Informal and Shared Mobility: Status and Opportunities in India

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Foreword

Informal and shared mobility systems play a key role as part of urban transport systems. While data around the usage of these transport solutions are limited, there is sufficient evidence that informal and shared mobility plays a fast growing role in all regions of the world, enabling access to goods and services for the local population. However, research indicates that the impacts of shared mobility on social, environmental and equity issues is rather mixed and there is often a lack of integration into the wider transport system in cities.

In 2022, VREF started a new program supporting research and educational activities on Informal and Shared Mobility (ISM) in Low- and Middle Income countries (LMICs). The aim of the program is to create new knowledge to better inform and enable stakeholders to govern, design or develop informal and shared mobility. The scientific profile of the program is built around three thematic areas: Impact – Governance – Integration. In summary, the program is characterized by:

- A geographical focus on LMICs;
- Comparative studies between different urban contexts;
- Collaboration and exchange among researchers globally, in LMICs as well as in High Income Countries (HICs);
- Interdisciplinary approaches in knowledge building, education and learning.

In November 2023 a new program milestone was achieved: VREF commissioned an International Research Program (IRP) with an international consortium under the leadership of Columbia University. The IRP is a cohesive, multi-year research program, under which research projects will be implemented by a consortium through multicountry collaboration.

Complementary to the work of the IRP, VREF will continue initiating and supporting further activities such as special research studies in areas beyond the scope of the IRP, think pieces, knowledge synthesis reports and data collecting initiatives.

One of the complementary activities is to commission a series of research studies to better understand the current situation and status of informal and shared mobility and related policies in selected regions. The first study, on the Status and Future of Informal Public Transport in China, was conducted by WRI China and published in 2022.

This paper is the latest contribution to share data, policies and latest research on informal and shared mobility in India. The authors Rutul Joshi, Pranjali Deshpande, Subhasish Borah and Manish Sharma have collected the latest data on the sector, and provide key recommendations for future policy and research activities in India. VREF would like to further encourage the transport community to draw more attention to the sector and make use of the growing number of research activities to make the informal and shared mobility sector more accessible, safer, affordable and greener.

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Chapter one: Introduction

1.1 Background and the Need for the Study

The transport sector in India currently faces the epochal challenge of mitigating the high demand impacts while adapting to the low-carbon future. The transport sector is crucial to finding pathways to limit global warming to 1.5°C as part of the four critical systems: energy, land use and ecosystems, urban and infrastructure, and industry (SR 1.5 of IPCC) (IPCC, 2019). This would entail a share of low-carbon fuels (electricity, hydrogen, and biofuel) of 12% by 2030 and 55% by 2050. Urban transport planning and policy initiatives that decrease the need for carbon-intensive transportation – such as compact, pedestrianized cities and towns – play an essential role in limiting future emissions. Such planning and policy action are critical to decarbonization, coupled with policies encouraging improved fuel efficiency, zero-emission vehicles, and modal shifts toward walking, cycling, public transport, paratransit, and shorter commute distances.

The public transit (and paratransit by extension) operations have suffered the impact of the Covid-19 pandemic and need support to cope in the post-Covid world. While public transit ridership is reaching pre-pandemic levels, there has been unprecedented growth in the purchase and use of private automobiles in the last few years (almost doubled in some cities compared to five years ago). However, various categories of urban residents have limited access to private automobiles – low-income groups, many women, children, senior citizens, and persons with disabilities. Their mobility is severely compromised by limited or absent public transport coverage. Such groups in most Indian cities rely on informal and shared mobility (ISM) to meet the unserved demand as users and service providers.

Public transport in India extends beyond formal transport systems and encompasses a range of informal services. Informal public transport (IPT), or paratransit services, extends public transport services and provides shared ride solutions. New digital aggregators have entered the stage to provide shared mobility services, and the transition to electric mobility in recent years has challenged the status quo and created new possibilities. The conventional paratransit services and the new-age aggregator-based shared mobility services have made Indian cities more accessible. These services can be combined and viewed as 'shared mobility', which are often informalized (not formalized or entirely regularized), given that they often operate and grow in the gaps of formal institutions, markets, policies, and regulations. For the purpose of this study, we have combined the issues of conventional paratransit and new-age shared mobility services as a combined sector of 'informal and shared mobility' (ISM).

This study aims to provide a holistic understanding of the various informal and shared mobility modes and services in India with a primary objective of facilitating more efficient, evidence-based policy-making processes. It considers informal public transport with several types of services, which may be classified based on the variation in routing, fare, and personalized or shared service use. For ease of understanding, they belong to two predominant types: those that provide point-to-point services – auto-rickshaws and taxis – and those for shared services – shared auto-rickshaws, bicycles, and minibuses. The study is concerned with shared mobility as a new mobility service emerging in addition to traditional services, drawing on Internet technologies to meet the demand with high efficiency: rideshare taxis, public bike sharing, bike renting, carpooling, car renting, and ride-hailing services (including minibuses) emerging in various Indian cities. The study views conventional informal mobility and the new shared mobility services as one sector contributing to paratransit services for a large population in Indian cities.

Informal and Shared Mobility (ISM) is an umbrella term encompassing a diverse range of mobility options characterized by their informal and semi-formal regulatory nature and the sharing of vehicles or services among multiple commuters in urban and peri-urban areas in India.

The informal and shared transportation services create direct employment opportunities for drivers and indirect job opportunities (Behrens et al., 2021). India's informal and shared mobility sector is closely linked with informal livelihood, crucial for many households moving out of poverty. However, severe customer competition leads to road safety challenges, a lack of traffic discipline, and operational inefficiency. The vehicles often need to be better maintained, and the selective crackdown by the authorities coupled with a lack of efficient regulatory mechanisms add to the 'informality' of these services. With the emerging shared mobility market, there is an opportunity to organize this sector with better legislative and regulatory support. This study aims to provide the most recent overview of this sector to understand and appreciate the issues while building a case for better policy and regulatory support. The present study aims to address these issues by posing the following research questions:

1. What is the status of informal and shared mobility services in Indian cities regarding the level of service, regulatory frameworks, and emerging socio-economic trends?
2. What are the gaps in the existing research, and how can they be addressed in the future research agenda for ISM services in India?

The study aims to provide state-of-the-art knowledge of informal and shared mobility in India, drawing on a review of academic and gray literature, dialogues with stakeholders, and data collection with quantitative and qualitative analysis. Existing literature from India concerned with operation and services, policy, regulations, governance, society and environment, business sustainability, and resilience for all kinds of shared mobility services, including shared bikes and e-bikes, ridesharing and ride-hailing, mobility-as-a-service, courier network services, and demand-responsive transport is particularly pertinent in this context.

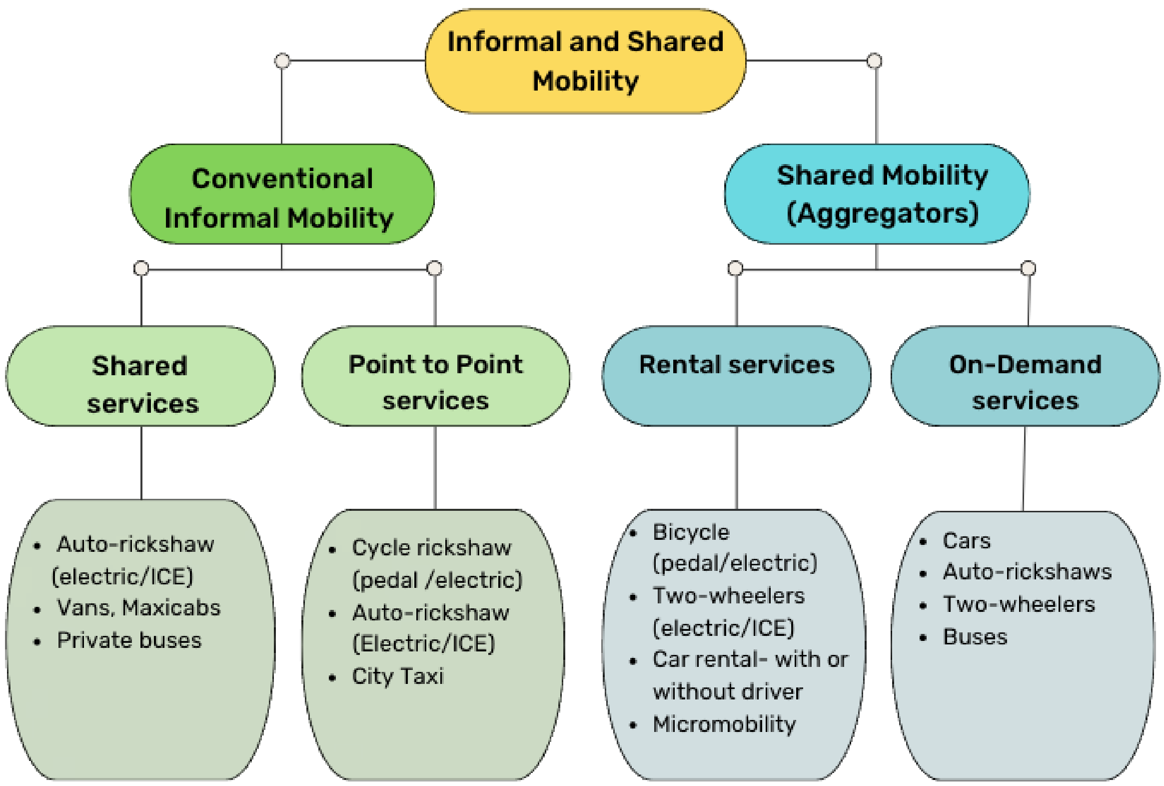
Target group and stakeholders: This report, *The Status and Opportunities of Informal and Shared Mobility in India*, is intended to help funding agencies, research, academic institutions, and government agencies to shape research and policy-related initiatives for informal and shared mobility. The formal and informal transit operators and public transport agencies are the indirect beneficiaries of the project. All the agencies that can play an essential role in shaping policies – civil society and academic institutions – are seen as catalysts.

1.2 Definitions and Categorization

Informal urban transport in Indian cities can be broadly categorized into conventional informal and shared mobility.

Conventional informal mobility: Including all informal services that provide individual mobility by ride-hailing service providers, the services in this category are often offered by low-carrying capacity vehicles, such as two-wheelers, e-rickshaws, auto-rickshaws, and cars/vans that can accommodate up to three or four passengers.

Figure 1.1: Types of ISM in India



Shared mobility: Services in which multiple individuals share a single vehicle or mode of transportation are considered shared mobility services. Depending on the nature of operations and services, shared mobility is offered in a conventional form with stage carriage permits under The Motor Vehicle Act of 1988, or through digital platforms like Ola and Uber which operate in the semi-formal regulatory framework. Vehicles with a carrying capacity of three passengers or more offer these services, such as auto-rickshaws, cars, tempos, Vikrams, Jeeps, Tata Magic, chakdas, minibuses, etc. Car-pooling and ridesharing are among the common shared mobility offered digitally.

> From a policy, regulatory, and commuters' perspective, combining informal and shared mobility services into one sector that provides mobility services in urban and peri-urban areas is prudent.

For the commuters, these are all the shared services available to them. This report understands informal urban transport as informal and shared mobility (ISM).

1.3 Overview of Informal and Shared Mobility in India

India's urban population is on the rise. Over 475 cities and towns already have a population higher than 100,000, and the overall urban population is expected to reach 40% by 2030. The need for safe and low-carbon transport systems has never been more urgent for sustainable development and to ensure that citizens have access to necessary goods, services, and activities. However, cities in India have limited public transportation infrastructure and services, and most small and medium-sized towns are yet to have any. Alternate modes of transportation have increased, resulting in higher road congestion, compromised road safety, deteriorating air quality, and issues related to gendered mobility. Private cars and two-wheelers are still expensive for a large section that relies on public transportation, and many cities and towns have low per capita incomes and vehicle ownership rates. This is an opportunity for innovative and creative solutions to address the issues and help create a sustainable future for all.

As a first step to understanding this ISM sector, here is an overview of the informal public transport in Indian cities. To provide a comprehensive overview, it is necessary to address three critical aspects of the sector: who provides these services? what is the nature of the service, and who regulates it? what do these services offer?

Who provides informal public transport?

Individual entrepreneurs usually own and operate a single vehicle or a small fleet of vehicles, such as three-wheelers or vans, to provide point-to-point services. The formal public transport network is planned and designed based on operational and economic efficiency and maximum demand and often covers some parts of the city. Unskilled and informal labor enters the transport workforce to provide independent transport services in areas not covered by formal transport systems. The informal and shared mobility options available to commuters in India include both shared and individual hire services. Various vehicles with two to four seating capacity offer individual or collective hire services within the city, while vehicles with higher seating capacity, ranging from four to seven, provide shared transportation services between nearby towns.

The three-wheeled auto-rickshaw is the most widely used mode of informal public transport in Indian cities. The production of passenger commercial vehicles and three wheelers has increased from 3.6 million units in 2009-10 to 6.4 million units in 2019-20. (MoRTH, 2021). In smaller towns and on the outskirts of metropolitan cities with low public transport penetration, 'shared auto-rickshaws' exist as a service variant. They operate on a fixed to semi-fixed route, with no designated stops, and passengers share their rides with others, and pay fares based on the distance traveled. Taxicab services are now also commonly available in the million-plus Indian cities. They were traditionally used in the large metropolitan cities of India, such as Delhi, Mumbai, and Kolkata. Still, with the advent of mobile and online taxi aggregator services, several million towns have gained access to call taxi services. Registration of taxis has grown in the last decade at 11% per annum, and many are used in rideshare services.

Over the last two decades, auto-rickshaws have adopted cleaner fuels such as CNG and LPG, and online and mobile aggregation. However, some cities have restricted their movements to specific routes or zones citing 'congestion'. Mumbai has banned the entry of auto-rickshaws into South Mumbai, while Bengaluru has restricted their movement to dedicated lanes on certain roads. These services run outside formal government regulations, without registrations, and with fares based on everyday consensus among drivers and commuters rather than government regulations. As a result, they are also often overcrowded to maximize each trip.

What is its nature, and who regulates the services?

Despite being an affordable, flexible, demand-responsive mode of urban transport, informal public transport has a less clear regulatory framework. Citizens rely on it because of the poor or unreliable operations of formal public transport, but they are blamed for adding to the chaos, pollution, accidents, and traffic congestion. The vehicles are old and poorly maintained, and driving could be safer. Ad hoc restrictions posed by the government or traffic police often do not allow IPT (Intermediate Public Transport) vehicles to enter the city limits. Sometimes, they function as feeders to formal bus services that connect to the peri-urban areas. Contrary to popular belief, they are not only the 'feeders' or 'first/last mile connectivity' services. Perception issues limit the opportunities of IPT operators to access financing options that improve their overall service quality and enhance passenger patronage. The sector is often at odds with transport and traffic police departments and city governments because of its informal nature, and in many Indian cities, it also involves contractual issues. IPT operators are subjected to financial risks, and face social challenges and a lack of social protection, though IPT is a form of urban livelihood.

IPT often operates in a gray area between the formal and informal sectors, without any clear regulatory framework (Cervero, & Golub, 2007; Gadapalli, 2016; Tiwari 2011; Gwilliam, 2002; Singh et al., 2018). Various aspects are regulated by the traffic police, the regional transport office (as part of the state government), and the urban local bodies. According to India's National Urban Transport Policy (NUTP), IPT offers semi-regulated transport services that operate without adequate permits, and the operators typically provide these services with a variety of vehicles such as auto-rickshaws, cycle-rickshaws, e-rickshaws, minibuses, and regular buses. Though characterized by informality of various kinds and the absence of a regulatory and institutional framework, the IPT sector organizes itself through self-formed or elected unions or associations. Services may appear unstructured and unplanned, but they are well-organized and subject to their forms of institutionalization and taxation, despite their vulnerability.

The Motor Vehicle Act of 1988, amended in 2019, partially regulates informal and shared modes in terms of routes, permits, and vehicle types. Public service vehicles are classified as 'contract carriages' and 'stage carriages', including informal and shared modes. The act does not formally acknowledge informal public transport like shared auto-rickshaws or shared cabs and does not use terms such as ISM, para-transit, or feeder service. The Act also does not recognize the digital intermediaries or aggregators as transport service providers, which instead are governed as IT companies.

What does the informal public transport service offer?

Informal public transport caters to the mobility needs of Indian cities by providing affordable and flexible transport services. In most Indian cities, it serves as the primary mode of transport, feeder mode, gap-filler, inter-city or regional transport service provider, and/or peri-urban transport service provider. Informal and shared mobility plays an essential role in transportation, particularly for low-income groups, and offers several key features that meet travel demand by efficiently moving people and goods.

Key features of ISM sector

Primary transport and gap-fillers: In most Indian cities, informal public transport is often the only means available, acting as the primary public transport system. In cities with poor formal public transport services, it serves as a 'gap-filler' by providing services in areas that are not covered.

Flexibility and adaptability: IPT is known for its flexibility and adaptability to the diverse needs of passengers. These transport systems cater to local demands, provide affordable services, and adapt to changing demand patterns like peak hours or in response to events or emergencies. This allows them to provide commuters with more frequent, fast, and reliable service.

First and last mile connectivity: Informal public transport modes connect passengers to public transport systems like buses, metros, and railways by ensuring that all parts of the city have access to public transport stations.

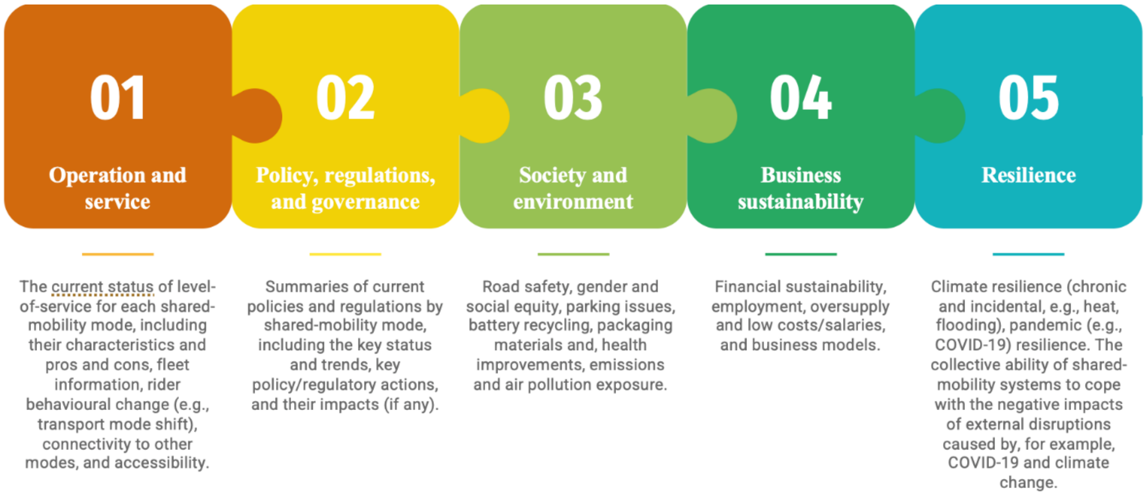
Point-to-point service: It offers on-demand service for occasional airport or emergency health-care trips without relying on private vehicles or public transport. The local knowledge of the operators and the smaller fleet size of the informal public transport modes provide easy access to areas not covered by formal carriers, such as narrow lanes and bylanes.

Accessibility and faster service: IPT provides a means of transportation that is not only easily accessible but quicker than regular public transport. Due to their smaller sizes and flexible routes, informal public transport vehicles can traverse through narrow and congested streets, providing a faster and more efficient service for their passengers. Additionally, they offer greater accessibility to public transit stations in bigger Indian cities, which makes them a crucial mode of transportation for many people, especially those who live in low-income areas.

Importance for the economy: Informal public transport contributes significantly to the informal economy in Indian cities, providing employment opportunities ranging from low-skilled to skilled labor for people engaged in various transport-related activities, such as driving, repairing, and maintaining vehicles (Roy, 2009; Mittal, 2022; Agarwala, 2009).

1.4 Methodology and Approach

This study provides state-of-the-art knowledge about the operation and service, policy, regulations, and governance of ISM in Indian cities, the impact on society and the environment, their business sustainability, and resilience.



The study draws on different approaches to respond to the range of concerns:

Critical literature review and desk research

A 360-degree view of existing literature, including a systematic literature review carried out via bibliometric tools/software like PoP (Publish or Perish), and Netdraw (for social network data) provided an overview of the existing situation analysis for each mode of transport. The intention was to understand the current scenario, overarching policies, acts and regulations, and initiatives undertaken by national governments and large and medium-sized cities in various states of India. Gray literature from India on these topics contributed to these concerns, accessed by moving beyond search engines like Google Scholar for formal academic/policy literature and into LinkedIn, ResearchGate, and Academia, along with various mailing lists and email groups with the help of sustainable mobility groups. To understand the discourse of academic research on ISM, 223 publications ranging from 1980 to 2022 were studied and categorized based on six research themes.

Stakeholder mapping

'Better' practice case studies were identified to create a stakeholder map with the implementing agency and a network of supporting actors – governments, experts, civil society organizations, and academics. Stakeholder mapping helped identify critical interviewees with first-hand knowledge of city-specific reforms and innovations.

Key informant interviews

In-depth, qualitative interviews with 19 key informants – industry experts, policy experts, officials, and research scholars – were undertaken to understand perspectives or motivations based on qualitative and descriptive information. The in-depth interviews with key officials and experts helped understand the current issues, research gaps, and future agendas.

Key informant interviews were conducted with operators such as aggregators in the ISM sector (Uber, Ola, MYBYK, etc.), auto-rickshaw associations, mass transit agencies running integrated IPT services, chairpersons/ secretaries of IPT cooperative societies, and government officials (local, state, and national level). Key informant interviews were also conducted with think tanks like the World Resources Institute (WRI), the Institute for Transportation and Development Policy (ITDP), and advocacy groups to discuss the opportunities and challenges in formalizing IPT in India.

Data analysis and findings

The interviews were transcribed and analyzed to understand the process, benefits, policies, regulations, paratransit, and shared modes. The data analysis and findings were validated through an online roundtable of experts and industry representatives, which helped finalize the report.

Peer-review

The study benefited from internal and external peer review by sector experts and research scholars.

1.5 Structure of the Report

The study focusing on the challenges and opportunities of informal and shared mobility (ISM) in India is divided into six broad chapters.

Chapter 1, the present chapter, provides the background and rationale for the study, along with an overview of India's informal public transport sector, addressing three key questions: who provides these services, the nature of the services, who regulates them, and what they offer. The section also presents definitions and categorizations of ISM modes used in this report. It articulates the primary research questions framed to provide up-to-date knowledge of informal and shared mobility in India, along with the methodology adopted for this research, which evolved from the five aspects of ISM in India discussed in the chapter: operation and service, policy, regulations, and governance; society and environment; business sustainability; and resilience.

Chapter 2 critically appraises informal and shared mobility (ISM) in India, considering conceptual positions, contestations in the ISM sector, ongoing shifts in the perception of ISM in Indian cities, and the rise of e-ISM. It addresses the role of ISM as service provider partner and the impact e-ISM has on mobility, livelihoods, and sustainability. The chapter offers insights into the complexities of the ISM sector, including the power dynamics, governance challenges, and regulatory dilemmas faced by policymakers.

Chapters 3 and 4 present a comprehensive market research analysis of the existing conventional informal and shared modes, followed by the market analysis of aggregators or digital intermediaries operating in Indian cities. The study is divided based on the five identified aspects of ISM. For both conventional modes and aggregators, it looks at the current status, the issues faced by operators, and the problems faced by the passengers.

Chapters 2, 3, and 4 address the first research question, investigating the status of informal and shared mobility services in Indian cities regarding the level of service, regulatory frameworks, and emerging socio-economic trends.

Chapter 5 turns to the second research question, providing an overview of the academic research and discourse surrounding informal and shared mobility (ISM) in urban India. It discusses various theoretical research perspectives and themes, including traffic growth, containment, livable cities, the formal-informal dichotomy, and technology-based solutions.

