021; Rehman et al., 2023). Investments such as NEOM, Red Sea Development, and Qiddiya are giga-scale projects aimed at making the Kingdom an international tourist hub. The projects are meant to create employment opportunities and foreign investment, along with concerns about socio-cultural impacts and the sustainability of the environment in the long run (Aldusari, 2023; Bahreldin et al., 2025; Robitzch et al., 2023).

Despite these, there is a significant lack of conventional analytical frameworks to assess tourism's conformity with the SDG standards. In most studies, the research focuses on economic projections or qualitative analyses, with little attention to incorporating time-series forecasting or data science methods. Practically none of them use Python-based analytics and real-time dashboarding to track SDG progress. This paper fills that gap with a qualitative sustainability policy analysis and a quantitative Python-based analysis of domestic tourism indicators. Doing so contributes to the scholarly discussion and practical policymaking within the Saudi and the greater Gulf region.

3. Methodology

3.1 Proposed Framework Architecture

Figure 1 presents a scientifically oriented, Python-based method for evaluating Saudi tourism data between 2015 and 2020.

This started with cleaning up the data, after which analytical techniques were applied, including CAGR and correlation analyses using pandas and numpy. The SDG 8 and 12 proxies are read and represented in radar charts, time series, and a heatmap. They provide insights to assess the effectiveness of Vision 2030 and the extent to which it balances growth and sustainability, enabling the establishment of tourism policies based on evidence.

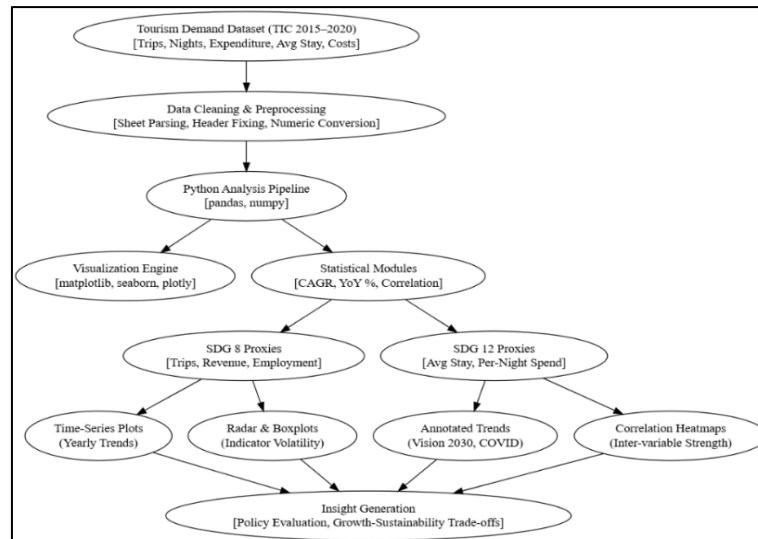


Figure 1: System Framework

3.2 Data Source and Preprocessing - The study used the [Tourism Demand Statistics 2015-2020 Saudi Arabia](#) dataset, which provides key performance indicators for examining both the economic and environmental aspects of tourism. The most significant variables derived in this research were total tourist trips (in thousands), tourist nights, total tourist spending (in Saudi Riyals), average trip length (in nights), average trip spending, and average night spending. The indicators provide a holistic picture of the factors that determine the alignment of Saudi tourism with SDG 8 (economic growth) and SDG 12 (sustainability).

As the dataset covers data through 2020 but not this year, which is excluded due to disruptions from the COVID-19 pandemic, the analysis is based on the years between 2015 and 2019 to ensure consistency and eliminate distortions associated with the pandemic's effects on tourism. The preprocessing process entailed several major steps, including cleaning and preparing the data for analysis. To start with, the raw dataset had more than one sheet; the data about which was in sheet G1. Non-numeric values were replaced with NaN and later removed to maintain data integrity. Also, the column names were changed, and all multilingual artifacts and formatting anomalies were scrubbed to remove data inconsistencies.

The cleaned data were then transposed to prepare for time-series analysis, with years (2015–2019) as the index labels and tourism indicators as the column headers. This conversion enabled trends and comparisons to be easily monitored and tracked over time. The study may have excluded 2020 data, which was affected by global disruptions, to focus on pre-pandemic trends and provide a clear view of how Vision 2030 affected tourism growth and sustainability. Time-series analysis was performed on the final processed data to monitor the development of the major indicators from 2015 to 2019.

