



Growth and Environmental Impacts of the Automotive Sector in India: An Analysis of Trends, Emissions, and Public Health

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Abstract:

This study explores the significant expansion of the Indian automotive sector since the economic reforms of the 1990s, focusing on its impact on economic growth and air quality. The sector's contribution to India's GDP has grown to nearly 8%, driven by rising middle-class incomes, favourable loan policies, and substantial foreign direct investment. However, the surge in vehicle numbers has led to severe air pollution, particularly in metropolitan areas like Delhi, where vehicles exhaust are a key contributor to deteriorating air quality. The study uses correlation analysis to show the direct relationship between rising automobile sales and increased carbon dioxide emissions, highlighting the severe environmental and health consequences of this growth. Despite the inception of stricter vehicle exhaust norms like Bharat Stage VI, the surge in vehicle sales has continued to worsen air pollution levels. The study calls for stronger policies to broaden transit systems infrastructure, and improve urban planning to decline dependence on private cars. It also emphasize on need for broadening public understanding about the environmental and health risks posed by vehicle emissions. The study concludes that a multi-faceted approach, including stricter emission standards and better urban planning, is essential for mitigating the negative impacts of the automobile sector while ensuring sustainable economic growth.

Keywords: Environment Industry, CO₂, GDP.

INTRODUCTION:

From 1947 to 1991, India experienced an average GDP uptick rate of 2.5% to 3%. This slow growth was largely protectionist policies adopted administered by the government during its five-year plans, concentrated on expanding Public Sector Undertakings (PSUs). The government invested heavily in sectors like steel, cement, machine tools, shipbuilding, electricals, oil refining, telecommunications, automotives, and mining through PSUs. Similarly, the service sector was also dominated by public institutions, with the government controlling key areas like banking, electricity, water supply, railways, transport, insurance, and education.

However, the return on investments in PSUs was generally low, and the Indian market offerings were not competitive enough in the global marketplace. This hindered export growth, as the products failed to meet international requirements for quality or price. While PSUs created jobs and helped build a middle class with a relatively higher standard of living, India's economy remained stagnant, lagging behind other developing nations. Countries like China, Singapore, and Malaysia, which had opened their economies to international competition and attracted private investments, experienced rapid growth and surpassed India's economic progress.

By 1990, India faced a major balance of payments crisis, which prompted significant economic reforms under the leadership of Prime Minister P.V. Narasimha Rao. These reforms, which involved liberalizing the economy, reducing government controls, and encouraging private sector participation, marked a turning point for India. Key sectors such as transportation, banking, telecommunications, IT, and education were opened up to private and foreign investments. The relaxation of foreign direct investment (FDI) norms attracted major international companies, including Suzuki, Honda, Nokia, and National Instruments, to set up operations in India. The reforms introduced in 1991 were continued by successive governments, leading to a substantial increase in India's GDP growth rate, which surged to an average range of 5% to 8%. During this period, the structure of India's economy changed significantly. The service sector grew rapidly, now contributing 57% to the GDP, while the manufacturing and agriculture sectors saw a relative decline, contributing 25% and 18%, respectively.

AUTOMOBILE INDUSTRY IN INDIA:

India's automobile sector is the largest globally and has experienced notable growth over the years. Until around 1975, automobile manufacturers, including Premier Automotives, and Standard Motors, which produced cars. Popular two-wheeler brands included Vespa and Lamberti, while Tata Motors and Ashok Leyland were in manufacturing commercial vehicles. In recent years, the industry has grown considerably, with annual growth rates extending from 9% to 18%, contingent upon the vehicle category. For instance, two-wheelers saw about 10% growth, while sedan grew between 13% and 18%. Currently, India is the third-largest producer of motor vehicles globally. The total turnover of the sector is now 38.3 billion USD, representing nearly 8% of the nation's GDP, and the industry employs around 19 million people.