Finally, Chapter 6 comprehensively analyzes current informal and shared mobility research in India to identify gaps in research and policy and suggests an agenda for future research.

Chapter Two: A Critical Appraisal of ISM in India

2.1 Conceptual Themes

This chapter presents various conceptual themes developed around the informal and shared mobility sector. It discusses the urban transport policy landscape that has evolved through the decades and lays the foundation of academic literature and policy responses in this sector, which will be referred to in later chapters.

2.1.1 Contestations in the ISM sector

The flexibility and resilience of informal shared mobility (ISM) are often associated with subversion of rules and regulations. This, in turn, is linked to power and political patronage issues, making the sector a complex socio-political issue in the urban transport landscape. Operating informal urban transport involves negotiations, alliances, and conflicts between actors, including transport operators, government authorities, interest groups, and informal transport unions. ISM is seen as a manifestation of the informal economy characterized by a lack of formal regulations, low barriers to entry, and flexible work arrangements, wherein the informal economy is not a 'problem' to be solved but a 'solution' to the challenges faced by the urban poor in accessing affordable transport services (Garcia-Bolivar, 2006).

ISM operators use various strategies to subvert regulatory frameworks for their daily functioning: operating without a license, bribing government officials, or exploiting legal loopholes (Gadepalli, 2018). These allow them to bypass formal regulations and maintain control over their operations. Auto-rickshaw drivers in India, for example, often use expired permits to avoid paying fines for violating traffic rules (Kumar et al., 2016).

The ISM service providers are often represented by unions that connect with local politicians, bureaucrats, and law enforcement agencies to gain political protection and influence policy decisions regarding licenses, permits, and routes. These networks of political patronage create a parallel system of governance that undermines the formal regulatory framework (Agbiboa, 2018). In many instances, the contestations and resistance of ISM operators create friction with the top-down institutional urban mobility frameworks (Benjamin, 2008), thus forming their own set of regulations as a form of transgression to rules and regulations (Espinosa & Contijoch, 2021). The unions engage in political negotiations, demonstrations, and strikes to influence policy decisions mainly related to fare and formalization processes (Espinosa & Contijoch, 2021).

Government institutions face a regulatory dilemma in addressing informal urban transport. On the one hand, they recognize the need for regulation to ensure safety, efficiency, and environmental sustainability. On the other hand, attempts at stringent enforcement can lead to economic disruptions and political backlash. Governments must adopt a pragmatic approach that balances regulation with providing affordable transport services (Pojani & Stead, 2015). By recognizing the political dimensions of ISM, policymakers can adopt inclusive and participatory decision-making processes that balance the needs of informal operators and passengers with the broader urban transport system in Indian cities.

2.1.2 Ongoing transitions

For the local authorities in Indian cities, ISM oscillates between being seen as essential service providers and 'civil nuisances.' While the government's attitude has not changed much, online aggregators have seen them as partners and mobility service providers in recent years. This shift in perspective portrays a shared responsibility between aggregators and ISM drivers in India's overall landscape of informal transport.

ISM as service providers

ISM has emerged as a service provider for multiple reasons: the lack of public transport, a considerable mismatch in the transport demand and supply, a surplus labor force, and the operational flexibility it offers, with the ability to respond quickly to changing demand characteristics. ISM plays a crucial role as a service provider in urban transport in India, providing a wide range of services that vary with the transport characteristics of each city. It acts as a primary mode of transportation, a feeder mode, and a gap filler, providing inter-city and peri-urban connectivity.

The National Institute of Urban Affairs (NIUA) report on urban transport in India in 2017 acknowledges the significant contribution of ISM as a service provider in meeting the growing demand for mobility. The report emphasizes the sector's responsiveness to changing travel patterns and ability to adapt quickly to urban dynamics. The National Sample Survey Organization's (NSSO) 2004 survey on (un)employment in India also reveals a significant presence of ISM workers in the urban transport sector, acknowledging them as service providers. Many workers are engaged in transport-related activities, often acting as micro-entrepreneurs who manage their vehicles and generate income through transport services, strengthening the local economy and developing employment (NIUA, 2013).

ISM workers – auto-rickshaw drivers, Jeep or Vikram drivers, and street vendors – form an integral part of the urban transport ecosystem in Indian cities (Mitra, 2020). Their services are essential in filling the gap in formal transport systems, particularly in areas where traditional public transport is limited or inaccessible (Cervero, 1998). The ISM workforce possesses deep local knowledge and expertise, allowing them to provide fast and flexible transport services by navigating through congested streets and finding alternative routes during peak hours (Kumar et al., 2021).

The World Bank report on urban transport in India (2001) recognizes the importance of ISM in providing affordable and accessible mobility options. It suggests that formalizing and integrating ISM services into the overall urban transport system can help enhance efficiency, safety, and accessibility for all urban residents. By providing affordable options for daily commutes, especially for low-income groups, ISM is vital in enhancing the mobility of marginalized communities in urban areas, particularly in congested and underserved areas (Kumar & Barrett, 2008; Arora et al., 2016).

ISM as 'partners'

In recent years, technology companies that act as 'aggregators' have started referring to ISM service providers as 'partners,' reflecting a growing recognition of the contribution and value of the informal transport workforce in the urban transport sector. Uber was the first online aggregator to refer to drivers as 'partners,' followed by Ola, Rapido, and others. The term 'driver-partners' emphasizes the collaborative relationship between the platform and the independent drivers, conveying a sense of mutual benefit and shared responsibility between the platforms and their drivers, unlike traditional cab aggregators like Meru Cabs (started in 2006) and Mega Cabs (started in 2001). Recognizing the ISM service providers as partners has several key benefits for users, service providers, and the government, which include the safety and security of users, accumulation of digital data service provision, local knowledge, expertise in navigation, inclusive development, and social security, collaborative solutions, and opportunities to move under a formal regulatory framework.

Informal transport service providers were earlier overlooked or stigmatized due to their informal status and lack of formal recognition. However, there has been growing acknowledgment of their essential role in meeting urban transport needs in recent years due to changes in the urban mobility policy landscape (Verma et al., 2021), especially in areas where formal public transport services are limited or inaccessible.

Academic literature on the informal transport sector highlights the importance of recognizing informal transport drivers as partners and addressing their challenges, including low earnings, lack of social protection, and harassment by law enforcement agencies (Lopez-Carreiro et al., 2020; Shaheen, 2018; Agarwal et al., 2023). By involving informal transport drivers in decision-making processes, policymakers can leverage their knowledge and experience to develop more effective and context-specific solutions.

Informal transport drivers can be critical in promoting sustainable mobility by providing affordable and accessible transport services to underserved communities (Hernandez & Titheridge, 2016), which could enable policymakers to develop sustainable mobility solutions that meet the needs of all urban residents. Additionally, involving informal transport drivers in decision-making processes can help ensure that the benefits of urban transport development extend to all, including those operating in the informal economy (Kathait & Agarwal, 2021). This approach could help promote social equity and reduce inequalities in urban transport provision.

While this is one of many approaches to improving the situation of the workforce involved in ISM, it provides a scope for bottom-up policy interventions needed in the current transport policies.

2.1.3 The rise of e-ISM in India

The concerted effort to arrive at innovations in traditional cycle rickshaws in the mid-1990s led to the development of electric informal public transport (e-IPT) in India. Cycle rickshaws used to be ubiquitous, but their traditional designs were highly inefficient and exacted a significant physical toll on their pullers. The first electric rickshaw prototype was designed to address these obstacles. Nimbkar Agricultural Research Institute in Maharashtra was the first to successfully develop a model in the late 1990s, which paved the way for the emergence of the electric rickshaw as a viable option for urban transportation in India by the late 2000s.

E-ISM in India comprises two popular forms of electric ISM vehicles, e-autos, and e-rickshaws, sometimes used interchangeably to refer to electric-powered vehicles used for urban transportation. The two differ in design, battery, seating capacity, and purpose. They also differ in operation: e-autos are similar to traditional three-wheeled auto-rickshaws and operate as primary modes or gap fillers in urban areas. E-rickshaws are three-wheeled open cabin vehicles with a seating capacity of 2–4 people, and they primarily enable last-mile connectivity to the primary mode of transit, like BRT or metro.

Figure 2.1: New E-ISM Vehicles in India: E-auto (left) and E-rickshaw (right)

Source: (Left) Photo by a correspondent of Economic Times (Right) Photo by Subhash Barolia/Flickr

The Delhi government started to promote e-rickshaws during the Commonwealth Games in 2010, as an option to provide last-mile connectivity. Their low cost and minimal maintenance requirements led e-rickshaws to proliferate and operate in a regulatory vacuum. As of 2021, out of more than 1,500,000 e-rickshaws in use, merely 150,000 were registered (MoRTH, 2021).

Policies and regulatory frameworks for e-rickshaws are unclear – they are not considered motor vehicles because their speed is lower than 25 kmph and their motor power lower than 25Nm. Drivers don't need commercial licenses to run them, which provides an easy entry into the informal transport workforce. At the same time, because e-rickshaw drivers do not hold valid licenses, the risk of compromising passenger safety and violating traffic rules increases. Additionally, there is an increase in the sale of informally manufactured e-rickshaws, and in modifications to the approved designs. Formal manufacturers sell around 1500-2000 vehicles per month, while the unorganized and informal sector sells around 10,000 e-rickshaws per month throughout the country (Down to Earth, 2021). Informal manufacturers use lead-acid batteries of 48V 100Ah, weighing between 60 and 80 kilograms, compromising the design and safety of the vehicle. These batteries last for approximately six months, and the careless disposal of lead-acid batteries will harm the environment and public health. Most modifications use parts imported from China and assembled in India, which do not follow Indian standards. Due to the lower cost of lead-acid-based e-rickshaws compared to traditional internal combustion engine-based (ICE) auto-rickshaws, their sales increased to 28,304 per month, including e-rickshaws and e-carts (Ministry of Heavy Industries, 2021).

Low maintenance and ease of operation made e-rickshaws popular with commuters. After the formation of NITI Aayog in 2015, they have garnered immense support from government initiatives like Faster Adoption and Manufacturing of Electric Vehicles I (FAME-I), the Smart City Mission, the Pradhan Mantri Mudra Yojana, and state Electric Vehicle (EV) policies. The FAME-I subsidy provides INR 55,000 for lead-acid batteries used in electric three-wheelers, but this amount regrettably proved inadequate in easing their purchase. The FAME 1 subsidy was terminated in October 2019 with the arrival of FAME-II. The Ministry of Road Transport and Highways (MoRTH) has reduced the GST on e-vehicles from 12% to 5% and announced that battery-operated vehicles would be given green license plates and be exempted from permit requirements. Policy advice issued by MORTH on reduced road tax further increased the proliferation of e-ISM modes of transportation, particularly e-rickshaws. In many Tier 2 and Tier 3[1] Indian cities, e-rickshaws operate as the primary mode of transit. Over the years, the e-ISM sector has evolved, with major manufacturers like Mahindra, Atul Auto, Piaggio Vehicles, Jeeza Motors, manufacturing e-autos with lithium-ion batteries rather than lead-acid ones.

The rise of e-ISM in Indian cities has brought about notable changes in the urban transport landscape. The various impacts of e-ISM on mobility, livelihoods, and sustainability have drawn the attention of policymakers and scholars. Over the last decade, academic literature has focused on six aspects of e-ISM: urban mobility and transformation, livelihood, and socio-economic changes, policy and regulatory framework, social inclusion, environmental benefits and sustainability, operations, and safety.

1. As per Census of India, Tier 2 cities are defined as cities with population ranging from 50,000 to 99,999 and Tier 3 cities with population ranging from 20,000 to 49,999.

- **Impact on urban mobility and transformation:** Shared e-rickshaws improve last-mile connectivity, reducing congestion and promoting sustainable urban transport (Kumar, & Roy, 2019). They have the potential to complement existing modes of transport and address mobility gaps in urban areas (Chatterjee & Paul, 2022), and have improved mobility options for commuters, especially in congested urban areas (Ahmad & de Oliveira, 2016).
- **Impact on socio-economic conditions and livelihoods:** Recent academic research has focused on examining the socio-economic implications of shared e-rickshaws, including their impact on livelihoods, employment generation, and the drivers' income levels (Majumdar & Jash, 2015). The e-ISM has created new employment opportunities for individuals in the informal sector, contributing to poverty reduction and economic empowerment (Agarwal & Gogoi, 2019). E-rickshaws provide affordable transport for low-income individuals and enhance economic opportunities for drivers for low maintenance and operation costs (Bansal et al., 2023). e-ISM modes allow for shorter trips, resulting in higher income for operators (Mishra et al., 2022).
- **Policy and regulatory framework:** A clear policy framework that addresses licensing and safety standards is needed (Ghosh & Kalra, 2016). Regulations and institutional support would facilitate the effective integration of e-rickshaws into urban transportation systems (Priye, Manoj & Ranjan, 2021). The lack of a comprehensive regulatory framework specifically addressing e-rickshaws has been a challenge, and issues related to permits, licensing, safety regulations, and standardization of e-rickshaws must be addressed to ensure their smooth and regulated operation (Singh, 2014).
- **Operational challenges and safety:** E-rickshaws have received a push from the government because they use clean fuel technology through registration and tax benefits and by not mandating permits. Most cities offer permits in the open category without restricting the number of vehicles plying in the city, leading to an increase in the number of drivers without licenses and documents in the ISM workforce who enter the workforce with minimal investment and no skills (Priye, Manoj & Ranjan, 2021). This, in turn, compromises the safety of passengers and other street users. While their lower speed makes e-rickshaws a safer mode of transportation, illegal modifications, and heavy lead-acid batteries compromise their stability and increase the risk of accidents (Ghate & Suneja, 2018). The lack of charging infrastructure also poses an operational challenge for the sector, leading to increased electricity theft (Trivedi, 2019).
- **Social inclusion:** E-ISM also has the potential to enhance social inclusion by providing accessible transportation for people with mobility challenges (Singh et al., 2021). They offer low-floor designs and easy boarding, making them suitable for older individuals and persons with disabilities, promoting inclusivity and ensuring everyone can access transportation services (Majumdar & Jash, 2015; Singh, 2016). The sector has also provided opportunities for women to enter the transport workforce by becoming e-rickshaw drivers, challenging traditional gender roles, and contributing to women's economic empowerment (Alter Chen, 2016; Dhillon, 2022).

- **Environmental benefits and sustainability:** E-rickshaws have the potential to contribute significantly to sustainable urban transportation and address pollution concerns (Gupta, 2021). These vehicles effectively reduce carbon emissions and improve air quality compared to traditional fossil fuel-based vehicles (Jain and Gupta, 2019). Moreover, e-rickshaws operate silently, reducing noise pollution and creating a more serene and pleasant urban environment (Kumar et al., 2022). Additionally, they consume less energy per kilometer than conventional fossil fuel ISM modes, thereby aiding in the conservation of natural resources and reducing dependence on fossil fuels (Jain and Gupta, 2019).

2.1.4 New mobility alternatives in Indian cities

The way people move around in Indian cities is changing in ways that go beyond past trends like the increasing use of private vehicles. Technological innovations, socioeconomic shifts, and new policies lead to disruptive changes in cities, like the rapid growth of car and bike-sharing services, smartphone travel apps for multimodal travel, and a renewed focus on cycling and walking. These shifts are now a central focus of transportation policies in major Indian cities. Following their rapid growth, the Government of India has recognized digital intermediaries as 'aggregators', which act as digital marketplaces to connect passengers with individual entrepreneurs who provide individual or collective point-to-point transport services.

The rise of new alternate mobilities, such as bike-sharing, electric scooters, and ride-hailing services, has disrupted the urban mobility landscape and changed how people move through cities. There are new options to get around; individuals can now travel shorter distances quickly and easily using bike-sharing and e-scooters, without relying on cars or public transportation. This has reduced traffic congestion and improved the air quality in urban areas. These new mobilities have also challenged the dominance of traditional informal transportation providers like auto-rickshaws, taxis, and minibuses. Ride-hailing services like Uber and Ola have made it easier for people to get around without owning a car while providing a more personalized and convenient travel experience. Active modes like walking and cycling are no longer only a transportation choice, but they also reflect cultural, political, and social values (Aldred, 2012), while the adoption of new mobilities based on digital platforms is not solely driven by their practical benefits but also by the cultural and symbolic meanings attached to them (Sheller & Urry, 2006). Informal transport operators have leveraged mobile technology and social media platforms to improve communication with customers and increase the visibility of their services (Sarangi, Manoj, Tiwari, 2022)

In recent years, India has turned to electric vehicles to address poor urban air quality and fuel prices and invest in clean energy. This shift towards electrification marks a radical departure from traditional fossil fuel-powered transportation and represents a significant step forward in the country's efforts to decarbonize its transport sector. The use of electric vehicles has increased noticeably since the introduction of the National Electric Mobility Mission Plan 2020

(NEMMP) in 2013, followed by FAME-I in 2015 and FAME-II in 2019. The country has made progress in deploying electric vehicles across all segments, including passenger vehicles. E-rickshaws and e-autos are the two primary types of electric vehicles in the ISM sector, different from the regular e-vehicles used in ride-hailing services.

The changes in India's transport, disrupting traditional modes of mobility through the rise of new alternate mobilities, the adoption of electric vehicles, and digital platforms, are bringing about a more sustainable, efficient, and convenient transport system that is better suited to the needs and aspirations of urban residents. The future of transport in India will likely be characterized by further innovation, experimentation, and policy intervention. As technology continues to evolve, new modes of mobility are likely to emerge, providing people with more options for getting around. The adoption of electric vehicles is also set to increase, helping reduce emissions and improve air quality in urban areas. Digital platforms are likely to expand, making it easier for people to access information about transport options and facilitating a more seamless travel experience.

2.2 Locating ISM in the Urban Transport Policy Landscape of India

In the 75 years since Independence, India has made significant strides in transportation. The liberalization of the Indian economy in 1991 brought a need to recognize various modes of transportation and create an efficient and reliable urban transportation system to enhance the productivity of daily commutes and compete with the global market. Several new modes and technologies were introduced into the urban transport sector then. However, due to a lack of holistic policy interventions and public transport investments, most new interventions are concentrated in a handful of Indian cities. In contrast, other cities rely heavily on informal and shared modes.

Policies and regulatory frameworks for informal and shared mobility contribute towards meeting cities' daily travel demands. In a market or a mixed economy, the frameworks that the central government of India provides for the transport sector largely determine the level of implementation, cost, and modes of transport and operations. It is, therefore, necessary to create a policy environment that encourages coordination between formal public transport and ISM modes to provide an integrated transport solution that ensures the mobility of people and goods at maximum efficiency and minimum cost. Various ministries and institutions work together at various scales to achieve this objective, and urban transport policies themselves have evolved through three phases:

2.2.1 Phase I: the Motor Vehicle Act of 1988

Before economic liberalization in 1991, transport policies in India focused primarily on developing and expanding public sector enterprises. The government played a central role in planning, implementing, and regulating various modes of transportation. Transport policies were characterized by state ownership, infrastructure development, regulation and control, public service obligation, multimodal integration, addressing regional disparities, and employment creation.

State ownership dominated essential transport infrastructure and services, including railways, national highways, ports, and public bus transport. The emphasis was on expanding transportation infrastructure, such as the railway network, national highways, ports, and airports, to connect different regions and promote economic growth. The government tightly controlled and regulated transport services in urban areas, where operational decisions were often centrally determined. Although it recognized and stressed the coordination and integration of different modes of transport – railways, roadways, and inland waterways – to improve efficiency and connectivity, it did not recognize informal and shared mobility as key service providers in urban and rural areas. Its urban transport policies viewed the transport sector as a significant source of employment and implemented policies to create job opportunities, particularly in the public transport sector.

These transport policies affected the informal and shared mobility sector and the economy: the emphasis on public sector enterprises and state ownership led to inefficiencies and suboptimal outcomes, and the public sector dominance limited the participation of the public sector and led to underinvestment in it (Kharola, 2013). The only major regulatory framework governing the informal and shared mobility sector before 1991 was the *Motor Vehicle Act of 1988.*

The Motor Vehicle Act of 1988

The Motor Vehicle Act 1988 regulates motor vehicles, road safety, and transport operations throughout India. Although it does not explicitly address ISM, the act applies to all types of motor vehicles, including those used in the informal transport sector, such as auto-rickshaws, cycle rickshaws, and other non-conventional modes of transport. The Act establishes provisions and regulations related to various aspects of motor vehicles, such as registration, licensing of drivers, road safety standards, and insurance requirements, and sets up penalties for violations.

These provisions apply to both formal and informal transport operators. However, the enforcement of these regulations varies across states and regions in India. Additionally, specific regulations and policies related to the functioning and regulation of the informal transport sector exist at the state or local level, rendering the sector extremely complicated, with multiple sets of regulations to cater to various types of modes used in different Indian cities.

The Motor Vehicle Act of 1988 divides ISM modes in Indian cities into two categories, depending on the size of the city and transportation expectations. Contract carriage services, part of the first category, are flexible and demand-based, allowing passengers to choose their destination, and often, auto-rickshaws and taxis operate under contract carriage permits. Informal shared transport services, the second category, operate on a fixed route with intermediate stops for boarding and alighting. Some forms of informal transport, such as shared auto-rickshaws, tempos and minibuses, require stage carriage permits to run on specific routes in the city.

2.2.2 Phase II: A new focus on urban transport policies

Liberalization had a significant impact on the ISM sector, presenting both challenges and opportunities. Its effects vary depending on the specific mode of informal transport and the local context (Masoodi, 2016). Increased competition had repercussions for both formal and informal transport alternatives. Private players have entered the market, increasing competition for informal transport operators (Chadchan & Shankar, 2012). Taxis, app-based ride-hailing services, and private bus operators emerged as the formal sector alternatives that further challenged the conventional informal and shared mobility sector (Agarwal, Mani & Telang, 2023). With the entry of private operators, consumers had more choices, leading to the increased popularity of auto-rickshaws as a more convenient mode of transport in most Indian cities (Badami et al., 2016).

Efforts were made to reform policies and regulations governing the urban transport sector, including aspects related to informal sector mobility. The National Urban Transport Policy of 2006 (NUTP 2006) was one of the first policies that considered ISM. Several other policies and missions were subsequently introduced to regulate and bring ISM under an institutional framework that supports the formal public transport system in providing last-mile connectivity. Some states introduced reforms to regulate and formalize specific segments of the informal transport sector, such as issuing permits and introducing fare regulations (Kumar et al., 2016).

Table 2.1

Year	Policies / Mission	Description	Remarks / Current Status
2003	National Auto Fuel Policy	Tackles problems related to vehicle emissions and technologies by implementing standards for the quality of fuel.	Ongoing – roadmap for the auto fuel quality till 2025. Upgraded in 2017 and 2020.
2005	Jawaharlal Nehru National Urban Renewal Mission (JnNURM)	Facilitates economically productive, efficient, and responsive cities, Basic Services for the Urban Poor (BSUP), reforms in urban governance and infrastructure including transport.	Mission concluded in 2014.
2006	National Urban Transport Policy (NUTP)	Aims to establish a sustainable and efficient urban transport system that can meet the mobility needs of people; a multi-modal public transport system that is well integrated and provides seamless travel across various modes, and land-use transport integration.	Approved and adopted. Modified in 2014 but the government did not publish it officially.
2010	National Road Safety Policy	Aims to increase road safety by improving the standards of road infrastructure in accordance with international best practices. Also focuses on enhancing the licensing process and improving the safety and design of vehicles.	Prepared in 2007 and approved in 2010.

Overview of Urban Transport Policies

JnNURM, 2005: In 2005, the Ministry of Urban Development (MoUD) launched the Jawaharlal Nehru National Urban Renewal Mission (JnNURM), a visionary initiative that aimed to revolutionize the way urban infrastructure was developed and improved. Focusing on urban-level reforms and expedited development of urban transport, JnNURM provided much-needed financial assistance to cities across the country. Although the policy did not explicitly mention the ISM sector, the overall boost in infrastructure had a profound impact on the sector, leading to a major surge in its growth.

