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Original Research Article

Tourism Efficiency Across Indian States: A Data Envelopment Approach

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Abstract: Tourism has become a dynamic economic driver in India, propelled by global openness, affordable travel, and rising incomes. Despite its rapid growth and significant policy support evidenced by India's rise from 65th to 34th in the 2019 Travel & Tourism Competitiveness Index and subsequent rebound to 39th by 2024, the sector exhibits persistent regional disparities. Employing a two-decade (2003–2022) Output-Oriented Technical Efficiency (OOTE) analysis using the DEA-BCC model across 18 tourism-centric states, this study benchmarks performance separately for domestic and foreign tourism. Inputs include employment, accommodation capacity, and tourism investment. The results reveal that only a minority of states achieved near-full efficiency: 16.7% in domestic and 22.2% in foreign segments. Mean OOTE scores are 0.60 and 0.65 for domestic and foreign tourism, respectively, with notable temporal trends: efficiency growth till 2008, a dip post-global crisis, recovery into 2016, pandemic-induced declines, and a post-pandemic resurgence. Spatial analysis highlights top performers (e.g., Uttar Pradesh, Bihar, Sikkim) and laggards (e.g., Assam, Odisha). Correlation analysis shows strong alignment between domestic and foreign efficiency in some states, but stark divergence in others. These findings offer new subnational insights into tourism efficiency, providing a data-driven foundation for targeted policy interventions aimed at reducing regional inequities and promoting sustainable growth.

Keywords: Data Envelopment Analysis, Tourism efficiency, Output-oriented technical efficiency Domestic Tourism and Foreign Tourism.
JEL Classification: C61, C67, O18

1. INTRODUCTION

In recent years, tourism has emerged as a powerful economic engine globally, fuelled by increased international openness, regional mobility, low airfares, and rising income levels. Developing countries, including India, have embraced tourism as a strategic tool for regional development. It contributes significantly to national income and job creation, making it the fastest-growing service sector in India. Before the COVID-19 pandemic, India ranked 34th in the Travel & Tourism Competitiveness Index (TTCI) 2019—an impressive leap from 65th in 2013. However, in the 2021 Travel and Tourism Development Index, India slipped to 54th, reflecting pandemic-induced disruptions and again it improves its position to 39 out of 119 countries (TTCI, 2024). The tourism sector showed strong recovery in post-COVID period. According to the World Travel & Tourism Council (WTTC), in 2023, India's tourism GDP contribution reached 5.9%, and the sector created 14.6 million jobs in 2022. By 2033, it is expected to employ over 58 million people and contribute nearly 7% to GDP. Recognizing its potential, the Indian government has launched several initiatives as (a) Incredible India campaign (2002) to showcase India's cultural and spiritual wealth, (b) Swadesh Darshan Scheme (2014–15) to promote theme-based tourism, (c) E-Tourist Visa (2014) for simplifying international travel, (d) National Integrated Database of the Hospitality Industry (NIDHI) to organize the hospitality sector, and (e) "Heal in India" & "Heal by India" (2022) to promote medical tourism. Despite these initiatives, regional disparities remain daunting task for policymakers and scholars worldwide (Trejo-Nieto, 2025; Tan *et al*., 2023). Tourism can play a crucial role in reducing these by redistributing wealth from developed to underdeveloped states in a country like India and many other countries (Zhang, 2023; Rasmita *et al*., 2022; Natasha & Satar, 2018; Ohlan, 2017; Banday & Ismail, 2017). The literature on tourism efficiency demonstrates that DEA and its extensions—such as the Malmquist index, two-stage/network DEA, bootstrap adjustments, and Tobit regression—are