3.3 Python-Based Analytical Pipeline - The analysis was conducted using Python-based tools, including pandas for data manipulation, matplotlib and seaborn for data visualization, and NumPy for numerical operations. The dataset was divided into two periods: pre-Vision 2030 (2015–2017) and post-Vision 2030 (2018–2019), to evaluate the impact of Vision 2030 policies on tourism. Key analytical techniques included:

- Compound Annual Growth Rate (CAGR) to assess long-term growth.
- Year-over-Year (YoY) percentage fluctuations to capture short-term trends.
- Pearson correlation to examine relationships between key tourism indicators (e.g., tourist trips, expenditure, average stay).

3.4 SDG Alignment Proxies - In the case of SDG 8 (Decent Work and Economic Growth), total trips and expenditure were adopted as proxies for macroeconomic indicators. These variables indicate the sectoral growth, revenue generation, and employment that can be made available in the tourism industry. For Sustainable Development Goal 12 (Responsible Consumption and Production), proxies included average length of stay and average expenditure per night. These signals provide a glimpse into resource consumption, accommodation pressure, and per-capita consumption trends that influence sustainability.

3.5 Visualisation Strategy - The visual analytics approach in the study consisted of numerous plots and diagrams to clearly and effectively convey insights. The long-term magnitude of changes across the major indicators was shown through time-series plots, annotated line graphs that marked policy milestones of the Vision 2030, and the disruptive effect of COVID-19 in 2019. It was observed that variance and outlier behaviour across indicators were visualised in boxplots and heatmaps to facilitate the interpretation of SDG alignment and inter-variable dependencies.

4. Result and Analysis

4.1 Time-Series and Growth Patterns - Tourist travel and overall spending in Saudi Arabia grew steadily between 2015 and 2018. As noted in Figure 2, both indicators have been on the upswing over the years, with total tourism revenue recovering significantly relative to the growth in the number of tourists. This trend indicates that Saudi Arabia was attracting more value tourists or expanding its premium tourism products, which may have been driven by the strategic adjustments under Vision 2030. This is in line with SDG 8 (economic growth), as the increase in tourist numbers and spending indicates economic diversification and the creation of job opportunities in the tourism industry. This trend was interrupted, though, in 2019, with tourist trips and spending decreasing significantly. The sharp decline, as shown in Figure 2, underscores the tourism industry's vulnerability to external factors, including the COVID-19 pandemic, which severely affected international travel. This is a counter-intuitive decline that underscores the importance of resilient planning in the tourism sector to protect business development and reduce risks in the event of a global crisis.

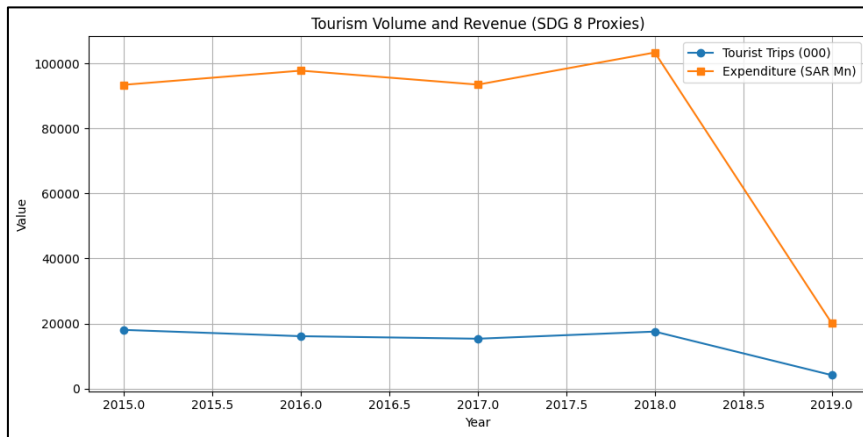


Figure 2: Tourism Volume and Revenue (SDG 8 Proxies)

4.2 Pre vs Post-Vision 2030 Comparison - To determine the extent to which policy reforms influence the desired outcomes, Figure 3 presents the means for each indicator across two time periods: pre-Vision 2030 (2015-17) and post-Vision 2030 (2018-19). As seen through the visualisation, in the post-reform period, all core indicators, tourist trips, nights, and expenditure experienced increased averages, which indicates the early signs of the effectiveness of the implemented policy. These gains were compromised by the pandemic's systemic shock, which largely eroded the momentum by the late years of 2019. This trend highlights the success of the initial reforms and the vulnerability of tourism-based economic plans unless they are countered with resilience systems.