NUTP, 2006: In 2006, the Indian government laid the foundation for an innovative approach to urban transportation by establishing the National Urban Transport Policy (NUTP). The policy attempted to unite the various organizations involved in urban transportation under the Unified Metro Transport Authorities (UMTAs) in cities. Its memorandum defined informal urban transport or paratransit as transportation for occasional or emergency trips when waiting for public transport is not feasible. It noted that, while these modes of transportation are not typically used for daily commutes, they become the go-to for many city dwellers when the quality of public transport declines, and proposed sustainable development and a people-centric perspective as a shift in focus from mere transportation to an inclusive version of urban mobility that extends across the country. The policy shifted focus from moving vehicles to moving people through an approach that prioritized public transport, acknowledged the need for a unified agency dedicated to passenger transport, aimed to integrate land use and transport planning as well as public transport systems, proposed capacity building at various levels; emphasized non-motorized transport and aimed to address environmental concerns and came up with innovative financing mechanisms.

2.2.3 Phase III: New policies towards low-carbon mobility transition

From 2012 onwards the focus of transport policies in India underwent significant changes. The Government of India adopted a more market-oriented approach, aiming to promote private sector participation, encourage competition, and improve efficiency in the transport sector. Transport policies focused on:

- Privatization and public-private partnerships
- De-regularization and market competition
- Multi-modal integration and infrastructure development
- Policy reforms for efficiency and sustainability
- Regulatory framework and safety
- Technological innovations and integration

Table 2.2

Year	Policies / Misson / Act	Description	Remarks / Current Status
2012	National Electric Mobility Mission Plan for 2020	Aims to achieve national fuel security by promoting hybrid and electric vehicles in the country.	Ongoing
2014	National Urban Transport Policy (NUTP)(draft)	Emphasizes on promoting sustainable modes, financing and resource mobilization, multi-modal integration of various modes of transport.	The draft was never finalized
2015	Smart Cities Mission	Established to promote the sustainable and inclusive development of cities by using technology and innovation, urban mobility, and public transport, promoting a variety of transport options – Transit Oriented Development (TOD), and last mile para-transport connectivity.	Ongoing
2015	Atal Mission for Rejuvenation and Urban Transformation	Aims to provide basic services (water supply, sewerage, urban transport) to households and build amenities that improve the quality of life for all city residents. Focuses on promoting public transport and non-motorized transport in cities. Focuses on urban governance by strengthening municipal institutions, improving service delivery mechanisms, and promoting citizen participation in urban planning and development.	Ongoing
2015	Heritage City Development and Augmentation Yojana	Planning and executing heritage-sensitive infrastructure development projects in heritage cities. Aims to improve access and mobility to heritage sites through the development of pedestrian-friendly pathways, cycle tracks, and public transport facilities and to provide last-mile connectivity to heritage sites through feeder services and shuttle services.	Ongoing
2015	FAME: Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles	Aims to promote the adoption of electric and hybrid vehicles in the country to reduce vehicular emissions and dependence on fossil fuels.	Expanded to FAME II.

2017	National Transit-Oriented Development (TOD) Policy	Promotes compact and mixed land-use development patterns that encourage walking and transit usage. Aims to develop sustainable urban transportation systems by promoting the use of public transit, non-motorized transport, and intermediate transport systems for last-mile connectivity.	Published, but no subsequent scheme launched.
2017	Green Urban Mobility Scheme	Aims to improve the quality of life in Indian cities by promoting sustainable and environmentally-friendly transport solutions. Encourages the use of green modes of transport such as electric vehicles, hybrid vehicles, and public transport systems that use cleaner fuels.	Concept document published, but no subsequent scheme launched.
2017	Metro Rail Policy	Provides a framework for the planning, financing, and implementation of metro rail projects, with a focus on private sector participation and innovative financing mechanisms. Envisages integration of the metro with other modes of public transport.	Ongoing
2019	FAME II: Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles	Aims to encourage faster adoption of electric vehicles by providing financial incentives for electric buses, three-wheelers, and four-wheelers.	Ongoing
2019	The Motor Vehicle Act 2019 (amended)	Under the recent amendment of the Act in 2019, changes specific to ISM are made: states have been empowered to frame schemes for promoting shared mobility; the Act promotes aggregators to facilitate mobility and introduces regulations for taxi aggregators, which can promote the use of informal public transport. The Act provides a boost to last-mile connectivity by allowing non-transport vehicles to be used for public transport under certain conditions.	Ongoing

Transport Policies Post 2012

2.3 Summing Up

The informal and shared mobility (ISM) sector is a crucial aspect of urban mobility in Indian cities, providing affordable and accessible transportation options to millions of people. However, the lack of a comprehensive policy approach towards this sector has led these services to operate outside the purview of a formal regulatory framework. The ISM sector adapts to the wide range of informality and operates according to the needs and transport characteristics of cities to provide services. Researchers and policymakers have studied the sector through different approaches, complicating the understanding of the sector and making it necessary to further understand its informal nature.

The subversion of formal regulations by the service providers of informal transport poses another problem, raising complex socio-political issues that require a nuanced understanding of power dynamics, contestations, and governance challenges. While attempts at stringent enforcement can lead to socio-economic disruptions, and political backlash, ignoring the sector would have a long-term social, economic, and environmental consequences. A comprehensive approach towards the informal transport sector in Indian cities is needed, balancing regulation with the provision of affordable transport services.

Policymakers need to adopt inclusive and participatory decision-making processes that consider the needs of informal operators, passengers, and the broader urban transport system in Indian cities. An important recognition is about the weak State capacity of enforcement on one side and on the other side, the networks of political patronage create a parallel system of governance undermining the formal regulatory framework. The approach should consider the various perspectives that offer different views on informality in the Indian context, addressing historical, economic, political, and spatial dimensions. The policy approach should be more self-regulatory with certain checks and balances that does not hinder the flexibility of an informal system but provides for safer and healthier standards.

A nuanced study of the sector is necessary to provide an overall and universal understanding of ISM in Indian cities. Defining the services under informal transport as Informal and Shared Mobility is one possibility, establishing an umbrella term that encompasses a diverse range of mobility options characterized by their informal and semi-formal regulatory nature, as well as the sharing of vehicles or services among multiple users.

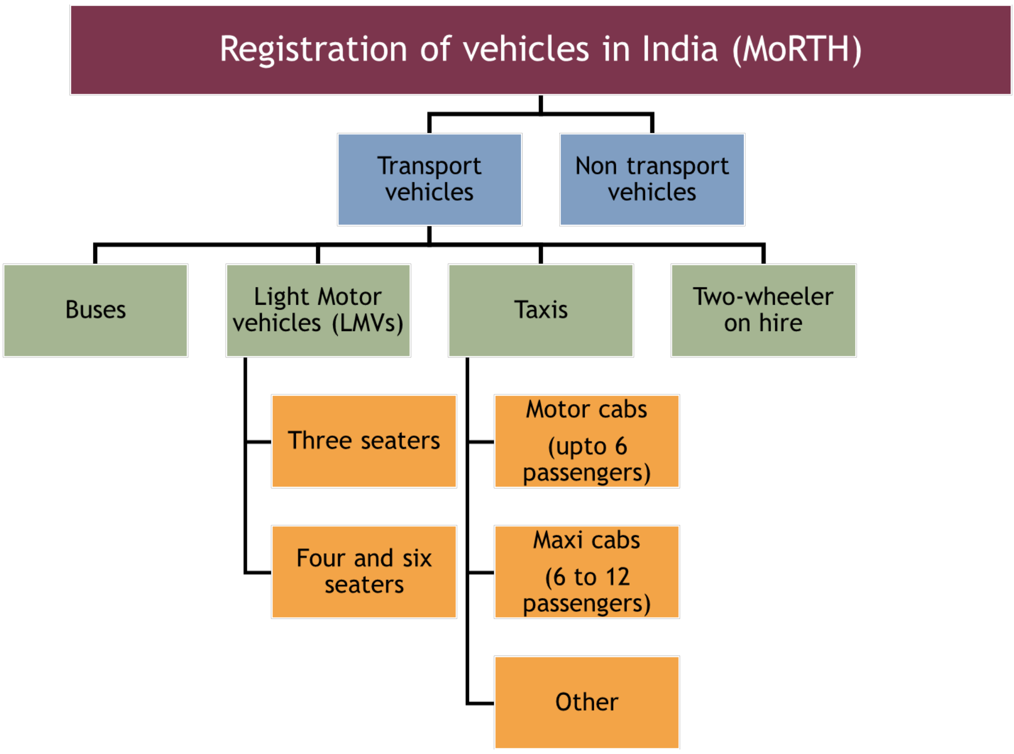
Chapter Three: Conventional Informal Mobility (CIM)

The informal public transport sector in India plays a significant role in catering to the transportation needs of the urban population, especially in areas where formal public transport options are limited or inadequate. Additionally, shared mobility services, such as ride-hailing and bike-sharing platforms, have recently gained popularity. This chapter focuses on a comprehensive market research analysis of informal public transport and shared mobility in Indian cities, concerned with market size, trends, regulatory framework, and prevalent issues.

3.1 Introduction

The Ministry of Law and Justice 2019 classified vehicles in India into transport and non-transport categories. The non-transport category primarily concerns vehicles for personal use. The transport category comprises buses, light motor vehicles (passengers), taxis, and two-wheelers available for hire. These are used for public transport, paratransit, freight, and renting. Subcategories are also defined based on the capacity of the vehicles rather than their size or function.

Figure 3.1: Registration of Vehicles



Note: 'Other' includes vehicles such as tractors, trailers, and miscellaneous vehicles not classified separately.

3.1.1 From vehicle registration to operation

Transport vehicles require permits issued by the state governments to operate, whether they function independently, collaborate with aggregators, or engage in a combination of these. The process from registration to on-road operation has multiple stages.

Most vehicles owned by private companies or individuals usually acquire contract carriage[2] permits. The monopoly of the state government restricts stage carriage permit[3] registrations, which are issued to vehicles which undertake public transport, especially buses. Consequently, the percentage of vehicles operating under contract carriage permits exceeds those operating under stage carriage permits. In several cities however, informal mobility vehicles operate based on contract carriage permits, while others impose restrictions on transport vehicles by issuing licenses specific to areas or routes. The vehicle owner then decides on a business model, whether operating individually, renting out vehicles, or partnering with an aggregator.

Figure 3.2: The Process Followed by Transport Vehicles from Registration to Operation

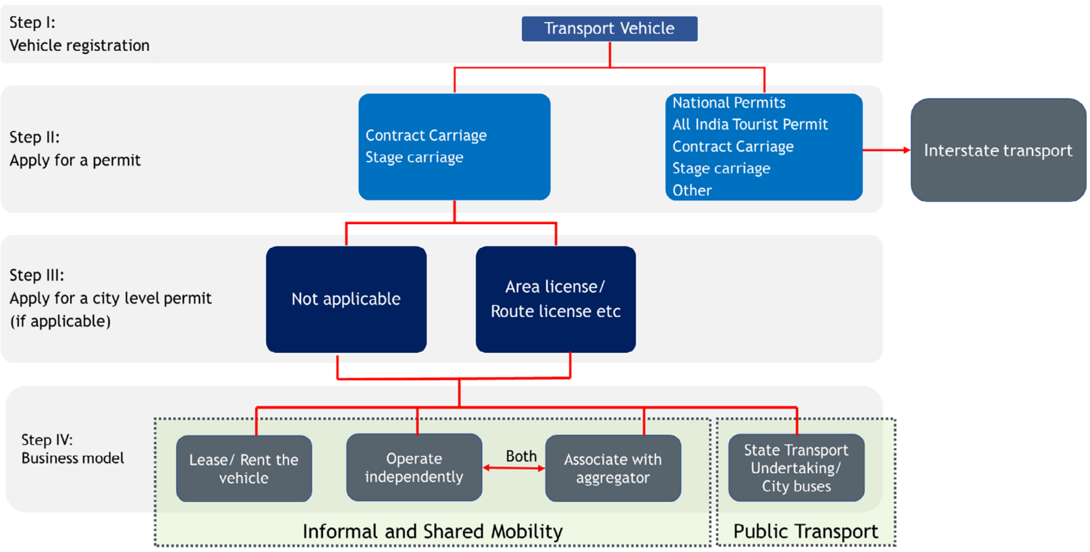


Chart does not include Goods vehicles permits and Private Service Vehicle Permits

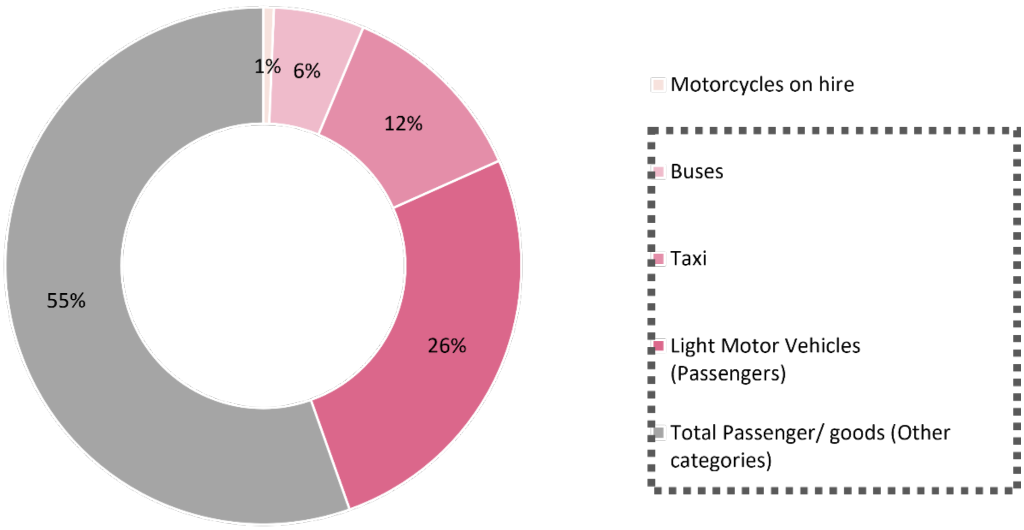
2. 'Contract carriage' means a motor vehicle which carries a passenger or passenger or passengers for hire or reward and is engaged under a contract, whether expressed or implied, for the use of such vehicle as a whole for the carriage of passengers mentioned therein and entered into by a person with a holder of a permit in relation to such vehicle or any person authorized by him in this behalf on a fixed or an agreed rate or sum – (a) on a time basis, whether or not with reference to any route or distance; or (b) from one point to another, and in either case, without stopping to pick up or set down passengers not included in the contract anywhere during the journey, and includes – (i) a maxicab; and (ii) a motor cab notwithstanding that separate fares are charged for its passengers.

3. 'Stage carriage' means a motor vehicle constructed or adapted to carry more than six passengers excluding the driver for hire or reward at separate fares paid by or for individual passengers, either for the whole journey or for stages of the journey.

3.1.2 Types of ISM vehicles

The total number of registered transport vehicles in India in 2019 was 25.89 million, with 45% belonging to the buses, light motor vehicles (passengers), taxis, and two-wheelers on hire categories (MoRTH, 2021). Light motor vehicles (LMVs) – three-seaters, four-seaters and six-seater vehicles – had the maximum share in this percentage, followed by buses and taxis, while motorcycles on hire accounted for the smallest portion of the registered transport vehicles. Vehicles registered in Faridabad (1.86 million), Bengaluru (0.8 million), Delhi, Chennai, and Ahmedabad accounted for more than 50% of the total transport vehicles registered in the million-plus cities as of 2019.

Figure 3.3: Registered Transport Vehicles (25.89 million) in India, 2019

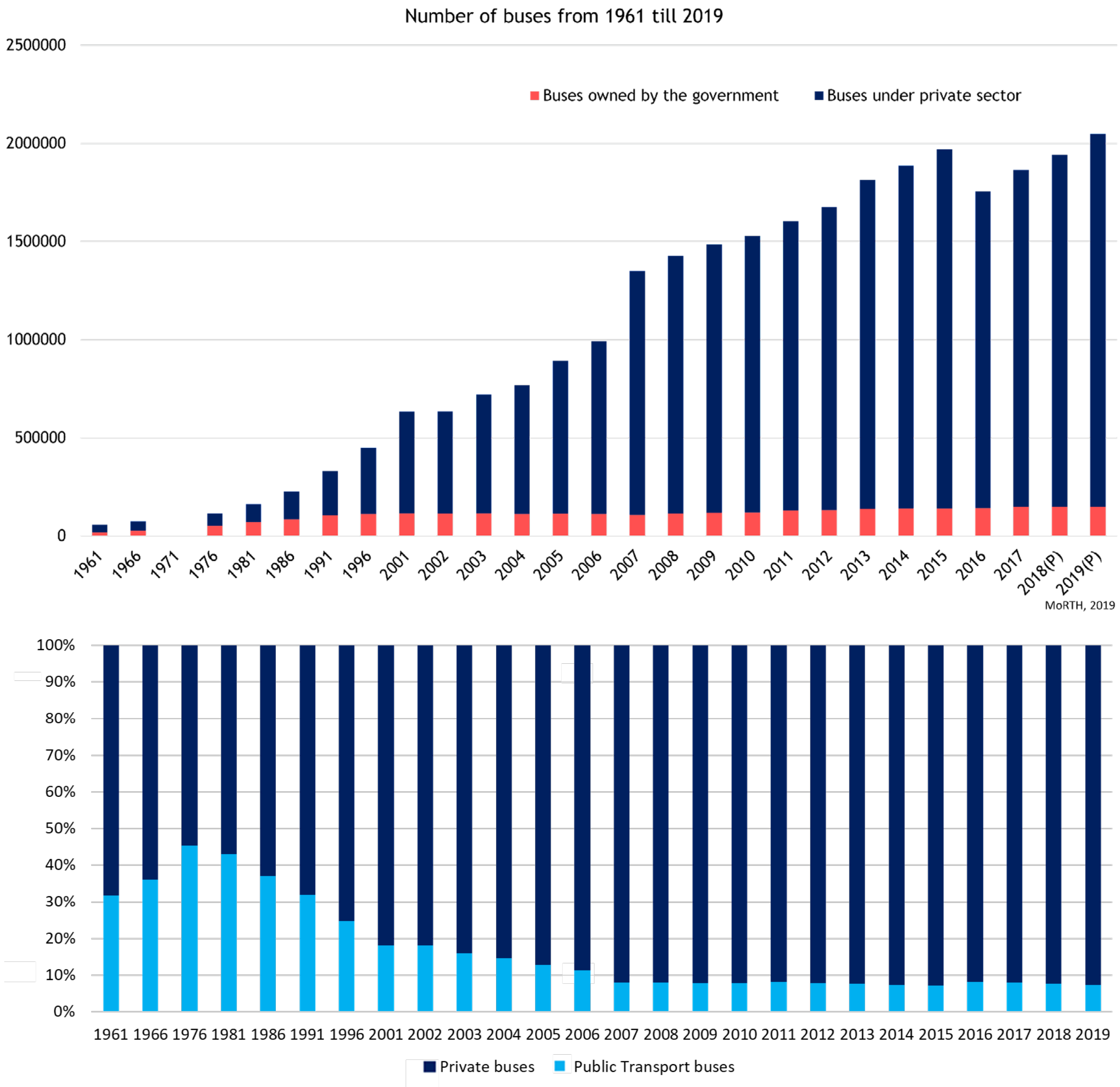


Source: MoRTH, 2021

Buses: As of March 2019, India had 1,471,624 registered buses. Private operators accounted for approximately 92% of the total, while government-run buses constituted a significantly lower proportion. While the number of government buses increased slightly from 1961 to 2019, the overall ratio of buses owned by the government has declined substantially.[4]

4. Data from various sources indicates the total number of registered vehicles without deducting the scrapped vehicles, making it difficult to calculate the exact number of vehicles operating in various cities.

Figure 3.4: Private and Public Transport Buses in India in Actual Numbers and Percentage

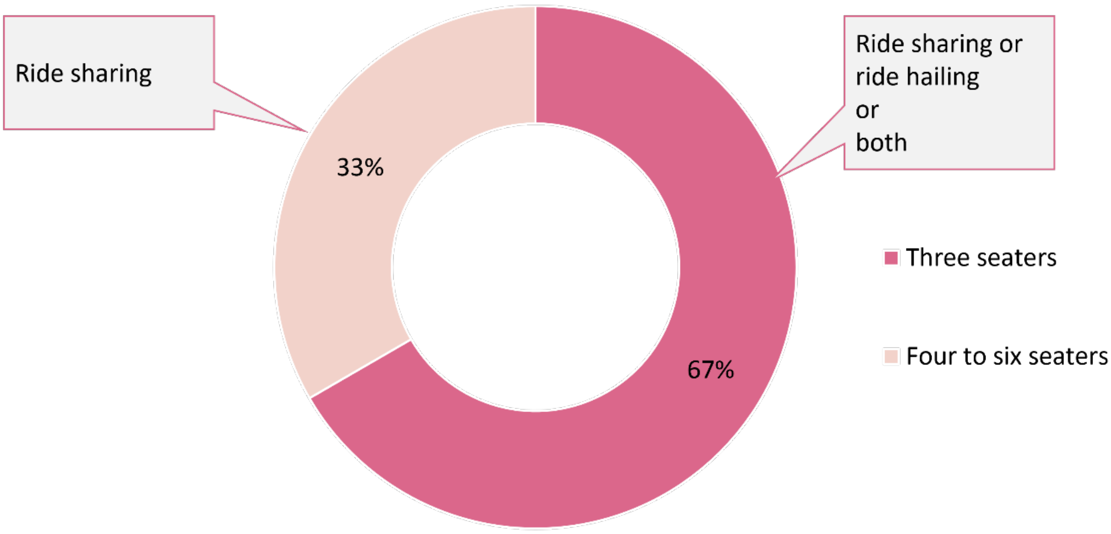


Source: Office of State Transport Commissioners/UT Administrations in Morth (2021)

Light motor vehicles (passengers): Light motor vehicles (LMVs) carry goods or passengers. Under the passenger category, there are three main types of LMVs: three-seater, four-seater, and six-seater vehicles. Three-seater vehicles are commonly employed for ridesharing or ride-hailing purposes, while four-seater and six-seater vehicles are predominantly utilized for ride-sharing services.[5]

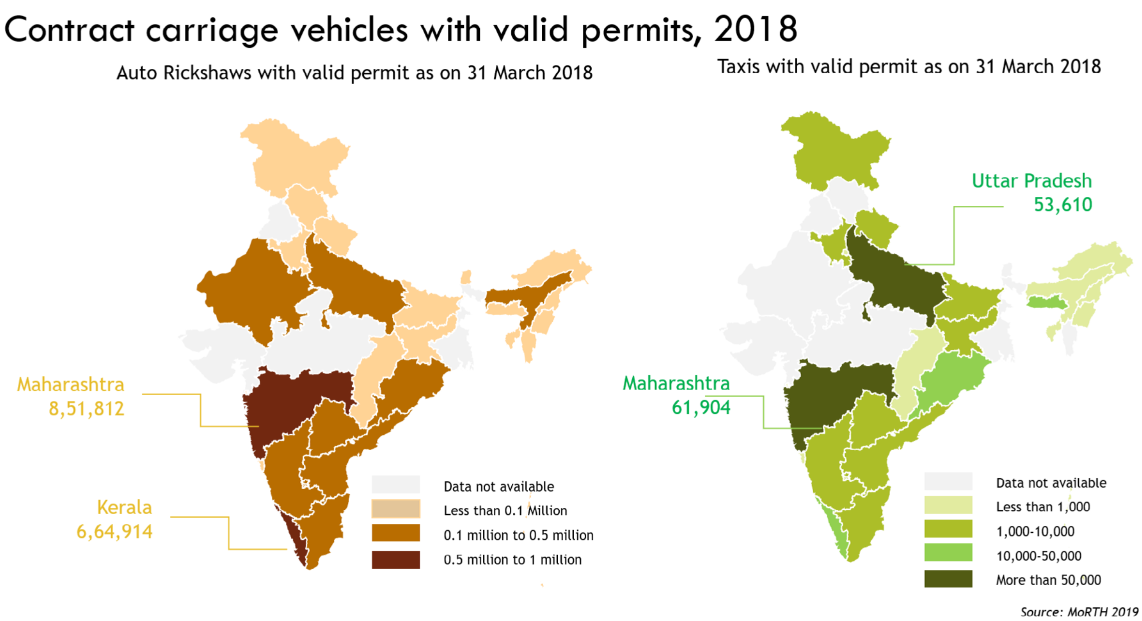
5. Vehicles can operate independently, in association with aggregators, or adopt a combination of approaches, which makes obtaining disaggregated data a challenge. The data provided includes vehicles operating in both capacities.