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effectively applied across multiple scales (regional, national, firm-level) to evaluate technical, environmental, and service-quality performance. Studied by Cracolici *et al* (2007) applied DEA to Italian regions, finding stagnant efficiency from 1998–2001 and recommending output-focused strategies—e.g., boosting bed-nights and enhancing destination branding through coordinated public planning. Botti *et al*. (2009) similarly DEA in 22 French regions, identifying 12 underperformers and highlighting the role of "E attractions" in prolonging tourist stays. Bi *et al*. (2011) used DEA across China's 31 provinces, revealing stark regional disparities and urging local governments to improve internal efficiencies. Pandey & Satapathy (2014) illustrate DEA's efficacy beyond tourism—examining India's oil refineries and showing 91.66% operational efficiency—highlighting scope for broader sectoral adoption. Soysal Kurt (2017) extended this approach for evaluating 29 European nations and found sixteen countries were found efficient, and thirteen inefficient, with tailored recommendations aimed at optimizing resource allocation. Prorok *et al*. (2019) and Radovanov *et al*. (2020) applied DEA &Tobit regression to assess efficiency across Economic Union, West Balkan, and global contexts, underscoring GI-strategies, GDP contributions, and visa processes as key drivers. Complementary to technical efficiency analyses, Qiu *et al*. (2017) assess China's tourism eco-efficiency via CO_2 emissions and the LMDI decomposition, identifying uneven eco-performance contingent on scale, structure, tech, and policy. At national and firm levels, Li *et al*. (2021) critique standard DEA for scale inefficiencies in tourism firms, advocating for frontier models capturing non-convexities and firm consolidation. Similarly, Hosseini & Hosseini (2021) show inadequate infrastructure limits tourism efficiency in developing countries via a super-efficiency slack-based DEA. On the determinant side, Selvakumar (2014) explores demand-side opportunities in India's "Special Interest Tourism," noting a 63% global market share and sizable domestic potential. Chen *et al*. (2018) evaluate Taiwan's service-quality efficiency, discerning source-market variations—e.g., higher spending but lower satisfaction among South Korean visitors—and stress supply-demand balance. Meanwhile, He *et al*. (2021) integrate undesirable outputs into Malmquist index models, revealing low energy efficiency and capital-energy misalignment in Chinese tourism, recommending green investments. Li & Liu (2022) demonstrate how industrial clustering positively affects efficiency via three-stage DEA adjustment for environmental factors. Hence, evaluating tourism efficiency across Indian states is crucial for effective policy formulation. The existing literature remains limited in this area, and the present study aims to bridge this gap. Specifically, the objectives of this paper are twofold: to estimate output-oriented technical efficiency (OOTE) for both foreign and domestic tourism and to identify the lagging states. This study makes two significant contributions to the existing body of research. First, most prior studies have primarily focused on trends and growth performance of the tourism industry at national and international levels, with limited attention to efficiency at the subnational level. Second, although a few studies have assessed efficiency at the international level, there is dearth in the study at the national level. This study, however, offers a comprehensive analysis of tourism efficiency across Indian states. The findings are expected to contribute meaningfully to the design of policy frameworks that are essential for promoting regional development and guiding targeted policy interventions.

