URBAN FREIGHT SECTOR DEMANDS SPECIAL PROVISION FOR ADOPTION IN BIHAR's EV POLICY

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INTRODUCTION

Road transport is the most preferred mode of transport, compared to rail and air transport for both freight and passengers. It plays an important role in propelling the state's economic development and social integration. As per Year Book of Road Transport 2019, Bihar was the second fastest growing state in India (15.88 percent) in terms of registration of vehicles during 2009-19. Being centrally located, Bihar act as a crucial point in the development of the Amritsar-Kolkata Industrial Corridor (AKIC) project initiated by the Central Government. The AKIC will pass through seven states including Bihar. Tapping upon such economic opportunity, the state government envisages adequate connectivity to important urban centers in Bihar and development of two economic corridors by 2023, i.e. Aurangabad-Chordaha

01 Bihar was the second fastest growing state in India (15.88 percent) in terms of registration of vehicles during 2009-19

02 Bihar has witnessed an annual growth of 7% in passenger vehicles, 9% in private vehicles, and 4% in commercial vehicles under newly registered vehicles from 2017-2019

03 Freight vehicles are responsible for 40% of total emissions from transport sector because of their average trip length of 200-300 Km per day

04 Bihar will attain 34% of urbanization growth by 2031

05 The number of establishments in Bihar including urban and rural have grown from 3,94,043 in 2005 to 11,79,739 in 2022

(via Hazaribagh) and Bakhtiyarpur (via Patna) to Ormanjhi (via Ranchi) to improve its regional connectivity[1].

NITI Aayog study suggests that 70% of Indian goods and services are transported by road and only 17.5% through rail[2]. Bihar has witnessed an annual growth of 7% in passenger vehicles, 9% in private vehicles, and 4% in commercial vehicles under newly registered vehicles from 2017-2019[3].Commercial vehicles means any motor vehicle that carries goods in or out through or within the urban area, commonly termed as urban freight movement. Such movements are usually conducted by both light commercial vehicles (LCVs) & medium commercial vehicles (MCVs) depending upon service areas, distance traveled & volume of goods carried. Freight vehicles are responsible for 40% of total emissions from transport sector because of their average trip length of 200-300 Km per day[4], which makes freight vehicle major contributor of emissions in transport sector.

Many interventions including public policies are being designed to support the adoption of clean fuel vehicles in public and private vehicles, however commercial vehicles have remained unexplored & untouched due to a lack of data on the transportation of goods and services. As the commercial sector is highly unorganized and privately owned by small and medium industries, it becomes a challenge to implement clean fuel transitions in urban freight sector.

Bihar has observed a significant growth in urban population in past two decades, adding 199 new towns. It is also projected that Bihar will attain 34% of urbanization growth by 2031, which will result in demand for more commercial activities and movement of goods and services[5]. The number of establishments in Bihar including urban and rural have grown from 3,94,043 in 2005 to 11,79,739 in 2022[6]. The growth in urban population and establishment will lead to increase in transportation of goods and services. Clean fuel transition in urban freight sector holds potential to reduce 14% of overall emission from transport sector[7].

[1] The Times of India
[2] Fast Tracking Freight in India, NITI Aayog, 2021
[3] VAHAN SEWA Dashboard
[4] Assessment of urban freight travel characteristics, Madhu Errampalli, 2020
[5] Bihar Economic Survey 2021-22, Finance Department, Govt. of Bihar.
[6] Directorate of Economics and Statistics, Govt. of Bihar
[7] Shakti Sustainable Energy Foundation, 2020