Figure 3.5: Distribution of Three-Seaters and Four- To Six-Seaters (Out of a Total of 6,792,000 Vehicles)



Source: MoRTH, 2021

Figure 3.6: Auto-rickshaws with Valid Contract Carriage Permits as of March 31, 2018



Source: MoRTH, 2021

Most of the conventional ISM vehicles fall under the LMV category. Some of these vehicles may be associated with aggregators.

Taxis: Taxis are divided into motor cabs, maxi cabs, and others. While motor cabs can provide ride-hailing or ridesharing services, maxi cabs are predominantly used for ridesharing operations. The Ministry of Road Transport and Highways provides various taxi permits for operating in urban areas or as interstate transport. Vehicles with an All India tourist permit cannot operate as stage carriages (MoRTH, 1989).

As of 2019, motor cabs – constructed or adapted to carry up to six passengers, excluding the driver, for hire or reward – hold the highest number of registrations (Figure 3.8) They engage in ridesharing, ride-hailing, or both, and can operate independently or by associating with an aggregator, depending on the business model chosen by the vehicle owner.

Figure 3.7: Taxis with Valid Contract Carriage Permits as of March 2018

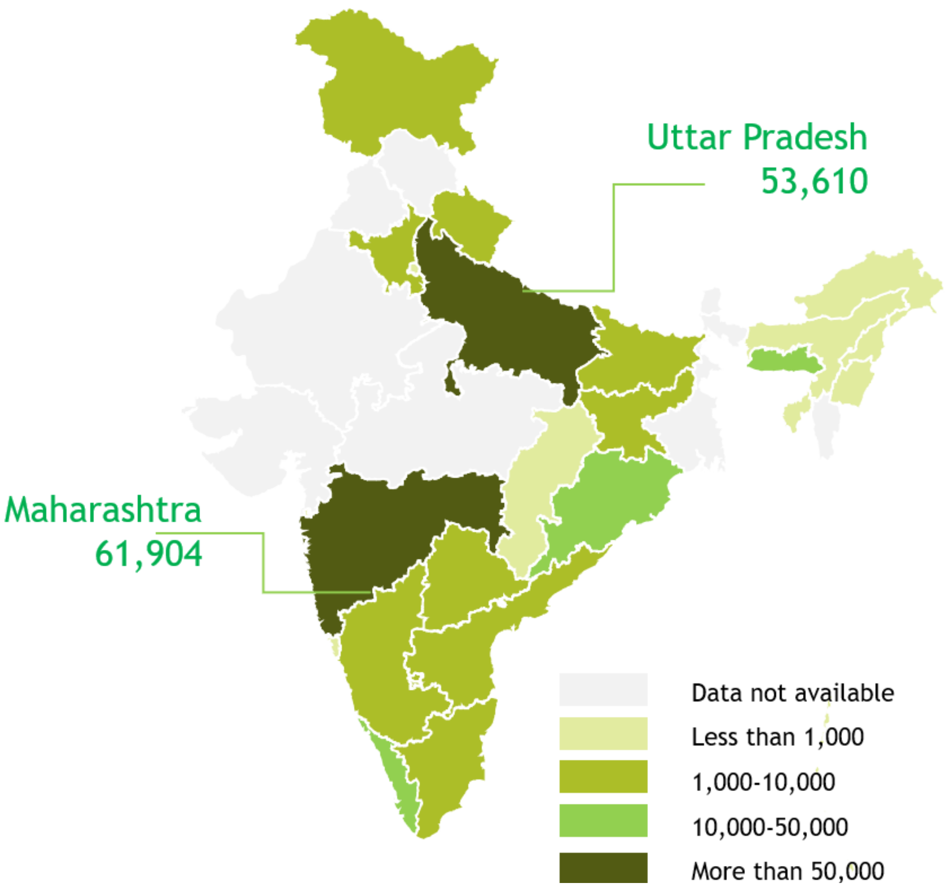
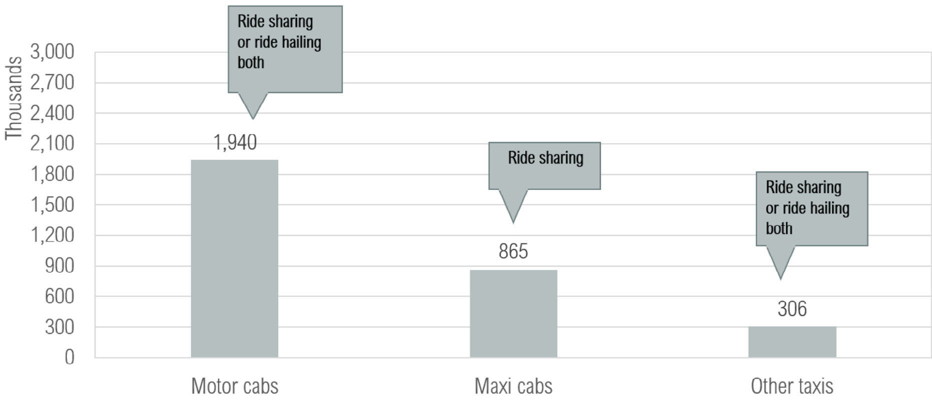


Figure 3.8: Taxi Registrations by Mode

2. Taxis (Passenger)



- 4,982 electric rickshaw permits in 2019 under FAME scheme;
- 3,477,813 auto rickshaws in 2019- all fuel types

Source: MoRTH, 2021

3.2 Operations and Services

3.2.1 Current status

Many Indian cities are dependent on informal public transport. Only 66 of the 450 cities with more than 100,000 inhabitants have access to a formal city bus service (Gadepalli et al., 2018), while the rest rely on informal and shared mobility, paratransit, or informal public transport. The vehicles used for conventional informal mobility (CIM) differ across cities, and due to type or flexibility of vehicle, they can be used as a vehicle for ride-hailing or ride-sharing.

Table 3.1

Type of CIM	Visual representation	Specifications	Examples of cities
E- Auto-rickshaw		Fuel: Electric Battery Seats: 3+1(driver)	Found in most Indian cities like Ahmedabad
Auto-rickshaw		Fuel: CNG Seats: 3+1(driver)	Found in most Indian cities like Delhi, Pune
Vikram		Fuel: Diesel Seats: 6+1(driver)	Lucknow, Gaya, Dehradun (predominantly North Indian cities)
Tata Magic (Maxi cab as per MV act)		Fuel: Diesel/ CNG Seats: 7+1(driver)	Chennai

Vehicles Used for Informal Mobility in Indian Cities

3.2.2 Issues faced by operators

Discussions with industry experts and operators highlight the following issues:

Competition among operators: The CIM sector needs to be more cohesive and organized. Often, operators need to be registered under a union or cooperative. In some cities, the unions are informal and not registered legally, resulting in poor coordination and a lack of faith in the sector. Ultimately, this leads to competition for passengers, making for unsafe driving and increased road safety risks for all.

Poor condition of vehicles: In most cities, vehicles under CIM are old and poorly maintained. Low earnings lead the operators to ignore the maintenance of vehicles. Driving in an ill-maintained vehicle reduces their performance and affects public health.

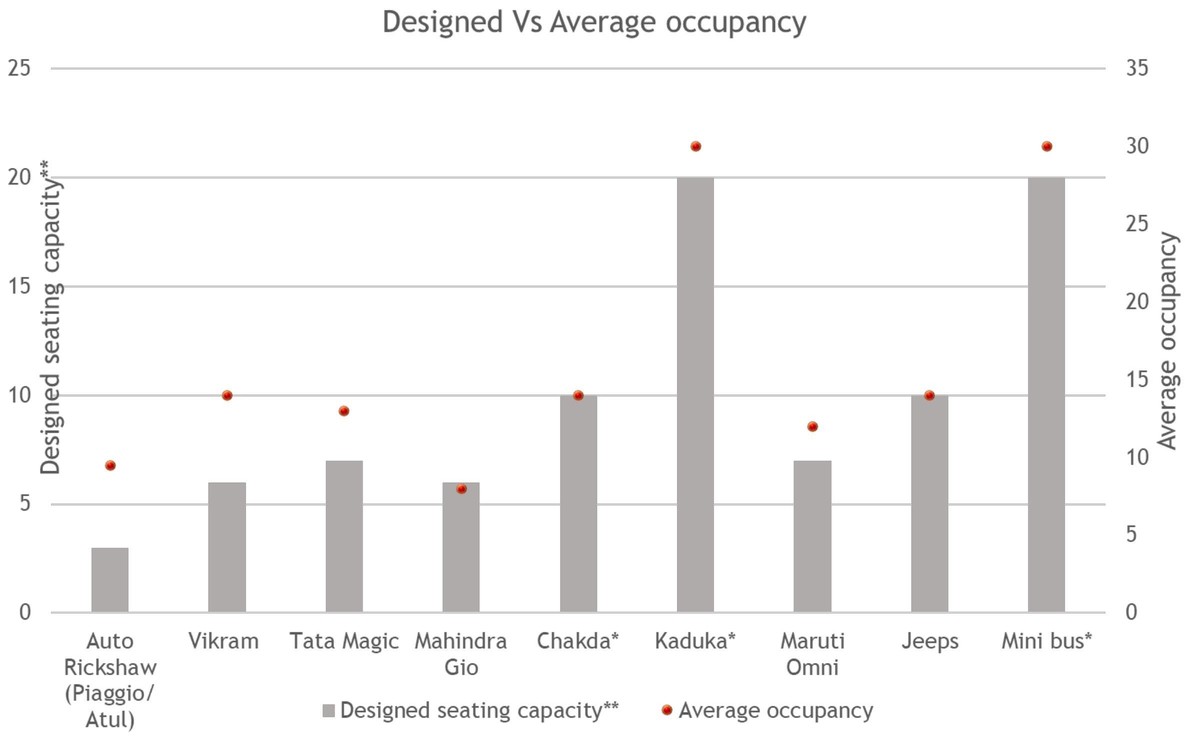
Constant exposure to pollution: The CIM operators ply their trade on major roads and essential locations in the city – bus stands, railway stations – which are typically highly polluted, with high PM2.5 and PM10 percentages. The operators are constantly exposed to air pollution that can affect their health and performance.

Lack of infrastructure: Most cities do not have designated parking spaces for informal mobility vehicles. While on-street parking is accessible for private vehicles in most Indian cities, parking CIM vehicles is considered illegal and causes congestion. CIM operators also need exclusively reserved infrastructure facilities like toilets and restrooms.

3.2.3 Issues faced by passengers

Poor passenger safety: Vehicles take passengers beyond their capacity in many cities (Kumar et al., 2016), for lack of regulations and because of informalities. This leads to poor passenger safety and increases the risk of accidents. Some carry two to three times more passengers than their designed capacity, and the passengers compromise and risk their safety for lack of affordable alternatives..

Figure 3.9: Designed Capacity and Average Occupancy of CIM Vehicles

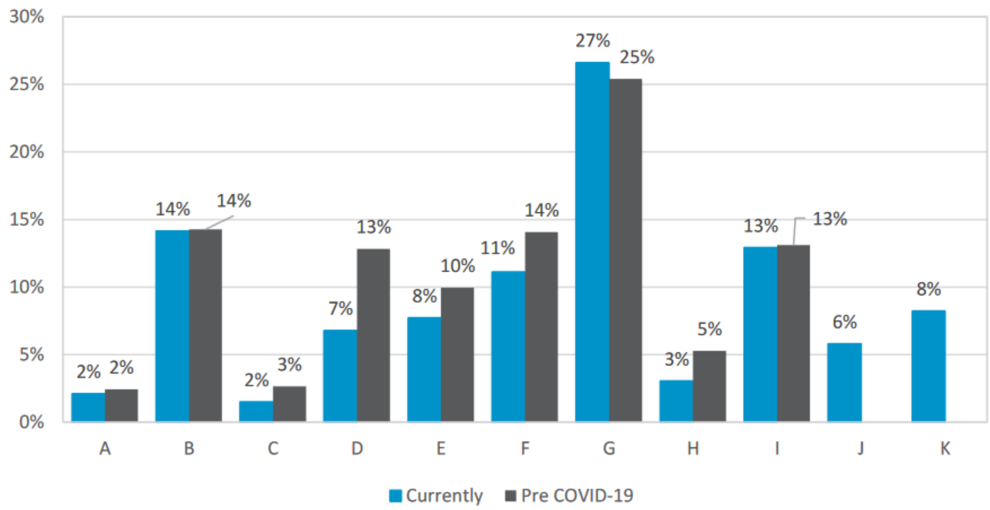


Source: Kumar et al., 2016

Dependence on cash-based transactions: Many CIM operators do not have access to smart-phones or digital payments, and passengers need to spend more time completing travel cost transactions by cash and have to carry smaller denominations of money.

Rash driving and road safety: The competition to take more passengers and complete more trips leads drivers to speedy and rash driving which incurs road safety risks. A Delhi-based study indicated that rash driving is the primary concern raised by most respondents (Shah et al., 2020).

Figure 3.10: Concerns Raised by Passengers Regarding Informal Mobility



A: IPT does not serve my area
B: Low availability of shared IPT
C: Poor quality pedestrian infrastructure access to and from the shared IPT stand
D: IPT drivers do not follow the meter
E: Increased rickshaw/ Gramin Sewa fares due to the pandemic
F: Shared rickshaws/ Gramin Sewas are overcrowded
G: Rash driving by the shared IPT vehicle driver
H: Sexual harassment in the shared IPT vehicle
I:NA
J: Co-passengers do not wear masks
K: Driver does not wear a mask

3.3 Policy, Regulation, and Governance

3.3.1 Current status

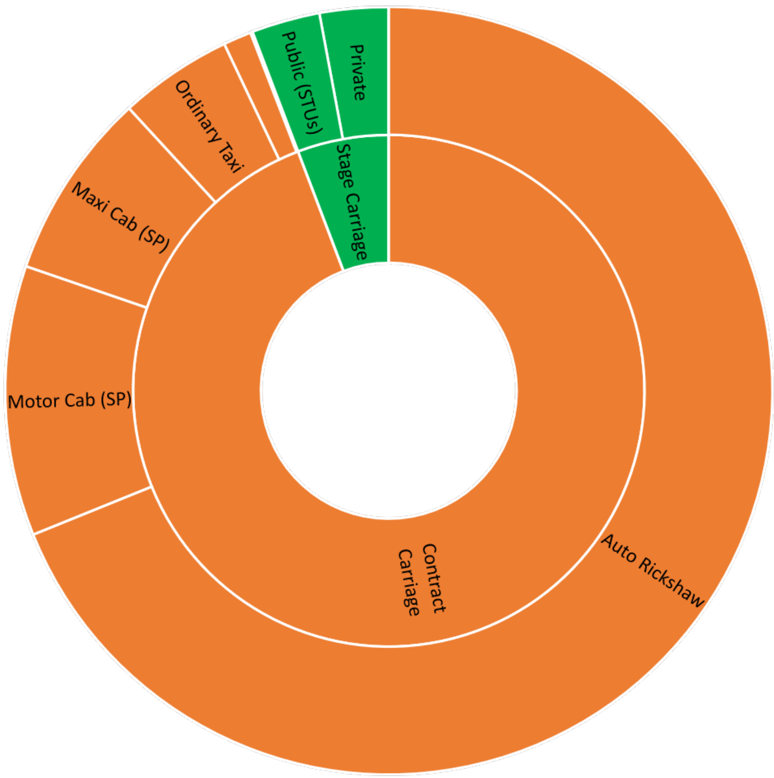
The allocation of responsibilities for formulating and implementing regulations in India is outlined in the seventh schedule of the Constitution. Specific rules, such approval for the vehicle type and driver licensing, are standardized nationwide. However, the central government establishes guidelines for vehicle permit issuance, taxation, and fare regulations, while individual states have the flexibility to make necessary adjustments according to their requirements (Gadepalli et al., 2018).

The Motor Vehicle Act 2019, The Central Motor Vehicle Rules (CMVR) 1989, and The Motor Vehicle Aggregators Guidelines 2020 are key pieces of legislation concerning informal and shared mobility in India. The Motor Vehicle Act 2019 regulates the issue of permits by a state or regional transport authority or any prescribed authority, where permits are defined as an authorization allowing the use of a motor vehicle as a transport vehicle (Ministry of Law and Justice, 1988). The

Ministry of Law and Justice empowers the state and regional transport authorities to formulate routes for plying stage carriages. In many Indian cities, issuing stage carriage permits (which allow operating as a shared vehicle on predefined routes with multiple stops to pick up and drop off passengers) is restricted to formal public transport agencies. This leads IPT vehicles to operate illegally under contract carriage permits, while they ply on given routes with multiple stops (Joshi et al., 2021). Most transport vehicles are registered under the contract carriage category.

Registered buses operate based on the type of permit – stage carriage, contract carriage, or private service vehicles. The private service vehicle (PSV) is a category corresponding to buses owned by a private entity (e.g., school) which operate to transport passengers, but not as public transport vehicles. Since the stage carriage permit is linked to the vehicle's capacity, buses possessing stage carriage permits have the highest share (MoRTH, 2021). Out of various CIM vehicles, auto-rickshaws account for the highest number of contract carriage permits, mainly due to their occupancy of less than six passengers. Though registered under the contract carriage permit, operators often run these vehicles as stage carriage vehicles by allowing multiple stops and increasing their capacity through local engineering modifications.

Figure 3.11: Stage Carriage vs. Contract Carriage Permits (Valid as of 31st March 2018)



Note: The graph does not include All India permits for motor cabs, maxi cabs, and omnibuses.
Source: MoRTH, 2021

3.3.2 Issues faced by operators

Conventional ISM operators face several issues:

Permits linked to the seating capacity rather than the type of operation: In many cities, authorities issue contract carriage permits to vehicles without considering their seating capacity (Kumar et al., 2016). Vehicles like Tata Magic, Mahindra Gio, and Vikram, designed to have seating capacities of seven to eight passengers, hold contract carriage permits, allowing them to seat only three to four passengers. At the same time, the definition of 'stage carriage' is based on the vehicle's capacity rather than the type of operation and means a motor vehicle constructed or adapted to carry more than six passengers excluding the driver, for hire or reward, at separate fares paid by or for individual passengers, either for the whole journey or for stages of the journey (Ministry of Law and Justice, 1988). The discrepancy treats some types of vehicles as violating the terms of the contract carriage permit by operating as shared services seating far more passengers than the permits allow. In addition, contract carriage permits also give specific origin and destinations in the permit but there's no on-ground monitoring of its implementation.

Difficulties in meeting the requirements of stage carriage permits: Stage carriage permit vehicles are expected to publish their schedules of operations, but the fragmented nature of these services makes it challenging to comply with this requirement.

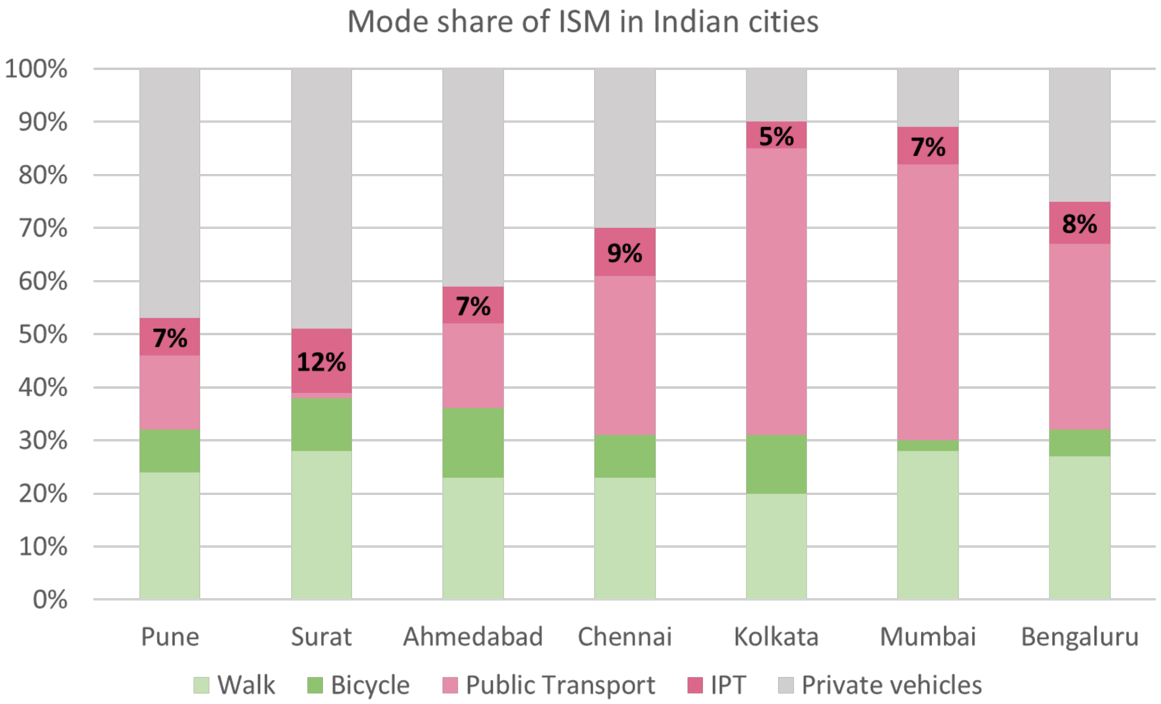
Lack of supporting infrastructure to comply with permits: The stage carriage permit requires that vehicles pick up and drop off at designated locations approved by the Regional Transport Authority (RTA). Urban local bodies are required to assign formal stops in coordination with the RTA. However, the urban local bodies or equivalent agencies designate stops for formal city bus services, but are reluctant to assign stops, stands, or terminals for informal vehicles.

3.4 Social and Environmental Impact

3.4.1 Current status

Informal shared mobility (ISM) plays a crucial role in meeting the transportation needs of many Indian cities. While aggregators are a recent addition to mobility in these cities, the role of conventional ISM in filling the gap created by formal public transport is substantial (Gadepalli et al., 2018). A study shows that around 10% of the total number of trips in cities with a population lower than a million are undertaken with ISMs.

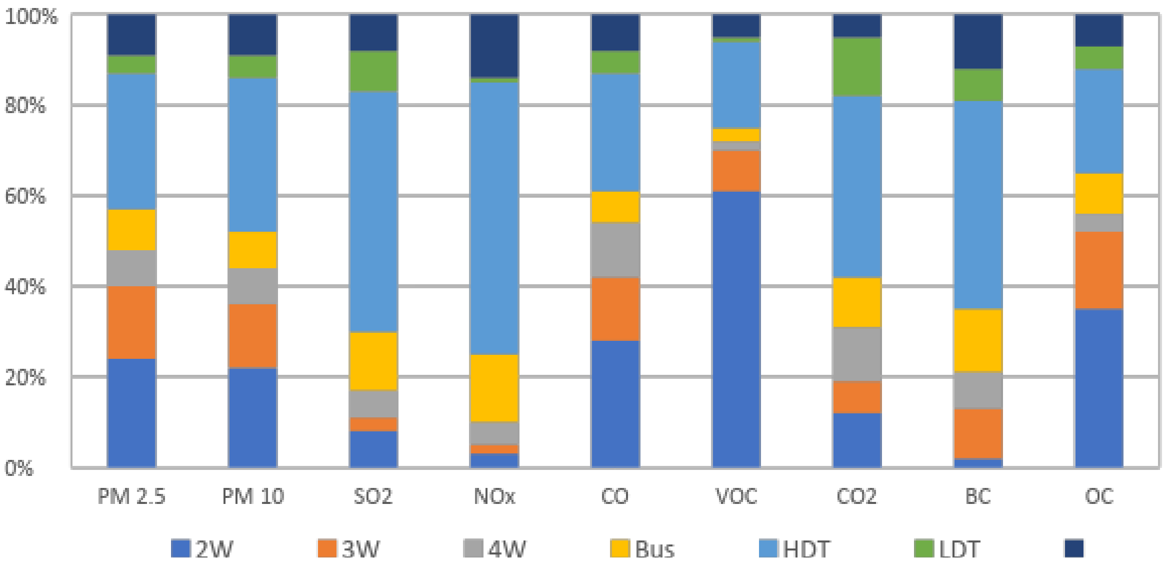
Figure 3.12: Mode Share of ISM in Indian Cities



Source: Ghate & Suneja, 2018

Emissions from private vehicles are much higher than public transport and CIMs (Guttikunda & Jawahar, 2012), and hence the role of CIM vehicles is critical in curbing air pollution. However, many cities regard CIM vehicles as a significant cause of air pollution.