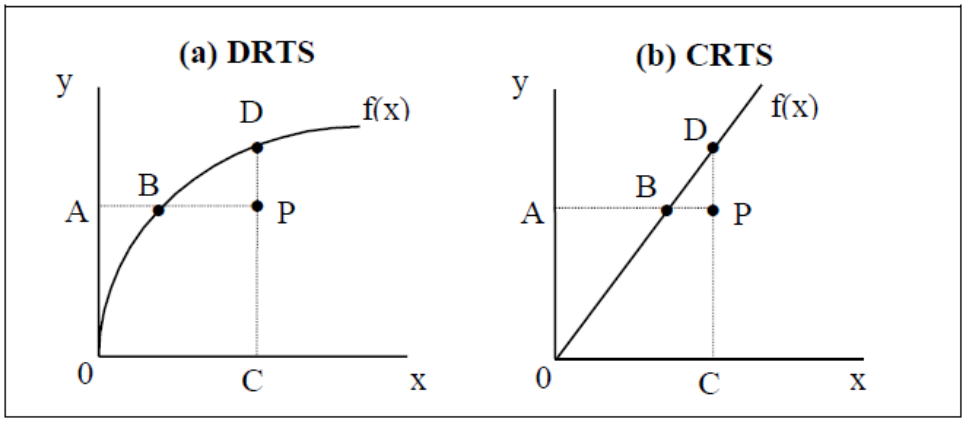
2. DATA SOURCES

To examine the state-level efficiency of foreign and domestic tourism and its key determinants in India, this study utilizes secondary data spanning the period from 2003 to 2022. The data have been compiled from a variety of reputable sources, including: India Tourism Statistics at a Glance; Basic Tourism Statistics, Ministry of Tourism, Government of India; Census of India (2001 and 2011); Reserve Bank of India (RBI) Database on Indian Economy; National Sample Survey Office (NSSO) Reports – 65th and 72nd Rounds on Domestic Tourism in India; Indiastat.com. For the purpose of this analysis, 18 tourism-prone Indian states have been selected based on their prominence in the national & international tourism landscape. These states are: Kerala, Rajasthan, Goa, Punjab, Himachal Pradesh, Uttar Pradesh, Gujarat, Jammu & Kashmir, Karnataka, West Bengal, Andhra Pradesh, Assam, Madhya Pradesh, Maharashtra, Sikkim, Bihar, Tamil Nadu, and Odisha.

3. METHODS

Banker, Charnes, and Cooper (BCC) version of DEA method has been applied in order to compare the efficiency of tourism development in 18 Indian states during the time span from 2003-2022. DEA is a non-parametric approach which can accommodate multiple inputs and outputs without needing a specific functional form (Radovanov *et al*., 2020; Horvat,2018; Chen *et al*., 2018; Skrinjaric, 2018, Horvat & Radovanov,2016). This study estimates the Output-Oriented Technical Efficiency (OOTE) using DEA approach to analyze the tourism industry's performance across Indian states—separately for foreign and domestic tourism. Inputs used are Number of Employees (a person engaged actively as full-time/part-time in the tourism sector basically in the hotels), Accommodation (number of governments recognised hotels under the normal, star and heritage category) and Investment (Number of projects sanctioned by the Ministry of Tourism, government of India essentially in relation to Infrastructure Development, Promotion and Marketing, Skill Development, Research and Information Technology [Lisowska, A. (2017); Matakovic and Cunjak (2019); Biagi and Detotto (2014); Mawby and Vakhitova (2022); Hua and Zhang & Li (2020); Mihalic (2014); Sharma, S. (2022)]. Here variable returns to scale (VRS) have been assumed.

A foreign tourist is a person visiting India on a foreign passport, staying at least twenty-four hours in the country. Whereas domestic tourist is considered as a person who travels within the country to a place other than his usual place of residence and stays at hotels or other accommodation establishments run on commercial basis or in dharam shalas/ sarais /musafir khanas /agrashalas/ choultries etc. for a duration of not less than 24 hours or one night and for not more than 12 months at a time. To visualise the output oriented technical efficiency, we are assuming that there is data on a single input (X) and single output(Y). In the left side figure (a) depicted below indicates that output is measured on the vertical axis and input is measured on the horizontal axis. We have a decreasing return to scale technology represented by f(x) and a firm is operating at point 'p'. But the maximum attainable output with the same input is the point 'D' on the production curve. Therefore, the output oriented technical efficiency will be equal to CP/CD. Whereas the input oriented technical efficiency will be equal to AB/AP. In case of CRS these two measures will be equal which is shown in the right-hand side figure. The efficiency score of a decision-making unit (DMU) varies between 0 to 1 where 1 indicates fully efficient and vice -versa.