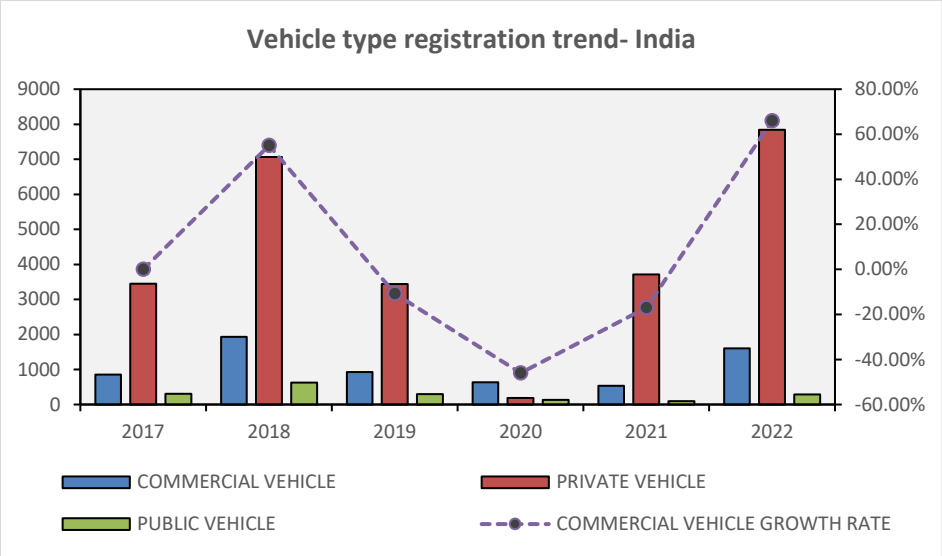

Figure 1: Vehicle registration trend in India 2017-22
Source: Vahan Dashboard

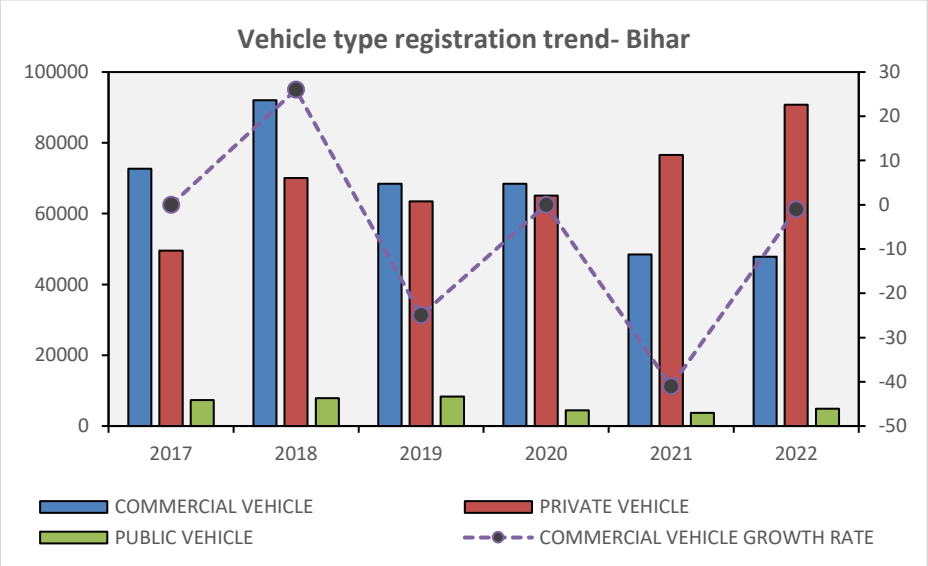

Figure 2: Vehicle registration trend in Bihar from 2017-22
Source: Vahan Dashboard

As Vehicle Registration trend in Bihar shows that commercial vehicles have higher percentage share then private and public vehicle when compared to vehicle registration trend of India. In 2017 commercial vehicle registration was higher compared to private vehicles, whereas in 2022 commercial vehicle registration was lower than private vehicles. This may be due to the degradation of the market during COVID. Bihar has witnessed the growth of total vehicle registration from 9,10,763 in 2017 to 11,29,468 in 2022, which also lead to various transport challenges such as congestion, road accidents, air pollution & noise pollution at the local level. To decarbonize transportation sector, require a shift from fossil fuel powered vehicle to electric vehicles.

RESEARCH OVERVIEW

Bihar's freight services are crucial for its future economic growth, given its close linkage to cost-effectiveness, fuel technologies, and infrastructure development. The National Electric Mobility Plan

(NEMMP) has committed the electrification of Light Commercial Vehicles (LCVs) & projected the penetration of 30,000 to 50,000 units by 2020, which was later[8] supported by subsidy scheme FAME II of Rs. 10,000 Crore to incentivize electric LCV vehicles[9]. This policy encouraged states to develop an ecosystem for the adoption of electric vehicles. The Bihar government has identified the issue and has introduced Draft Bihar Electric Vehicle Policy in 2019, to bring 100% electric mobility by 2030. For this Bihar government decided to incentivize the first 1,00,000 electric vehicle buyers for different vehicle segments. Bihar government has launched clean-fueled vehicles in passenger transport, with 75 E-Buses & 12,000 e-rickshaws introduced by 2020-22 and introduced subsidies for E-Rickshaws. But, commercial vehicle has not yet shown any positive intervention toward adopting clean fuel.

In 2019 The Government of Bihar introduced the "Bihar Clean Fuel Scheme" to encourage the operation of clean fuel vehicles (CNG & battery-powered vehicles) to adopt alternative transportation systems with an expectation to improve ambient air quality. One of the main objectives of this scheme is to prohibit the operation of diesel-powered three-wheeler in Patna Municipal Corporation[10].

This paper discusses about identification the top districts in Bihar contributing to the major movement of urban freight. As no such data represent the clear scenarios of commercial transportation in Bihar, assumptions were made to understand the commercial transportation perspective in Bihar; Districts having more economic growth will have more urban freight transportation, which can also help to develop the implementation plan at a later stage of the project. This paper presents an overview of the quantum of various transport vehicles plying in the different commercial sectors of Bihar.

ROLE OF TRANSPORTATION SECTOR IN ECONOMIC DEVELOPEMENT

Bihar had a significant impact on the tertiary sector even when the pandemic affected the overall country's GDP. Bihar state GDP raised by 2.5% whereas India's GDP shrank by 7.3% in 2020-21 only because of the higher demand for commercial services and goods transportation. The rapid increase in motorized mobility during the last two decades is primarily due to an increase in urbanization, improvement in road transport, accessibility of import and export from rural to urban and from urban to rural areas, and improved infrastructures in Bihar. The primary sector in Bihar growing at 6.4% and the tertiary sector is growing at 6.7%[11]. The structural composition of Bihar's economy are as follows:

- **Primary Sector:** Declined steadily from 22.1% in 2016-17 to 19.2% in 2020-21. In the primary sector crop sector decreased from 12.6% to 9.3% in 2020-21 and Livestock increased from 5.75 in 2016-17 to 6.6% in 2021.
- **Secondary Sector:** recorded a small decline from 20.6% in 2016-17 to 19.5% in 2020- 21. In the secondary sector EGWUS increased from 1.4% in 2016-17 to 2.3 % in 2020-21

[8] Ministry of Heavy Industries & Public. 2020. "National Electric Mobility Mission Plan 2020.
[9] Ministry of Heavy Industries & Public. 2020. "National Electric Mobility Mission Plan 2020.
[10] Gazette, B. (2019). Bihar Clean Fuel Scheme.
[11] Finance Department, G. o. (2022). Bihar Economic Survey 2021-22. Govt. of Bihar.

