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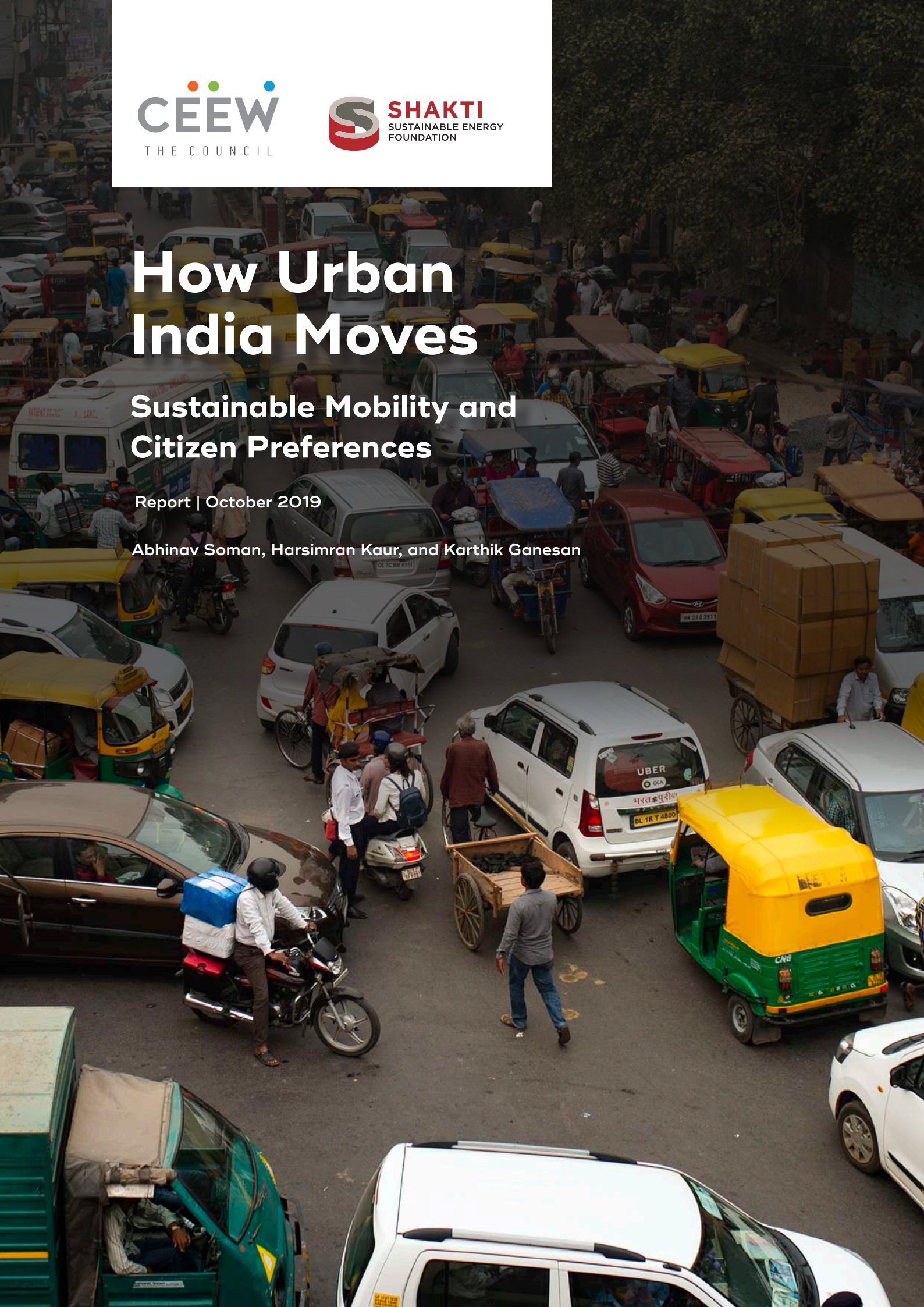
How Urban India Moves

Sustainable Mobility and Citizen Preferences

Report | October 2019

Abhinav Soman, Harsimran Kaur, and Karthik Ganesan



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Shakti Sustainable Energy Foundation works to strengthen the energy security of the country by aiding the design and implementation of policies that encourage energy efficiency, renewable energy and sustainable transport solutions, with an emphasis on sub-sectors with the most energy saving potential. Working together with policy makers, civil society, academia, industry and other partners, we take concerted action to help chart out a sustainable energy future for India (www.shaktifoundation.in).

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The Council on Energy, Environment and Water (CEEW) is one of South Asia's leading not-for-profit policy research institutions. The Council uses data, integrated analysis, and strategic outreach to explain – and change – the use, reuse, and misuse of resources. The Council addresses pressing global challenges through an integrated and internationally focused approach. It prides itself on the independence of its high-quality research, develops partnerships with public and private institutions, and engages with the wider public.

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In nine years of operations, The Council has engaged in over 230 research projects, published over 160 peer-reviewed books, policy reports and papers, advised governments around the world nearly 530 times, engaged with industry to encourage investments in clean technologies and improve efficiency in resource use, promoted bilateral and multilateral initiatives between governments on 80 occasions, helped state governments with water and irrigation reforms, and organised nearly 300 seminars and conferences.

The Council's major projects on energy policy include India's largest multidimensional energy access survey (ACCESS); the first independent assessment of India's solar mission; the Clean Energy Access Network (CLEAN) of hundreds of decentralised clean energy firms; the CEEW Centre for Energy Finance; India's green industrial policy; the USD 125 million India-U.S. Joint Clean Energy R&D Centers; developing the strategy for and supporting activities related to the International Solar Alliance; designing the Common Risk Mitigation Mechanism (CRMM); modelling long-term energy scenarios; energy subsidies reform; energy storage technologies; India's 2030 Renewable Energy Roadmap; energy efficiency measures for MSMEs; clean energy subsidies (for the Rio+20 Summit); Energy Horizons; clean energy innovations for rural economies; community energy; scaling up rooftop solar; and renewable energy jobs, finance and skills.

The Council's major projects on climate, environment and resource security include advising and contributing to climate negotiations in Paris (COP-21), especially on the formulating guidelines of the Paris Agreement rule-book; pathways for achieving INDCs and mid-century strategies for decarbonisation; assessing global climate risks; heat-health action plans for Indian cities; assessing India's adaptation gap; low-carbon rural development; environmental clearances; modelling HFC emissions; the business case for phasing down HFCs; assessing India's critical minerals; geoengineering governance; climate finance; nuclear power and low-carbon pathways; electric rail transport; monitoring air quality; the business case for energy efficiency and emissions reductions; India's first report on global governance, submitted to the National Security Adviser; foreign policy implications for resource security; India's power sector reforms; zero budget natural farming; resource nexus, and strategic industries and technologies; and the Maharashtra-Guangdong partnership on sustainability.

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The authors of this study would like to thank the team at Shakti Sustainable Energy Foundation for their support in collecting primary data, which is of critical importance for designing improvements in transportation. We thank Vivek Chandran and Avni Mehta in particular for their inputs and feedback on various aspects of this study.

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Abhinav Soman is a Programme Associate at The Council. He researches the transitions required at three levels to enable sustainable mobility – the transport sector, urban mobility, and the auto industry. He has previously researched behavioural interventions that induce mode shift to public transport in the UK. Abhinav holds an MPhil in Engineering for Sustainable Development from University of Cambridge and is a Young India Fellow 2013–14.

"There is an urgent need for course correction towards sustainable mobility, as it will be much easier now than in the future. As seen in the study, the use of sustainable modes of transport is high in urban India, and there is a need to build better infrastructure and services for such modes. There is also enthusiastic support for various policy interventions. With rising income levels, we will witness a higher dependency on motorised private transport, which will be difficult to reverse."

Harsimran Kaur
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Harsimran is a Research Analyst at The Council. Her research focuses on the economic impact of a transition to electric vehicles and policy interventions for promoting sustainable mobility. In the past, she has worked on estimating subsidies to fossil fuels and analysing the key policy drivers to accelerate the adoption of electric vehicles in India. She holds an MTech degree in Renewable Energy Engineering from TERI School of Advanced Studies, New Delhi, and a BTech in Electrical and Electronics Engineering from GGS Indraprastha University, New Delhi.

"As India treads on the path to a low-carbon future, current mobility choices and investments will need to be rethought. Much of the sustainable mobility interventions in India have been under contention for quite some time and through a first-of-its-kind pan-India survey, this report informs the debate by analysing public support to policy measures and perceptions on commuting in urban India."

Karthik Ganesan
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An engineer by training, Karthik leads The Council's work on the power sector. His research focus includes the operational reform of discoms in India and the competitiveness of various power generation sources. He has also led a first-of-its-kind evaluation of the impact of industrial policies on the renewable energy sector in India. Karthik holds a master's degree in Public Policy from the Lee Kuan Yew School of Public Policy at the National University of Singapore. He also holds an undergraduate degree in Civil Engineering and an MTech in Infrastructure Engineering from the Indian Institute of Technology, Madras.

"What stands out for me is that we are headed the way the west was – dependent on private transport for much of our needs. Equally, we have an opportunity to change it. I hope this study helps nudge that."