The Tremendous growth of this sector has significantly bolstered the India's economic structure economy by generating millions of jobs. However, it has also led to considerable ecological challenges, including smoggy pollution and global warming. Automobile emissions are a major contributor to air pollution, which has caused various health issues like respiratory and heart diseases. According to the (WHO), air pollution estimated to accounts for half a million deaths in India each year. Many Indian cities still fail to meet WHO's recommended air quality standards, with dangerous levels of (PM2.5 and PM10) and harmful gases like (SO2) and (NO2). Among the 20 most polluted cities globally, 13 are in India, with Delhi ranking as the worst. The surge in vehicals numbers has also led to higher emissions of (CO2) and (HC), contributing to planetary warming and climate change. Addressing these issues, the central government has introduced the Bharat Stage (BS) emission standards, starting in 2000. These regulations were progressively strengthened in 2005 and 2010, with BS IV standards becoming mandatory nationwide in 2017. The government plans to skip BS V standards and enforce BS VI norms for all conveyance by 2020.

OBJECTIVE OF THE STUDY:

- To examine the expansion of the automotive in India.
- To analyse the consequences of automotive on air quality & pollution.

LITERATURE REVIEW:

- **Jatinder Singh (2014):** highlighted that the Indian domestic automotive industry has transformed since the economic reforms of 1991. The sector's offerings to India's GDP have grown to nearly 8%, energized by surge in the incomes of middle-class households. Additionally, favourable loan policies from banks, which made purchasing two-wheelers and cars easier, have spurred rapid growth. Foreign Direct Investment (FDI) has also played a necessary role
- **Jimmy Corton Gaddam (2013):** emphasized that the Expansion in output and sales within the automobile industry can be credited to the strengthening of the Indian economy and the increasing

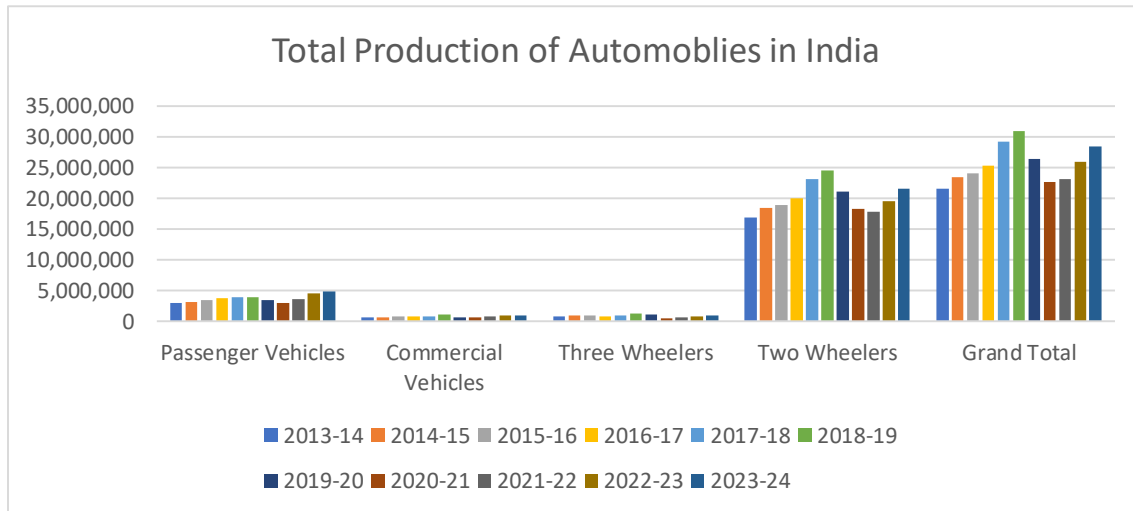
income levels of consumers. He also pointed out that the automobile market in India holds significant future potential due to its still relatively low vehicle penetration rate.