Figure 3.13: Total Emissions from the Road Sector in India, 2016



Note: 2W: 2-wheelers; 3W:
3-wheelers; 4W: 4-wheelers including cars and jeeps; HDT: Heavy Duty Trucks; LDT: Light Duty Trucks; OTH: Other including tractors & multi-utility vehicles. Source: Guttikunda & Jawahar, 2012.

3.4.2 Issues faced by operators

The sector does not welcome female operators: The sector is highly male-dominated. Lack of regulations, support from the government, and lack of facilities make it difficult for women to enter the sector as operators.

The burden of electrification: Various policies at the national level encourage the electrification of vehicles. The penetration of electric passenger vehicles in India indicates 793,370 three-wheelers, 544,643 two-wheelers and 54,252 four-wheelers as of August 2022 (Economic Times, 2022). While the government provides subsidies under FAME II for electric vehicles, the cost of an electric auto-rickshaw is INR 0.3 million INR[6], which places the financial burden of switching to a new vehicle on the driver. Apart from Kochi (Kerala) and Amritsar (Punjab), this is the only urban local body or smart city company that provides subsidies for switching to electric auto-rickshaws. Additionally, The Motor Vehicle Act mandates that vehicles older than 15 years need to be scrapped. Many diesel auto-rickshaws in various Indian cities are old and need immediate replacement, but banning old fossil fuel vehicles without subsidy for switching to electric vehicles burdens the CIM operators.

6. 1 INR= 0.01202 USD as on 21st August 2023.

Barriers in access to opportunities due to socio-economic conditions: Surveys of operators in Delhi indicate that around 65% are illiterate, and 12% do not have a bank account (Shah et al., 2020). The level of education limits their opportunities to access various facilities and adapt to modernization for the benefit of the passengers and their own well-being.

3.4.3 Issues faced by passengers

Risk of sexual harassment due to overcrowding: Women rely more on IPT than men (Shah et al., 2020). However, overcrowding increases the chances of sexual harassment and often makes them uncomfortable traveling in CIM vehicles. Unpleasant travel experiences can compromise opportunities, leading women to avoid travel to access education or jobs.

Lack of information about routes or operations: One of the main issues that commuters face is the absence of fixed routes and schedules for these modes of transportation. Vehicles operate based on ad-hoc demand and may deviate from traditional routes or change their operations according to local conditions. As a result, passengers struggle to find accurate and up-to-date information on the routes followed by the vehicles or where to find them.

Higher expenditure than anticipated: The operators often charge more than the fare limits set by the RTO (Kumar et al., 2016), leading passengers to pay more than the expected fare.

3.5 Business Sustainability and Resilience

The sector has three business models based on the modes of operation:

1. The owner is the operator.
2. The owner owns a single vehicle and rents it out for operations.
3. The owner owns multiple vehicles and rents them all out.

The first two models are most common in many cities, while the third model is found predominantly in the cycle rickshaw and e-rickshaw industry.

The rent in rental models increases according to the capacity of the vehicle. In the cycle rickshaw sector, a single owner owns more than 100 cycle rickshaws and gives them out for rent (Kumar et al., 2016). Due to a lack of data and transparency, it is difficult to calculate the earnings per km, cost per km, maintenance costs, etc.

3.5.1 Issues faced by operators

Informality leading to insecurity: The informal nature of operations often leads to insecurity caused by threats of bans on operations in certain areas or corridors, and illegal rentals for parking vehicles in certain regions of the city.

Lack of financial support: COVID-19 impacted the sector adversely (Shah et al., 2020), with operators witnessing a reduction in the number of passengers. The study estimated a loss of INR 1,741 crores in revenue for 200,000 registered vehicles in the nine months from 24 March 2020 to 24 December 2020. Operating expenses in December 2020 ranged from 28% to 56% of the gross revenue, higher than the pre-COVID-19 reported operational expenses (24% to 51%). While the government offered subsidies or financial packages to industrial and other sectors, the informal mobility sector was ignored by most state governments.

Lack of legal papers: The owners often sell their vehicles based on affidavits, without completing any registration process. The resale procedures are not recorded in any government records.

Lack of access to finance: The operators often do not have valid CIBIL scores[7], and so they are not eligible to apply for loans from nationalized banks. They seek loans from the informal market, with high interest rates.

7. The CIBIL (Credit Information Bureau India Limited) score provides an overview of an individual's credit health, creditworthiness, and credit utilization.

Chapter Four: Aggregators or Digital Intermediaries

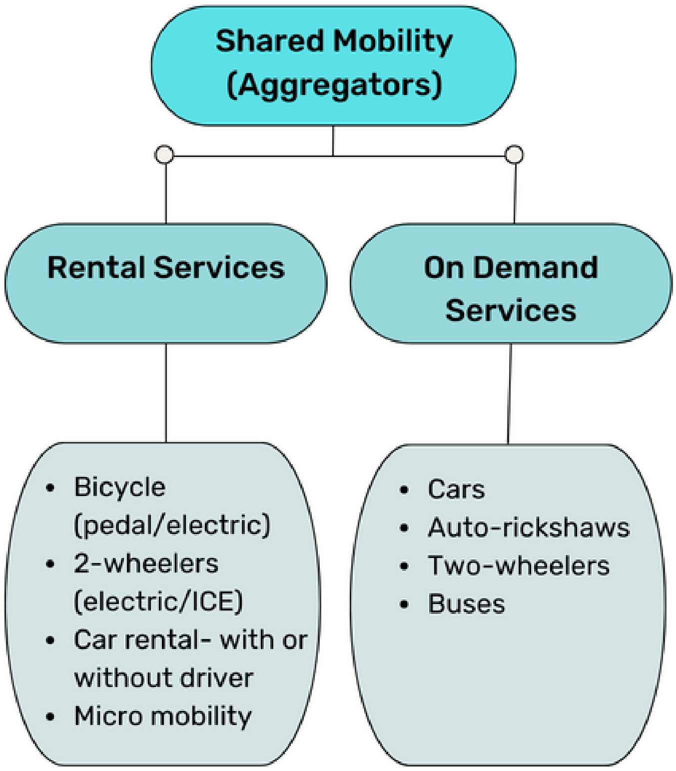
Shared mobility services have become rapidly popular in Indian cities in the last decade or more. This chapter focuses on a comprehensive market research analysis of the shared mobility in Indian cities, concerned with market players, trends, regulatory framework, and prevalent issues.

4.1 Introduction

An aggregator is a digital intermediary or marketplace for a passenger to connect with a driver for transportation (Ministry of Law and Justice, 2019). Aggregators in India provide a platform where customers connect with various mobility services, such as taxi, ridesharing, and car rental services. These aggregators act as a third party that uses digital technologies like mobile applications to match commuters with available vehicles and drivers to cater to mobility demands. The principle behind aggregator-based mobility services is 'using instead of owning' or 'as needed basis' (Kathait & Agarwal, 2021). From 2001 to 2011, the annual growth rate of motor vehicles was 9.9% (MoRTH, 2012). These services aimed to shift away from 'asset ownership', and indeed the volume of shared rides is increasing in a context in which shared mobility and electrification can potentially reduce the emissions of greenhouse gasses by 1.5 Gt by 2030 (Niti Ayog, 2018).

The arrival of ride-sourcing in 2010 with Ola altered the mobility patterns of Indian commuters. With heavy incentives for drivers, low fares, and commuter convenience, these services quickly gained momentum in the Indian market. No official data is available on the many registered aggregators in India because of the absence of a centralized platform at the national level. However, market analysis shows more than 30 companies in the shared mobility space in India (Frost & Sullivan, 2019). It categorizes its services as rental and on-demand, with various modes used by different aggregator platforms.

Figure 4.1: Types of Services Provided and Modes used by Aggregator Platforms



4.2 On-Demand Services

On-demand transportation services provided by transport network companies, known as aggregators in India, refer to the various modes of transportation that can be booked instantly through a mobile app or website. These services typically connect riders with nearby drivers or vehicles, based on real-time information and communication technologies, allowing them to arrange transportation quickly and easily on an as-needed basis. The on-demand transportation services provided by aggregators in India comprise ride-sourcing, ride-splitting, and e-hail (radio cabs).

4.2.1 Operations and services

The aggregators cater to around 4 million rides in around 200 cities daily (Gupta, 2023). The on-demand services that started with Ola in 2010 for the four-wheeler segment later expanded to the other vehicle segments, including two-wheelers, bike-taxis, and auto-rickshaws in Indian cities. Now there are more than 30 companies in the shared mobility space in India, with diverse services provided and coverage.

Table 4.1

Aggregator	Started In	Services	Geographical Coverage – Cities (2022)	Market Share (2022)
All modes available				
Ola	2010	Cabs (shared & rental), auto-rickshaw, two-wheeler taxi	75 (Tier 1 & 2)	41%
Uber	2013	Cabs (shared & rental), auto-rickshaw, two-wheeler taxi	100 (Tier 1 & 2)	37%
Cabs – Shared & Rental				
Meru	2006	Cabs (shared & rental)	24 (Tier 1 & 2)	22%
BluSmart	2019	Cabs (shared & rental)	10 (Tier 1 & 2)	
Quick Ride		Cabs (shared & rental), carpooling	9 (Tier 1)	
Lyft	2021	Cabs & bike taxi	West Bengal	
Bike, taxi and auto-rickshaw				
Rapido	2015	Auto-rickshaw, two-wheeler taxi	Bike taxi: 100 Auto: 26	
Jugnoo	2014	Cabs (shared) & auto-rickshaw	30	

Predominant Aggregators in Indian Cities
Source: Market share data from Anupam (2023); geographical coverage data from the websites of respective aggregators for 2022.

The Indian shared mobility market is dominated by Uber Technologies Inc. (UBER) (American) and ANI Technologies Pvt. Ltd. (OLA) (Indian). As reported by Statista, Ola and Uber held 78% of the market share in 2022 (Anupam, 2023). They offer various modes of transportation, including bike taxis, auto-rickshaws, cars, and even limousines. Ola and Uber initially offered a range of fleet options for the four-wheeler segment based on the car's size, capacity, and comfort. For example, Ola offers cabs with a variety of options – Ola Micro, Ola Mini, Ola Prime Sedan, Ola Prime SUV, and Ola Luxury – and Uber offers UberX, Uber XL, Uber Pop, Uber Black, and Uber SUV, depending on the size of the car. In December 2014, Ola introduced its auto-rickshaw service to respond to the Indian context, and Uber followed suit and introduced auto-rickshaw services in 2015. Rapido launched the motorbike taxi service in 2015 in Bengaluru; Ola and Uber followed suit and launched their version of bike taxis in 2016. Ola introduced its bike taxi service, Ola Bike, in 2016, and by 2019, it had expanded its presence to 200 cities and towns across India. Concurrently, Uber also initiated its bike taxi services in the same period, and as of 2019, it had established a presence in 30 cities (Cheema, 2019). These companies initially provided low-fare rides and high subsidies to establish their base, and the addition of auto-rickshaws in 2015–16 further increased their reach and appeal.

In 2017, the Ministry of Electronics & Information Technology reported that Uber and Ola provide 3–5 million daily rides and livelihood for 600,000 to 700,000 workers. In 2018, before the onset of the COVID-19 pandemic, Ola was in 110 cities, whereas Uber operated in 26 cities. Ola's strategic focus was predominantly on Tier 2 and Tier 3 cities, while Uber maintained a broader coverage, emphasizing larger cities. After discussions with both Ola and Uber in 2023, it was found that Ola rationalized its service coverage post-COVID, narrowing down its presence to 75 cities. In contrast, Uber has expanded its market reach and is currently accessible in 100 cities.

Between 2010 and 2019, several transportation network companies, including Ola, Meru Cabs, Uber, and others, emerged and established ride-sourcing operations in the Indian market. Nevertheless, not all transportation network companies (TNCs) managed to survive in the highly competitive business market, which was further exacerbated by the adverse effects of the COVID-19 pandemic. Bounce, Drivezy (bike rental), and mGaadi (auto-rickshaws) were among the companies that shut down their services permanently due to financial losses.

Several new entrants have been entering the market, and one noteworthy addition is Namma Yatri in Bengaluru. This platform operates based on Open Network Digital Commerce, (ONDC). Launched in November 2020, Namma Yatri operates on a distinctive model compared to existing platforms, as it eliminates any intermediaries between the service provider and service receiver.

Another notable addition is inDrive, which employs a fair-price setting model. In this system, passengers and drivers negotiate to determine fares directly between themselves, offering a distinct approach to pricing within the platform. A similar model has been observed in Uber in smaller cities like Jodhpur, Rajasthan.

Issues faced by aggregators

Low retention of drivers and commuters due to multi-homing[8]: Drivers and commuters usually opt for the platform offering the most attractive discounts, as there is minimal or no cost for switching platforms. It makes the retention of commuters and drivers difficult for aggregators and poses a significant risk.

Conflict with conventional informal mobility providers: Due to the similarities in their operations, the emergence of ride-sharing platforms has brought significant disruption to traditional transportation services, particularly taxi companies. However, the divergences between taxis and ride-sharing services have sparked conflicts and tensions. Taxi drivers often perceive themselves as being exploited, leading to protests and turf battles driven by concerns about unfair competition, particularly in large cities in developing countries where taxis are a primary mode of transportation.

Meru, an Indian radio taxi operator functioning within the legal framework for taxi services, had to adapt its operational model to resemble a ride-sharing platform to attract customers. However, many taxi companies struggle to survive in the face of the price wars triggered by the intense competition between ride-sharing platforms, resulting in depressed fares for transportation services (Chakrabarti, 2016).

Auto-rickshaw drivers in several states, including Maharashtra and Karnataka, launched strikes to protest against the operation of bike taxis (Anagha, 2023; Gupta, 2022). The strikes emphasized the concerns of auto-rickshaw drivers who felt marginalized and feared the encroachment of bike taxis on their traditional territory and played a significant role in influencing the decision to ban bike taxi services in these states. The conflicts between auto-rickshaw drivers and bike taxis have caused disruptions in the services provided by aggregators, impacting their revenue streams coming from the two-wheeler segment.

Deceptive practices by drivers to bypass the system: Drivers have started to employ deceptive tactics to bypass the system and avoid paying commissions to aggregators. One method involves requesting users to cancel their ride after it has been booked through the aggregator's platform. Once the ride is canceled, the driver can directly offer their services to the user at the same or lower price without involving the aggregator, thereby avoiding the commission fees that would otherwise be charged (LocalCircles, 2022).

8. Multi-homing refers to a situation in which multiple platforms are used by drivers simultaneously.

Issues faced by drivers

Transparency: A primary survey with drivers registered with aggregators in four cities (Tier 1, Delhi and Mumbai; and Tier 2, Jaipur, and Indore) revealed that most drivers are unaware of how the total fare is calculated (Kaur, 2022). The incentive structure of surge pricing and the commission percentage charged on each trip need to be declared and defined.

Information asymmetry: A significant problem faced by drivers working for ride-sharing platforms is the information asymmetry they experience. Until recently, they had to accept ride requests without prior knowledge of the destination or the amount they would earn. While this was done to reduce ride cancellation rates and increase acceptance rates, it significantly limited the drivers' freedom to make informed decisions about their work (Van Doorn, 2017). The platforms also require that drivers maintain a high ride acceptance rate and low ride cancellation rate to avoid being permanently blocked by the platform, placing the burden of risk firmly on workers' shoulders.

Inability to use their knowledge of the city for shorter routes: Ride-hailing aggregators have implemented an in-built application mechanism that restricts drivers from deviating from designated routes, to prioritize safety. The app may issue warnings or cease functioning where drivers attempt to alter routes. This limits drivers from utilizing their knowledge and experience of the city to choose more efficient routes.

Hefty commissions: Currently, the commission charged by the aggregators per trip varies from 25% to 30% depending upon the mode type, like auto-rickshaw, bike taxi, or cab (Kaur, 2022). However, the Motor Vehicles Aggregator Guidelines, 2020 restricts ride commissions to 20%. The high commission charges mean a reduced income for drivers. The ONDC based Namma Yatri is an initiative that is trying to work on the commission rate for the benefit of the partners. The platform enables users to book an auto-rickshaw directly, with the payment directed straight to the driver. The absence of intermediaries results in a commission-free transaction process.

Reduced earnings: In the initial phase of their entry into the Indian taxi market, aggregators enticed drivers to join their digital platforms by offering substantial incentives besides a share in the ride income. At that point, drivers could earn around INR 70,000–100,000 monthly. Aggregators also floated multiple advertisements assuring high incomes. This encouraged drivers to invest in their vehicles. Over time, the income earned by drivers reduced to INR 22,000–25,000 per month (a decrease of 68–75%) due to increased commission charges, the reduction of minimum guaranteed business, high targets for incentives, and increased fuel and maintenance costs (Indian Federation of App-based Transport Workers & International Transport Workers' Federation, 2020).

The burden due to targets: The targets set for drivers – typically based on the number of trips completed or the cost of trips completed – to receive incentives have also increased. In 2017, Uber modified its incentive structure, reducing the incentive from INR 2,400 for 40 trips to INR 1,800 for 48 trips (Ayyar, 2017). In the same year, Ola gave INR 1,800 for trips earning INR 1,500;

INR 4,750 for trips worth INR 2,300, and INR 5,570 for journeys worth INR 2,550. This has been reduced further since then, and the incentives also vary depending on the driver's performance on the platform (Kulkarni & Metha, 2018). Due to the increased targets and changes in the structure of incentives, many drivers do not earn enough to meet their loan repayment obligations for the vehicles they purchase, which has also made several banks cautious.

Issues faced by passengers

Long waiting times and high cancellation rates: Customers often experience long waiting times when booking a cab. Sometimes, this is a strategy the driver uses, compelling the customer to cancel the ride, and enabling them to collect cancellation fees (Nigotiya, 2020). In 2023, Mumbai Grahak Panchayat, a non-profit organization, conducted an extensive online survey involving commuters from 43 cities across Maharashtra, as well as Ahmedabad, Ranchi, Bhubaneswar, Bengaluru, Hyderabad, Madhya Pradesh, Goa, and Kolkata. Trip cancellation emerged as a top issue with online platforms, followed by drivers taking longer routes and unhelpful behavior (Minhas, 2023). Other significant difficulties included slow response times (40.6%), delayed confirmation of bookings (38.3%), tardy arrival of drivers (17.2%), lack of response (15%), and poor internet services (5.9%). Sometimes, drivers also cancel the trip if the mode of payment is online.

4.2.2 Policy, regulation, and governance

The operations of aggregators in India began in the early 2000s, but they existed in a regulatory gray area until 2014. With the significant expansion of services offered by these online platforms and growing concerns about safety, state governments initiated the development of guidelines. In 2015, Delhi took the initiative to address safety concerns following a horrible rape case by introducing the City Taxi Scheme, which implemented regulations regarding vehicle permits, driver verification, and passenger safety measures.

Karnataka introduced the Karnataka On-Demand Transportation Technology Aggregators Rules, 2016, establishing compliance details for both aggregators and drivers. Under this, individuals or registered companies can be considered aggregators if they maintain a fleet of 100 taxis, either owned by them or in agreement with individual taxi owners. Aggregators require a license from the state authorities, and aggregator vehicles are required to comply with the Motor Vehicles Act 1988, be equipped with GPS/GPRS technology for tracking purposes and prominently display a yellow board indicating their status as taxis. A driver for such a service requires a valid driving license for a light motor vehicle, a driving badge, minimum of two years of experience, working knowledge of Kannada and another language, a clean criminal record, and a KYC-verified[9] bank account (Transport Secretariat, Karnataka, 2016).

9. KYC (Know Your Customer) is a process through which businesses verify and collect essential customer information to ensure compliance with regulations and mitigate the risk of fraudulent or illicit activities.

In 2017, the Maharashtra state government implemented The Maharashtra City Taxi Rules, which included provisions for app-based taxi aggregators and mandated panic buttons, tamper-proof GPS devices, and a control room for monitoring operations.

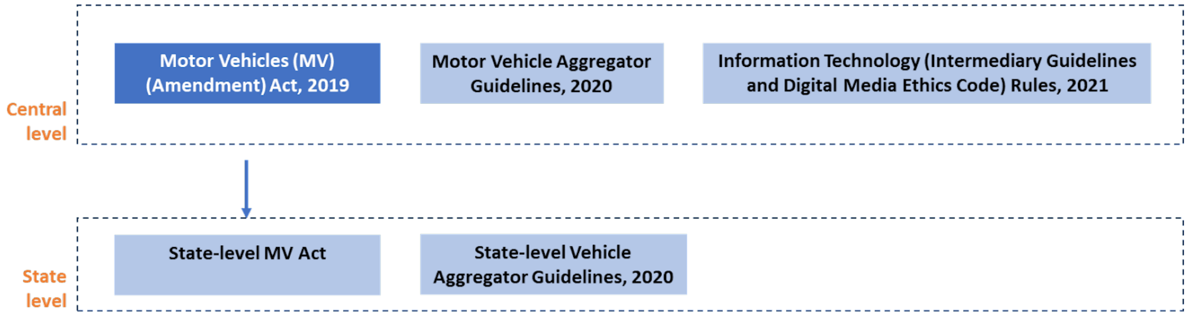
The term 'aggregators' for online platforms was introduced into The Motor Vehicles Act in 2016, through a bill passed by the Indian government. However, it wasn't until 2019 that The Motor Vehicles Act of 1988 was amended to include a specific definition – an aggregator is 'a digital intermediary or marketplace for a passenger to connect with a driver for transportation' – and license requirements for aggregators (effective November 27, 2022). Earlier, aggregators came under the purview of city taxi schemes or guidelines. It was the first step towards regulating aggregators and incorporating them into Indian legislation. Since transport is a state subject, the act mandates that aggregators obtain licenses from the state governments and comply with the provisions of the Information Technology Act, 2000.

However, according to the aggregators interviewed, obtaining licenses from each state separately is costly and creates additional obstacles for those seeking to serve multiple regions. The unique licensing requirements of each state pose challenges, particularly for start-ups in the sector. These factors contribute to increased complexity and difficulties in expanding aggregator services across multiple states.

Under Section 93 of The Motor Vehicle Act, the Central Government issued the Motor Vehicles Aggregator Guidelines in 2020. These guidelines provide a comprehensive framework for granting licenses to aggregators and regulating their operations. They cover various aspects, including issuing and renewing licenses, eligibility criteria for aggregators, compliance requirements for drivers and vehicles, regulations for aggregator applications and websites, and fare regulations.

The Guidelines also specify penalties to be imposed on the aggregator, including suspension of license and cancellation on multiple grounds, like failure to ensure the safety of the riders, charging higher rates repeatedly, and failure to comply with the contractual obligations towards drivers. If the aggregator receives more than three suspensions in a financial year, its license is canceled, and the aggregator is forced to stop operations immediately. The Guidelines also provide for a procedure of appeal to the state government by the aggregator whose license has been canceled.

Figure 4.2: Rules and Regulations for Aggregators in India



Issues faced by aggregators

Differing compliance frameworks across states: The guidelines allow state governments to legislate further when framing their laws. Several states, including Delhi and West Bengal, have already notified state-level guidelines for aggregators, while Maharashtra and Odisha are notifying state-specific guidelines. Multiple states enacted their version of guidelines and demanded that the aggregators have different compliance requirements for every state they operate from.