Raymond
Bata
SREENIVASA GLAMOUR STORES
PRAJAYYA SHILPA SILKS

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Abbreviations

ASI	Avoid Shift Improve
CAFE	corporate average fuel economy
GST	goods and services tax
EV	electric vehicle
ICE	internal combustion engine
MoRTH	Ministry of Road, Transport and Highways
MoPNG	Ministry of Petroleum and Natural Gas
NMT	non-motorised transport
OMC	oil marketing company
ULB	urban local bodies
2W	two-wheeler
4W	four-wheeler
LOS	level of service

Glossary

Carpool	Arrangement in which a passenger travels in a private vehicle driven by its owner
Commute	Work and education related trip
Corporate	Commute transport provided by organisations to their employees
Non-Motorised Transport	Walking and bicycling modes of transport
Shared	Arrangement in which multiple passengers use the same vehicle to arrive at similar/different destinations along the same route

Public transport is the third most preferred mode of transport in urban India, next to walking and using a personal motorbike.

Image: iStock

Executive summary

The urban mobility landscape in India is rapidly evolving. Population growth, rising income levels, increasing motorisation and changing preferences are among the factors driving change in how people move in a city. Monitoring and shaping urban mobility through periodic data collection and analysis is currently limited in India. In this study, we have captured through a primary survey, travel and commute characteristics as well as preferences and perceptions of 3,682 urban citizens. In doing this, we also covered diverse geographical zones and city tiers in India.

Urban India walks, rides motorbikes and uses public transport most frequently

We asked residents of urban India about the modes of transport they used. Walking (more than 500 m) and public transport use were reported by a large share of respondents. However, motorbikes are the second-most used mode of transport – a worrying sign – because this mode, while filling the void left by deficiencies in public transport is contributing to urban congestion and adding to the bulk of petrol use in the economy. Even among people who use private modes of transport, walking and public transport use were found to be high.

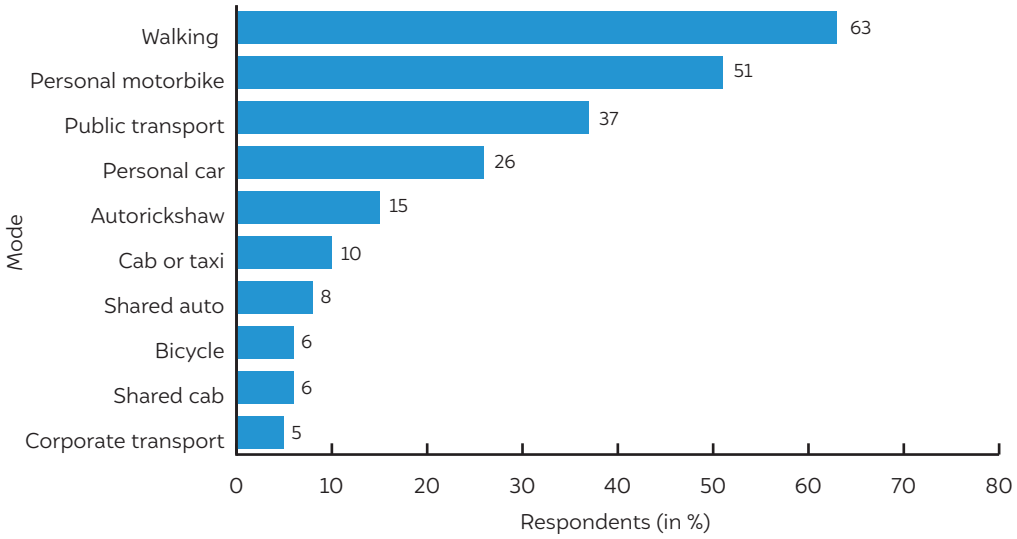


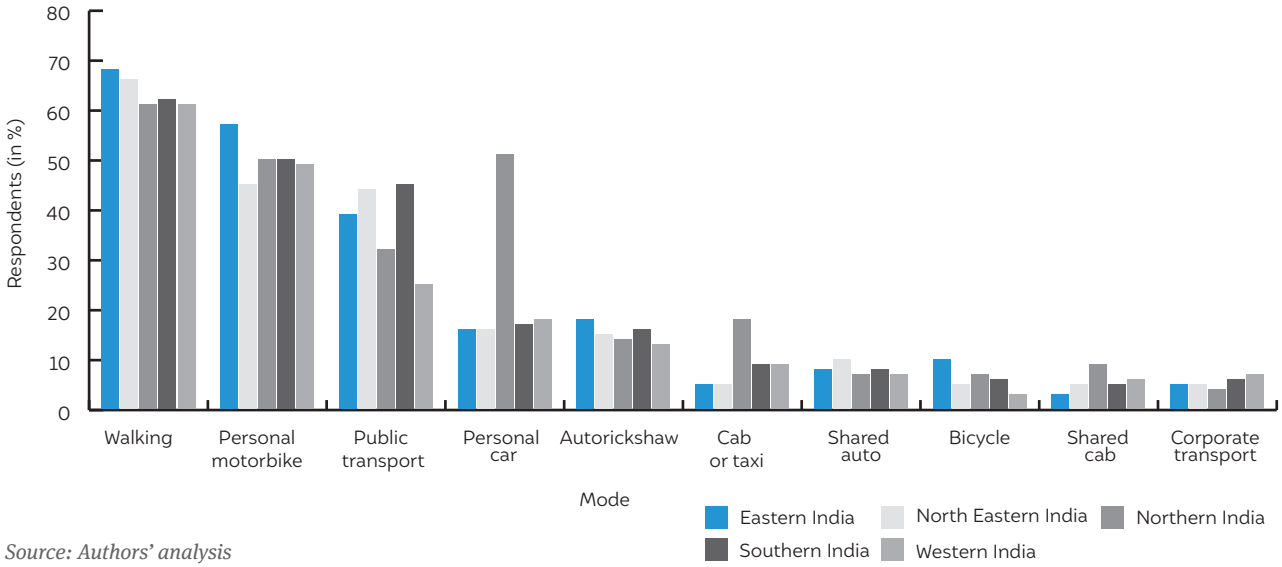
Figure ES1
More than half of the urban population walks (more than 500 m) for their weekly needs

Source: Authors' analysis

Northern India has a significantly high share of private car users

Regional differences in mode share were found to be striking with regards to private car and public transport use. While a range of factors make the different regions of India non-homogenous, at least 60 per cent of the population walks and nearly the same share uses motorbikes across all geographical regions.

Figure ES2 Personal car and hired cabs are the most frequently used modes of transport among people living in Northern India

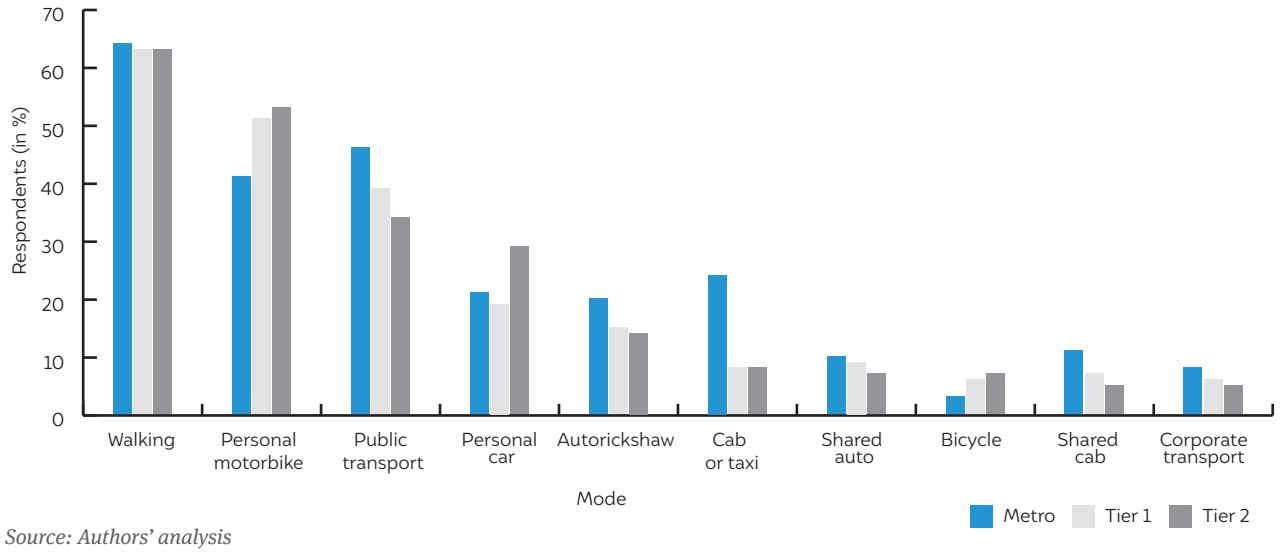


Source: Authors' analysis

Tier 2 and Tier 1 cities have more motorbike users than Metros

Tier 2 cities were also found to have the highest share of personal car users while metro cities had the greatest share of public transport patronage. Tier 2 and Tier 1 cities are at a greater risk of displacing public transport, even as it remains fledgling in such cities.