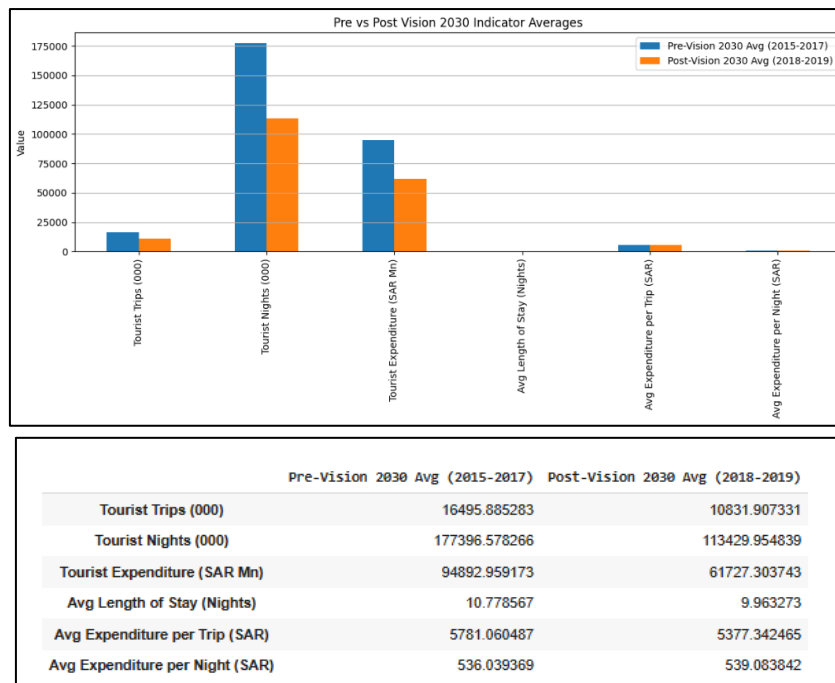


Figure 3: Pre vs post-Vision 2030

4.3 Annotated Trends and Policy Markers - Figure 4 places the time-series data in the context of policy and world event annotations. Vision 2030 was introduced in 2016 and is associated with all KPIs, resulting in positive trends and demonstrating its short-term impact. The downturn in 2019 is evident, though, in the world's COVID-19 crisis. This annotated plot illustrates why policy implementation guidelines must go hand in hand with contingency planning. The gains realised by enforcing reform may be erased without sound systems that mitigate shocks.

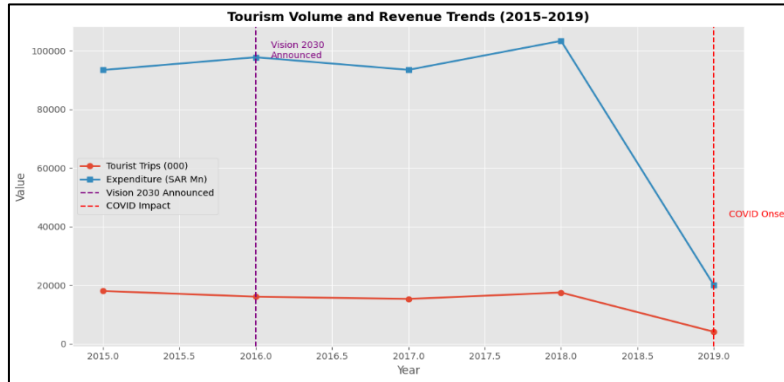


Figure 4: Tourism Volume and Revenue Trends (2015-2019)

4.4 Growth Rate Summary (CAGR) - The compound annual growth rates (CAGRs) of each indicator from 2015 to 2019 are summarised in Figure 5. The results are impressive: tourist trips decreased by 30.8%, tourist nights by 32.9%, and total expenditure by 31.8%. The average expenditure per night grew by 1.59%, indicating that, although the number of tourists travelling and the number of nights stayed the same, tourists spent more per night. This points to a movement towards quality tourists and raises questions about sustainability and accessibility.

