Challenges due to tourism and industries in fulfilling SDG12 in Goa with possible suggestions

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Abstract— The 17 Sustainable Development Goals (SDGs), the centerpiece of the 2030 Agenda for Sustainable Development, were a sacred translation of development that offered a navigation to peace and prosperity for all planetary residents. The SDGs were adopted by all UN Members in 2015. SDG 12 discusses the various aspects of sustainable production and usage of energy and resources by raising awareness and promoting responsible practices among governments, businesses, and consumers. It comprises 11 targets which include, such as, sustainable management and efficient use of natural resources, responsible management of chemicals and wastes, substantially reducing waste generation, promoting a universal understanding of sustainable lifestyles, etc. India's smallest coastal state, Goa, is well regarded socially throughout the nation. But shockingly, Goa ranks last in SDG 12 as compared to other states. Barriers to the same are being built by the unplanned and poorly managed expansion of tourism and industrialization in the western ghat region, particularly in Goa. Goa, a state known for its culture, has preserved the presence of Portuguese even after their departure which brings tourists not only from the country itself but from Europe too, which gives it a tourism significance at the global level. The number of tourist arrivals in Goa has increased from 4.4 lakhs in 1981 to almost 25 lakhs in 2009 and 5.48 million in 2018. The magnitude of the industry has infused a good number of ancillary and service units in and around Goa. This eases the availability of most types of packaging material, consumables, and allied services necessary for the smooth running of the industry. Simultaneously, traders trading in a variety of raw materials, chemicals, packaging material and other consumables, which contribute to the productivity and progress of the industry, have set up shop in Goa. All these activities are generating more employment, and industrialization and elevating the quality of life in Goa. But this rising approach of these industries is causing huge drawbacks which put the whole sustainability into a big question box as it is showing a clear positive correlation between economic growth and environmental degradation in the state. For instance, both sectors' reliance on carbon-based energy, the enormous amounts of waste generation (such as bio-waste that pharmaceutical businesses produce), water-intensive industries, modifications to LULC patterns, high usage of single-use plastic and a plethora of other factors. The diverse and evolving nature of the state in terms of topography, ecosystem, culture, economy and a host of others gives an understanding that a single model cannot bring all desirable targets of SDG12 there. In order to develop a new comprehensive and integrated solution that addresses every issue, this article analyses the challenges posed by growing industries and faster tourism growth in achieving the targets of SDG 12 individually and presents suitable solutions drawn from different regions and nukes of the world that are appropriate for the area in question. A few of them are, ramping up marketing for sustainable products which would also create new jobs and business opportunities, strategic waste management, reducing using of packaging materials, encouraging people to buy non-toxic and eco-friendly products or that give back locally and finding hotspots in the value chain and minimizing carbon emission at each stage. The technique is entirely reliant on secondary data, including information from district handbooks published by the census, open-source media, and others. To understand the analysis and answers, maps and graphs are also added. In conclusion, recommendations for sustainable development are offered.

Keywords— *SDG12, Tourism, Industrialisation, Waste management, Sustainability, Goa*
Abbreviations and Acronyms

UN- United Nations
SDG- Sustainable development goals
LULC - land use land cover
COP- Conference of Parties
UTs- Union Territories
PV- Photovoltaics
GSDP- Gross State Domestic Product
SDG- Sustainable Developmental Goals
FY- Financial Year
ULBs- Urban Local Bodies
MW- Megawatt,
EDG- Electrical Density Gauge
PV- Photovoltaic
MLD- Minimal Liquid Discharge
MSW- Municipal Solid Waste
CPCB- Central Pollution Control Board
TPA- Tonnes Per Annum
MTPA- Metric Tonnes Per Annum
TPD- Tonnes Per Day
BMW- Biomedical Waste