For example, the guidelines state that the online platform must support both English and Hindi, and an additional language can be added based on state-specific context. The Bengal Guidelines require that the app and the control room be available in English, Hindi, and Bengali, which entails a change in the entire user interface. The state governments may implement a broader scope of the guidelines, leading to variations in definitions, like in Delhi, where entities managing drivers for product delivery services for products, packages, or parcels are considered aggregators.

The definition of aggregator under the central guidelines only covers entities that provide mobility services for commuters. Inconsistent reports and regulations can hinder the expansion of aggregator services across state boundaries. The lack of clarity and harmonization among states can result in conflicting interpretations, legal disputes, and prolonged litigation. Navigating through these uncertainties is challenging for aggregators, users, and the legal system, leading to delays and inefficiencies in the enforcement of laws and the protection of rights.

The onus of electrification of vehicles is on aggregators when they do not own any fleet: The guidelines for aggregators in Delhi put the onus of the electrification of vehicles registered on the platform on the aggregators. The aggregators have expressed concern as they own no electric vehicles. Drivers also received limited financial support during COVID-19, which meant that some could not repay their vehicle loans and consequently chose not to return to the platform. Given this situation, expecting drivers to transition to electric vehicles immediately would pose a significant challenge.

Duplication of insurance under different regulations: According to the guidelines, aggregators must provide a health insurance policy for the drivers with a minimum coverage of USD 0.5 million and a term insurance policy with a minimum coverage of USD 1.5 million. They are required to provide annual refresher training, limit working hours to 12 hours per day, and implement a remedial training program for drivers with a customer rating below the second percentile. They are also advised to allow drivers the flexibility to work for multiple aggregators simultaneously.

Aggregators have expressed concerns regarding the overlapping of regulations for insurance. According to the Code on Social Security Regulations (a bill passed in 2020), platform workers should receive health insurance of up to 0.5 million and life insurance of up to 1.0 million, and aggregators must provide insurance coverage twice. This can lead to confusion and potential complications when making insurance claims, as it is unclear which policy should be utilized or which insurer should be approached. The existence of multi-homing drivers further complicates the process. Each aggregator then covers drivers registered on multiple platforms, leading to delays in claims settlement and added complexity for workers navigating the insurance system. However, insights shared by experts during the panel discussion revealed that state governments have yet to implement these regulations, leaving drivers without adequate social security measures.

Data requirements by state governments: Data generated by the aggregators' online platform must be shared with state governments as per the due process of law. However, aggregators receive multiple types of data from drivers and users, including but not limited to their personal data, information such as credit card data, debit card data, payment interface data, and passwords, and there is no clarity on the type of data that needs to be shared.

Data localization requirements also vary across states. For example, the guidelines in West Bengal mandate that aggregators localize all data within the state, whereas the central guidelines require data localization within India. Suppose each state government follows the West Bengal model and implements similar provisions. In that case, aggregators will need a data center in each state, leading to a significant cost increase and potentially making the business unviable.

Safety-related concerns: The other compliances include a zero-tolerance policy on the use of drugs and alcohol, establishing a control room 24x7, call centers with valid phone numbers and operational email numbers, and an effective complaint redressal mechanism. However, the predominant players in the Indian market do not have a phone number or working email address for their consumers. Automated pre-written support messages are sent to consumers without redressing the grievance.

The safety-related compliances include the installation of GPS, spot-checking vehicles, ensuring that the driver plies on the route assigned by the app, and developing a mechanism that indicates the fault to the driver and control room if the given route is not followed. Aggregators have developed inbuilt navigation systems to enforce compliance with the courses assigned by the app. If a driver deviates from the prescribed path, the app prompts warnings, and the application might stop working in case of continued deviation.

Fare regulations: Aggregators can charge a fare 50% lower than the base fare and a maximum surge pricing of 1.5 times the base fare. Passengers should not be charged for dead kilometers; cancellation charges could be 10% of the total fare not exceeding INR 100. The guidelines also regulate the fare by limiting the ride commissions to 20%. The state government can allow 2% over and above the fare by issuing a notice. It will enable drivers to get 80% of the fare.

Carpooling concerns: The central guidelines have also provided a framework for ride-pooling services, which recommends that only KYC-compliant users can access them. In such a shared mobility arrangement, a maximum of four ride-sharing intra-city trips per day and two ride-sharing inter-city trips per week are permitted for each vehicle with a driver integrated with the aggregator. While the legal position on the regulation of aggregators has been developed at the central level, it is still a gray area at the state level.

Issues associated with bike taxis

The journey of bike taxis in India is complex and has faced numerous challenges because of lack of clarity in regulations and legal uncertainties. Technically, bike taxis fall outside the ambit of the central Motor Vehicles Act. Taxis in India ply under contract carriage permits, defined as a motor vehicle that carries a passenger or passengers for hire or reward and is engaged under contract (The Motor Vehicles Act, 1988, section 2.7). Contract carriages encompass maxi cabs (section 2.22) – which are motor vehicles designed to carry between 6–12 passengers (excluding the driver) for hire or reward – as well as motor cabs (section 2.25) – which are motor vehicles capable of carrying a maximum of 6 passengers (excluding the driver) for hire or reward. However, in the definition of the Act, a motor vehicle cannot have less than four wheels (section 2.28). Hence, using motorcycles for commercial purposes under the ambit of a carriage contract is not technically recognized.

While there is no central legislation, multiple committees set up by the central government have recommended that state governments allow two-wheeler taxis (Jha, 2022). State governments have taken different stands on bike taxis under sections 72 and 73 of The Motor Vehicles Act, and the dispute between them and aggregators regarding the legal status of bike taxis is ongoing. At the time of this report, the Supreme Court reestablished the prohibition on bike taxis, citing concerns over safety, pollution, and the usage of non-transport vehicles for commercial purposes without adequate commercial registration (Outlook Business Team, 2023). Currently, only 14 states – including Goa (2016), Haryana (2016), Andhra Pradesh (2017), Gujarat (2018), Telangana (2018), West Bengal (2016), Punjab (2017), Rajasthan (2017), Bihar (2019), Chandigarh (2019), Jharkhand (2019), and Uttar Pradesh (2018) – have allowed the operation of bike taxis either by introducing bike taxi scheme/guidelines or by issuing notifications (Jha, 2022).

Other states have recently started to regulate bike taxis. After banning them in 2016, Karnataka introduced the Karnataka Electric Bike Taxi Scheme in 2021 and permitted electric bike taxis to operate up to 10 km within the state. Maharashtra banned bike taxis and set up a committee to formulate rules for aggregators, including bike taxis (Mitaksh, 2023). In February, the Delhi government prohibited all operators from providing bike-taxi services within the capital following The Motor Vehicles Act of 2019. The government warned that individuals found contravening these regulations would be subject to penalties of up to INR 10,000 and suspension of licenses for a minimum of three years (The Hindu, 2023).

4.2.3 Resilience and business sustainability

Aggregators in the Indian market employ two primary business models: the marketplace business and asset-light models. The marketplace business model is the predominant approach, used successfully by industry leaders like Ola and Uber, which hold the largest market share in India. These platforms serve as two-sided marketplaces, connecting commuters with drivers.

The marketplace business model

Under the marketplace business model, the aggregator is an intermediary, facilitating transactions between commuters and drivers through an online platform. The operational costs include developing and maintaining the technological platform, marketing and promotional activities, driver incentives, support and training programs, insurance expenses, and licensing and permit costs. The model operates on a commission-based revenue system. The primary revenue sources include trip commission charges, which entail a percentage share of the total fare earned from each trip, along with in-cab promotions and advertisement commissions, surge pricing, and trip cancellation charges.

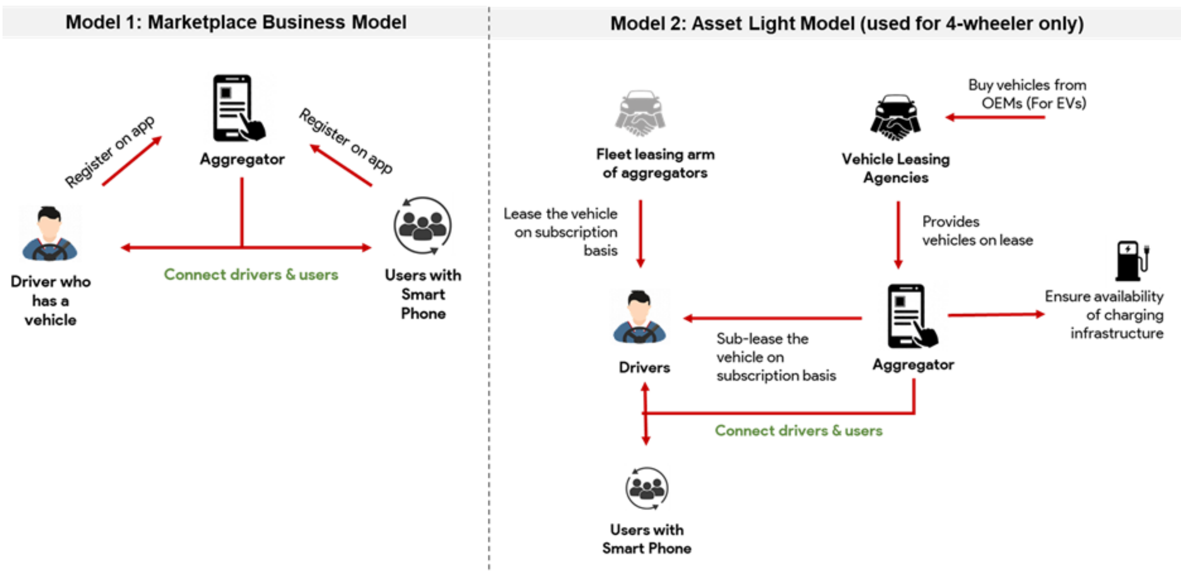
The asset-light model

The other newly emerging model in this landscape is the asset-light model, where aggregators are responsible for owning and maintaining the vehicles and employing drivers. This model allows aggregators to have more control over the quality of service, but it also requires a larger investment.

BluSmart, an aggregator operating in the Indian market, follows the asset-light model. They have established an all-electric fleet since their inception in 2019 and presently operate around 2,500 cabs in Delhi and Bengaluru. In addition to the typical operational costs associated with the marketplace model, BluSmart incurs expenses related to its vehicle fleet, such as acquiring or leasing the vehicles and ensuring maintenance, including regular servicing, repairs, and cleaning. As an all-electric fleet operator, BluSmart is responsible for establishing and managing charging infrastructure to support their vehicles by installing charging stations, ensuring availability and functionality, and handling the associated electricity consumption costs. It employs drivers in its operations, bearing the costs associated with driver recruitment, training, and management. This includes providing incentives, conducting driver performance evaluations, and addressing driver-related issues or grievances.

In September 2015, Ola introduced its vehicle leasing program, Ola Fleet, while Uber launched UberMOTION in 2016. Both involve leasing cabs to drivers in an asset-light model to attract and onboard more drivers to their platforms. By providing an option for drivers to lease a cab, Ola and Uber can expand their driver network and increase the availability of vehicles on their platforms.

Figure 4.3: Business Models Employed by Aggregators in the Indian Market



The following table provides a comparison of the revenue models.

Table 4.2

	Marketplace Business Model / Commission-based model	**Asset-Light Model / Subscription model**
Vehicle ownership	Drivers	Vehicle leasing agency
Vehicle maintenance	Drivers	Aggregator
Ride hailing commission	Commission per trip 15-20*% of total fare paid by the rider	Daily, weekly or monthly subscription + commission per trip Subscription Cost: · Initial Non-refundable fee: (Rs 4,000) · Security Deposit (Rs 21,000–31,000) · Rental cost: Rs 700–1,150 per day (varies depending on the city)
Revenue streams	• Trip commission • Surge pricing • Revenue from cancellation of rides • Advertisements	• Subscription cost for drivers • Subscription cost from users (if subscription option available) • Trip commission
Cost structure	• Cost of revenue • Operations and support costs • Sales and marketing	• Cost of revenue • Operations and support costs • Sales and marketing • Vehicle lease and maintenance • Charging stations, electricity
Operational complexity	Do not need to manage and maintain their fleet	Need to ensure the availability of fleet and vehicles charged and maintained
Examples	Ola, Uber	BluSmart

Meru, a prominent player in the Indian ride-hailing industry, started as a traditional taxi service provider. With the emergence of aggregator models like Ola and Uber, Meru adapted its business strategy and now operates on both marketplace and asset-light models.

4.2.4 Social and environmental impact

The emergence of e-ride-hailing services has revolutionized transportation in Indian cities, with both positive and negative social and environmental impacts. Ride-hailing services have created employment opportunities: Ola and Uber have created 2.2 million livelihood opportunities for their partner drivers in India during 2010–2018 (Pradhan, 2019). These platforms have improved access, particularly in areas with limited public transportation options, providing convenience and reducing the dependence on private vehicle ownership. However, there have also been safety concerns, with reports of harassment and unsafe situations. Ride-hailing services have responded by implementing safety features like alert buttons, but the challenges remain in ensuring the security for both drivers and passengers.

Ride-hailing services have also improved the mobility of people who live with disabilities, like visually impaired persons (Kameswaran & Pal, 2020), by offering enhanced safety, convenient door-to-door transit accessibility, flexibility, and reduced emotional stress. Nevertheless, clients living with disabilities face difficulties in picking and choosing destinations and finding the precise location of the cab on arrival. The lack of awareness regarding disability among drivers also posed difficulties in accessing these services occasionally (Kameswaran & Pal, 2020).

Ride-hailing services can potentially reduce private vehicle ownership, decreasing traffic congestion and parking demand. Wadud and Namala (2022) analyzed vehicle registrations in 18 large Indian cities over 17 years to examine the impact of ride-sourcing services on vehicle ownership and observed a statistically significant reduction in vehicle ownership. On average, the growth in vehicle ownership across the cities decreased by approximately 7.7% with the inception of ride-sourcing services, indicating a notable impact.

The impact of ride-hailing services on congestion is complex and varies. They have the potential to reduce congestion by optimizing infrastructure usage through demand pooling, complementing public transit systems, and decreasing private vehicle ownership. However, most Uber and Ola drivers participate full-time on these platforms because of high ownership costs and regulatory barriers (Fleitoukh & Toyama, 2020), which is likely to impact congestion (Benjaafar, 2020). As the supply shifts towards full-time drivers, they operate more without passengers, increasing deadheading[10] miles.

Agarwal et al. (2022) reveal in their study that ride-hailing services contribute significantly to congestion in Indian cities. The study utilizes real-time traffic and route trajectory data from Google Maps to observe that periods of ride-hailing unavailability during driver strikes result in noticeable reductions in travel time. The most significant impacts are observed in heavily congested areas during peak hours, with travel times reduced by approximately 10.1% to 14.8%. This reduction in congestion can be attributed to deadheading removal, modal substitution with high occupancy transit/non-motorized modes, and trip cancellations.

10. Deadheading in the ride-hailing industry refers to the additional distance traveled by vehicles without any passengers on board, resulting in no revenue generation or specific transportation purpose.

A user behavior study in New Delhi (Raj et al., 2023) finds that relatively age groups are more likely to adopt Ride-Hailing Services (RHS) than the senior generations. This concerns the familiarity with smartphones, income strata, and inability to buy a car. RHS satisfies the need to travel in a car without buying one. However, owing to higher travel costs compared to public transportation, low-income households are not the most frequent users of these services. Women are more likely to be frequent users of RHS mainly because using transit or auto rickshaws might not be perceived as a safe mode of travel, particularly at night. One of the most adverse impacts RHS seemingly creates is deriving their customers primarily from public transit and more sustainable modes.

Issues faced by drivers

Uncompensated work: In the ride-sharing industry, drivers often face situations where users cancel their rides due to traffic delays, citing excessive waiting time. The driver, who may have already reached or had almost reached the pickup location, bears the fuel costs and time associated with the unfulfilled trip.

Unstable employer-employee relationship: The drivers registered on the aggregators' platform do not have stable employer-employee relationships with aggregators. The cab-aggregator model significantly reduces transaction costs for firms by categorizing workers as freelancers or micro-entrepreneurs, allowing them to work as independent contractors or part-time drivers (Stefano, 2016; Hall & Krueger, 2017). This approach enables aggregators to distance themselves from formal employment obligations and liabilities like paid leave, fixed salary and stability, retirement benefits etc. (Surie & Koduganti, 2016). To emphasize this new employment relationship, aggregators often refer to their drivers as service partners rather than employees.

Issues faced by passengers

Inadequate grievance redressal mechanism: The difficulty in contacting aggregators for complaint resolution is prevalent in the Indian market. Unlike traditional customer service channels that provide a phone number or an active email address for direct communication, Ola and Uber rely on in-app support systems or pre-written consumer support messages (Pandey, 2022; Uber, 2023; Ola, 2023). This lack of direct contact information makes it challenging for users to seek immediate assistance or have real-time conversations with customer support representatives.

Safety: Safety, particularly for women passengers, continues to be a concern associated with services offered by ride-hailing aggregators, specifically in the context of ride-pooling and bike taxis.

Unprofessional behavior by drivers: Users frequently express dissatisfaction with the rude behavior of drivers, instances where drivers refuse to turn on the air conditioning inside the cabs or request additional payment after completing the trip (Paliwal, 2022).

4.3 Rental Services

Before the emergence of aggregators, the rental mobility market in India was dominated by local operators and individual car owners who offered small-scale rental services. These were limited to specific locations like public transportation stations, hotels, and bike rental shops and had minimal technological integration. The initial shift in rental mobility came with the entry of radio taxis in major cities. Companies like Meru Cabs and Mega Cabs introduced on-demand taxi services with a centralized call center for bookings. While they improved convenience, the services still relied on phone bookings and lacked the technology-driven approach seen later. A major shift occurred in the early 2010s with the entry of aggregator-based platforms such as Ola and Uber. These utilized mobile apps to connect drivers and customers seamlessly, revolutionizing the rental mobility landscape. They introduced real-time tracking, digital payments, and user ratings, significantly enhancing the convenience and efficiency of the services. The bicycle rental service known as Public Bicycle Sharing (PBS) was first launched in 2017 in Mysuru.

Micromobility

Rental services also include 'micromobility' vehicles. Micromobility was introduced in 2017 by Horace Dediu, who defined it based on the weight of vehicles, specifically to refer to those weighing less than 500 kg (Reid, 2019). Over time the definition evolved, but micromobility still lacks a standard, agreed-upon definition. The mode can be defined either in terms of vehicle specifications – dimension, number of wheels, weight, payload capacity, power train, range, the availability of a seat (Zarif, 2019), or in terms of usage – passengers per vehicle, typical distances covered per trip (ITDP, 2022).

The International Transportation Forum (ITF) defines micromobility as the utilization of 'micro vehicles with a mass of less than 350 kg and a design speed of 45 kmph or less'. However, due to their evolution, it is advisable not to confine the term to specific vehicle types or energy sources.

Table 4.3

Vehicle Specifications	Usage of Mode
Less than 500 kg	Short trip distance – up 10 km
2- or 3-wheeler, electric or human powered	Can be shared or personal
Equipped with an electric motor with an output of less than 750 watts	Predominantly used by an individual
Not capable of exceeding a speed of 25 kmph	

Parameters Used to Define Micromobility
Note: Though the modes used for micromobility can be for both personal and shared use, this report focuses on the shared usage of micromobility.

The definition of micromobility across different countries revolves around vehicle specifications. For example, the California Vehicle Code defines an 'electrically motorized board' as a wheeled device with a motor of less than 1,000 watts and not capable of exceeding 32 kmph (20 miles per hour) (ITDP, 2022). In India, micromobility refers to 'battery operated vehicles' (BOVs) and is also defined by vehicle specifications. The Motor Vehicles Act, 1988 defines battery operated vehicles as those powered exclusively by electric power with a maximum motor power output of 250 watts and a maximum speed not exceeding 25 kmph. Micromobility solutions are appealing for their role in enhancing access and connectivity to public transport. In essence, they pertain to short-distance transportation, typically covering distances of less than 8 km. Increasingly, micromobility is synonymous with the emerging landscape of bike and scooter-sharing enterprises that are poised to redefine urban transportation paradigms.

Table 4.4

Vehicle	Illustration	Vehicle specifications	Example of companies
Electric scooter		Speed: < 25 kmph Battery operated Weight 55 kg	YULU
E-kick scooters		Battery operated	BOOZ Mobility
E-rickshaw		Speed: < 25 kmph Occupancy: 4 passengers +1 driver Battery operated Battery < 250 watt	EVahak

Vehicles Commonly Utilized for Micromobility in Indian Cities

4.3.1 Operation and services

Currently, the Indian market offers a variety of rental models for mobility services, including self-drive car rental, chauffeur-driven car rental, bike rental, and bicycle rental. Aggregators like Zoomcar, Myles, and Revv introduced self-drive car rentals in India, allowing customers to rent vehicles for a specific duration and drive themselves. Self-drive car rentals gained popularity among individuals and tourists, offering a flexible and personalized travel experience. Chauffeur-driven car rentals provide customers with a driver – a convenient option for people who do not want to drive themselves or who are traveling to an unfamiliar place.

With the success of ride-hailing and self-drive car rentals, aggregators like Bounce, Vogo, and YULU introduced two-wheeler[11] rentals in Indian cities. These dockless rental services allowed users to locate and unlock bikes or electric scooters using mobile apps and facilitated short-distance travel and last-mile connectivity. This innovation eliminated the need for physical rental outlets and enabled users to conveniently rent and return vehicles at various locations within the

11. In addition to the aforementioned rental aggregators, it is important to note the presence of local rental players offering two-wheelers for rent specifically in tourist locations. Their operations are beyond the scope of this analysis that focuses on the broader landscape of app-based rentals.

city. As environmental concerns grew, there was an increased focus on electric mobility solutions. Rental services such as Bounce, YULU, and Vogo expanded their fleets to include electric scooters, providing eco-friendly transportation options. Electric vehicle-based rental services gained traction, contributing to the adoption of sustainable mobility practices.

Public bicycle sharing (PBS) systems have been implemented in 14 Indian cities since 2017 (The Urban Lab & GIZ, 2021), catering to short trips of around 2–4 km. The geographic coverage of the Indian public bike sharing systems has been limited, with cities focusing on smaller-scale networks instead of city-wide implementation. Systems did not expand beyond the pilot stages, and cities like Ranchi, Bhopal, and Mysuru have not increased the number of bicycles since their launch. In Bengaluru and Pune, operators withdrew, resulting in reduced service areas despite modest increases in the size of the fleet.

Micromobility encompasses a range of compact transportation devices, including motor scooters, powered two-wheelers, motorcycles, mopeds, bicycles, e-bikes, pedal-assisted bicycles, speed-pedelecs, mobility scooters, standing scooters, and e-scooters.

Niti Ayog recognizes micromobility as a mode of transportation for short-distance trips, focusing on first and last mile connectivity. It acknowledges bicycles as a form of micromobility within this context. In this report, the section pertaining to bicycles has been included within the rental services section, because of the increasing trend of bicycle sharing programs and services offered by various rental companies. These allow users to rent bicycles for short- and long-use, providing an efficient and flexible mode of transportation for short-distance trips. In recent times, micromobility has experienced a resurgence of interest in India, primarily driven by the first and last mile connectivity to Mass Rapid Transit Stations (MRTS). By including bicycles within the rental services section, the report aims to highlight the role of rental companies in facilitating access to bicycles as a form of transportation mode for shorter distances. It acknowledges the convenience and availability of bicycles through rental services, which contribute to enhancing first and last mile connectivity and addressing the transportation needs of individuals for short trips.

4.3.2 Policy, regulation, and governance – current status

Aggregators in India offer rental mobility services through two models: business-to-person (B2P) and peer-to-peer (P2P). Aggregators like Ola and Uber operate under the B2P model, whereas Zoomcar follows the P2P model. The former falls within the scope of The Motor Vehicles Act and central guidelines, while the P2P model is specifically utilized by aggregators in the context of self-drive car rentals and has a different regulatory framework. In the P2P model, individuals who own vehicles can list themselves on the platform to offer them for rent and commuters can book vehicles for personal use, directly from the owners.