Figure ES3 Private modes of transport are popular among people living in Tier 2 cities



Source: Authors' analysis

Public transport agencies must prioritise quality of infrastructure, frequency of service and comfort as areas for improvement

The main barriers to the wider adoption of public transport relate to infrastructure, reliability, and speed. Women were found to rely more on non-motorised and public transport. This calls for an assessment of gender sensitive needs of commuters to ensure public transport gets a better chance of being adopted.

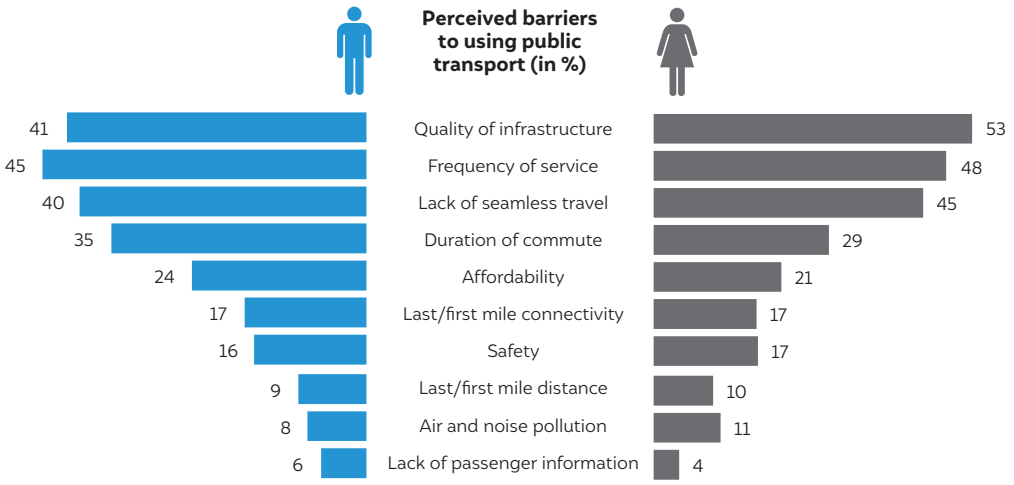


Figure ES4 **'Frequency of service' and 'quality of infrastructure' are the top barriers to public transport among both men and women**

Source: Authors' analysis

Nearly 70 per cent of the surveyed population supports congestion pricing for private vehicles

Overall, we found significant support among respondents for a majority of the policy interventions for sustainable mobility and deployment of clean fuels presented during the survey including congestion pricing.

Table ES1 **Summary of response to congestion pricing**

A potential approach to reduce congestion in cities is to charge a fee to all private vehicles for using certain roads during peak hours. To what extent do you agree with such a measure?	
Oppose	23%
Neutral	10%
Support	68%

Source: Authors' analysis

The study also presents views and preferences on themes such as transition to clean fuels and emerging paradigms such as shared mobility and electric vehicles. Based on our assessment of these responses, we recommend further awareness generation to enable informed public opinion and drive demand for clean and affordable mobility solutions.

The prolonged underinvestment in widely used and sustainable modes of transport is not justified, and there is an urgent need to assess and reorient investments towards non-motorised transport and public transport services. Support for such policies, as assessed through this survey, is also strong. This indicates that public opposition is not a barrier that needs to be overcome. Instead, the persistent governance deficit arising from the limited devolution of powers and finances towards urban local bodies and local agencies engaged in transport planning, are more pertinent maladies that require treatment. In the absence of concerted action, it is likely that private transportation will quickly scale to meet the demand. This then locks investments for years and also drives infrastructure provision that caters to private choices.

Tier 1 and Tier 2 cities have higher levels of two-wheeler use compared to metros.

Image: iStock

1. Background

India is rapidly urbanising. This is reflected in the ballooning of urban populations, their concentration in large cities, and the surge in motorisation (Mishra 2019). As per 2011 Census data, the urban population accounts for 31 per of the total population, but it contributes to 62 per cent of the GDP, which is projected to increase to 75 per cent by 2031 (Ahluwalia 2016). The urban population in India increased from 286 million to 377 million between 2001 and 2011, and its share in the total population is expected to increase to 40 per cent by 2031 (Baindur 2015). An increase in motorisation has accompanied the population rise, with the number of car and two-wheeler (2W) registrations increasing by 35 per cent and 98 per cent, respectively, in 2018 compared to 2010 (Ministry of Road, Transport and Highways [MoRTH] 2019). Cars and 2Ws account for 30 per cent of trips made but occupy 80 per cent of the road (Mishra 2019). Between 2000 and 2015, while the total road length in the country increased by 39 per cent, the number of registered motor vehicles increased by 158 per cent (Mishra and Mishra 2017). On the other hand, cities in India are deficient in public transport due to inadequate spatial planning and limited investments, resulting in 'backlogs' in meeting the demands of transportation and poor quality level of service (LOS) for transport services.

Rapid motorisation, particularly the surge in 2Ws in existing and emerging cities in South East Asia, is a global concern considering the rapid population growth, urbanisation, and industrialisation in this region (Loo et al. 2015). A range of externalities, including air and noise pollution, congestion, road accidents, and climate change can be traced back to increased motorisation, as evidenced by numerous studies that demonstrate detrimental levels on all fronts (Goel and Guttikunda 2015; Pathak et al. 2018; Akbar et al. 2018; S. K. Singh 2017; Dhar and Shukla 2015). A sustainable mobility transition that addresses these externalities is, therefore, imperative and requires urgent action to materialise. Further, 95 per cent of the Indian transport sector's demand for fuel is met by petroleum-based derivatives, with 72 per cent met by diesel, 23 per cent by petrol, and the remainder by a fuel mix comprising CNG, LPG, etc. However, the domestic supply of crude oil is limited, and 82 per cent of the total requirement is met through imports (MoPNG 2018). Therefore, curtailing transport fuel consumption and substituting it with domestically produced renewable fuels for low-carbon mobility is also an energy security priority for India.

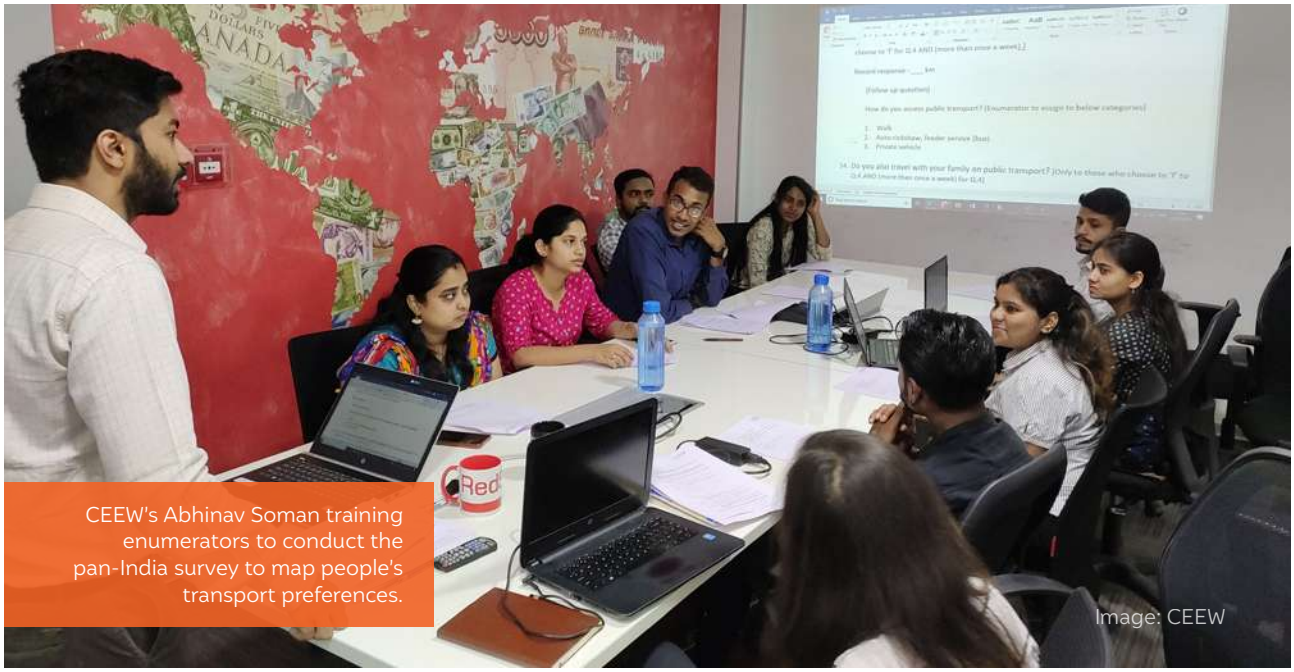
95 per cent of the Indian transport sector's demand for fuel is met by petroleum-based derivatives

National, state, and local governments have a critical role to play in shaping urban transportation in India. As it stands today, there is meagre horizontal and vertical coordination between and within various government entities, and there is no comprehensive regulation that addresses urban transport needs (Baindur 2015). The 74th Constitutional Amendment was introduced to devolve certain powers and finances from

the state to urban local bodies (ULBs) and to officially instate them as the third-tier of the government (MoHUA 2019). However, this devolution is yet to happen, and ULBs remain constrained by both funding and capacity. Moreover, urban India is also underrepresented in the political process, as parliamentary and state legislative constituencies do not reflect the increased population share of urban areas over the years (Ahluwalia 2016). Effective decision making and governance require frequent and updated data on commute characteristics and transport demand, which is limited today (Taylor and Richter 2015; Gadgil 2018).