1.Introduction

The centerpiece of the 2030 Agenda for Sustainable Development, the 17 Sustainable Development Goals (SDGs), was a spiritual translation of development that offered a roadmap to peace and prosperity for all planetary citizens. All UN members endorsed the SDGs in 2015. By increasing awareness and encouraging responsible practices among governments, businesses, and consumers, SDG 12 tackles the various facets of sustainable production and utilization of energy and resources. There are 11 goals in total, including "sustainable management and efficient use of natural resources," which emphasizes finding a responsible way to handle and deal with natural resources; "responsible management of chemicals and wastes," which highlights the dangers posed by chemicals and bio waste produced by various human activities and the need to treat them appropriately; To lead a sustainable lifestyle, it is important to emphasize prevention and the 3Rs (reduction, recycling, and reuse) of trash; "promote universal understanding of sustainable lifestyles" is another goal. ensures that people have access to the necessary knowledge and awareness for sustainable development, lifestyles that are in harmony with the

environment, etc. This essay focuses on the circumstances in Goa, the smallest and most urbanized state in all of India. Goa, a seaside state, enjoys high social standing across the country. But shockingly, Goa ranks bottom among states and union territories (UTs) in SDG 12. Barriers to the same were generated by the unplanned and poorly managed growth of tourism and industrialization in the western Ghat region, particularly in the concerned state. For instance, both industries rely on carbon-based energy, pharmaceutical businesses produce a lot of bio-waste, many industries use a lot of water, LULC patterns are changing, and there is a tonne of other issues. This paper examines the challenges posed by expanding industries and faster tourism growth in meeting the SDG 12 targets individually and presents suitable solutions drawn from various fields and regions of the world that are appropriate for the area in question in order to develop a new comprehensive and integrated solution so that every gap can be filled. The technique is entirely dependent on secondary data, which was obtained through government-verified publications, open-source media, district handbooks published by the census, and other sources.

2. Study Area

Geographically speaking, Goa is the tiniest state in India and is situated on the Arabian Sea coast. In 1987, it attained statehood. Due to its extensive coastline, it is both economically and environmentally prosperous. The state is known for its picturesque natural beauty, alluring beaches, distinctive architecture, and celebrations of a distinct culture. The state's total area is roughly 3,702 square kilometers. Goa has been described in a variety of ways and by a variety of authors at various points in its history. In the past, it was known by the ancient Indian native languages Konkani and Mundari as Gomantak, Govapuri, Govarashtra, or Goym (Goem) (Gomes, 2010). The Portuguese are credited with inventing the name Goa for the capital of their State of India (Estado da India), to rhyme with their capital city, Lisboa, after it underwent westernisation and acquired a Portuguese veneer. (Kamat, 1999). Even though Goa is well-known for its beaches, nearly two-thirds of its area is covered in forests (Forest Department, Government of Goa). Due to its proximity to the North-Western Ghats rainforests, one of the world's rare biodiversity hotspots, Goa contains a diverse range of plants and animals. Amazing geological characteristics of Goa includes rocky capes along the palm-lined beaches and estuary openings. At Carambolim, there are additional wetlands. Six rivers make up the aquatic ecosystem: Tiracol, Chapora, Mandovi, Zuari, Sal, and Talpona. They run into the Arabian Sea from the west, coming from the Sahayadri mountain ranges. Eleven talukas and two districts make up the state (local sub-districts). An industrial estate, an industrial training institute, and upper secondary education resources are available in each of the state's 13 tehsils (revenue centres) (Dr. Jyoti Parikh et al., 2008). The nation's capital, Panjim, is situated along the Mandovi River. Among the state's significant towns are Vasco, Margao, Mapusa, and Ponda. Recent economic growth, which has been primarily fueled by industry, mining, and tourism, has put increasing pressure on the state's environment and natural resources. The SDG India Index 3.0 (2020-21), published by the NITI Aayog, tracks the progress of all the states and UTs on a set of key national indicators. Despite the state improving its composite score from 7th position to 5th position by securing a 72 score, both government and civil society are still facing sustainability issues, and the possibility of ongoing climate change has alarmed many people. (NITI Ayog, SDG INDIA Index & Dashboard 2020-21)

Figure 1: Administrative Map of Goa

3. Tourism

The fastest-growing industry in Goa, which hosts 8–10% of all foreign visitors to India each year, is tourism. It undoubtedly contributes significantly to the state's economy and impacts the vibrant native culture, and it also creates around one-fifth of all jobs there but has a significant impact on socio-demographic trends. Domestic travellers travel to Goa in pursuit of a culture that is distinct from that of the rest of India because of its mysticism, sense of freedom, and unique clothing. Goa is home to a wide variety of tourist attractions, including those related to sports, culture, religion, gastronomy, entertainment, commerce, health, and relaxation. Prior to the growth of tourism, the state's primary businesses relied on the extraction of natural resources, mainly timber, minerals, and fishing. In addition to the well-known benefits of high income and employment, tourism was chosen as a vital industry for the country's development because of its ability to create non-manual jobs in a state with a growingly educated workforce and slow industrial expansion. However, industrial pollution was a key worry for planners and decision-makers, so they decided against expanded industrial development in addition to mining and instead chose tourism as a source of income for the state (Sawkar et al., 2000).