- **Tertiary Sector:** Increased from 57.3% in 2016-17 to 61.2% in 2020-21. In the tertiary sector TSC&S (9.8 to 11% in 20-21), Road Transport (5.0 to 6.1% in 20-21), and Financial Services (3.8 to 5.9 % in 20-21).

The agriculture and allied sector has seen a growth of 2.1% from 2018-22. Livestock & fisheries are the most important growth driving sectors growing at rate of 10% & 7% from 2018-22. The annual growth rate of individual industrial sectors like mining and quarrying, manufacturing, EGWUS, and construction have been fluctuating. Sugar and dairy industries are two major industrial sectors among agro-based industries, as these industries produce many by-products. Handloom and power loom are very large non-agro-based industry in Bihar spread over 14 locations. Three major industries which are kept in high priority by the Bihar government are ethanol, food processing, renewable energy, and cement factory.

As Bihar's economic growth accelerates, emissions from transportation especially the commercial sector are expected to grow at an even faster pace. Considering the case of Bihar, where the contributor for the emissions is majorly through the service sector and demands commercialization. The urbanization of Bihar has expanded rapidly in the last ten years. According to the 2011 census, the level of urbanization in Bihar has also increased from 130 in 2001 to 199 in 2011 and 207 in 2017[12]. Resultantly, increase in service demands for trade and e-commerce.

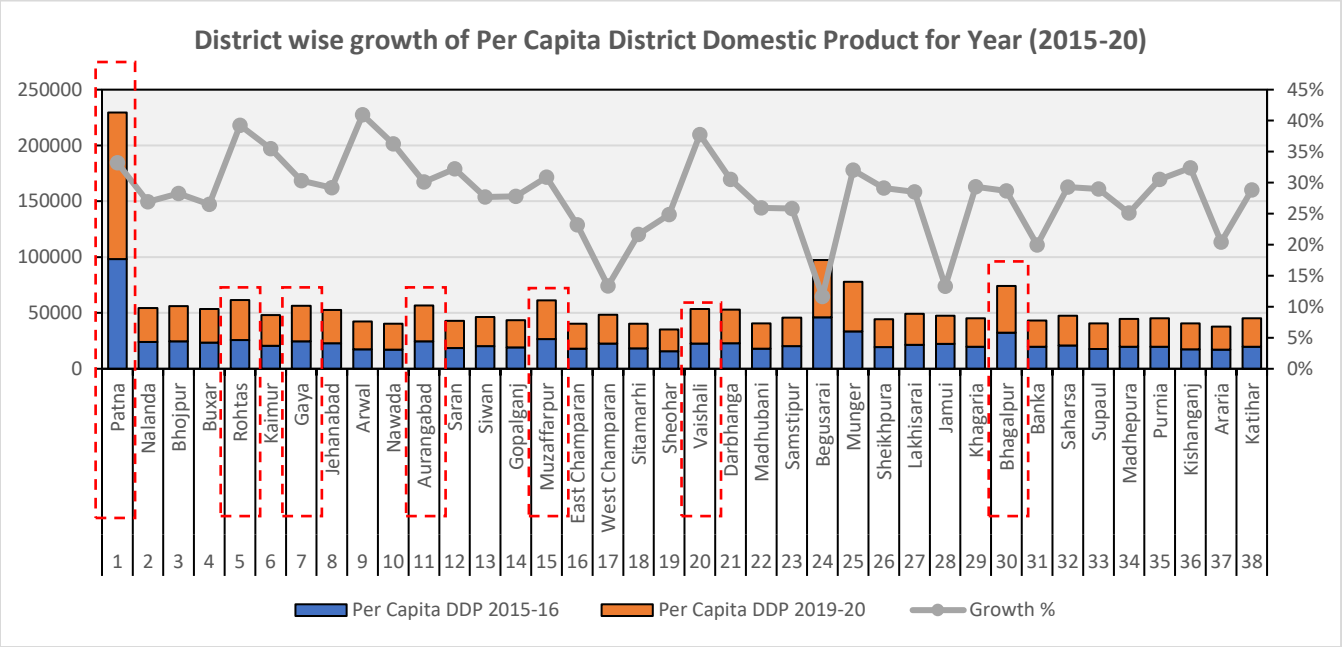

Figure 3: District-wise growth of Per Capita District Domestic Product for the Year (2015-20)
Source: Bihar Economic Survey 2021-22

The above Figure District-wise growth of *'Per Capita District Domestic Product for the Year (2015-20)'* shows the growth of per capita District Domestic Product (DDP) from Year 2015-20. Patna has the highest per capita DDP of Rs.131064 with a growth rate of 33%. Following with other districts which have more than 30,000 per capita DDP (2019-20) along with a growth rate of more than 30%. Rohtas, Gaya

[12] Directorate of Economics and Statistics, Govt. of Bihar. 2008. District Domestic Product 2004-05 to 2007-08. Govt. of Bihar.