Public opinion is an important driver for public policy change (Wlezien and Soroka 2016). The public's attitudes and support for various policies are in turn dictated by the differing ideologies, values, and worldviews held by citizens, which are difficult to change. Communicating objective knowledge to target audiences through trusted sources and channels is thus critical (Drews and Bergh 2016). This study aims to gauge the perceptions of the Indian urban populace on various sustainable mobility interventions; this will support policy design and awareness generation. We have also captured the characteristics of Indian urban travel to fill existing data gaps and facilitate better-informed governance of urban transport.

2. Methodology



CEEW's Abhinav Soman training enumerators to conduct the pan-India survey to map people's transport preferences.

Image: CEEW

A survey agency with the capacity to carry out interviews in English and regional languages was employed to administer the survey. They telephonically interviewed 3,682 respondents from June–July 2019. An average response rate of 14 per cent was achieved. We used a stratified sampling approach to mirror India's population distribution across geographical regions and city tiers (see Figure 1). The country was geographically divided into five zones – Eastern, North Eastern, Northern, Southern, and Western. Due to the limitations of the contact database used for the survey, responses from the central zone (Madhya Pradesh and Chhattisgarh) could not be captured. City tiers[1] considered for the sample were metro, tier-1, and tier-2 cities, with a minimum population of 1 lakh (see Figure 2). The detailed sample statistics are presented in the next section (see Figure 4).

The survey questionnaire comprised 28 questions in total. However, certain questions were dependent on previous responses, and applied to only some respondents. So, the effective number of questions per respondent was slightly lower. The following themes were covered in the survey – policies to support clean fuel and the clean vehicle transition, urban commute characteristics, views on public transport, support for road-use policies, views on electric mobility, and views on shared mobility.

We used a stratified sampling approach to mirror India's population distribution across geographical regions and city tiers

1 The following classification has been used for the city tiers:
Metro: Population of above 7 million
Tier 1: Population between 2 million and 7 million
Tier 2: Population between 0.1 million and 2 million

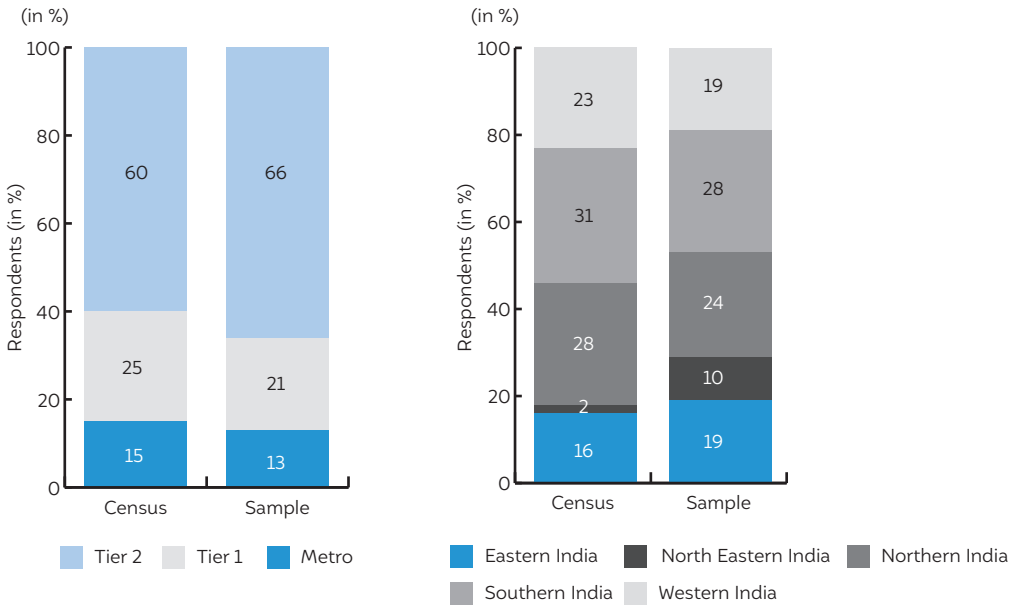


Figure 1
Comparison of the distribution of urban adult population across tiers and zones in the sample and 2011 Census

Source: Authors' analysis

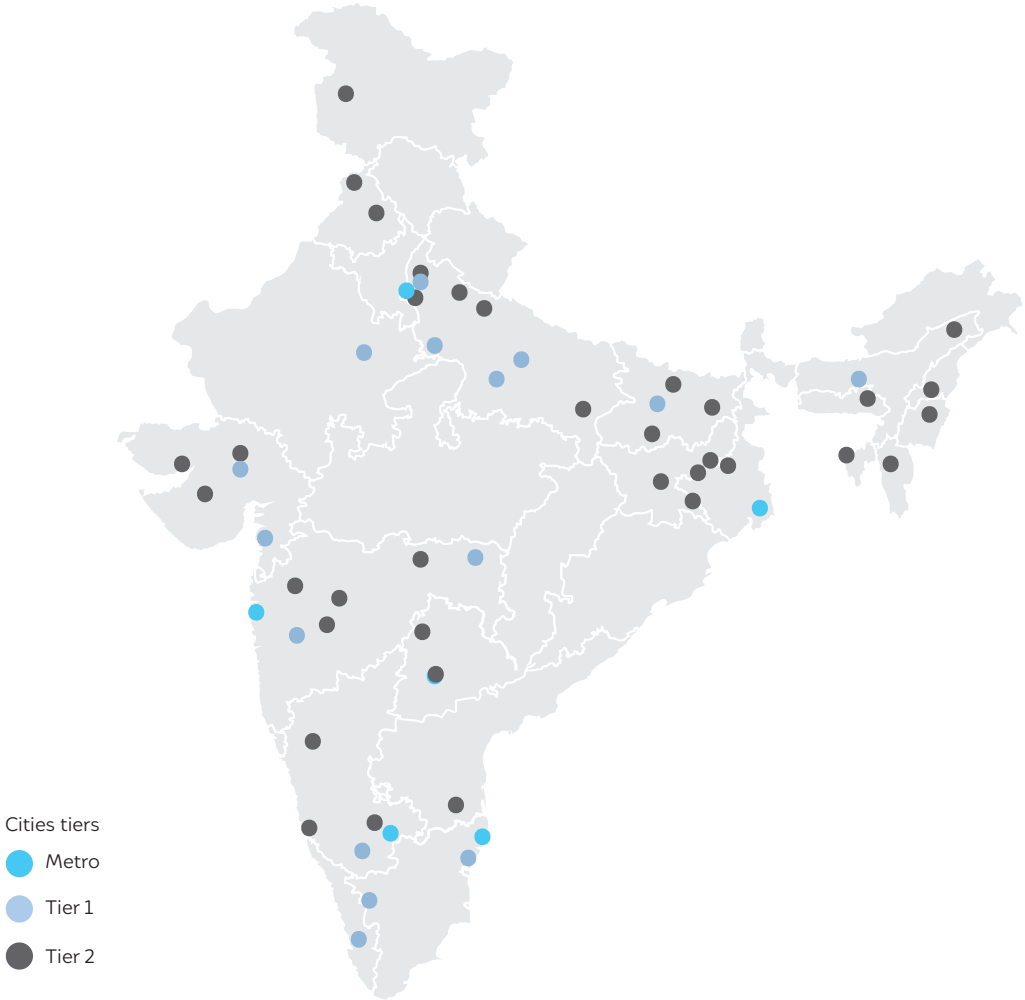


Figure 2
Distribution of the cities covered in the survey across tiers

Source: Authors' analysis

Respondents were from **6** Metro cities **16** Tier 1 cities **38** Tier 2 cities

2.1 Data validation and analysis

The data collected was validated through various logical checks (listed below) to ensure consistency of responses and the representativeness of the data in terms of stratification:

- The duration of the interviews
- The distribution of responses along various choices
- Consistency of the responses in terms of logical skips and distance and time recorded values
- Enumerator bias by analysing the mean of Likert scale responses

In order to make the sample data representative in terms of age and gender as per the 2011 Census, survey weights were used (see Figure 3). Thus, all statistical analyses were carried out on the weighted survey data. It is to be noted that the 'income' variable was not considered in the analysis since 56 per cent of the respondents surveyed did not disclose their income.

In addition to descriptive statistics, regression analysis was carried to identify statistically significant relationships between demographic characteristics and independent variables such as travel mode and support for road-use policies. The results have been reported for a confidence level of 95 per cent. Detailed tables supporting the inferences from the regression analysis are provided in the Annexure.