Control over Goa's ports meant control over seaborne trade along the coast and across the Arabian Sea, therefore the state's commercially and militarily significant port has grown to be a significant maritime hub for both traders and travellers (Trichur, 2013). This notion is supported by antiquated buildings like the oldest lighthouse in Asia, the

one in Aguada. Since the beginning of recorded history, Goa has drawn traders, historians, monks, and missionaries. As a result of a continual process of change, Goa's development—whether social, cultural, economic, or environmental—has been profoundly impacted (CA D'Mello, 2015).

The concentration of tourists varies greatly depending on location and weather conditions. While the interior of the state is less congested with tourists, beaches and the coastline region are more alluring to visitors. For domestic visitors, the tourist season lasts about eight months, while it lasts for half the year for visitors from other countries. Typically, the monsoon is off-season for this industry.

The state's enormous hospitality business, including even the franchises of renowned hotels and resorts from around the world, is developed as a result of the yearly expansion in visitor numbers. There are all kinds of facilities set up to give visitors the tranquilly and fun they want. Although this rate of growth is leaving a highly favourable impression on the state's economy, there are differing opinions regarding its sustainability.
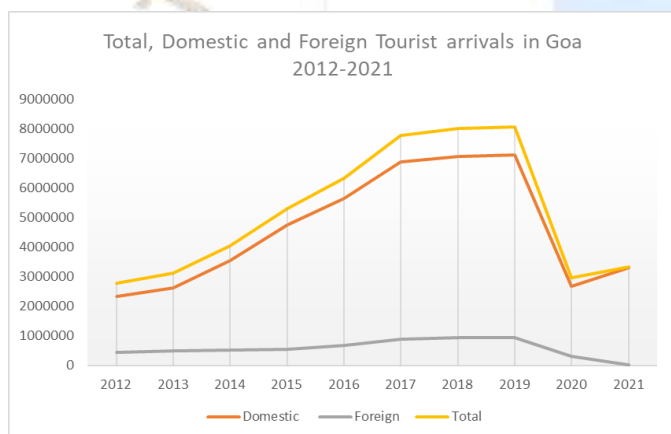

Figure 2 Year-wise change in tourist arrival

4.Industries

According to a survey by the Rajiv Gandhi Institute for Contemporary Studies and the Confederation of Indian Industry, Goa's industrial sector is placed fourth in the nation (Map of India, 2003). Goa's industries have established themselves as one of the best places to invest. With one of the highest per capita income ratios in the nation, one of the highest literacy rates, the densest road, rail, air, and sea network, the lowest crime rates, and a positive trade union-management relationship, it is both investor-and environment-friendly. All of these elements help to maintain a favorable business environment in Goa.

Numerous federal and state agencies have been established over the years to establish industrial parks, estates, and businesses in Goa as quickly and orderly as possible. Iron and manganese ore is abundant in Goa, making it a rich state in terms of minerals. Bauxite and laterite are also available in significant quantities, offering the state potential for economic growth. The state's industrial sector has expanded significantly over the past 40 years, and its contribution to value addition in the Gross

Domestic Product (GDP) has climbed from roughly 8% at the time of independence to over 33% as of the present (Dr. Jyoti Parikh, et al., 2008). The fishing, agricultural, tourism, and pharmaceutical sectors are strongholds for Goa. The Northern part of the state is home to the iron and manganese mining, pharmaceutical, and iron and steel industries, while the Southern region is home to the mining and shipbuilding sectors. Leading enterprises in Goa are setting up a strong manufacturing base there in the areas of fertilizers, tires and tubes, cement, electrical machinery, fish net manufacturing equipment, automatic washing machines, printed circuit boards, medicines, and pharmaceutical machinery. The state's long-standing industry of cashew processing contributes to its prominence in the processing industry. Goa has a 105 km long coastline and 250 km of inland waterways. Most of the coast is covered in streams and estuaries that rivers have created. Given that 125.6 thousand tonnes of marine fish were collected in the state in 2019, this sector is likewise just starting to grow significantly. For instance, the state exported marine items worth US$72.34 million in 2021–22. (Annual Report, IBEF, 2022-23).