The regulatory framework for shared mobility and vehicles in India is governed by The Motor Vehicles Act, which does not allow the sub-rental of private vehicles (specifically those with private number plates). Sub-renting a private vehicle may encounter several legal challenges.

Section 66 of the Act mandates car owners to obtain a permit from the regional or state transport authority if they intend to use their private vehicle as a transport vehicle for passengers. Since leasing out a private vehicle to a stranger in exchange for money is considered a commercial activity, the government requires compliance with relevant taxes, and a yellow number plate to indicate that the car is leased out for self-drive rental purposes. Section 147 of the Act specifies that insurance companies are not obligated to cover contractual liabilities associated with private package policies for cars. These policies typically provide coverage only for the private use of the vehicle by the owner or individuals known to the owner, not a third party who drives the car and is not known to the owner.

Vehicles powered exclusively by an electric motor are categorized as battery operated vehicles (BOV) under the Central Motor Vehicles Rules, 1989, and are liable to comply with all extant rules and regulations related to motor vehicles. Vehicles are exempted if the 'thirty minutes power' of the motor is less than 0.25 kW; the maximum speed of the vehicle is less than 25 kmph or they are bicycles with pedal assistance which are equipped with an auxiliary electric motor having a thirty-minute power (as per AIS 043: 2003) less than 0.25 kW, whose output is progressively reduced and finally cut off as the vehicle reaches a speed of 25 kmph. E-bikes and e-scooters under the existing public bike share systems are not classified as motor vehicles since their power is less than 0.25 kW and the maximum speed lower than 25 kmph. Transport rules such as mandatory registration, mandatory driving license, road tax, insurance, etc., do not apply to them.

The micromobility regulations in India are not well defined, and there are no specific rules governing this sector (Singh et al., 2022). Additionally, micromobility does not fall within the scope of The Motor Vehicles Act.

The absence of appropriate of rules and regulations leads to issues with:

- Safety: Micromobility vehicles are limited to a speed of 20–25 kmph, because of which their drivers are not required to wear helmets in India, making them prone to accidents risking their safety.

- Speed: The permission for speeds up to 25 kmph is intended to position micro-vehicles as a competitive alternative to cars, aiming to minimize environmental costs. However, the presence of high-speed vehicles on sidewalks poses a threat to pedestrians. Furthermore, the utilization and parking of these micro-vehicles on footpaths jeopardizes pedestrian safety, particularly for individuals such as wheelchair users and those with visual impairments.

In response to these concerns, Singapore has implemented a ban on e-bikes on sidewalks to mitigate potential risks.

4.3.3 Resilience and business sustainability

Four-wheeler and two-wheeler segment

The rental market has two primary models, which differ in terms of ownership and operation of the rental assets: the asset-heavy model and the asset-light and marketplace model.

In the initial stages of rental services, the industry adopted the asset-heavy model, where the aggregators held ownership of the vehicles, with approximately 75% of the fleet acquired through loans or established partnerships with well-known car manufacturers like Ford, Mahindra, Tata Motors, and others. By adopting the asset-heavy model, these aggregators took on the responsibility of owning and maintaining most of the vehicle fleet, enabling them to offer rental services to customers efficiently.

These companies have now shifted to an asset-light marketplace model to reduce the risk of ownership of vehicles. Aggregators like Zoomcar have introduced a peer-to-peer initiative, only available for self-drive rental cars, that allows individuals to list their own vehicles on the platform for rental purposes.

Table 4.6

Financial model	**Business model**	
	B2P	**P2P**
Asset-heavy model	Zoomcar, Myles, Revv, VOGO, MyByk, YULU	
Asset-light / marketplace model	Ola rental, Uber rental with driver	Zoomcar self-drive

Financial and Business Models for Rental Services for the Four-wheeler Segment

Table 4.7

	Asset-heavy model	Asset-light model/ marketplace model
Vehicle Ownership	With the aggregator or leased from automobile companies	Individual vehicle owners registered on the platform
Vehicle Maintenance	Aggregators	Individual vehicle owners registered on the platform
Ride hailing commission		15–25% per trip from vehicles owners
Revenue streams		Commissions from drivers
Cost structure	• Cost of revenue • Operations and support costs • Sales and marketing • Vehicle maintenance costs	• Cost of revenue • Operations and support costs • Sales and marketing
Operational complexity	Need to ensure the availability of fleet and vehicles, adequately maintained	Do not have to be involved in the operations
Examples	Revv, Zoomcar, Myles, Revv, VOGO, MyByk, YULU	Ola rental, Uber rental (with driver)

Financial and Business Models for Rental Services for the Four-wheeler Segment

Bicycle segment

There are two main models for operating bike-sharing systems in Indian cities: the publicly owned and the privately operated or privately owned and operated. In the publicly owned model, the public sector takes the revenue risk, while in the privately-owned model the private sector assumes the revenue risk. These models are commonly referred to as gross cost contract (GCC) and net cost contract (NCC).

The system in Mysuru follows a GCC model where the city reimburses both capital expenditure (capex) and operating expenditure (opex) through periodic payments to the operator selected through competitive bidding. Bhopal employs the NCC model, where 50% of the capital expenditure is reimbursed along with viability gap funding (VGF) for operating expenditure. The remaining 50% is borne by the operator. In the Ranchi variant of the NCC model, the operator receives payment as a service charge per cycle per day, which covers both expenditures. In all systems, the initial capital expenditure is funded by the private operator.

The appointment of operators differs in these models. They are selected through competitive bidding in the GCC model, while in the NCC model they are based on permits or Memoranda of Understanding (MoUs). Mysuru, Bhopal, and Ranchi follow a tendering process to appoint PBS operators, while Bengaluru and Pune use a permit-based system. In Bengaluru, YULU pays a permit fee to the Directorate of Urban Land Transport (DULT) on a per-cycle-per-year basis.

All business risks in the NCC model are borne by the operator. For some, relying solely on bicycle-based systems is not financially viable, as fares alone are insufficient to sustain the system. Additional sources of income, such as advertisements on station panels, can help generate revenue (Bhopal). Their implementation can face institutional challenges due to competition with existing street advertisement rights awarded to other agencies (Ranchi) or city-level prohibitions (Mysuru).

The initial 30 minutes of use are often offered free of cost to registered system users who have paid a membership fee. Attempts to charge a fee for the first 30 minutes in Mysuru resulted in a decline in ridership, and the decision was reversed. An analysis of primary data done by The Urban Lab indicates that approximately 80% of the trips through PBS are within 30 minutes, so the revenue generated from fares is typically insufficient to cover even the operating expenses (The Urban Lab & GIZ, 2021).

A detailed examination of YULU would help understand the business model of micromobility, looking at strategic approaches, collaborations, challenges, and pricing strategies, and highlighting their adaptability in India's evolving micromobility sector.

YULU's micromobility operations in Indian cities demonstrate diverse business models tailored to each location. In Bengaluru, YULU operates under a permit model, strategically identifying operational sites and determining the optimal number of bikes to be deployed. In Mumbai, the company has forged partnerships through MOUs with key agencies like CIDCO (City and Industrial Development Corporation), NMMC (Navi Mumbai Municipal Corporation), and MMRDA (Mumbai Metropolitan Region Development Authority), offering varying agreements such as security deposits and rental fees. After the electrical vehicle policy, the introduction of multi-operator permits in Delhi enabled YULU to establish a satellite station in North Delhi. It allowed operators to obtain permits at no cost. However, YULU faced challenges in Ahmedabad due to high operational costs, leading to service rollback. The Business to Customer (B2C) pricing model YULU uses involves a refundable registration fee, ride charges per minute, and innovative savings packages. YULU manages battery swapping in the B2C model. It has collaborated with Adani Electricity, the largest electricity supplier in India, and set up battery swapping stations to avail electricity at discounted prices. This comprehensive model underscores YULU's adaptability and strategic partnerships within India's evolving micromobility landscape.

Table 4.5

Aggregator	Started In	Services	Geographical coverage (Cities)	Fleet	Fare starts at (INR)	Rental duration (Hours unless specified)		Security deposit
						Min	Max	
Four-wheeler segment								
Zoomcar	2013	Self-drive cars	28	10,000	200/ hr	6		None
Ola Rental Ola Drive	2015 2019	Car rental with driver and self-drive cars			260/ hr	1	10	None
Myles	2013	Self-drive cars	21		350/ hr	4	Unlimited	Loss damage waiver of INR 150 non-refundable or refundable security deposit of INR 5,000
Uber Rental Uber Auto Rental	2018 2020	Car rental with driver Auto rental with driver	17 6		300/ hr	1	12	None
Revv	2015	Self-drive cars	22	3,500+	200/ hr 15,000/ month	10	90 days 24 months	INR 5000
Two-wheeler segment								
VOGO	2016	Scooter rental	25		7/ hr	15 mins	Monthly subscrip-tion	
Bicycle segment								
MYBYK	2014	Bicycle rental	6	10,000	25/ day	1	Monthly subscrip-tion	INR 500
YULU	2017	Bicycle rental	8		20/ hr	10 mins	60 days	INR 100

Chapter Five: State of the Research on Informal and Shared Mobility

This chapter outlines, catalogs and categorizes the ISM sector research and policy actions in India, with an aim to identify research gaps and develop a future research and policy agenda.

5.1 Perspectives and Discourses

The development of informal and shared mobility in urban India results from a multifaceted and dynamic set of interactions within rapidly growing cities. On the demand side, shifting demographic patterns spurred by economic growth and societal changes have constructed new consumption patterns. Meanwhile, on the supply side, many vehicles and services have emerged to meet the unique needs of each context, now powered by technology, electrification, and digital applications. The academic research and gray literature contributed by various non-state organizations have played a significant role in setting the narrative of the ISM sector in India. Academic research predominantly concerns itself with transport revolutions triggered by significant advancements in urban transportation (Gilbert & Pearl, 2010) across the world and can be summarized under several broad discourses.

Traffic growth: a vehicle-based perspective

Academic discourse examines the growth of traffic and how the ISM sector impacts urban mobility and is impacted by policy changes. Following the liberalization of the Indian economy in 1991, car ownership and use saw a significant surge in cities. Policies were introduced to accommodate the resulting increase in motor vehicle traffic and prevent cities from coming to a screeching halt. Academic research before 2000 sought a solution to this problem in engineering and scientific terms, requiring investment in a major urban road-building program and in measures to maximize vehicle capacity on existing urban streets. This intervention needed to address the presence and growing role of informal public transport in providing urban transport services, including the economic contributions to the urban transport sector in India (Banister & Berechman, 2003).

Numerous policymakers and academics contributed to transport policies to rationalize the use of urban space by expanding road space to accommodate more vehicles. Indian cities looked to American city models, leading to the emergence of vehicle-based academic research with two main agendas in urban transport: one was including mathematical skills to create comprehensive origin-destination models for vehicles, utilizing tools from social physics such as gravity models and entropy maximizing techniques. Additionally, urban economists focused on developing formal appraisal methods prioritizing the formalization, economic efficiency, and utility of formal and informal public transport in Indian cities. Academic scholarship focused primarily on forecasting models, origin-destination studies, and traffic management and infrastructure, which led Indian cities to adopt City Traffic and Transport Studies (CTTS).

In the mid-2000s, there was a notable shift in academic focus toward public transport and the promotion of Comprehensive Mobility Plans (CMPs) to address transportation challenges in urban areas (Harsha & Verma, 2022). Simultaneously, the adverse effects of increased car usage, such as traffic congestion, air pollution, and traffic accidents, became more evident in major Indian cities (Chakrabartty & Gupta, 2014). A considerable amount of academic literature began to discuss the issues caused by informal and shared mobility (ISM) modes, including traffic congestion and violations (Badami et al. 2016), environmental degradation such as air and noise pollution (Goel et al. 2017), parking problems, and concerns regarding traffic and road safety (Priye et al., 2020), as well as harassment and exploitation (Jain & Tiwari, 2020).

Managing traffic growth without building more roads challenges academic research and policy. To address this issue, it is crucial to redefine the problem by prioritizing expanding personal movement instead of simply accommodating vehicular growth and unrestricted vehicle movement within urban areas. This paradigm shift can contain road traffic growth while improving overall urban transport, including recognition of the importance of the ISM sector in providing daily urban mobility in Indian cities. Academic research emphasizing the necessity of a comprehensive approach to urban transport planning, which considers the role of the informal public transport sector in providing affordable and accessible transportation options, was absent until the policy landscape in India shifted after 2005 (Akbar, et al. 2023; Singh, 2012).

Traffic containment: a people-based perspective

The discourse around traffic containment in India's informal and shared mobility sector takes a collective urban mobility perspective. It examines the impact of traffic growth on people, particularly about the environment, accessibility, and safety in urban transport (Pucher et al., 2007). This discourse considers the experiences of passengers, pedestrians, and other road users and how the growth of traffic impacts them (Pucher et al., 2005; Agarwal, 2006; Tiwari & Jain, 2012; Reddy & Balachandra, 2012). It also explores how the urban transport sector, including ISM, can be made more accessible and safer for all users (Mani et al., 2012).

Significant research focused on the formalization of the ISM sector, operations and services, socioeconomic characteristics and travel behavior, and economic contribution towards the overall development of cities (Kumar et al., 2016; Tiwari, 2002; Joshi, 2014; Cervero & Golub, 2007; Behrens et al., 2021). The narrative of ISM as 'nuisance contributors' shifted as academic research began to see it as a service provider of a crucial urban resource, i.e., urban mobility (Cervero, 2001).

The policy shift from providing additional road space to private vehicles enhanced the interest in state-sponsored public transport systems to provide urban mobility services. Scholars and policymakers showed a renewed interest in bus-based and rail-based mobility systems, leading to a rise in the literature focusing on the formalization and integration of ISM with primary transit modes (Badami & Haider, 2007). Literature around first and last-mile connectivity, transit-oriented development, local area plans, and station accessibility plans (Joshi et al., 2017; Kanuri et al., 2019; Badami, 2009; Ahmad & de Oliveira, 2016), started emerging across various Indian cities. This shift in perspective was coupled with empirical studies that focused on increasing restrictions on car use, particularly parking controls in urban centers and access restrictions to counter high levels of air pollution, but without any significant cutback in the provision for car use (Akbar et al., 2023). This affected informal and shared modes of transportation, as the conventional modes of ISM, like auto-rickshaws, consume street space in parking (Cervero, 2013).

Although ISM has gained significant popularity in academic and gray literature research, a pertinent question arises as to whether the aforementioned perspective truly provides a comprehensive understanding of the ISM sector, including its social and cultural significance. The focus of academic and policy research has shifted towards the burgeoning urban population, escalating travel demand, and the imperative for high-quality public transport systems. As a result, the urban mobility sector in India has witnessed a new policy that prioritizes moving people over moving vehicles (NUTP 2006). This shift has also sparked a growing research interest in livelihood and creating livable cities (Giduthuri, 2015), including the pursuit of transitions to low-carbon mobility (Canitez, 2019).

Livable cities: just urban transition perspectives

The discourse around livable cities focuses on creating sustainable and equitable urban environments that promote well-being for all residents, regardless of socio-economic status. As defined in the report, Urban Mobility: Strategies for Liveable Cities, 'Liveable cities are mobile cities' and well-integrated public transport is one of the primary aspects (BMZ, 2016), which in the Indian also includes ISM. With initiatives like JnNURM 2005, NUTP 2006, NEMMP 2012, Smart City Missions 2015, AMRUT 2015, and HRIDAY 2015, academic discourse shifted radically from 'urban transport' to 'urban mobility' (UN-Habitat, 2020). The concern with livable cities and just urban transition perspectives led to introducing new themes around the ISM sector in India, emphasizing the integration of modes and provisions for safe and reliable urban mobility (NUTP, 2006).

The academic literature on ISM in urban India has contributed significantly to understanding the sector's subtleties and informing policy-making decisions. Activity-based studies have introduced new forms of data collection and participatory approaches (Ahmad & De Oliveira, 2016). The ongoing discussions and policy focus on enhancing mass public transport and integrating other modes have brought about research on alternative modes of urban mobility, such as shared bikes, ridesharing, e-bicycles, and e-rickshaws (Dhawan et al., 2017).

Many Indian cities have successfully implemented ISM projects under the category of livable cities. One notable example is Chennai's SmartBike program, a bike-sharing initiative that provides affordable and accessible transportation options for residents, particularly those in congested urban areas. This program attempted to provide a sustainable mobility option for first and last mile connectivity, thus contributing to a sustainable future (Sivaneswari & Karthigeyan, 2022). It serves as an excellent demonstration of how innovative transportation solutions can enhance the livability and sustainability of urban environments (Madapur et al., 2020). Another relevant case is India's informal auto-rickshaw sector, which has garnered significant research and discussion within the discourse on livable cities. While FAME I did not explicitly encompass public transport, FAME II has incorporated passenger mobility, specifically on three-wheelers, to ensure sustainability, combat climate change, and transition towards cleaner and greener transportation. Also, the recent amendment of the Motor Vehicle Act in 2019 includes a renewed focus on the ISM sector to boost first and last-mile connectivity (MoRTH, 2021).

The rise in academic research on ISM through the activity-based perspective has raised questions regarding the understanding of 'informality' present in informal mobility in the context of India (Mittal, 2022). There has been a growing interest in understanding informal mobilities through the analytical lens of global urban studies and moving away from the technocentric and neo-classical economic approaches (Schwanen, 2020).

The formal-informal dichotomy: The Informality lens

The sprawling metropolises of India are teeming with a vast array of informalities, including urban transport. Understanding these informalities is crucial to unraveling their causes, consequences, and implications on the urban landscape. As cities expand, the informal sector becomes prominent in every aspect, from the economy to markets, mobility, infrastructure, governance, etc. A comprehensive understanding of informalities is imperative to navigate the complicated terrain of Indian cities. Informality in India has been studied through various theoretical frameworks: the subaltern school of thought, initiated by scholars such as Ranajit Guha and Dipesh Chakrabarty, examines the agency and resistance of marginalized groups in the context of colonial and post-colonial India, highlighting how informality can be seen as a form of subaltern economic and political practice that challenges dominant structures and narratives (Guha et al., 1982; Chakrabarty, 1989).

The political economy framework expounded by scholars like Barbara Harriss-White and Jan Breman focuses on the structural dynamics and power relations that shape informal economic practices in India, analyzing the role of capitalism, globalization, and state policies in creating and sustaining informal sectors and labor markets (Harriss-White, 2002; Breman, 2013). Within development studies, scholars like Arjun Appadurai and Amartya Sen explore the social and human development dimensions of informality in India, examining how informal practices contribute to livelihood strategies, social capital, and capabilities of individuals and communities (Appadurai, 2004; Sen, 1999). In urban informality, Ananya Roy and Gautam Bhan adopt an urban studies perspective, examining the spatial dynamics, governance structures, and social implications of informal settlements, such as slums and unauthorized colonies within the urban context (Roy, 2005; Bhan, 2009). Given the significance of social hierarchies in India, caste and gender analysis provide crucial lenses for understanding how caste and gender dynamics intersect with informality, shaping access to resources, work opportunities, and social mobility (Srinivas, 1952; Agarwal, 1997; Chandhoke, 1995).

These frameworks offer different perspectives on informality in the Indian context, addressing historical, economic, political, social, and spatial dimensions. Informality in India is a complex and multifaceted phenomenon, and these frameworks provide analytical tools to comprehend its various aspects, including informal urban transport. Out of all bottom-up forms of informality (AlSayyad, 2021), informal urban transport fills the gap of institutionalized urban development by negotiating urban transport services and perceptibility in the public realm (Kamalipour & Peimani, 2020). An everyday informal activity in Indian cities, informal transport can be viewed through multiple lenses. From a neoclassical perspective, it is a response to the inefficiencies of the formal sector and provides low-cost services to consumers (Cervero, 2001), while from a Marxist perspective, it is a response to the lack of employment opportunities in the formal sector and the surplus of the labor force, which provides a means for the urban poor to earn a livelihood (Kundu, 2020). Again, there is an exhaustive discussion on 'informality' as a concept in Urban Studies that goes beyond a service sector or an economic category alone. Specifically in the urban transport sector, these perspectives on 'informality' are valuable contributions that bring the political economy and equity concerns beyond the technical or often simplistic assumptions about mobility services.

Technology-based solutions: a digital perspective

Research exploring the role of digital technology in the ISM sector in India investigates how digital applications, such as ride-hailing platforms, have transformed the sector and influenced urban mobility (Singh, 2020). Academic discussions on technology-based solutions delve into the growth of the shared mobility landscape (Kathait & Agarwal, 2021) and highlight emerging inequalities like the 'digital divide.' This divide can hinder access to ridesharing apps for low-income individuals, resulting in new forms of social exclusion and inequality (Graham & Marvin, 2001).

Technology-based platforms, such as ride-hailing apps, provide a previously unseen level of accessibility to informal transport services. These platforms connect commuters with auto-rickshaws and cab services, enabling them to hail a ride quickly. This enhanced visibility of services has reduced waiting times and greater passenger convenience (Shah et al., 2020). Technology-based solutions also empower informal transport operators by connecting them to a more extensive customer base. Apps that enable individuals to offer ridesharing services, like Uber, Quick Ride, allow drivers to supplement their income during spare hours, with socio-economic implications for informal operators (Mishra & Bathini, 2020). Integrating navigation and route optimization tools in the urban transport sector has contributed to decongesting urban traffic and reducing passenger travel time (NITIAayog, 2018a). Fare transparency and trust are also highlighted as crucial benefits of technology-based solutions, with ride-hailing platforms providing passengers with real-time fare estimates, promoting trust and predictability in transactions (Chaudhry et al., 2018), and building confidence among users. Digital technology also improves passenger safety by offering real-time tracking, emergency buttons, and sharing ride details (Goel & Haldar, 2020).

The increasing use of technology, innovations, and digital intermediaries has led to a focus on plural urban mobilities in India, drawing attention to the various conditions, meanings, and practices associated with movement. Conceptual work around the 'new mobilities paradigm' is emerging to explore urban mobilities, including ISM, as a relational, multifaceted, and context-dependent phenomenon. Consequently, a more nuanced understanding of ISM at the intersection of technology and society is possible while understanding its role in sustaining social connections across cities (Norton, 2020).

5.2 ISM Research in India: Coverage and Geographic Spread

Since India opened its doors to the sweeping winds of economic liberalization in the early 1990s, there has been an exponential rise in ISM services. ISM has been a topic of intense debate among scholars, policymakers, and various development agencies. The academic discourse surrounding ISM in India is a tapestry of perspectives, debates, and implications, revealing the intricate interplay of societal needs, governance challenges, and potential pathways toward sustainable mobility. In recent years, the urban mobility sector, including ISM, has undergone a significant disruption due to technological innovations, an increase in the use of EV and digital intermediaries, and sociocultural shifts in travel behavior (Rode et al., 2015), thus leading to a renewed research interest in the ISM sector in Indian cities (NITI Aayog, 2018b) that goes beyond the borders of socio-economic studies of traditional informal mobilities.

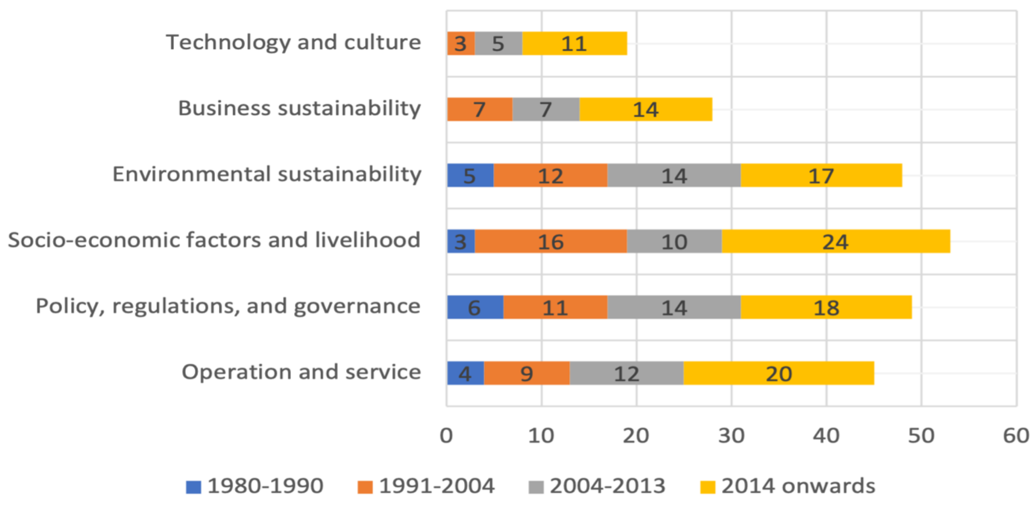
Based on the primary research done for this study, academic publications related to the ISM sector in India between 1980 and 2020 can be broadly categorized into five themes: 1) Operations and services; 2) Policy, regulations, and governance; 3) Livelihood and socio-economic factors; 4) Environment sustainability; 5) Business sustainability; and 6) Technology and culture.