The following linear programming model is considered to perform the analysis.

maxθ

Subject to $\sum_{j=1}^{n} x_{ij}\lambda_j \leq x_{i0}$ i=1, 2,……m;

$\sum_{j=1}^{n} y_{rj}\lambda_j \geq \theta y_{r0}$ r=1, 2,……s;

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j \geq 0$$

Here 'n' is the number of decision-making units (DMUs). Assume that we have*s* output variables and 'm' input variables. Observed output and input values are $y_r$and x_i, respectively, λ is the DMU's weight and the efficiency score is θ.

4. RESULTS & DISCUSSION

The output-oriented technical efficiency (OOTE) of domestic tourism visits (DTV) across India's 18 major tourism-prone states reveals that only 16.7 percent of these states achieved near-full efficiency (OOTE 0.91–1.00) during the sample period (2003–2022). Conversely, the remaining 83.3 percent fell short of full efficiency, with mean OOTE scores ranging from 0 to 0.90. Among them, 27.8 percent recorded low efficiency (0–0.40), 22.2 percent fell in the 0.41–0.60 range, 16 percent fell between 0.61–0.80, and another 16 percent were in the 0.81–0.90 bracket. In the case of foreign tourism (2003–2019), 22.2 percent of states achieved near-full efficiency (OOTE 0.91–1.00). Meanwhile, 29.4 percent of states scored very low (0–0.40), 16 percent scored between 0.41–0.60, another 16 percent fell in the 0.61–0.80 range, and 16.7 percent were in the 0.81–0.90 bracket. Overall, the grand mean OOTE for domestic tourism ranged from 0.06 to 1.00, with an average of 0.60—half the states scored below this norm and half above it. For foreign tourism, OOTE ranged from 0.26 to 1.00, with a grand mean of 0.65; approximately 44.4 percent of states scored below this average, and 55.6 percent scored above (Figure-1).