Aurangabad, Muzaffarpur, Vaishali, and Bhagalpur have the highest recorded per capita DDP with more than 30% growth. West Champaran, Begusarai, and Jamui are the districts with lowest growth rate in per capita DDP.

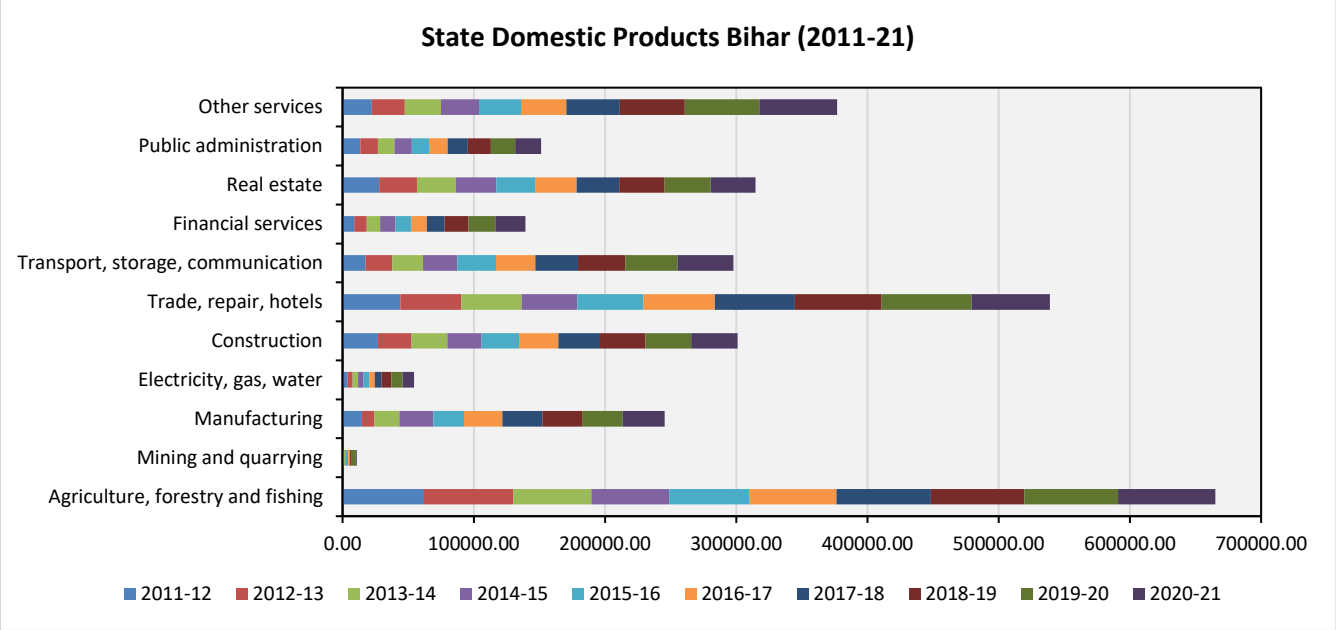

Figure 4: Sector-wise Gross State Domestic Product (GSDP) at Current Prices for the year 2011-21.
Source: Dept. of Planning and Development, Govt. of Bihar

On analyzing the sector-wise Gross State Domestic Product (GSDP) of Bihar from the year 2011-21, it shows that Agriculture, forestry and fishing sector has high contribution of 19% in total GSDP and also grown at rate of 19% from 2011-21. Other sectors such as, trade and transport have contribution of 15% and 11% respectively, mining is the least contributing sector as compared to all sectors. Road transport is the highest growing sector among all, with growth rate of 182% from 2011-21. . This shows the rising trend in the demand of urban freight among the districts of Bihar. Transportation plays a crucial role in equal distribution of goods and services among different local bodies. The majority of urban freight depends on road transport vehicle.

TRANSPORTATION SCENARIO IN BIHAR

Ministry of Road Transport and Highways of India (MoRTH) classifies vehicles into two categories: transport and non-transport. Transport vehicle generally covers the vehicles primarily used for commercial purpose such as freight and public transport. Freight vehicles can be further segregated into vehicle category such as Light Goods Vehicle (N1), Medium Goods Vehicle (N2), Heavy Goods Vehicle

(N3) have gross vehicle weight not exceeding 3.5 tons, 12 tons and more than 12 tons respectively[13].