- **Dr. MA Lokhande et al. (2013):** provided a historical overview of India's automotive industry, noting that the sector became more competitive after the deregulation of the economy in 1990. To remain competitive in this evolving market, companies must focus on creativity and innovation.
- **M. Krishnaveni et al. (2015):** observed that both production and exports in the Indian automobile sector have been steadily increasing. This growth is largely driven by rising domestic demand and significant FDI inflows, including 100% FDI investments, which have contributed to the sector's expansion.
- **Dr. Alpana Roy (2016):** explored the relationship between the expansion of the transport sector and climate change, particularly in major cities worldwide. Using Delhi and Kolkata as case studies, the research highlighted how the growing number of vehicles correlates with rising average temperatures in these cities.
- **Shrivastava R.K. et al. (2013):** discussed the negative environmental and health effects of rapid urbanization and the growth of motor vehicles. Many cities in South Asia, including those in India, are surging with high levels of air pollution caused primarily by emissions from the transport sector.
- **Geetha P et al. (2015):** explained that the rapid urbanization and population growth in major cities worldwide have led to a significant rise in vehicle numbers, contributing to air pollution and related health and environmental problems. Using simulation software Hysplit4, the researchers traced the path of pollutants, which depend on factors such as wind speed, temperature, and wind direction. Environmentalists use this data for urban planning, such as road and industrial site placement.
- **Kokila M et al. (2016):** explained that air pollution in a particular region often results not merely from domestic emissions but also from nearby areas, influenced by velocity of wind and direction. Using meteorological data and the Hysplit4 simulation model, they mapped the dispersion of pollutants from vehicles and identified the areas affected by this pollution.
- **Ravi Kumar & Shweta Sharma (2020):** Ravi Kumar & Shweta Sharma (2020) examined the growth of India's automobile industry, highlighting the rise of electric vehicles (EVs) due to government initiatives like the FAME scheme. However, they found that the overall increase in petrol and diesel vehicles continues to worsen air pollution in cities like Delhi and Mumbai. The study recommended stricter emission standards and more investment in green transportation infrastructure to combat pollution.
- **Neha Singh & Pradeep Tiwari (2021):** Singh and Tiwari's research focused on the impact of India's rapidly expanding automobile sector on urban air quality. They analyzed vehicle emissions in cities with the highest vehicular density, such as Delhi, Kolkata, and Bangalore. The paper found that while the introduction of Bharat Stage VI (BS-VI) emission standards in 2020 was a positive step, it was insufficient in reducing overall pollution due to the increase in the number of vehicles. The authors suggested a move toward stricter implementation of emission standards and urged local governments to invest in better public transportation to reduce the reliance on private vehicles.
- **Ankit Kumar & Vikas Agarwal (2022):** The paper discussed the growth of India's automobile industry, focusing on the rise of electric and hybrid vehicles. However, it highlighted that fuel-powered vehicles still dominate, contributing to worsening air quality and health risks like asthma and cardiovascular diseases. The study recommended policies to boost EV adoption, expand charging infrastructure, and enforce stricter air quality standards.
- **Sushil Kumar & Rajesh Verma (2023):** Kumar and Verma's study examined the environmental impact of India's growing automobile sector, noting that despite the implementation of BS-VI norms, rising vehicle sales continue to increase air pollution. They found high levels of particulate matter (PM2.5) in cities like Delhi, leading to serious health risks. The study emphasized the need for expanded public transport and greater adoption of electric vehicles to improve air quality.
- **Rohit Mehta & Anita Joshi (2024):** Mehta and Joshi's study explored the link between India's expanding automobile industry and its contribution to climate change, highlighting increased carbon emissions in urban areas. They discussed government initiatives like stricter fuel efficiency standards and EV incentives but noted challenges such as the growing middle class and limited affordable EV options. The study called for integrated urban planning to address air pollution and traffic congestion.

DATA COLLECTION

Data on the Indian automobile industry and air pollution levels was gathered from various sources. A linear correlation study was performed to investigate the relationship between the surge of the automotive sector and the level of air pollution.

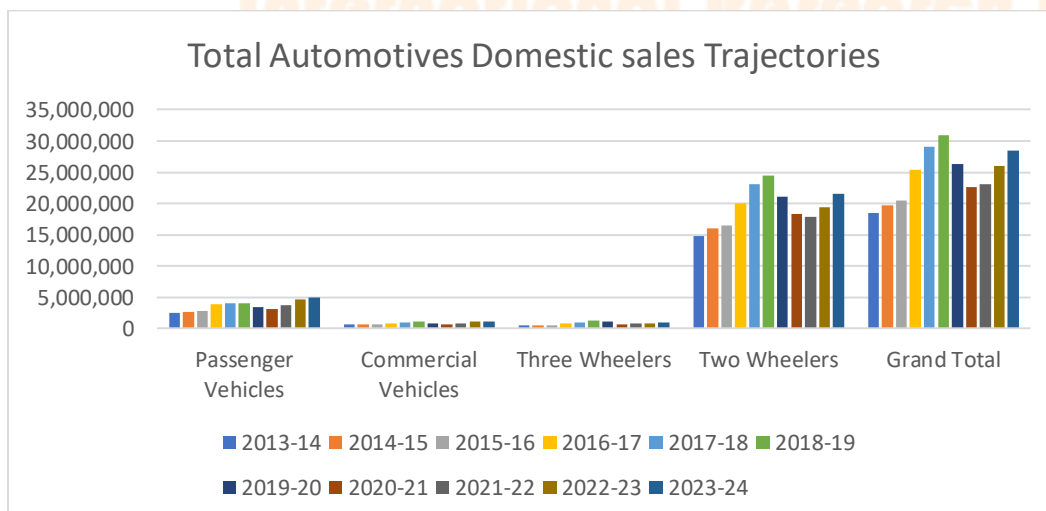
Figure 1: Production Trajectories of Automotives