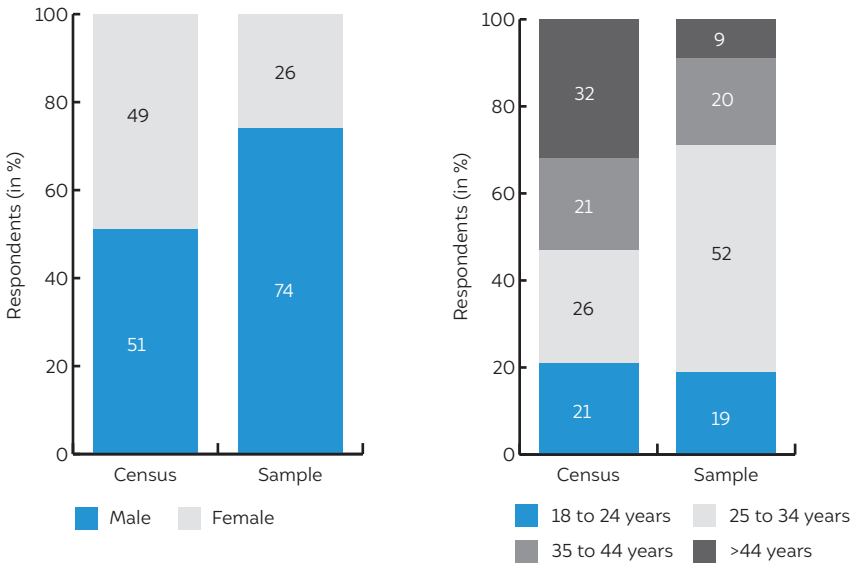


Figure 3
Distribution of the urban adult population by age and gender in the sample and 2011 Census

Source: Authors' analysis

Note: The 2011 Census population in the figures indicate urban population above 18 years of age.

2.2 Sample characteristics

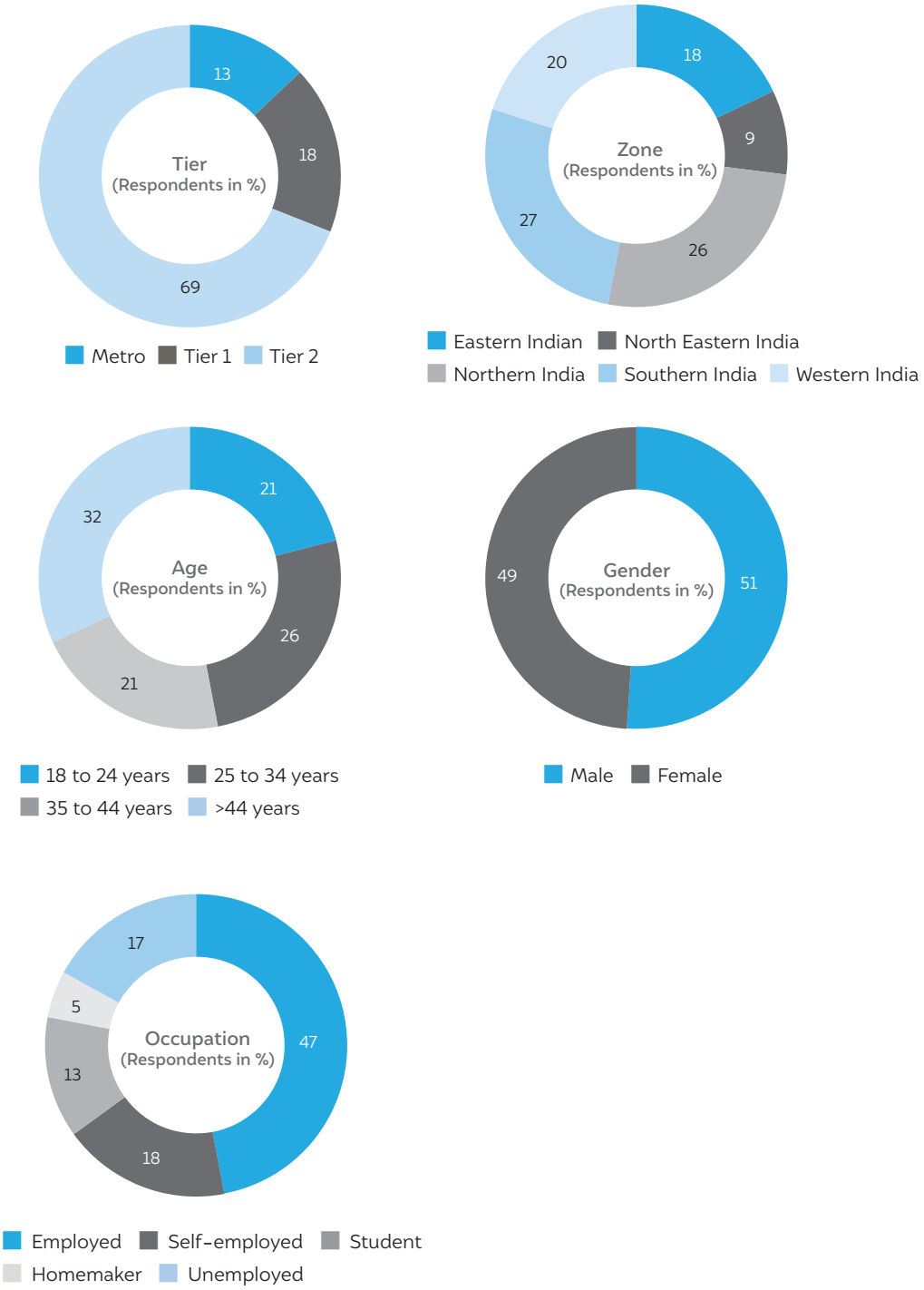


Figure 4
Descriptive statistics of the survey sample

Source: Authors' analysis

Note: The figures indicate descriptive characteristics for the weighted data.

3. Results and discussion

In the sections below we present and discuss the various findings based on the themes covered in the survey including perception on clean fuels, urban commute characteristics, perception on road-use policies, shared mobility, and electric mobility.

3.1 Transition to clean fuels

Nearly 70 per cent of the surveyed population reports congestion and local air pollution as undesirable outcomes of commuting in cities.

Image: iStock

Under a sustainable mobility paradigm, 'improve' initiatives are the last in a sequence of measures to be taken to transform mobility for the better as per the Avoid-Shift-Improve (ASI) framework (GIZ 2011). Arguably, from a behavioural change perspective, these measures are often easier to implement in the short term as compared to 'avoid' and 'shift' initiatives. We explored the urban public's perceptions on a range of policy levers available to effect the transition to cleaner fuels, alternative vehicle technologies, more fuel efficient internal combustion engine (ICE) vehicles, and measures that reduce dependence on private vehicles for transport.

A summary of the levels of support for various policies are presented in Table 1.

Table 1 **Summary of responses to questions regarding support for policies that enable a transition to clean transportation**

Should/Can/Will India replace most of its oil for transportation with cleaner over the next few decades?	Respondents (%)
Should	96
Can	66
Will	59
List of proposals to help achieve the goal of replacing oil for transportation	
Require transport fuel providers to gradually increase the amount of clean, low-carbon fuels	96
Require auto industries to increase fuel efficiency	91
Provide incentives to make it more affordable for the public to purchase clean fuel vehicles that run on electricity or hydrogen	95
Provide tax incentives to encourage technological innovations that will develop new transportation fuel alternatives	93
Encourage the development of more walkable, transit-friendly communities	95
Remove government incentives, subsidies, and tax breaks for oil companies	86