According to the State Budget 2022–23, Rs 55 crore has been set aside for the creation of the Electronics Manufacturing Cluster at Tuem, which will result in the employment of 2,000 people over the course of five years. Additionally, Rs 10 crore has been set aside for the implementation of the "Start-Up Policy," and Rs 576.49 crore has been set aside for urban development. The funds provided are intended to be used to carry out development projects in ULBs and to implement the Swachh Bharat Mission, Smart City Mission, Atal Mission for Rejuvenation and Urban Transformation (AMRUT), e-government in all ULBs, National Urban Livelihood Mission, Integrated Development of Major Towns, Solid Waste Management, etc. (Annual report, IBEF, 2022-23).

5.Rising tourism and manufacturing sector: barrier to SDG12

A growing economy driven by manufacturing and tourism is industrializing Goa, creating more jobs, and improving the quality of life there. However, the rise of these businesses has significant negative effects, raising serious concerns about sustainability as there is a direct link between state economic development and environmental deterioration. It is generally acknowledged that it is resulting in high levels of air pollution, water deterioration (both surface and subsurface), solid waste dumping, and unethical resource exploitation, all of which can be characterized as unsustainable. The change in the economy enabled massive production scales, but it also increased environmental pressure because it was difficult to manage leftovers like solid waste, water waste, and other waste in an area that was ecologically sensitive, with the western ghat at one end and the Arabian Sea at the other. The "demonstration effect," in which the local populace copies the tourist's high-consumption lifestyle and culture, has been frequently attributed to tourism. Additionally, to placing strain on local natural resources, this demonstration effect can also have a negative impact on the indigenous' customs, values, and way of life. It becomes simpler for them to dump trash on the sand dunes

as the number of shacks along the beach rises (Kazi, S., and Sequeira, A., 2001). International and domestic travelers utilize three times as much fresh water each year as is found in Lake Superior between Canada and the United States, produce the same amount of solid trash as France (35 million tonnes), and consume 80% of Japan's annual primary energy supply (5,000 million kWh). The overuse of resources harms not only the immediate environment but also the viability of tourism as a whole (Panandiker et al., 2015). And all of this is making it very difficult for Goa to meet the 11 crucial SDG 12 benchmarks. The following list of significant obstacles is briefly explained:

5.1.   High Energy consumption

Goa is one of the few states with electrification rates of 98% in urban areas and 96% in rural regions, according to the 2011 Census. The state's total energy demand is 540 MW (FY 2013–14). The state now has 471 MW of capacity available, which comprises electricity produced locally by private production companies but does not include unallocated quota shares with capacities ranging from 50 MW to 65 MW. (Electricity available every day, every week, 2013–2014) The demand for electricity in Goa has dramatically tripled over the past six years, and is expected to quadruple over the next fifteen years. When compared to the national average, the state's per-person energy use has almost doubled recently (R. Sethi, N. Sreekumar, 2021). Up till March 2021, Goa will have a total installed capacity of 595.77 MW, made up of 559.94 MW thermal (made of 492.27 MW of coal and 67.67 MW of gas), 2.00 MW hydro, 26.00 MW nuclear, and 7.83 MW renewable energy (R. Sethi, N. Sreekumar, 2021). Currently, the industrial consumer segment makes up around 52.2 percent of EDG's overall electricity sales. Electricity consumption in the tourism sector is substantial, notably in the high-end and luxury budget hotels. Studies show that the Goa hotel industry uses over 210 million units of electricity annually. (TERI, 2012). The majority of the state's electricity is provided by central power producing stations, 81% of which are coal-based power plants, which is obviously not good for the environment. Only three private power co-generators, Goa Energy Private Ltd. (30 MW), Goa Sponge Private Ltd. (12 MW), and Sesa Sterlite Ltd., are now operating in Goa. Because there aren't enough facilities for the safe evacuation of the grid, evaluating renewable resources is also highly challenging. The state's dense forest cover and hilly terrain restrict the amount of land that may be used to build substantial ground-mounted solar PV generating installations. More than 59% of the state's 3,700 square kilometers of total land area is covered in forest, and 18 percent of that area is used for mining. Furthermore, for optimal performance, grid-connected rooftop solar PV systems without energy storage support require a high level of grid dependability and constant grid availability. An energy storage device, such as a battery storage system, is necessary if power from the rooftop solar system is to be used during grid outages. As a result, these components dramatically raise the price of the system, making rooftop solar systems unaffordable for most people.