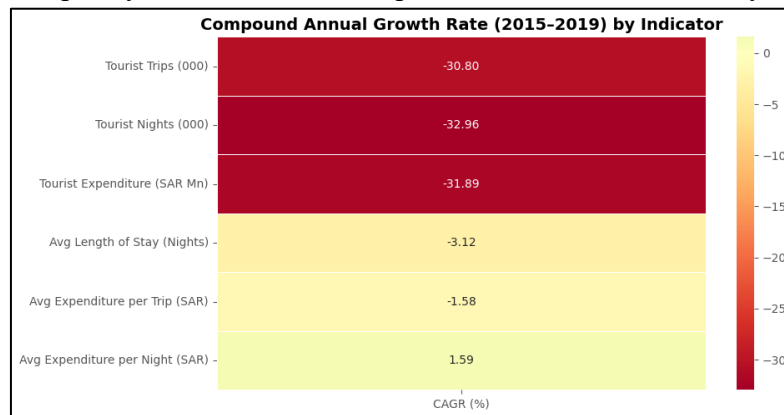


Figure 5: Compound Annual Growth Rate (2015-2019) by Indicator

4.5 Correlation Matrix Insights - Figure 6 presents the Pearson correlation matrix for the six leading indicators. All tourist trips, nights, and total expenditure exhibit a strong positive correlation, and the analysis indicates that volume leads to revenue under normal circumstances. In addition, average spending per night shows low or erratic relationships with other measures, suggesting it will not be part of the overall trends around volume-driven patterns. Its behavior may be connected with market segmentation or higher prices instead of being part of the systemic economic measure that could indicate the lack of sustainable consumption objectives within SDG 12 (Gasper et al., 2019).

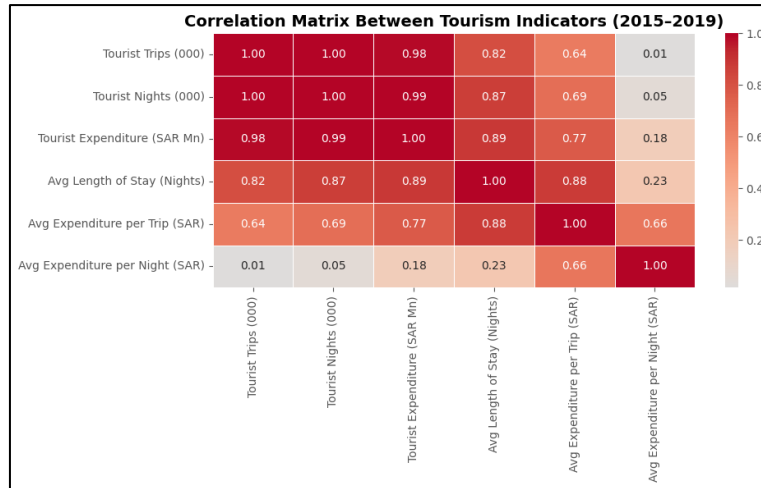


Figure 6: Correlation Matrix Between Tourism Indicators (2015-2019)

4.6 Expenditure & Consumption Trade-offs - Figures 7 and 8 also disaggregate the correlation between expenditure and consumption measures. Although average spending per trip increased steadily until 2018, the peak decreased significantly in 2019. Likewise, the average length of stay decreased over the same period, indicating shorter visits, potentially due to travel restrictions or cost increases. These changes imply that, though total revenue was robust, it was achieved at the expense of more intense short-stay tourism, potentially placing greater pressure per tourist attracted into the country.