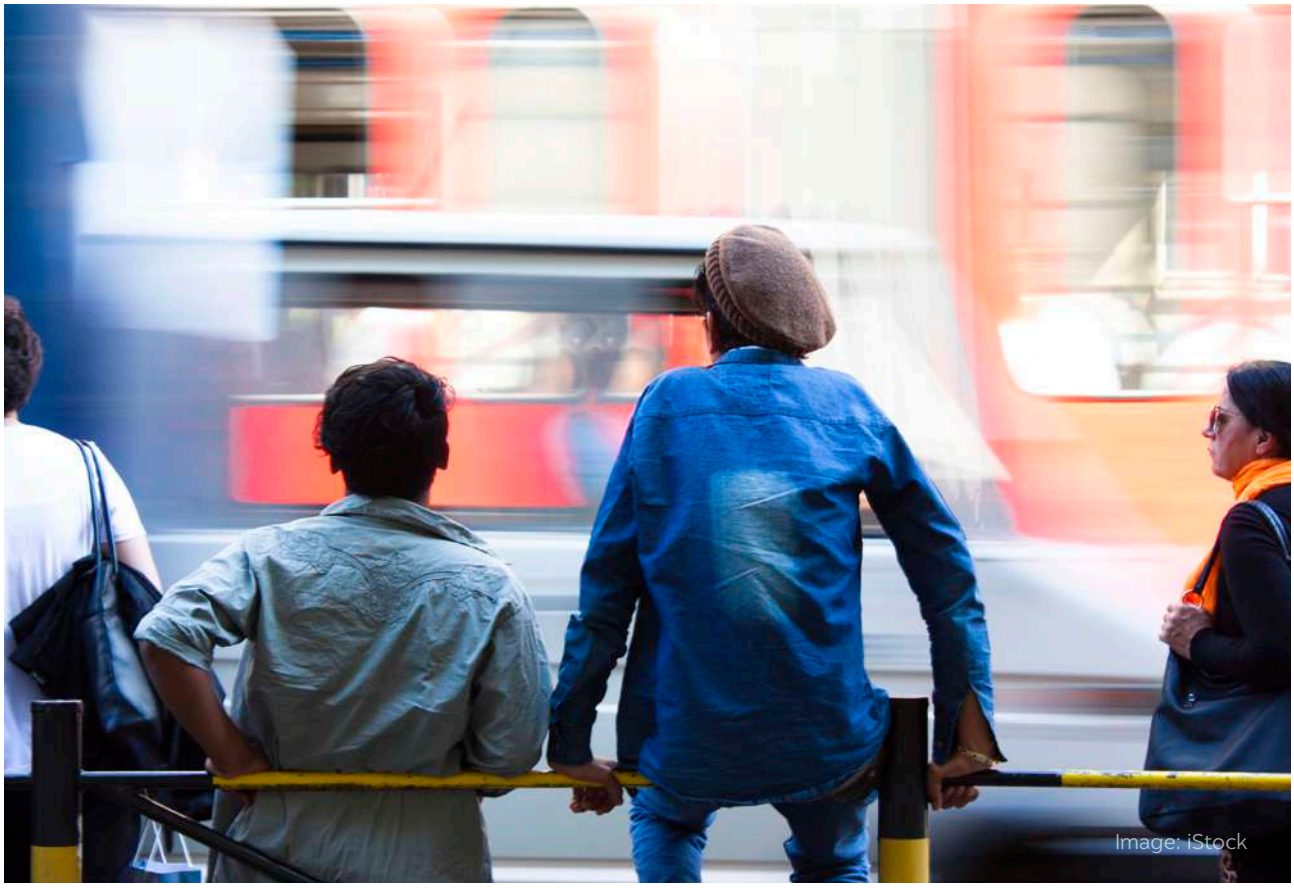
Source: Authors' analysis

While most respondents believed that India should transition to cleaner fuels, only 66 per cent and 59 per cent believed that India can and will be able to do this, respectively. The sample was split in such a way that only half the respondents were asked if India can replace oil with clean fuel alternatives and the other half was asked if India will make the transition. While a significant share of the respondents think that India's transport sector needs to make a clean fuel transition, they did not appear to differentiate between the vastly different policy options that were presented to them during the survey. This may be the result of a lack of understanding of the implications of the various policies for the respondents and, more broadly, for the economy.

Several of the policy measures that support a transition to clean fuels explored in this study have already been implemented in India. The ethanol-blending programme was established in 2001 with a 5 per cent blending target, and this was followed up with revisions to the policy in 2003 and 2006 to adjust for timelines, with the target remaining the same. *The National Policy for Biofuels* (2018) stipulates an ethanol-blending target of 20 per cent and a biodiesel-blending target of 5 per cent by 2030. This policy also proposes offtake assurance, with oil marketing companies (OMCs) entering purchase agreements with biofuel producers for a period of 15 years. FAME II, a capital subsidy scheme for EVs, was launched in March 2019 as a demand-side incentive. Most recently, the 2019 Union Budget included a reduction in the goods and service tax (GST) on EVs from 12 per cent to 5 per cent along with additional income tax deductions for EV buyers. India has introduced both emissions norms in the form of Bharat Stage VI (BS VI) and fuel efficiency norms as part of Corporate Average Fuel Economy (CAFE) standards.

Based on the responses received, there appears to be broad-based and strong support for a variety of policy levers available to the policymakers in India to promote clean fuels and vehicle technologies. An assessment of the costs and benefits of each policy intervention should guide decisions regarding the right combination of measures to promote sustainable mobility.

3.2 Urban commute characteristics



The vast majority (70 per cent) of urban dwellers in India travel distances below 10 km for work and education, as seen in Figure 5. Figure 6 represents the mode-wise distances travelled. The average time taken to cover these distances as reported by the respondents is presented in Figure 7. The average time spent travelling (one-way) was around 27 minutes for the majority of the respondents.

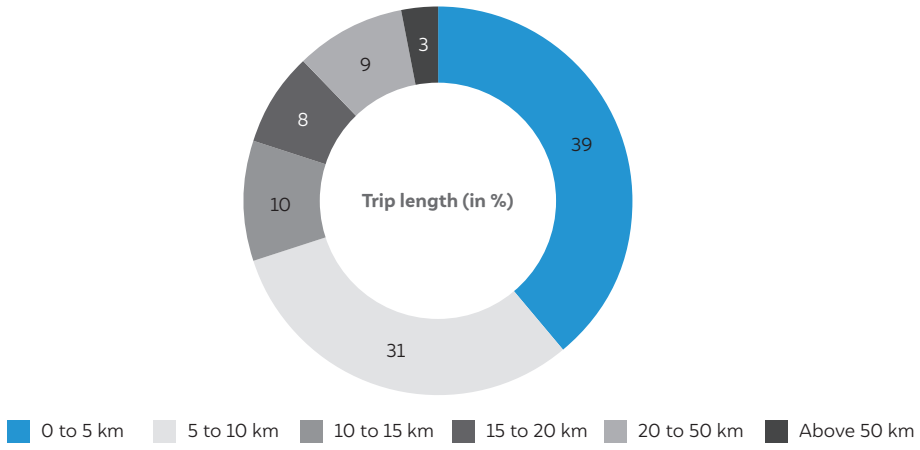


Figure 5
A majority of urban commute trips are below 10 km in India

Source: Authors' analysis

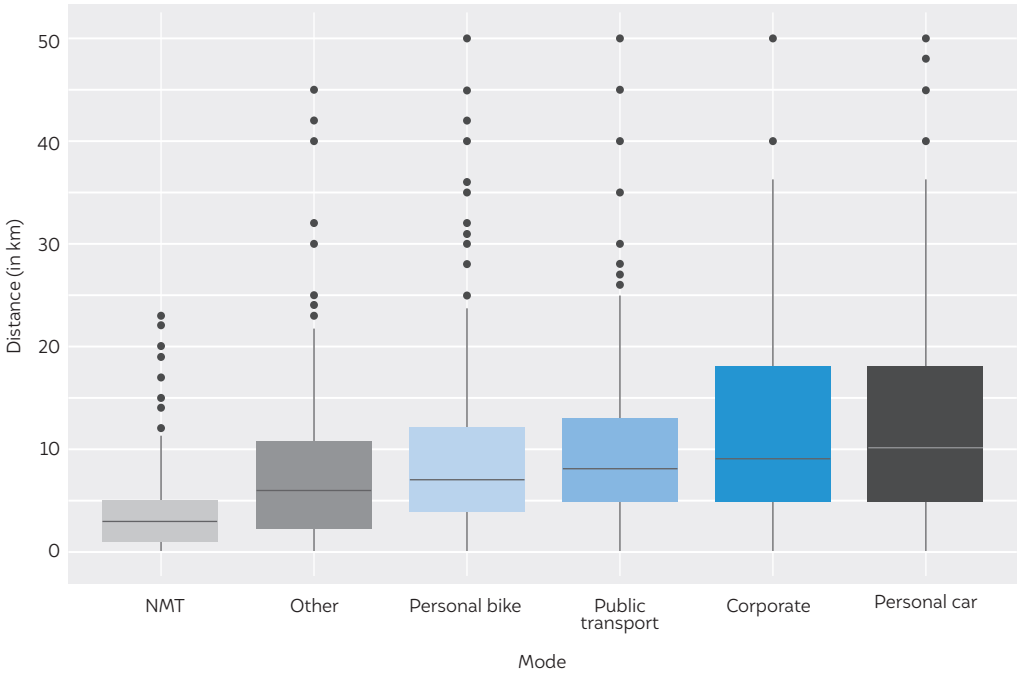


Figure 6
Mode-wise one-way distances for commute trips

Source: Authors' analysis

Note: 'Others' includes autorickshaw, shared auto, cab/taxi, and shared cab/taxi modes of transport.