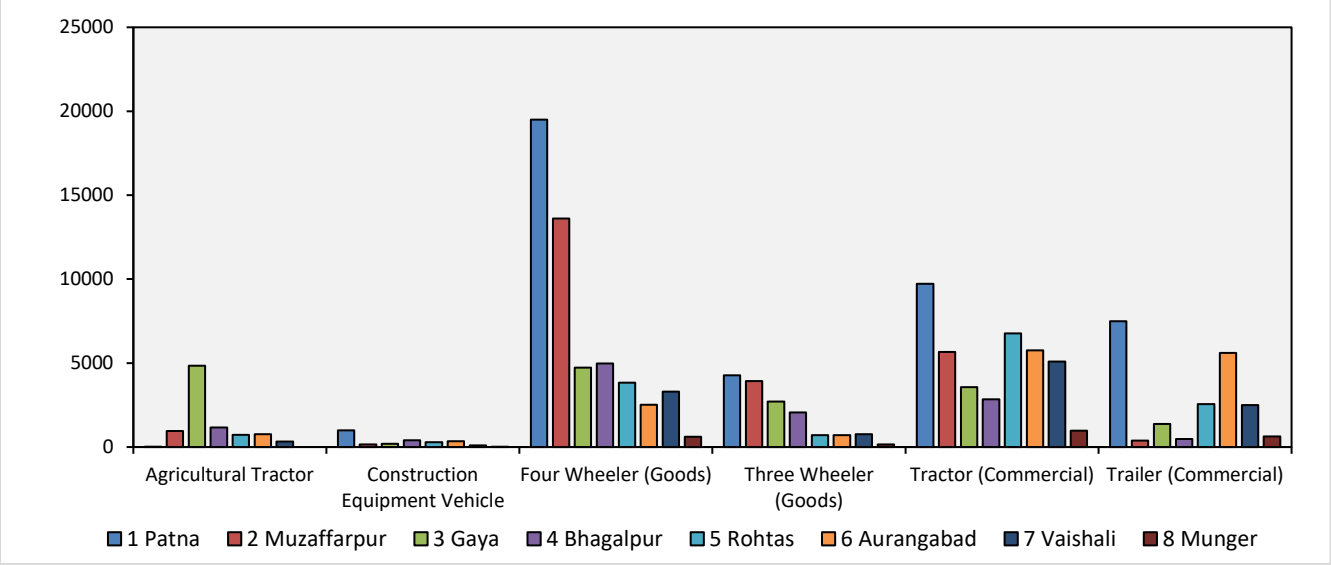

Figure 5: Total commercial vehicle (by vehicle class) registered in between Year 2017-22
Source: Transport Department, Govt. of Bihar

Figure 5 shows the total transport vehicle used for commercial activity, registered in between year 2017-22 by vehicle class. Among all the commercial vehicle type, Four-wheeler goods carrier vehicle having 38% share is highest among all followed by Three-wheeler goods carrier and commercial Tractors with 11% and 29% respectively. Patna being the economic center have the highest vehicle registration rate among all. Bihar has 34.46 Lakh MSMEs with 5% share in the overall MSMEs of India[14], which creates a substantial demand of four-wheeler and three-wheeler goods vehicles in market. These vehicles, plays a major role in connecting farmers producing raw materials to industries producing finished products to distribution centers and local shops. Although, most of the three-wheeler and four-wheeler goods vehicle are used for first mile and last mile connectivity, but the type of vehicle varies for different kind of commodities, such as tractors and trailers are majorly used by construction industries.

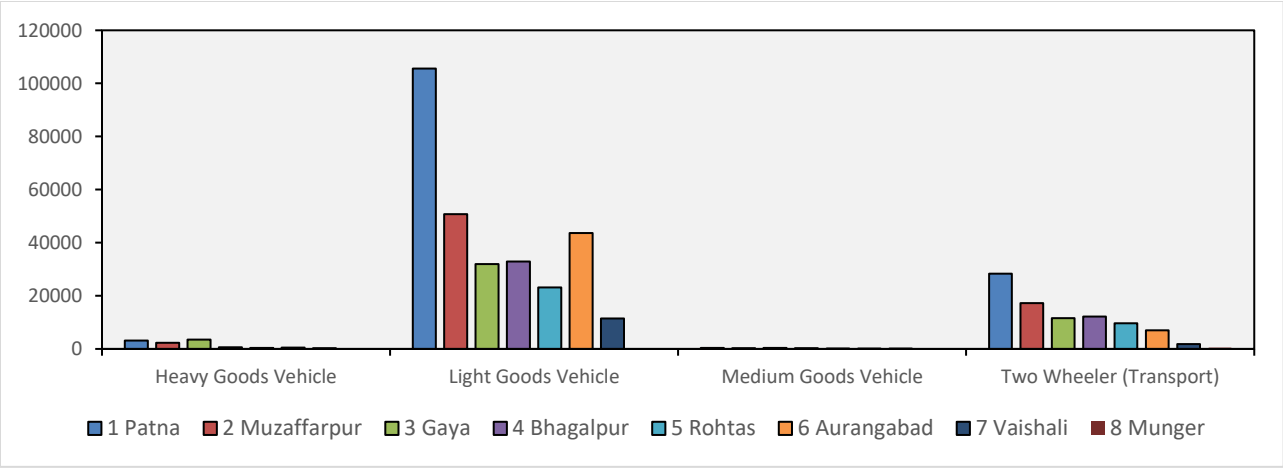

Figure 6: Total commercial vehicle (by category) registered in between Year 2017-22
Source: Transport Department, Govt. of Bihar

[13] Central Motor Vehicle Rule, 1989 (CMVR)
[14] GOI, MSME. 2021. "Annual Report 2020-21.

The annual domestic sales of freight vehicles grew from 37,837 units in 2017-18 to 53,798 units in 2019-20 and 37,507 units till 2021-22. The decline in 2021 was result of post COVID impact. The figure shows the pattern of sales of all four segments of vehicles over the last five years. Light Goods Vehicles and two-wheeler transport vehicles have 43% and 47% increase in sales respectively from 2017-22, while M/HCVs sales has declined. Light goods vehicle and two-wheeler commercial vehicle have major contribution in number of sales. Patna, Gaya, Muzaffarpur and Bhagalpur have highest number of vehicle registered in all vehicle category.