5.2.   Water demand and management

Goa's water supplies are under a lot of pressure due to the state's continuously growing residential, agricultural, tourist, industrial, and mining demands. Due to their coastal location, the majority of the rivers in Goa are affected by salt and tidal waves up to a distance of 20–40 km upstream. The availability of all drinkable water is impacted by the fact that the state's rivers are within the salty zone for almost half of their length. With the exception of the agricultural sector, industries account for the majority of the economy (52%), which includes the tourism sector. Domestic (21%) and mining (17%) are the next largest sectors, respectively. (TERI, 2012). Around 23 million liters of water per day are thought to be needed by Goa's hotel industry (MLD). Hotels receive 9.2 MLD of surface water from the public works department, but there is still a gap of more than 14.8 MLD that is filled by groundwater and tankers (Panandiker et al., 2015). The industrial and mining sectors are also emphasized as being more reliant on groundwater. The Goan industrial sector, which includes beverage and pharmaceutical businesses, uses the most water. Private borewells are used to extract groundwater to meet 92% of industrial water demand, which could cause the groundwater table to drop (TERI, 2012). Other problems in water treatment and supply include a lack of raw water due to sources' declining water levels in the summer from mid-February to mid-June, flaws in process design that cause bottlenecks and imbalances in process loading, broken instruments, a lack of flow measurements and flow control systems, and a lack of operational and maintenance manuals and plans.

5.3.   Question mark on beach ecosystem

Goa's fondness for the sea and sand has led to the development of tourist infrastructure along the coast. Coastal tourism is dependent on the 3 Ss, or sun, sea, and sand. Sand dunes, Khazans, and mangrove ecosystems have all been harmed by these developments. In accordance with its first announcement in 1991, the CRZ restricted construction between 200 and 500 meters from the coast, tranquility of beaches will be inaccessible to both visitors and locals. The future sustainability of the coast as a resource will not be possible (CA D'Mello, 2015).

5.4.   Recreation facilities

The natural resource base is under stress due to the rising demand from tourists for recreational activities; a few examples are given below.

• Water for swimming pools is almost often drawn from underlying aquifers. Huge amounts of groundwater being extracted in a small area can be bad for the area's water table, especially if it is a source of drinking water.

• Water sports: The habitat of threatened species and other marine life is disturbed by the constant usage of motorboats in shallow coastal waters. They also have a

tendency to decrease water quality by discharging oil and grease.

• Beach accommodations: Beach shacks quickly gained popularity in Goa during the early stages of tourism because of their scarcity, low prices, and straightforward interior design. But over a number of decades, these buildings clog the shorelines without leaving any room for comfort, and they lack environmentally suitable restrooms and effective trash collection, which all have the effect of ensuring that waste always ends up in the coastal seas.

5.5. Waste generation and deposition

In terms of the generation of plastic garbage per person during the fiscal year 2019–20, Goa led the nation. The Central Pollution Control Board's (CPCB) annual report for 2019–20 states that Goa produces about 26,086.3 metric tonnes of plastic trash annually (TPA) throughout the course of the year. The absence of appropriate infrastructure to handle and treat waste, a lack of knowledge and information about trash, and a lack of sustainable plans are just a few of the factors that contribute to this poor waste management, according to the final report of BMW Inception.

By examining the ratio, it is discovered that 912 of the 3602 functioning industrial units protected by the consent mechanism are generators of hazardous waste as specified by the 2016 Hazardous and Other Wastes Rules. There are 861 hazardous waste-generating enterprises and 20 industrial estates in Goa, which collectively produce about 80,000 MTPA of industrial hazardous waste annually, according to the DPR created by the operator, M/s. SMS Envocare Ltd., in 2016). "Used and spent oil" is the category of hazardous waste that contributes the most to overall waste production. (BMW, 2022).