Table 5.1

No	Categories	Description	No. of publications
1	Operations and services	Focuses on types of modes, services and operations, routes, road safety, environmental concerns, traffic management, etc.	61
2	Policy, regulations, and governance	Focuses on regulatory frameworks, role of government, unions, policy making and planning.	55
3	Livelihood and socio-economic factors	Focuses on socio-economic benefits, employment generation and livelihood, exploitations, social benefits of service providers, city culture, mobility, etc.	36
4	Environmental sustainability	Focuses on air and noise pollution, fuel type and consumption, energy usage, eco-friendly practices, and promotion of e-modes in the sector.	33
5	Business sustainability	Focuses on economic impacts, cost and benefits, financial sustainability, integration, business models, etc.	38
6	Technology and culture	Focuses on disruptive changes in urban mobility due to the rise in digital platforms and technological innovations.	18

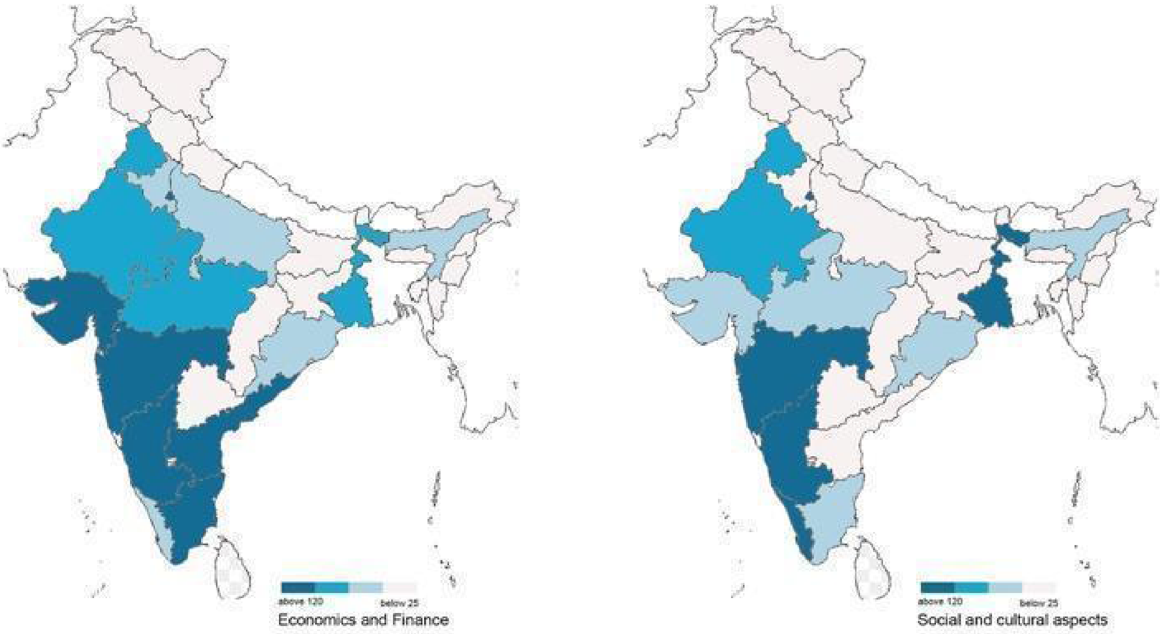
Mapping Academic Publications on Informal and Shared Mobility (ISM)

Figure 5.1: Year-wise Distribution of Categories of Academic Publications on ISM



The research themes in the ISM sector are predominantly concentrated on Delhi, Western states like Gujarat and Maharashtra, and Southern states like Karnataka, Tamil Nadu, Andhra Pradesh, and Telangana in India. Some studies have also been conducted in West Bengal. This uneven distribution of academic research can be attributed, first, to the unbalanced urbanization (Bose, 1976); and second, the dominance of large cities in the Indian economy, especially in the dynamic urban mobility sector, and the emerging economic opportunities like easy entry to the transport workforce (Shaban et al., 2020). It is worth noting that the concentration of research in specific regions reflects the importance of these areas in shaping the discourse on ISM.

Figure 5.2: Geographic Distribution of Academic Publications on Informal Transport



Significant transformations have occurred in academic and policy research within the ISM sector in the last three decades. These transformations can primarily be attributed to three key factors: the economic liberalization in 1991, the introduction of the Jawaharlal Nehru National Urban Renewal Mission (JnNURM) in 2005 and the National Urban Transport Policy (NUTP) in 2006, and the initiation of the Smart Cities Missions in 2015 (Chadchan & Shankar, 2012; Swamy & Sinha, 2014; Aijaz & Hoelscher, 2015). The latest area of research interest revolves around technology and mobility culture, specifically focusing on the rise of Electric Vehicles (EVs) and shared mobility. This momentum has been fueled by initiatives such as the Faster Adoption and Manufacturing of Electric Vehicles (FAME II) (ITDP, 2022).

Following liberalization in 1991, the increased participation of individuals as service providers in the ISM sector led to new research themes. These themes primarily centered on socio-economic benefits, livelihood, operations, services, and environmental sustainability (Chadchan & Shankar, 2012). The research focus during this period, from 1991 to the mid-2000s, contributed to developing discourse related to traffic growth from a vehicle-based perspective. Priority was given to the movement of vehicles, and the debates often revolved around traffic management, road widening, and the provision of new infrastructure to accommodate the growing number of vehicles (Badami, 2009).

With the introduction of the NUTP in 2006, the direction of research in the ISM sector shifted towards prioritizing the movement of people. This shift was accompanied by an extensive focus on policy, governance, regulations, operations, and environmental sustainability (Kuriakose, 2013). This conceptual shift aligned with the NUTP's agenda of prioritizing the movement of people over vehicles. Additionally, the government sought to formalize the ISM sector for better regulation and integration with mass public transport systems to enhance mobility (NUTP, 2006). Consequently, research efforts aimed to study the informalities within the sector in order to comprehend the dichotomy between formal and informal aspects (Mittal, 2022). Such investigations aimed to unpack the nuances of the informal nature of the ISM sector. Thus, the emergence of ISM research after 2004 gave rise to two distinct discourses: firstly, the perspectives on creating livable cities through just urban transitions, and secondly, the exploration of the formal-informal dichotomy from an informal perspective.

Another surge in research interest, focusing on technology and mobility culture, began with initiating the Smart Cities Mission in 2015 (Mishra, 2019). This mission provided opportunities to explore technology-based urban mobility solutions, with digital intermediaries as a primary example (Chowdhury et al., 2023). The proliferation of digital platforms such as Uber and Ola, which promote shared mobility, coupled with the promotion of Electric Vehicles under the FAME II initiative, has disrupted the mobility culture in Indian cities (Jacob, 2022). Notably, a significant change in the ISM sector occurred with the introduction of UberAuto in 2015, which facilitated the inclusion of traditional auto-rickshaws into the digital platform (Najar, 2015). This was followed by a shift in the business model to accept cash as a payment mode (Kalra, 2015). The increased utilization of technology has led to a steady transformation in mobility culture (Srikumar, 2017), thereby paving the way for current research endeavors that focus on technology-based solutions from a digital perspective.

Chapter Six: Gaps in Existing Research, Policy, and Future Research Agenda

This chapter summarizes and concludes the discussion on various policies, regulations, and research perspectives developed in the previous chapters and identifies research gaps and policy agenda.

6.1 Gaps in Existing Research

ISM has long been an integral part of the transportation landscape in India, serving as the primary mode of daily transport in most Indian cities. However, limited research has hindered its holistic development and regulation. A comprehensive understanding of the current gaps in research is essential to developing effective strategies and interventions to address the challenges and opportunities in the sector.

The limited availability of comprehensive data and analysis on the ISM sector in India hinders the identification of challenges and opportunities and the development of effective policies and interventions. There is a need for comprehensive research outputs on the social and environmental impacts of ISM, including the health, safety, and well-being of workers and passengers and the sustainability of practices and technologies employed. The governance and regulation of ISM in Indian cities have not received sufficient research attention either, and there is a need for in-depth analysis of the legal and institutional frameworks and the roles played by various stakeholders such as the government, the private sector, and civil society. These aspects are crucial in understanding the ISM sector in India, starting from the lack of nuanced definitions of the sector. By addressing these research gaps, researchers and policymakers can better understand ISM and its implications, leading to evidence-based decision-making and more effective interventions.

Nuanced definitions: Informal and shared mobility (ISM) is frequently used interchangeably with informal transport or shared mobility, intermediate paratransit, or just paratransit, confusing. The absence of a clear definition hinders the development of comprehensive policies that effectively address the specific needs and challenges of the sector. It is crucial to establish more nuanced definitions to facilitate a deeper understanding of ISM operations, regulation, and potential enhancements.

Policy interventions: The lack of well-defined policies and regulations has led to the unchecked expansion of the sector, giving rise to concerns regarding road safety, environmental degradation, unfair competition, and subversions of regulations. Exploring effective policy interventions and regulatory frameworks to tackle the issues and capitalize on the potential in this sector can offer valuable insights for enhancing its development and fostering greater integration.

Comprehensive data: Numerous studies have highlighted the significant data deficiency that hinders understanding the social and economic impact of ISM, particularly on the travel behavior and livelihoods of workers in this sector. Academic and grey literature from various Indian cities, including Mumbai, Delhi, Bengaluru, Kolkata, and Chennai, have also emphasized additional data on the informal and shared mobility sector. Comprehensive data on various ISM aspects can enhance research quality and effectively address multiple gaps.

Understanding of user behavior: To effectively prioritize the safety and well-being of passengers and workers, conducting a detailed analysis of user behavior within the sector is crucial. By gaining comprehensive insights into user mobility patterns, preferences, and constraints, policymakers can develop policies and interventions that align with users' specific needs and preferences. The concentration of current studies in only a few cities limits the policy-making process. It is essential to broaden the scope of research to encompass a broader range of cities to facilitate more informed and comprehensive policy decisions.

Attention to social equity and gender: The social equity implications of the ISM sector are an important aspect that requires research. Currently, the study of the impact of ISM on marginalized groups, including women, low-income communities, and people with disabilities is restricted. It is crucial to prioritize inclusive and accessible policies and interventions to prevent further marginalization of these groups. By focusing on equity, researchers and policymakers can significantly enhance the access to urban transport for millions of individuals who rely on the ISM sector for their daily commutes.

Attention to technological innovations: In the context of the ISM sector, there is a need to pay attention to technological innovations. Embracing technological advancements can greatly enhance the efficiency, safety, and user experience provided by informal transport systems. For example, implementing mobile applications for ride-hailing services or using GPS technology for route optimization can improve the overall functioning of the sector. Additionally, exploring the potential of electric or hybrid vehicles in the ISM sector can reduce environmental impacts and promote sustainability. By fostering technological innovations, researchers and policymakers can drive positive change in the ISM sector, benefiting users and the environment.

Focus on sustainability: There is a pressing need to prioritize sustainability in the realm of ISM, particularly in studying its impact on air quality, congestion, and fuel consumption and emissions, decarbonization, etc. Scholars also highlighted the need for an integrated approach to developing and regulating ISM in Indian cities that fosters sustainable and eco-friendly transportation modes while reducing reliance on non-renewable resources. Focusing on various aspects of sustainability in the ISM sector can also contribute to economic mobility and help in creating more sustainable and inclusive cities.

6.2 Gaps in Policy

Gaps in policy[12] pose significant challenges to the ISM sector in Indian cities. With millions of people who rely on ISM modes, there is a pressing need for comprehensive policy and regulatory frameworks to effectively govern these services. The gaps in policy cause safety concerns and are responsible for substandard working conditions for drivers, and a distinct lack of accountability and transparency. A meticulous study conducted by the Centre for Public Policy Research (CPPR) identified the unfortunate lack of coordination and communication among various government agencies and stakeholders involved in regulating and managing urban transport services as a significant reason for the gaps in policy (Ponodath et al., 2018). The conspicuous lack of substantial collaboration between state and non-state institutions, drivers, and local communities leads to widespread confusion and inefficiencies within the system, rendering it increasingly arduous to address the nuanced and specific urban mobility needs of individual cities. Given the burgeoning significance of the ISM sector, it is imperative to conduct comprehensive research leading to incisive policy interventions to steadfastly support and fortify this pivotal sector, so gaps in policy are promptly and effectively addressed. Such a concerted effort will undoubtedly pave the way to a cohesive, integrated, and all-encompassing urban transport ecosystem that unequivocally prioritizes the paramount principles of safety, efficiency, and sustainability.

Recognition and integration: The current urban transport policies do not pay sufficient attention to the crucial role that ISM plays in providing affordable and accessible mobility to millions of urban residents. The policies consider the sector as an occasional transport service provider when there are other options than waiting for public transport (NUTP, 2006). Despite being a popular mode of transportation for short distances in many cities, auto-rickshaws and other ISM modes often find it difficult to obtain permits and licenses, and to operate, due to poor institutional recognition. The lack of recognition for battery-powered cycle-rickshaws similarly marginalized them and made them vulnerable.

JnNURM and NUTP only emphasized the integration of various modes of public transport without specifying a clear integration pathway with ISM modes. The recognition and integration of different ISM modes in India would benefit the current status and policymaking by improving mobility options for a significant proportion of the population. ISM is crucial in filling the gaps where formal public transport is inadequate and by integrating it into the existing public transport system, policymakers can ensure that all segments of society have access to safe and reliable transportation options. This would lead to increased economic opportunities for ISM operators, improving the livelihoods of many low-income communities. Integration of routes, infrastructure, fare, and management and regulation are all required to boost the ISM sector.

12. The gap analysis draws on policies like JnNURM 2005, NUTP 2006, and FAME II 2019, and acts like the Motor Vehicle Act.

Regulation and formalization: When brought into the formal sector, ISM operators would be subject to restriction and oversight, improving safety, reliability, and service quality. Formalization would facilitate data collection and analysis, informing evidence-based policymaking and helping address policy gaps, such as inadequate regulation of informal transport providers, which lead to safety concerns and unfair competition with formal operators. Through regularization and formalization, policymakers can work with ISM operators to create a more sustainable and equitable transport system in India. ISM operators could access better financing and infrastructure to improve their operations and expand their businesses. Such an approach could also create a level playing field between ISM and formal operators, reducing unfair competition, and creating a more competitive marketplace. Policymakers can also encourage more operators to join the formal sector through incentives to formalize, such as tax breaks or access to government contracts.

Investment and support: Urban transport policies need to allocate more investment and support to improve the infrastructure and quality of ISM services. The lack of investment, which could have helped the sector provide safe, efficient, and reliable services (Singh, 2017), leads to accidents and fatalities, highlighting the urgent need for investment and support. The lack of financial assistance for auto-rickshaw drivers during the COVID-19 pandemic significantly impacted their livelihoods and ability to provide services to passengers. With the necessary resources and infrastructure, the sector can be formalized and integrated with the overall transportation system, making it safer and more reliable. This can lead to a comprehensive legal framework for the industry, resulting in a regulated and organized transport system that benefits passengers and operators.

Inclusive planning and decision-making: The gap between policy objectives and on-ground realities needs to be bridged by including informal public transport service providers in planning and decision-making. Current policies do not reflect the needs and concerns of these operators, leading to a lack of compliance and enforcement. Attempts to regulate the informal transport sector in Kolkata, Mumbai, and Hyderabad have been met with resistance because operators see the policies as arbitrary and not representative of their needs and those of their customers. Involving these stakeholders in decision-making can lead to more effective policies and greater compliance, ultimately benefiting the operators and the passengers they serve.

Skill development and training: While there have been efforts to strengthen capacity building at the state and city levels, the ISM service provides suffer from a lack of formal training and skill development to ensure better service quality. Increasing the professionalism and quality of service of ISM operators by providing the necessary skills and training is crucial for the effective implementation of policies aimed at developing sustainable and efficient urban transport across cities. Many auto-rickshaw drivers, for example, are yet to receive formal training on safe driving practices and customer service, leading to poor service quality. Adequate training and skill development would ensure safe, quality services, increase customer satisfaction, and ultimately improve the effectiveness of policies.

Social security and livelihoods: Attention to social security and livelihoods is needed to address policy gaps and improve the socio-economic significance of the ISM sector. The marginalization and vulnerability of informal service providers are caused by the lack of recognition of their livelihoods in India's urban mobility policies. Exclusion from government schemes undermines the importance of the sector. The impact is especially prominent in small and medium-sized cities, where informal service providers are crucial for urban mobility, where they act as the primary mode of public transport. Addressing social security and livelihoods concerns in the ISM sector would lead to acknowledging its significance and improving the socio-economic conditions of informal service providers.

Attention to innovation potential: Many informal operators have undertaken vehicle customization and innovated in service delivery, but this is yet to be encouraged by any policy. Significant improvements are possible through tapping into the innovation potential of ISM operators. Auto-rickshaws modified to run on compressed natural gas (CNG) reduce emissions and lower operational costs for the drivers, for example. However, the lack of policy support and infrastructure for CNG refueling stations has made it challenging to adopt this innovation in the informal transport sector. Another example of innovation in the ISM sector is the conversion of traditional cycle-rickshaws to e-rickshaws. Due to the weight of the battery and light structure of the vehicle, these modifications are banned for safety reasons (Singh, 2014). The Motor Vehicle Act 1988 does not permit modification to the entire body of the vehicle, thus restricts local innovations. However, acknowledging and supporting innovations with standard design parameters can help improve the ISM sector and bridge the policymaking and planning gaps about first and last-mile connectivity.

Connecting to local contexts: ISM systems across Indian cities are diverse and context specific. A one-size-fits-all approach to policy and interventions can have unintended consequences. The specific needs and characteristics of each city's informal transport system need to be considered. The ISM in Delhi, includes auto-rickshaws and e-rickshaws which have seen a significant rise, and served mainly as last mile connectors to access the metro or bus (Kumar & Roy, 2019). The ISM sector in Hyderabad is dominated by shared auto-rickshaws and buses, which connect suburban areas to the city center (Ramachandraiah 2007). In Ahmedabad, auto-rickshaws run within the city, while chakdas provide peri-urban services to connect Ahmedabad to Gandhinagar and peripheral smaller towns like Sanand and Viramgam (Kumar et al., 2016). By understanding each city's specific characteristics and needs, policies and interventions can be tailored to address the gaps and provide the necessary support.

Monitoring and evaluation: A robust monitoring and evaluation mechanism is necessary to ensure timely course corrections and improvements, leading to effective policy interventions. The lack of data on policy impact results in a lack of accountability and an inability to make informed decisions about future policy directions. A lack of regulation and monitoring of the auto-rickshaw sector in Jaipur, Rajkot, and Jamnagar has led to overcharging, refusal to ply, and unsafe vehicles (Kumar et al., 2016). The lack of monitoring and evaluation of the cycle-rickshaw segment in Kolkata has led to illegal modifications, unsafe vehicles, and passenger and road safety problems (Samanta & Roy, 2013; Sood, 2012; Tiwari, 2014). Monitoring and evaluation can help identify these issues and lead to effective policy interventions that improve the safety and regulation of the informal public transport sector.

Inadequate charging infrastructure for e-informal modes: While FAME I and II aimed to develop charging infrastructure, provisions and incentives are needed for charging stations that cater to everyday transport vehicles. This lack of infrastructure is a significant barrier to adopting e-rickshaws and other electric modes, particularly in major Indian cities and small towns where they are increasingly used as low-cost transportation options (Singh, Doddamani, Soni, & Jayaraman, 2022). Addressing this gap could help unlock the potential of electric modes in the informal sector and promote more sustainable and environmentally friendly transportation options.

Customization and adaptation incentives: Customization and adaptation are essential for informal transport vehicles to suit specific routes and operational needs. Policies like FAME I and II lack explicit incentives and support for electric vehicle adaptation to the unique requirements of informal transport. They ignore battery-swapping solutions for e-ISM modes, which could be an advantage for informal shared modes like auto-rickshaws and e-rickshaws. Incentives and support for customization and adaptation could solve policy gaps and promote the use of electric vehicles, bringing benefits such as lower emissions and fuel costs to the e-ISM sector in Indian cities.

6.3 Future Research Agenda

The discourse around ISM in India is complex and multifaceted, encompassing equity, regulation, integration, technology, and sustainability issues. As cities continue to grow and evolve, it is increasingly important to understand the role of these modes of transportation in providing mobility to marginalized and low-income communities, as well as their impact on the environment and the (in)formal economy. The gaps identified in research and policy make it imperative to develop a future research agenda to guide investigations and policy interventions in the sector. This agenda should prioritize comprehensive data collection, fair practices, understanding user behavior, social equity implications, technological innovations, sustainability, and policy interventions. It should also emphasize the importance of collaborative efforts between researchers, policymakers, government agencies, and other stakeholders to develop and implement evidence-based policies and interventions that effectively address the gaps identified. Some of the directions for future research for ISM in the Indian context may include:

Equity and accessibility: Future research should focus on ensuring equitable access to mobility for marginalized and low-income communities. This entails conducting research on the socio-economic importance of informal modes in enabling individuals to access education, healthcare, and employment opportunities that would otherwise remain beyond reach.

Regulatory frameworks: The delicate equilibrium of formalizing ISM modes without jeopardizing the livelihoods of drivers who often operate on the margins of the formal economy is another crucial area of investigation. Research on standardized fare structures and safety protocols is needed to ensure passenger safety and fair practices.

Integration into the urban fabric: Future research should focus on seamlessly weaving the ISM sector into urban planning and formal transportation networks by addressing the logistical, infrastructural, and policy challenges of integrating diverse modes into the urban fabric.

Technology and digital intermediaries: The transformative potential of technology-driven ride-hailing and sharing services and ways to regulate them to ensure fair competition and labor rights also require further exploration to understand the evolving nature of transportation intermediaries and how they can be integrated into the existing transportation ecosystem.

The synergy between traditional and new mobilities: A crucial item on the future research agenda for informal and shared mobility in the Indian context is the synergy between conventional modes and new mobility. Research is needed on how traditional methods of ISM, such as street-hailing auto-rickshaws, shared tempos, and jeeps, can be integrated with new mobility solutions like app-based ride-hailing and sharing services, finding a balance between the benefits of traditional modes (accessibility and affordability), and the convenience and flexibility of new mobility solutions.

Inclusion, social security, and the digital divide: It is essential also to understand how to ensure that informal and shared mobility systems are accessible to all members of society, regardless of socio-economic status. Questions like ways to provide social security benefits to drivers and other workers in the informal transportation sector and addressing the digital divide that may prevent some individuals from accessing technology-driven ride-hailing and sharing services need to be explored, along with the potential of technology to bridge the digital divide and improve access to transportation for all members of society.

Electrification and decarbonization towards sustainable urban mobility: As urban centers grapple with congestion and pollution, it is increasingly important to explore adopting eco-friendly technologies, such as electric rickshaws and other electric vehicles. Future research must focus on understanding the potential of electrification and decarbonization to reduce emissions and mitigate congestion while promoting sustainable urban mobility solutions. The economic feasibility of transitioning to electric vehicles and the potential impact on the livelihoods of ISM service providers are important factors to understand, to enable India to reduce its carbon footprint and create a more sustainable transportation ecosystem.

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