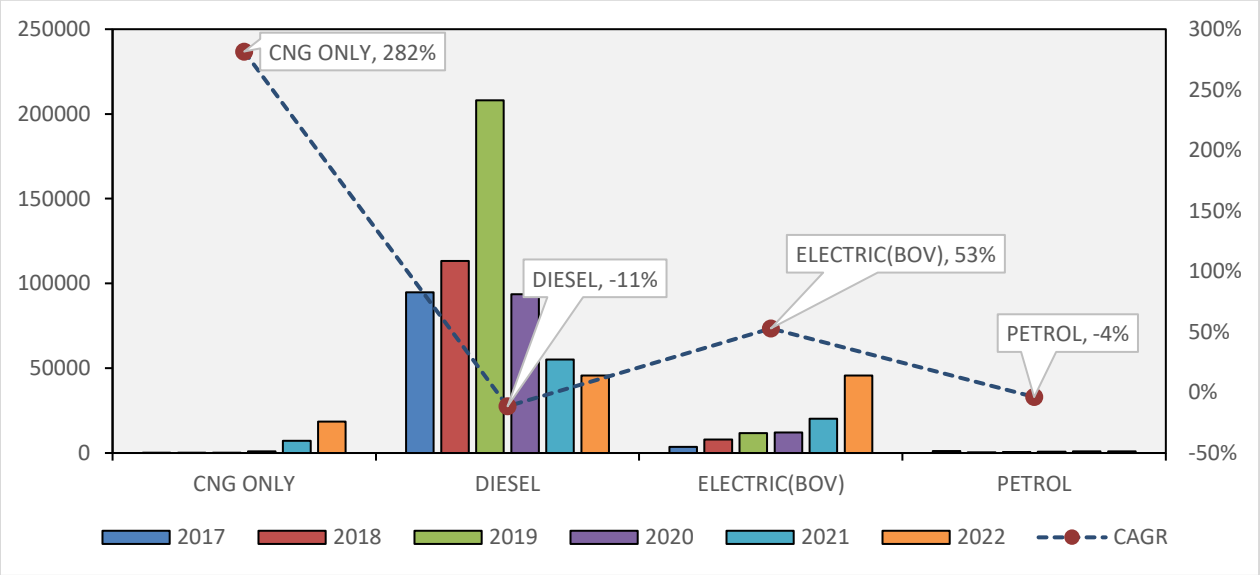

Figure 7: Trend of goods vehicle (LCV, MCV, HCV & 3-W) registered as per Fuel in Years (2017-22)
Source: Transport Department, Govt. of Bihar

Among all registered commercial vehicles (LCV,MCV, HCV & 3-W) in between year 2017-22, 82% were Diesel, 14% electric and 4% were CNG based. The high share of fossil fuel source indicates high-energy consumption and increase in vehicular emissions from the urban freight sector. But, upon seen the average annual growth trend, diesel-based freight vehicle decreased to -11%, whereas CNG and electric freight vehicle shown an increase of 282% and 53% respectively. This shows a positive sign to achieve clean fuel transition in commercial vehicles.

CLEAN MOBILITY TRANSITION IN BIHAR

Bihar's transportation sector, which presently contributes 10% of Bihar's GDP[15], is also second highest contributor of CO2 emissions with share of 12% (6.76 Mt CO_2) in 2018[16]. The key factors driving Bihar's transition towards cleaner alternatives includes the high prices of oil, rising pollution levels due to vehicular emissions, overcrowded roads, high vehicle density and commitment to achieve Net Zero Carbon Emission by 2040.

In November 2019, Government of Bihar released Bihar Clean Fuel Scheme to encourage the operation of CNG and battery powered three-wheeler to minimize the vehicle pollution generated by diesel vehicle in cities like Patna, Danapur, Khagaul and Phulwarisarif. Under the scheme government allocated the fund of Rs.5 Crore in 2020-21 to incentivize three-wheeler owners to retrofit CNG kit or battery powered

[15] Bihar Economic Survey 2022-23
[16] Trend Analysis of GHG emission of Bihar, GHG Platform India

three-wheeler. This resulted in growth in registration of battery operated three-wheelers from 3,576 in 2017 to 11,653 in 2019 to 45,666 in 2022[17].

Bihar's draft Electric Vehicle Policy 2019 objective was to develop a manufacturing eco-system for e-vehicles in Bihar and support center to achieve goal of 100% e-mobility BY 2030. The preference was to remove pedal rickshaws and replace them with 100% electric mobility by 2022. The nodal implementation agencies for this policy are Bihar State Road Transport Corporation (BSRTC) and Transport Department, Bihar. The government has made amendment to promote demand side and consumer side incentive in Bihar Industrial Investment Policy 2016, but it is still in draft stage.

Bihar Government also engaged in central scheme "Faster Adoption & Manufacturing of Hybrid & Electric Vehicle, Phase-II (FAME-II)". 5725 e-vehicle were added using incentives under Fame-II out of which 5250 were electric two-wheeler and e-rickshaw and other were public transport buses[18].