Figure 7: Tourist Expenditure vs. Avg Expenditure per Trip

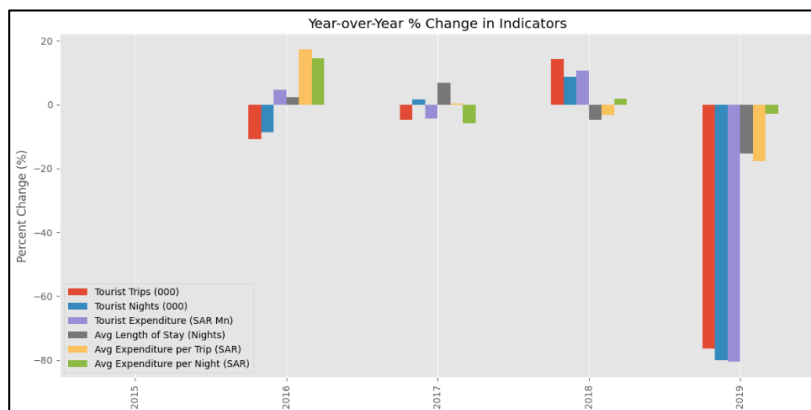
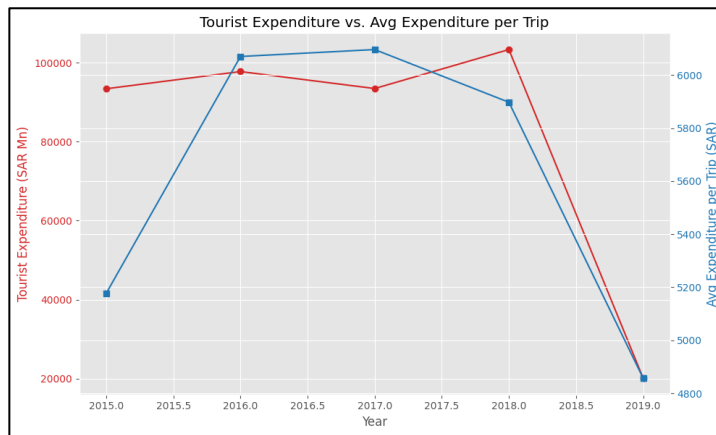


Figure 8: Year-over-Year % Change in Indicators

4.7 SDG 12 Sustainability Visuals - The trade-off is shown in Figure 9, which plots average length of stay against average expenditure per night, demonstrating a small but significant trade-off. Still, as stays became shorter, spending per night rose, suggesting an intensification of consumption. This insight can also be illustrated with Figure 10, a radar chart showing that most tourism performance gains are skewed toward macroeconomic KPIs. In contrast, the sustainability metrics are either flat or curved. This scale imbalance raises doubts concerning the industry's medium- and long-term ecological footprint.