Source: Society of Indian Automobile Manufacturer

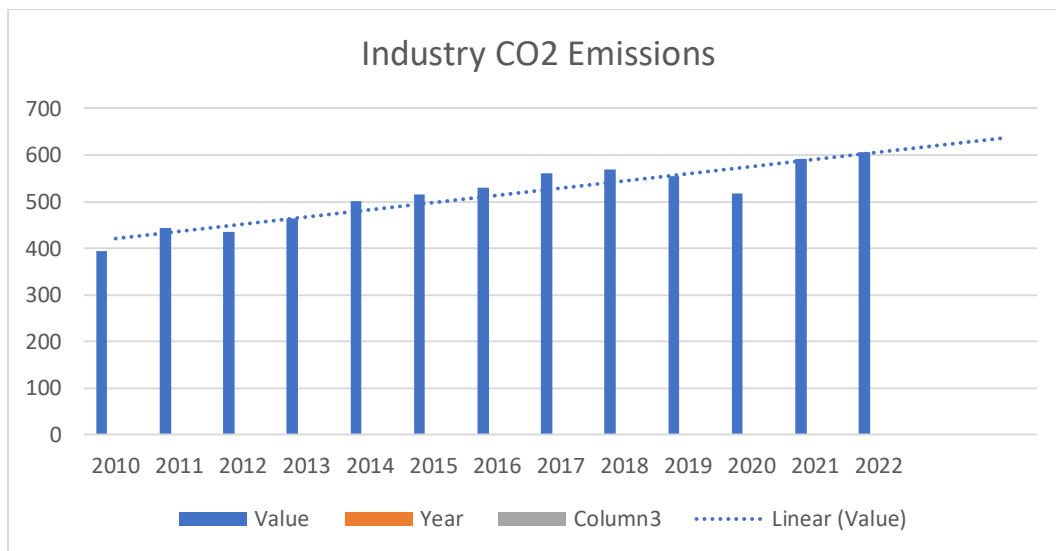
The Indian automotive sector witnessed significant growth from 2013-14 to 2023-24, driven primarily by two-wheelers. Passenger vehicles also exhibited consistent growth, while commercial vehicles and three-wheelers experienced fluctuations. The COVID-19 pandemic in 2020-21 impacted sales across all categories. The overall trend indicates a dynamic and expanding Indian automotive market.

Figure-2 Total Automotives Domestic Sales Trajectories



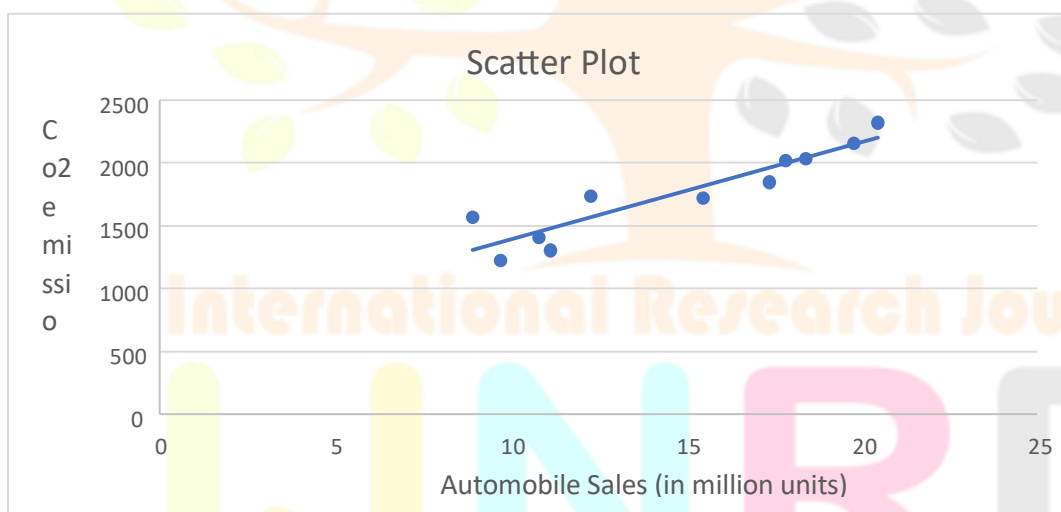
Source: Society of Indian Automobile Manufacturers