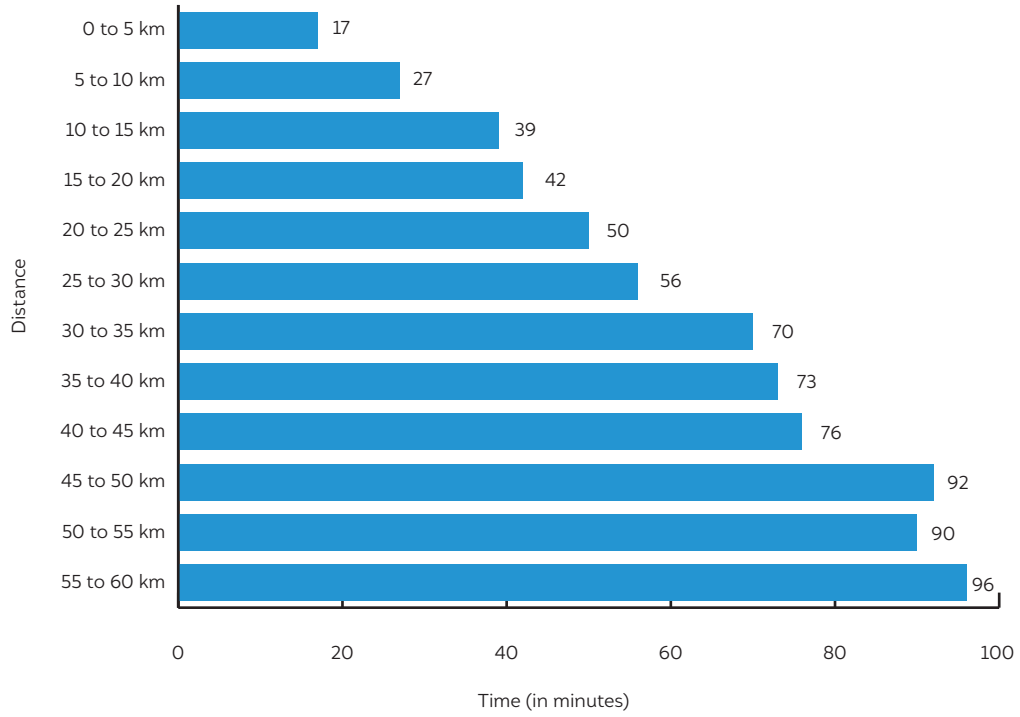


Figure 7
Average time taken (in mins) to cover various distances as reported by respondents

Source: Authors' analysis

3.3 Mode choice

The respondents were queried on all the modes of transport they use in a week (for all types of trips) . We categorised the modes based on ownership type, whether it is asset-sharing, the category of service provider, and types of vehicles. To reflect the realistic share of the various modes used, respondents were asked to state the multiple modes they used in a week. Only those modes that were used more than once a week were included in the analysis. Figure 8 shows the share of the various modes used in a week by the surveyed population.

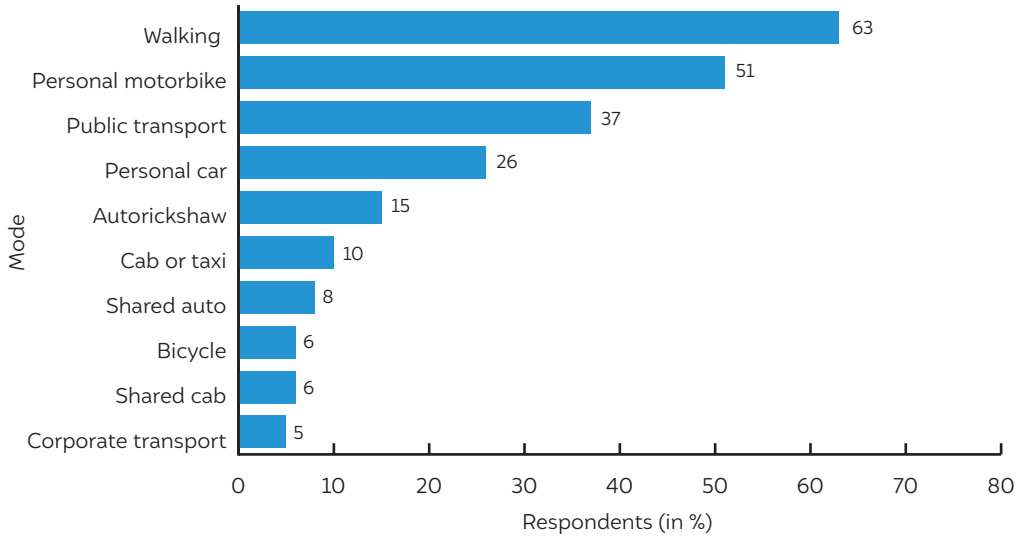


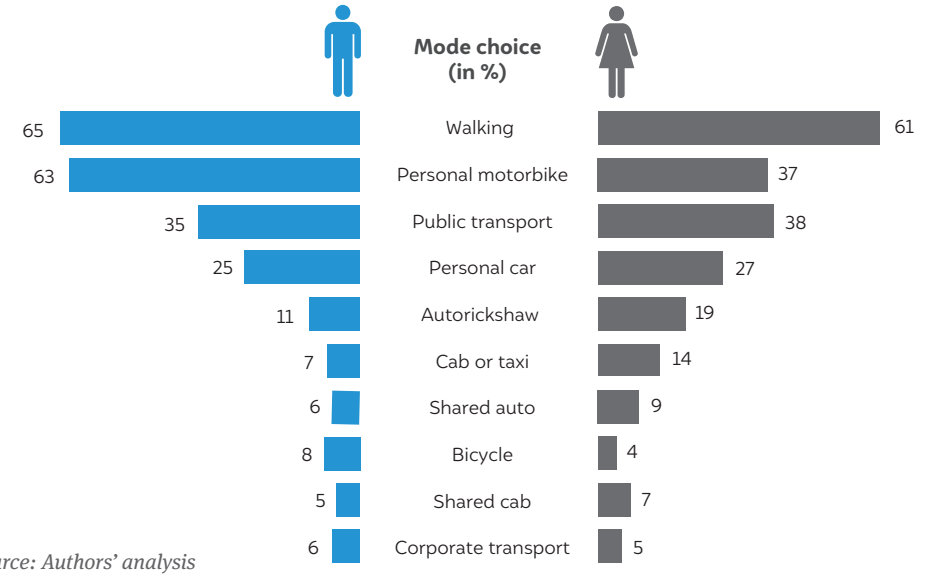
Figure 8
More than half of the urban population walks (more than 500 m) for their weekly needs

Source: Authors' analysis

The comparison shows that walking is the most widely used mode of travel followed by personal motorbike and public transport. Even among private mode users, we find that 63 per cent walk, 6 per cent ride a bicycle, and 37 per cent use public transport as part of their weekly trips. The logistic regression shows that gender, occupation, and age are significant determinants of use of non-motorised transport (NMT) and public transport.[2] Women and individuals in the 18–34 years age group are more likely to adopt public transport and NMT options than men and individuals in the age group of 45 or above (see Table 3 in the Annexure for regression results). Additionally, we observed a higher share of NMT and public transport users in the Eastern and North Eastern regions of India compared to other regions. Figures 9–13 provide descriptive insights into some of these significant determinants.

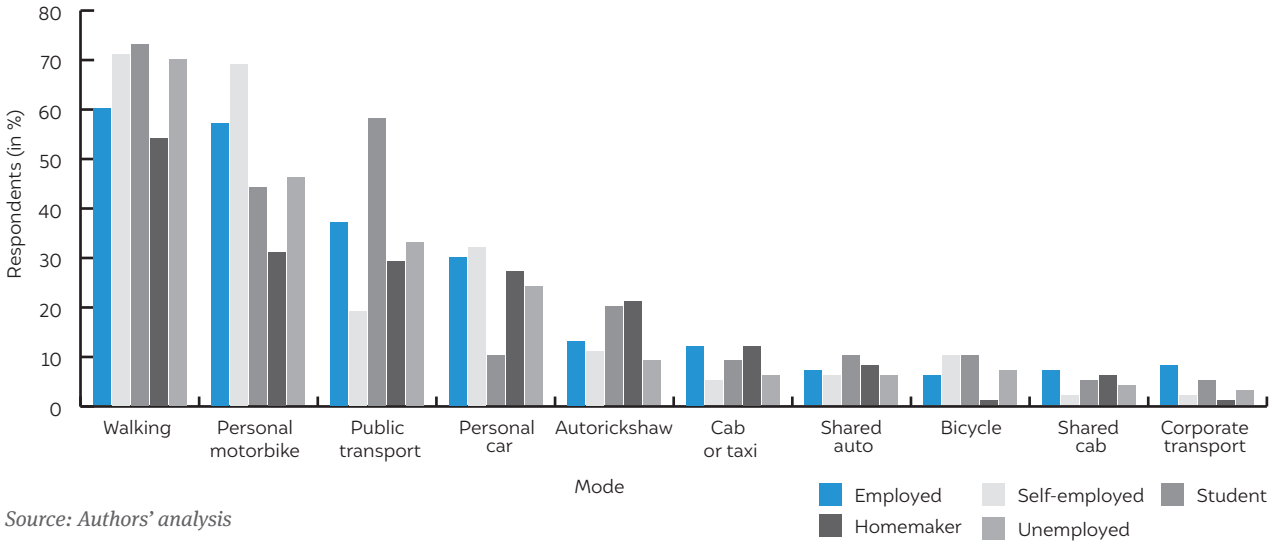
2 We combined pedestrians and users of bicycles and public transport to carry out the regression.