The Municipal Solid Waste (MSW) Management Policy, 2022–2037, seeks to enhance Goa's MSW management. According to a thorough assessment done in 2018, the state of Goa generated 766 tonnes of solid trash per day (TPD), with 52% of that garbage being biodegradable, 45% being non-biodegradable, and the remaining 20% being household hazardous and sanitary waste. But because of outdated infrastructure for sorting and storing, the issue is getting worse. There are now just two solid waste processing facilities operating, one with a capacity of 250 TPD in Saligao, North Goa, and the other with a capacity of 100 TPD in Cacora, South Goa. It is proposed to build two further facilities: one in the north at ainguinim (100 TPD), and one in the south at Verna (250 TPD + 250 TPD Energy Recovery Facility).

5.6. Changing LCLU and Depletion in Agriculture sector

Traditional crops like rice are becoming less valuable due to a shift in the state's labour force from agriculture to the industrial and tourism sectors. In Goa, there were more than 30 salinity-resistant, domestic rice types that were still in use today and had not been supplanted by high-yielding cultivars. This fast urbanization has a negative impact on the agricultural industry. Agriculture is

becoming more challenging in areas surrounding cities and towns due to unplanned urban expansion, and as natural watercourses alter, various problems such as water logging or shortages in prime agricultural fields are on the rise. Agricultural areas are more likely to be put to other purposes with real estate development, whether it be in the form of tourism or industry. The loss of traditional crop varieties, the drawbacks of monoculture, the rising expense of cultivation, the impossibility of connecting to local markets, and many other concerns are all connected to the agriculture sector.

5.7. Biowaste and harmful chemical generation

Goa has 434 healthcare institutions, including 153 hospitals and nursing homes, 65 pathological laboratories, and 216 clinics. These facilities produce between 2000 and 25,000 kg of biomedical waste (BMW) each day. In spite of these healthcare facilities, the state's many pharmaceutical businesses constitute a substantial generator of biowaste. In the backyard of these places are some large burial holes that occasionally overflow. To keep dumping the BMW, they also burn the garbage. The hospital's BMW segregation is not in compliance with either the 2016 or the 1998 BMW Management Rules (BMW, 2022). Most hospitals, both public and private, do not have established and working waste management committees. The majority of infectious garbage is unintentionally mixed with regular waste, contaminating all waste as a result. A sizable portion of this industry lacks the necessary waste handling tools for waste storage and transportation. Policymakers find it challenging to take hospitals' inadequate or degraded waste record keeping into account.

The hotel sector, which produces 18.2 MLD of effluent, is another producer of this type of wastewater. The projected total BOD (biochemical oxygen demand) load for this specific industry is 0.79 TPD. The most common method of wastewater disposal is in soak pits. If the overflowing pits are not treated, they can turn into perfect mosquito breeding grounds and spread disease. Overloading the pits produces this condition (Panandiker et al., 2015).

6.Possible Solutions

• Only changes in the top sectors of the economy will cause a sea change, but the high population (more than 60 million) living in urban areas, as well as growing urbanization and urbanism, must be kept in check on sustainability grounds, which is possible through a change in lifestyle.

• Rural development will control urbanization and promote agritourism and ecotourism. (a boost to negative employment in agriculture).

• Diversifying the economy to accommodate highly educated unemployed persons.

• Growing tourism is opening new jobs, but the skill needed and the skill they have, create a mismatch, creating

unemployment. Hence, they need vocational and training programs to fit in.

• Tourist registration with a signature provided post-arrival (possibly in the hotel) This will bring a sense of responsibility.

• For plastic waste management, the best way is to optimize the segregation of waste. The more fractions of plastic are sorted in, the better the results are from a waste management perspective. (Economic survey, 2020–21)

• Reducing plastic production is another way to manage it, so markets should promote plastic-free packaging. And similar initiatives should be taken by different industries as well.

• One step could be making tourism beneficial for the natives and environment by encouraging tourists to buy non-toxic and eco-friendly products manufactured by cottage industries, which will not only generate new jobs but also develop new business opportunities.

• A proper planned management of waste specifically, bio waste should be there from ground level, i.e., segregation process at generation sites only.

7.Conclusions

The rising tourism and manufacturing sectors in Goa are contributing to the state's economy but are also creating problems and obstacles for the environment 12SDG-12 score among Indian states and UTs. The state's unplanned development and expanding tourism have significantly increased the SDG12 target's obstacles, such as excessive energy consumption, water demand, waste management, and others, and it is essential to take action in this regard.

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