The Indian automotive sector witnessed significant growth from 2013-14 to 2023-24, driven by a surge in passenger vehicle and two-wheeler sales. Passenger vehicles consistently increased, while two-wheelers remained the dominant category throughout. Commercial vehicles exhibited a more fluctuating trend, and three-wheelers experienced growth followed by a temporary dip and subsequent recovery. The COVID-19 pandemic in 2020-21 presented a temporary setback, but the sector demonstrated resilience and continued its upward trajectory.

Figure-3 Industry CO₂ Emission

Source: International Energy Agency

The provided data reveals a concerning trend of increasing CO₂ emissions from the Industry Sector in India between 2010 and 2022. While there were minor fluctuations, the overall trajectory shows a steady rise, likely driven by economic growth, increased energy consumption, and the expansion of energy-intensive industries. This upward trend highlights the urgent need for India to implement and strengthen policies aimed at decarbonizing its industrial sector to mitigate the impacts of climate change.

Figure 4: Correlation between Automotives sales and CO₂ emission

Source: World Bank data

A strong positive correlation exists between automotives sales and CO₂ emissions, indicating that a rise in car purchases directly contributes to increased co₂ levels in the atmosphere. This signifies a significant environmental impact from the automotive industry, as it exacerbates air pollution. This assertion is supported by the (WHO) findings, which reveal that 13 out of the world's 20 most smoggy cities are located in India. Moreover, India's current emission levels and air quality standards fall far below the thresholds set by the WHO. This severe air pollution poses significant health risks, including respiratory diseases and an increased risk of cancer due to the presence of carcinogenic substances like particulate matter. Furthermore, burning of carbon-based fuels releases GHGs such as CO₂, NO, SO₂, PM, and HC, which are primary contributors to global warming. Evidence of this impact is seen in the rising average maximum and minimum temperatures observed in numerous Indian cities and towns over the years.

FINDINGS

The study examines the surge of India's automobile sector and its consequences on air quality and pollution. Since the economic reforms of the 1990s, the automobile industry has expanded significantly, contributing about 8% to India's GDP and employing millions of people. This surge has been emphasized by an expanding middle class, favourable loan policies, and foreign investment. However, the rapid rise in vehicle numbers has contributed to severe air pollution, particularly in major cities like Delhi, where emissions from vehicles are a leading cause of poor air quality. A strong positive correlation was employed between the surge in automotive sales and rising CO2 emissions, which has worsened health outcomes, including respiratory and cardiovascular diseases. Despite government efforts to implement stricter emission standards, such as the Bharat Stage VI norms,. The study emphasizes the requirement for stronger policies to promote electric vehicles, expand public transportation, and improve urban planning to reduce reliance on private cars. It underscores the significance of educating the public about the environmental and health risks of air pollution, suggesting that a multi-faceted approach is necessary to mitigate the growing environmental challenges posed by the automobile sector in India.

CONCLUSION

In conclusion, the rapid growth of India's automobile sector has contributed significantly the country's economic development, contributing to employment generation and increased GDP. However, this growth has come at a considerable environmental cost, with rising vehicle numbers directly correlating with an increase in air pollution and CO2 emissions, particularly in urban centres like Delhi. The worsening air quality has led to severe health issues, including respiratory and cardiovascular diseases, and has contributed to global warming. While the introduction of stricter emission standards, the study highlights the urgent requirement for extensive strategies, including greater adoption of electric vehicles, investment in public transportation, and more effective urban planning, to mitigate the environmental and health impacts of the automotive industry. Moreover, enhancing community awareness about these issues and implementing robust policies will be pivotal in ensuring sustainable growth for both the economy and the ecosystem in the coming years.

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