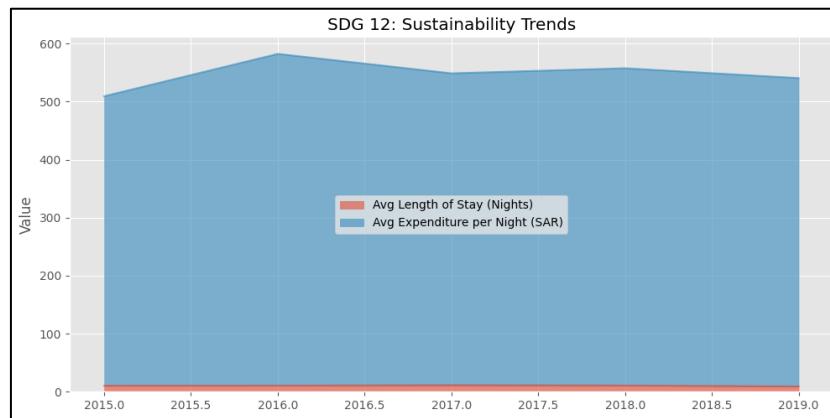


Figure 9: SDG 12: Sustainability Trends

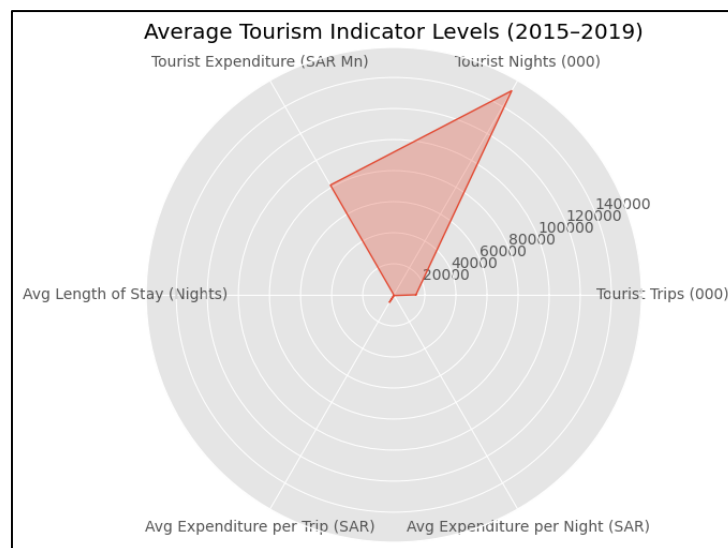


Figure 10: Average Tourism Indicator Levels (2015-2019)

4.8 Distribution Analysis - Figures 11 and 12 investigate resilience and consistency of the indicators. Figure 11 shows the grid layout of all tourism KPIs for 2019, highlighting their volatility. As shown in the boxplot in Figure 12, although tourist trips and nights declined sharply, expenditure remained quite stable. This suggests that high-value tourism segments could be more resilient, but at the expense of greater sustainability. In general, the evidence favors one of the questions, i.e., economic benefits were real but precarious, and sustainability alignment has yet to be achieved.

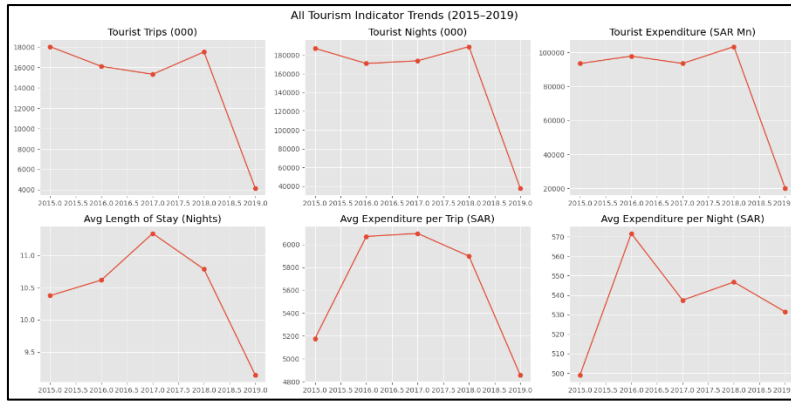


Figure 11: All Tourism Indicator Trends (2015-2019)

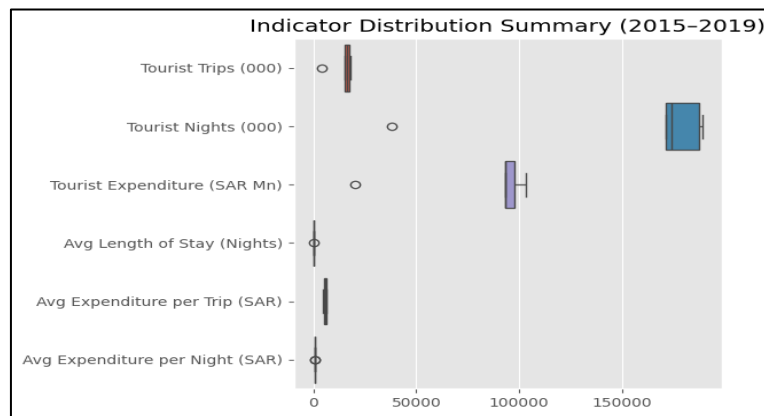


Figure 12: Indicator Distribution Summary (2015-2019)

5. Discussion

5.1 SDG 8 Alignment - The analysis strongly supports the claim that the tourism sector in Saudi Arabia was closely aligned with Sustainable Development Goal 8 (Decent Work and Economic Growth) in the early years of implementing Vision 2030, especially from 2016 to 2018. With an increase in the number of tourist trips and rapid growth in total tourism spending during this period, numerous job opportunities were created, and the expansion of tourism-related services positively contributed to GDP. This is consistent with the previous analysis conducted by Igoumenakis et al. (2024), which highlighted how tourism boosts emerging economies through diversification. The ascertained CAGR without this deterioration in 2019 suggests that the sector had strong momentum until the systemic management of COVID-19 disrupted it. Moreover, the correlation matrix demonstrated the adequacy and interdependence of tourist trips, nights, and expenditure, and their usefulness as macroeconomic proxies. It echoes the conclusions given by Gössling and Hall (2019) In their case, they wrote that, with adequate management of tourism volumes, it could be directly linked to SDG 8 through the employment and growth of the private sector in developing countries.