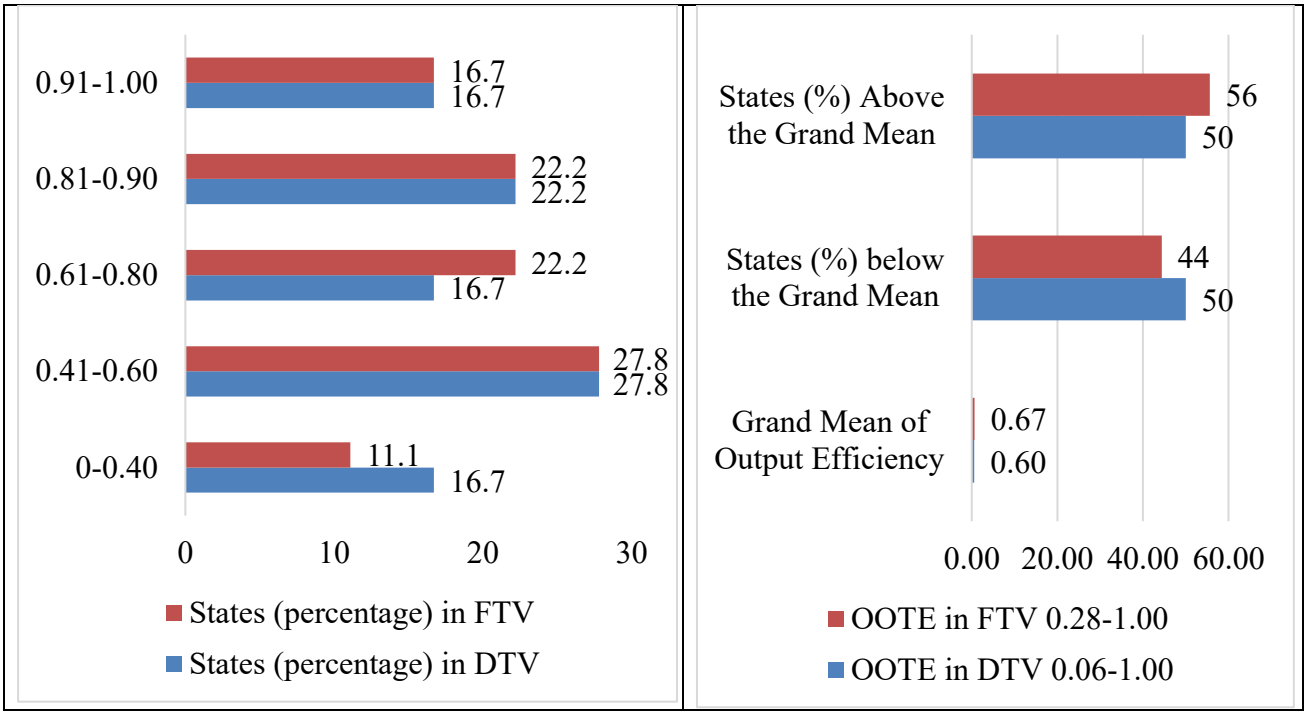


Figure 1: Output Oriented Technical Efficiency (OOTE) of Domestic Tourism Visits (DTV) and Foreign Tourism Visits (FTV)

Sources: Authors Calculation from Basic Tourism Statistics by Ministry of Tourism, Government of India, 2003-2022

Figure 2 shows the year-by-year average Output-Oriented Technical Efficiency (OOTE) of Domestic Tourism Visits (DTV, in blue) and Foreign Tourism Visits (FTV, in orange) across the sample of states, covering the years 2003 to 2022. From the period 2003–2008 both domestic and foreign tourism efficiency enhanced steadily, with foreign tourism consistently outperforming domestic until around 2008. In the post-2008 slowdown, both series dip after the 2008 global crisis, bottoming out roughly around 2011, indicating external shocks or operational inefficiencies. During 2012–2016, we observed this time span as a strong rebound period, especially notable in foreign tourism efficiency, which surged to 0.80 in 2016, the period's highest point. The pandemic period 2020–202, indicates a decline both DTV and FTV show significant declines in these years, with foreign tourism falling to 0.43 and domestic to 0.43 or lower—most likely reflecting pandemic impacts. After 2022, both metrics recover in 2022, with domestic tourism rising to 0.59 and foreign tourism to 0.62, showing signs of post-pandemic recovery.