Other policy incentives by Bihar Government are also steering the state towards Clean Mobility Shift. Along with policies, measures like leapfrogging from BS-IV norms to BS-VI norms to cutdown pollutants emitting form vehicles. The state government released its Ethanol Production Promotion Policy, 2021 to promote sustainable and alternative fuel and to reduce dependency on fossil fuel. This policy was launched in order to support the center on National-Bio-Fuel Policy 2018. The state government approved to provide capital subsidy of 15% of cost of plant or Rs. 5 Crore, whichever is lesser[19] to the owner to setup ethanol plant.

With these policies Bihar is in path to shift towards clean mobility, but it's not sufficient to achieve targets of Net Zero Carbon emission by 2040 and 100% e-mobility by 2030. The existing national policies like the FAME I and II, tax rebates and state level policies are showing results in accelerating EV adoptions in light duty vehicles. By leveraging these successful prior policies on heavy duty vehicles and with additional targeted interventions, Bihar can create a thriving shift towards clean mobility in next decade.

BEST PRACTICES AROUND THE GLOBE

Nationally and internationally several policies, implementation mechanisms and approaches are being promoted for the growth and uptake of clean vehicles in urban freight segment. Thus, it is important that global adoption practices in the clean freight vehicles to be identified and translated to the Bihar's context to address the associated challenges around the adoption of clean mobility in commercial vehicle segment.

Initiatives by Indian Cities

To reduce emissions from urban freight, many Indian cities adopted electric vehicle freight deliveries. There are some initiatives taken by cities such as New Delhi and Bengaluru to adopt electric vehicle fleet in the freight distribution by developing comprehensive electric vehicle policies. Some examples are as follows:

[17] Vahan Dashboard
[18] National Automotive Board, 2021
[19] Ethanol Production Policy, 2021

- Bengaluru has focused on light commercial vehicle sales to be completely electrified by 2030 and introduced regulatory to e-commerce delivery industries to adopt 100% electric two and three-wheeler for commercial transportation by 2030[20].
- Telangana introduced Electric Vehicle adoption in four-wheeler commercial vehicles for intra-city goods deliveries and encouraged e-commerce delivery services to shift 25% of their vehicle fleet to EVs by 2022 and 100% by 2030
- Delhi initiated additional purchase incentives for first 5000 three-wheeler goods vehicles including 50% of the incentives offered under FAME India.
- Kerala aimed to have registration of 1000 electric goods vehicle by 2022.

Key takeaways: Financial incentives are essential for shifting demand towards zero-emission vehicles and adding share in the fleet. Tax layoffs in specific segments such as vehicle registration, and toll charges can help owners to reduce their total cost of vehicle ownership for clean fuel vehicles. Encouraging big e-commerce delivery industries such as Amazon, Flipkart and Bluedart to shift their particular freight vehicles functioning at inter and intra city level from ICE vehicle to electric vehicles.

California, USA- Advanced Clean Truck Regulation 2024

It's an approach by California government to increase a large-scale transition of zero-emission heavy duty vehicles in order to achieve 100% zero-emission heavy-duty vehicles in California. The rule demands manufacture to increase zero-emission truck sales to 55% in pick-up trucks, 70% in heavy duty trucks and 40% of semi-tractor in terms of zero emission by 2035. Manufacturers gain credits through the sale of zero-emission vehicles, which later get converted in the form of incentives provided by the government and the credits can be traded among manufacturers. California government and legislature have dedicated over $5 Billion to transition to cleaner trucks[21].

Key takeaways: Policy for manufacturers of zero-emission vehicles to accelerate sales. Laying a platform for manufacturers through incentives such as low land registration/ rent, incentives on achieving the sales target of zero-emission vehicles, limiting the production of ICE vehicles, and green vehicle credits for manufacturers can encourage the development of zero-emission vehicles and it's supporting infrastructure such as batteries and charging units in the state of Bihar

[20] Commerce and Industries Department, Government of Karnataka
[21] California Air Resource Board, Govt. of California, 2020

OBSERVATIONS FROM PILOT SURVEY IN BIHAR

As per our pilot survey conducted in Patna city, Bihar to understand the inter-city and intra-city urban freight, more than 80% of logistic operations are conducted by small owners consisting of 1-5 vehicles per owner. This makes logistic market highly un-organized and operates as per market demand, which becomes difficult to understand the trip composition and numbers of commercial vehicles plying in streets.