5.2 SDG 12 Alignment - Contrastingly, with SDG 12 (Responsible Consumption and Production), the results were much more mixed. The average length of stay was quite steady throughout much of the study period, but average expenditure per night rose steadily. This

increase in consumption per night could indicate a shift to higher-value and luxury-oriented tourism segments- an upside on the revenue side, but on the sustainability front, it is problematic. According to Becken and McLennan (2017), the greater the per-tourist consumption, the greater the unequal pressure on local infrastructure, water, and energy sources, particularly through a decrease in tourist volume and an increase in stable or even growing revenues. The radar and boxplot plots highlighted this imbalance: national KPIs were skewed toward economic performance, while variability in resource efficiency indicators was either higher or stagnant. These results also resonate with earlier warnings by UNEP (2016), which documented the dangers of tourism-related environmental degradation in emerging economies that have become popular tourist destinations but lack proper regulatory enforcement.

5.3 Vision 2030 Policy Implications - The statistics show that Vision 2030 had a quantifiable short-term impact on tourism performance. The number of arrivals, beds, and expenditure have risen from 2016 to 2018, indicating that the policy has effectively stimulated the sector's growth. Nevertheless, this sudden decline in all measures in 2019 shows a severe weakness in the built-in resilience measures. According to Romão (2021) Sustainable growth requires both growth and stability, as well as resilience against external shocks. Saudi Arabia lacked protective buffers, such as domestic tourism strategies or diversified travel products, and thus was vulnerable to international shocks such as COVID-19. The results also show missed opportunities in institutionalising environmental protection and other systems to manage crises when implementing Vision 2030.

5.6 Global Benchmarking - Comparing the tourism industry in Saudi Arabia with those of the UAE and Malaysia offers some insightful insights. As an example, the Dubai Tourism Performance Dashboard provides real-time monitoring of such key performance indicators as the number of tourists, the average duration of spending, and the average length of stay, allowing for a response to the policy in a short period and making decisions based on the data (Shadab, 2018). The Malaysian Green Hotel Award encourages a clean, eco-friendly environment in the hotel industry, helping bring environmental development to the forefront of tourism. The adoption of initiatives such as real-time tourism monitoring tools and sustainability certifications by Saudi Arabia would improve its growth and sustainability, provided they are based on global best practices.

6. Conclusion & Policy Recommendations

The paper points out that the tourism industry in Saudi Arabia experienced robust growth until 2018, indicating a high level of congruence with SDG 8 (economic growth). This expansion has been reflected in increased tourist trips and overall spending, which point to the economic diversification targets of Vision 2030. Nevertheless, there is still no alignment with SDG 12 (sustainability), as spending per night is rising without a corresponding increase in resource efficiency.

A number of measures are suggested to achieve sustainability and resilience. Firstly, the Ministry of Tourism ought to lead the development of a real-time tourism performance dashboard to monitor key tourism indicators, such as the number of tourists, expenditure trends,

and resource consumption. This would enable timely policy changes based on real-time data, in line with the UAE's digital tourism monitoring systems. Secondly, to address the sustainability gap identified in SDG 12, eco-certification schemes should be promoted in policies, and sustainable tourism practices should be implemented across the entire hospitality industry. These would help reduce the resource-intensive nature of tourism and ensure sustainable long-term growth. Lastly, the sector needs to build resilience by developing strategies to support domestic tourism and diversifying its product offerings. Such a strategy would alleviate the effects of international uncertainties, such as the 2019 downturn in tourism indicators, making the industry more resilient to unexpected obstacles.

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Author Contributions - All authors contributed equally to the conception, design, data analysis, interpretation, and manuscript preparation.

Data Availability - The datasets analyzed in this study are available from the official Tourism Information and Research Centre (MAS) in Saudi Arabia.

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