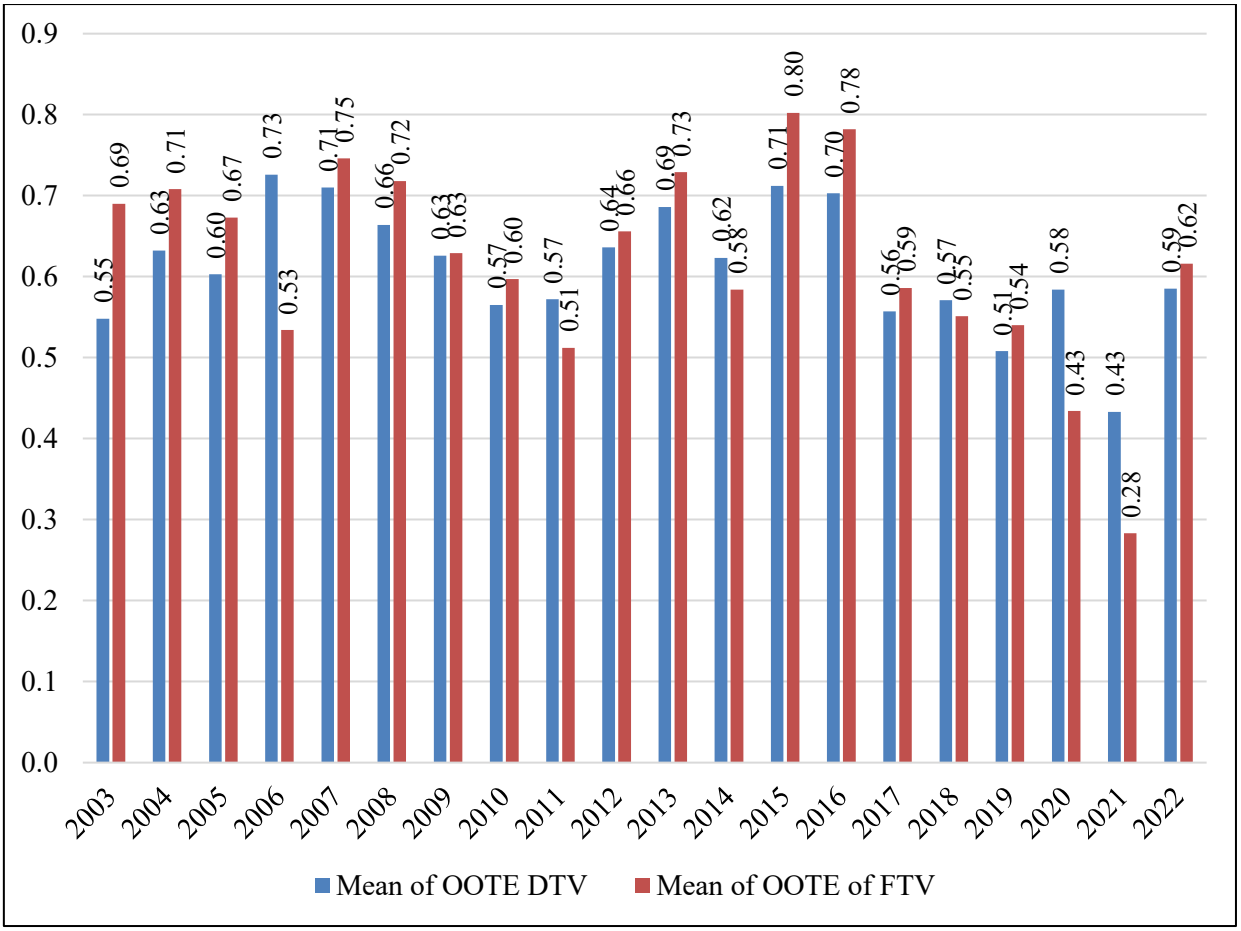
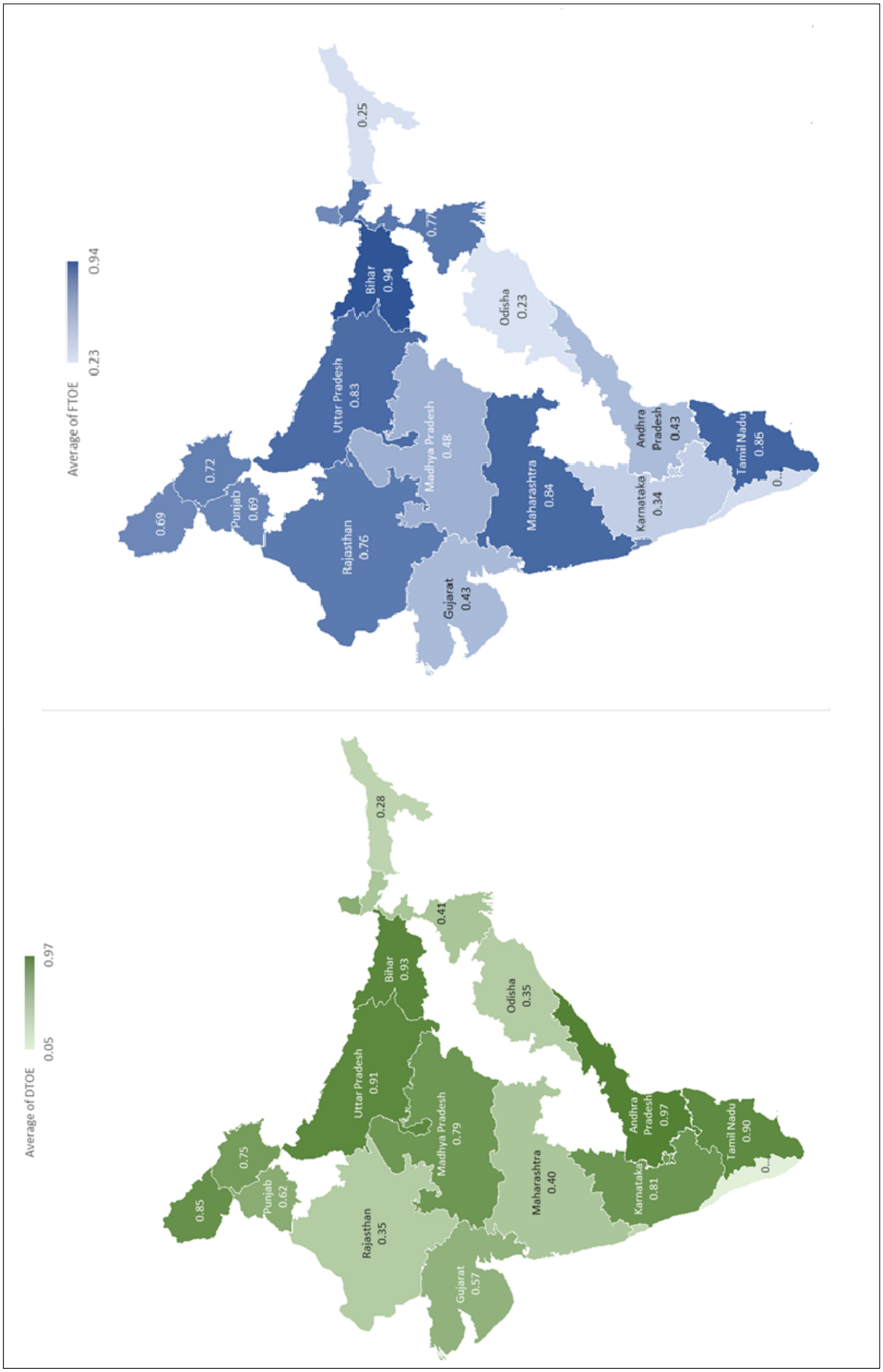