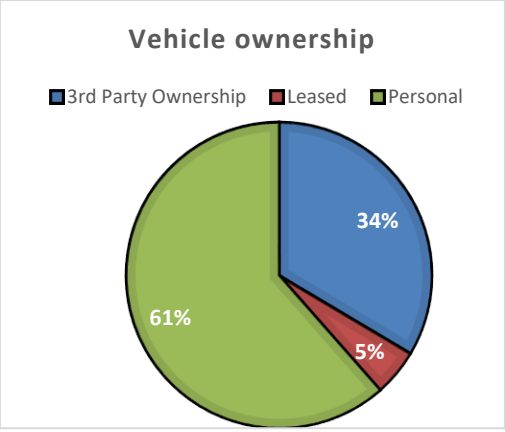

Figure 9: Vehicle Ownership
Source: Pilot Study Data, 2023

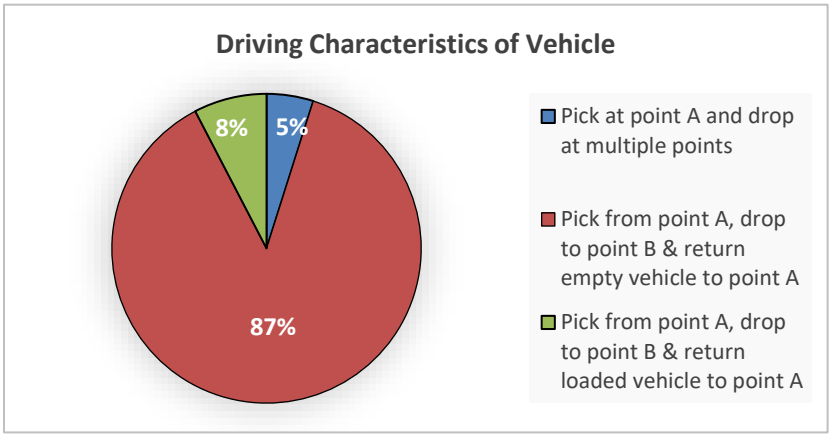

Figure 8: Driving Characteristics of Vehicle
Source: Pilot Study Data, 2022

In addition, 70% of vehicle picks commodity from one point, deliver it to another point and return back empty vehicle to same point. Therefore, more distance is being travelled by vehicle for small quantity of goods and increase the dead kilometers traveled by the vehicle, making only 50% of the efficient trip. This becomes the major challenge in terms of trip efficiency, fuel consumption, high cost, and uncertainty in trip patterns, which results in huge barriers to technological innovation in the commercial transportation sector. Therefore, there is a need for innovation in the logistic business model along with financial assistance that allows small and big logistic owners to shift to clean mobility. Analyzing the problems of inefficiency in urban freight can help policymakers to understand the problem in a methodical way, which positions them to effectively address the problem.

ADOPTION POSSIBILITIES IN BIHAR

In India, 26 states have come up with their electric vehicle policy, but most of them have not included any incentive for commercial vehicles. As stated in previous sections of the paper, commercial vehicles are also front runners for clean mobility transition and there is a need for a business model and financial incentives by the government for demand and supply under the E.V policy scheme of Bihar. Certain actions can provide the desired push to boost the incentive and efforts towards promoting clean mobility transition in the commercial sector.

Bihar's Clean Fuel Scheme 2019 initiated the growth of battery-operated and CNG three-wheeler in Bihar. The scheme also helped the Bihar government to phase out vehicles older than 10 years. This proves that with enough regulatory mechanisms, the ecosystem can be developed for a clean mobility transition. The study recommends following regulatory mechanisms for a clean mobility shift.

Encourage Vehicle Manufacturing: Allocation of dedicated industrial land for manufacturing zero-emission vehicles with low land tax, common faculties, and necessary infrastructure will attract manufacturing across EV ecosystem. Financial support for manufacturing industries in form of capital subsidy especially for small and medium scale industry. Special incentives for manufacturing batteries, charging station, and battery recycling plants.

Scrapping of old vehicles: As per the Registered Vehicle Scrapping Facility, Ministry of Road Transport and Highways, Govt. of India, there are a total of three scrapping centers in Bihar. Deregistration of older vehicles is equally important as much as newer clean fuel vehicles. The Bihar government has already had a notification for exemption on motor vehicle tax for purchasing of a new vehicle by having a scrapping certificate. More scrapping centers and proper awareness among people can encourage people to scrap out their old vehicles.

Charging Infrastructure: The state government can encourage DISCOM to set up both slow and fast charging facilities. Charging infrastructure and battery swapping stations plays a crucial role in adapting clean fuel vehicles. One of the main aims of Bihar's EV Policy is to create a fast charging station at every 50 Km on state highways/ national highways. In addition to these buildings such as residential complexes, commercial hubs, transport terminals, and parking spots should be encouraged to set up charging stations to promote first-mile and last-mile connectivity.

Financial Instrument: Although, the state government has already incentivized the purchase of passenger vehicles and three-wheeler autos. But, any program did not include any support at all for commercial vehicles. As most of the logistical owners have 1-5 vehicles, it becomes difficult for them to get financial assistance from banks and Non-Banking Finance Corporations (NBFC) as they are unable to fulfill minimum requirements. The other source left for vehicle owners is informal channels, which also have a high-interest rate.

Small Industries Development Bank of India has launched pilot scheme "Mission 50K-EV4ECO" for electric vehicle, in which they focused on challenges of MSMEs (including aggregators, fleet operators and EV leasing companies) to adopt EV ecosystem by providing direct lending and indirect lending of loans[22].

Shifting commercial road transport dependency to water waterways: One of the fastest approaches for transition in commercial vehicles is to shift from road transport to rail transport and waterways. Bihar being centrally connected to northern, western, and eastern states through rail networks and National Waterways, brings a great opportunity for Bihar. National Waterway-I passing through Bihar having port at Bateshwarsthan, Bhagalpur, Munger, Semaria and Buxar is operational for 365 days and have a cargo capacity of 500 tons per day with regular movement. The transportation of 7.7 MT cargo under RO Patna consisting of stone chips, building material, fly ash, etc. had been carried during the year 2019-20.

[22] SIDBI launches new financing solution for electric vehicle space, The Economic Times, Apr 2023