Figure 2: Year wise Output Oriented Technical Efficiency (OOTE) of DTV & FTV across states of India
Sources: Authors Calculation from Basic Tourism Statistics by Ministry of Tourism, Government of India, 2003-2022

Map 1 displays the state-specific output-oriented technical efficiency (OOTE) of domestic tourist visits (DTV) and foreign tourist visits (FTV). It has been found that throughout the years 2003-2022, none of the 18 main chosen states are totally efficient as well as extremely fluctuating, although Jammu and Kashmir(J&K), Karnataka (KR), Bihar (BI), Uttar Pradesh (UP), and Sikkim (SK) are typically above the mean (OOTE). On the other side West Bengal (WB), Goa, Orissa (OR), Rajasthan (RA), and Assam (AS) are among the states that are significantly below the (OOTE) average. In respect of foreign tourism, it is observed that none of the states are entirely efficient as well as the position of the states are very unsteady but predominantly some states are above the mean of OOTE as Uttar Pradesh (UP), West Bengal (WB), Bihar (BI), Panjab (PU) and Maharashtra (MA). Whereas states which are mostly below mean of OOTE are Orissa (OR), Gujrat (GUJ), Jammu and Kashmir (J&K), Sikkim (SK) and assam (AS). In West Bengal (WB), we can observe that it is below the OOTE mean for domestic tourist visits, while it is typically above the OOTE mean for international tourist visits.



Map 1 Average of OOTE of Domestic and Foreign Tourism Visits from 2003 to 2022

Sources: Authors Calculation from Basic Tourism Statistics by Ministry of Tourism, Government of India, 2003-2022

Table 1: Cross classification of states by OOTE of DTV and FTV in 2022

OOTE of FTV	OOTE of DTV					
		Low (0-0.40)	**Moderate (0.41-0.60)**	**High (0.61-0.80)**	**Very High (0.81-0.90)**	**Highest (0.91-1.00)**
	Low (0-0.40)	KE	OR			
	Moderate (0.41-0.60)		AS and Guj	MP	KR	AP
	High (0.61-0.80)		Goa	PU	J&K and SIK	
	Very High (0.81-0.90)		WB		HP, TN	
	Highest (0.91-1.00)	MA and RA				BH and UP

Sources: Authors Calculation from Basic Tourism Statistics by Ministry of Tourism, Government of India, 2003-2022

In the cross-classification table1, we observe that in 2022, the OOTE of FTV was low for Kerala and Orrisa. It was moderate for five states: Assam, Gujarat, Madhya Pradesh, Karnataka, and Andhra Pradesh; high for Goa, Punjab, Jammu & Kashmir, and Sikkim; very high for West Bengal, Himachal Pradesh, and Tamil Nadu; and highest for Maharashtra, Rajasthan, Bihar, and Uttar Pradesh. A one-to-one correlation between OOTE in FTV and DTV was identified for only eight states. Interestingly, Rajasthan and Maharashtra exhibited the highest OOTE in FTV but the lowest in DTV. Meanwhile, Madhya Pradesh, Karnataka, and Andhra Pradesh, which were moderate in FTV OOTE, showed high, very high, or highest levels in DTV OOTE.

Table 2 Correlation of states by OOTE of DTV and FTV between 2003 and 2022

States	**Corelation Between OOTE of DTV & FTV**	**States**	**Corelation Between OOTE of DTV & FTV**
Andhra Pradesh	0.3165	Madhya Pradesh	0.3501
Assam	0.9943***	Maharashtra	0.4675**
Bihar	0.8388***	Orissa	0.9368***
Goa	0.6105***	Punjab	0.8257***
Gujarat	0.4201*	Rajasthan	0.5068**
Himachal Pradesh	0.859***	Sikkim	0.7352***
Jammu and Kashmir	0.7585***	Tamil Nadu	0.6612***
Karnataka	0.3138	Uttar Pradesh	0.5042**
Kerala	-0.1051	West Bengal	0.5349**

Sources: Authors Calculation from Basic Tourism Statistics by Ministry of Tourism, Government of India, 2003-2022

Between 2003 and 2022, the Pearson correlation coefficients between the OOTE of DTV and FTV across Indian states display varied patterns. States such as Assam, Orissa, Himachal Pradesh, Bihar, Punjab, Sikkim, Tamil Nadu, and Jammu & Kashmir exhibit very strong positive correlations, indicating that the two metrics moved almost in lockstep over this period. In contrast, Maharashtra, Rajasthan, West Bengal, Uttar Pradesh, Gujarat, and Goa show moderate to strong correlations, suggesting meaningful—but less perfect—alignment (Table 2).

5. SUMMARY AND CONCLUSION

This paper breaks new ground by offering a state-level, two-decade (2003–2022) DEA analysis of tourism efficiency across 18 Indian states—separately evaluating domestic and foreign tourism. The study reveals significant inefficiencies i.e. 50% of states score below 50 in domestic efficiency and ~46% in foreign. Notably, foreign tourism generally shows higher technical efficiency than domestic, with state-specific results highlighting both consistently high-performing (e.g., Uttar Pradesh, Kerala) and lagging (e.g., Assam, Odisha) states. Our study suggests policy prescriptions by the respective state governments which can directly elevate their tourism efficiency scores—moving more states above the 50 percent OOTE threshold for both domestic and foreign segments. This integrated policy framework ensures that efficiency gains translate into broad-based economic growth, regional equity, and eco-friendly tourism expansion.

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