Figure 9 **Public transport is a more popular mode of transport among women compared to men**



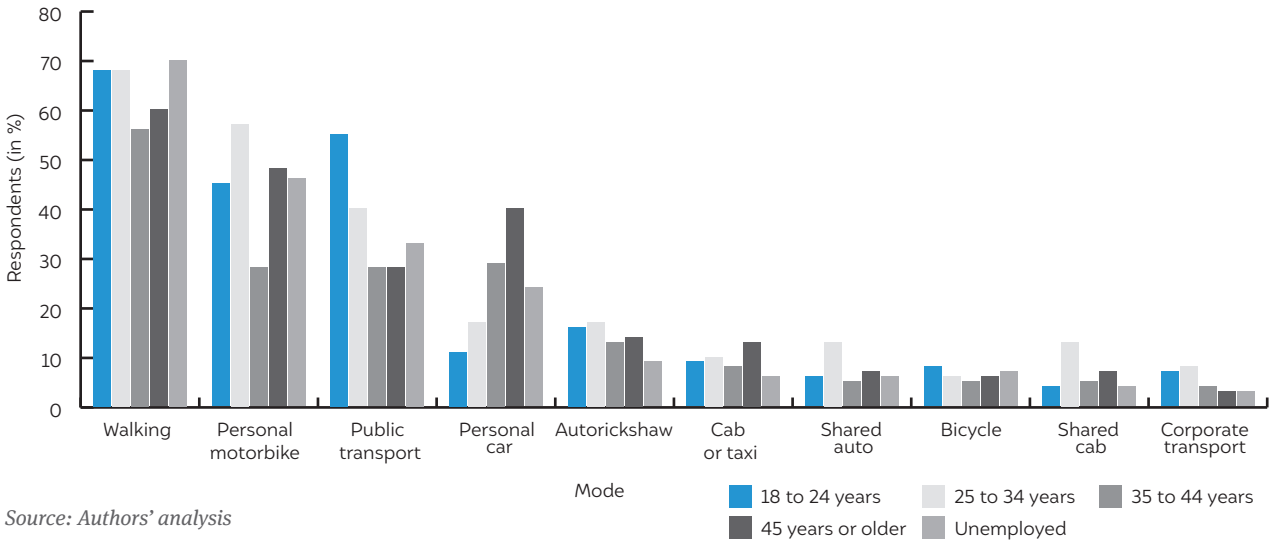
Source: Authors' analysis

Figure 10 **More than half the employed (including self-employed) population walks and uses a personal motorbike for their daily needs**



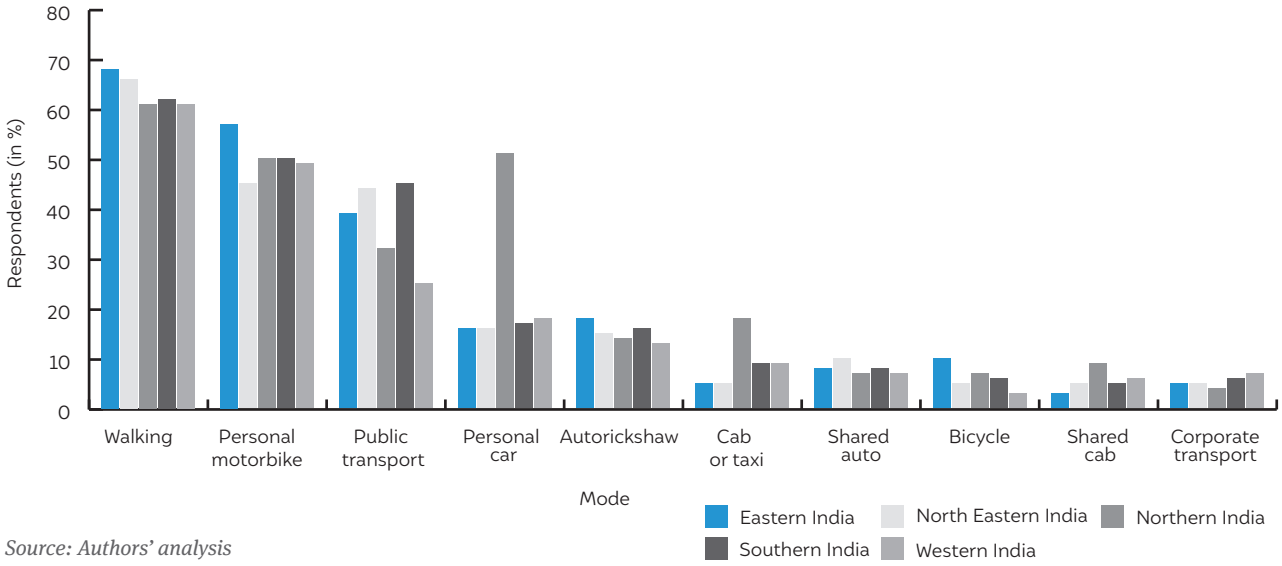
Source: Authors' analysis

Figure 11 **A majority of the population in the age group 18–34 years uses NMT, shared, and public transport**



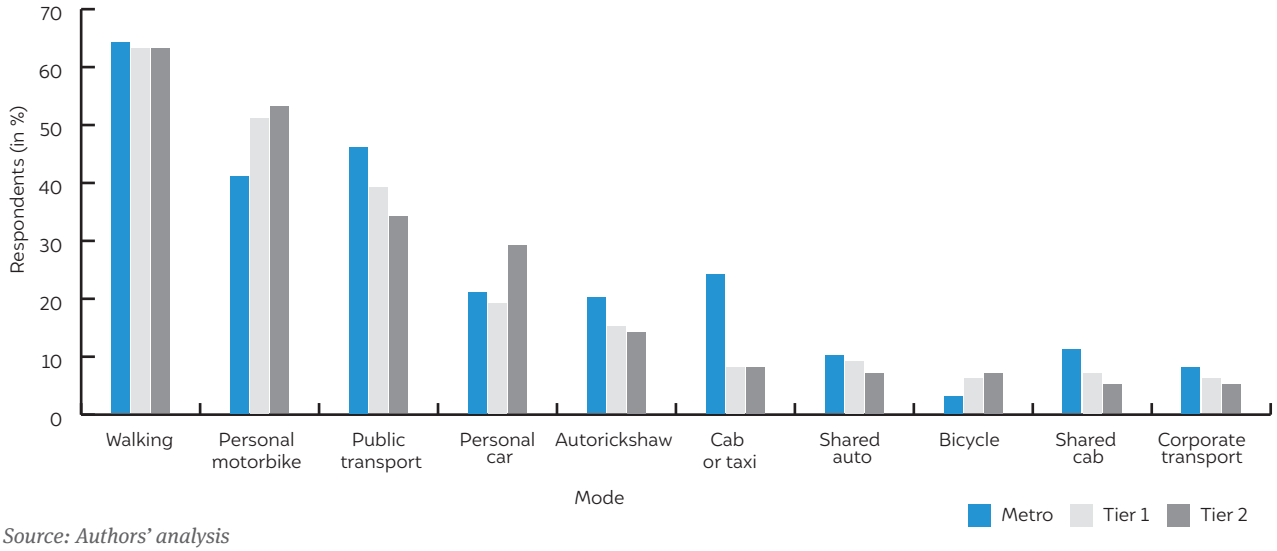
Source: Authors' analysis

Figure 12 **Personal car and cab/taxi are the most frequent modes of transport among people living in Northern India**



Source: Authors' analysis

Figure 13 **Private modes of transport are popular among people living in Tier 2 cities**



Source: Authors' analysis

Gender, occupation, and age are also determinants in use of private transport.[3] Males, working individuals, and individuals older than 45 years of age are significantly more likely to use private modes of transport (see Table 4 in the Annexure for detailed regression results). Additionally, we observed a higher share of car use among people living in Northern India, as seen in Figure 12. Smaller cities are at a greater risk of losing NMT share to private transport on account of the limited investment in NMT infrastructure and public transport in Tier 1 and Tier 2 cities (Baindur 2015). The study findings corroborate this, as we observe significantly higher levels of 2W use in Tier 2 and Tier 1 cities as compared to metros (see Figure 13).

We observed a higher share of car use among people living in Northern India

Analysing the responses regarding the use of shared modes of transport (including shared autos and shared cab rides such as UberPool and Ola Share) reveals that there is higher usage of these modes among females. A similar positive association was also observed among students and employed individuals (see Table 5 in the Annexure for detailed regression results).

3 We combined the users of private cars and private 2Ws under 'private transport' for regression analysis.

3.4 Public transport

Thirty-seven per cent of the surveyed population uses buses, trains (suburban or metro), or other forms of public transport. The average distance travelled by them to access public transport is 1.4 km and the majority of them walk the first-mile distance. About 80 per cent of the public transport users surveyed said that even when travelling with their families, they use public transport.

All respondents were asked to list barriers to using public transport. The most frequently cited barriers included poor 'quality of infrastructure' (poor quality bus stops or metro stations, inadequate lighting, lack of level access, etc.), low 'frequency of service', and 'lack of seamless travel' (too many interconnections, poor quality seating within the bus or metro, etc.) (see Figure 14). On carrying out logistic regression on the some of these barriers, we find that homemakers and students are more likely to report 'quality of infrastructure' as one of the barriers to using public transport compared to employed individuals. Additionally, women are more likely to report 'quality of infrastructure' as a barrier compared to males, at statistically significant levels (see Table 6 in the Annexure for detailed results). Given that women are more likely to use NMT and public transport, an evaluation of gender-specific needs and concerns and targeted investments are critical to sustainable mobility (Shah et al. 2017). Similarly, we observed that 'lack of seamless travel' was a strong barrier to individuals living in the Tier 2 cities compared to those living in metros.

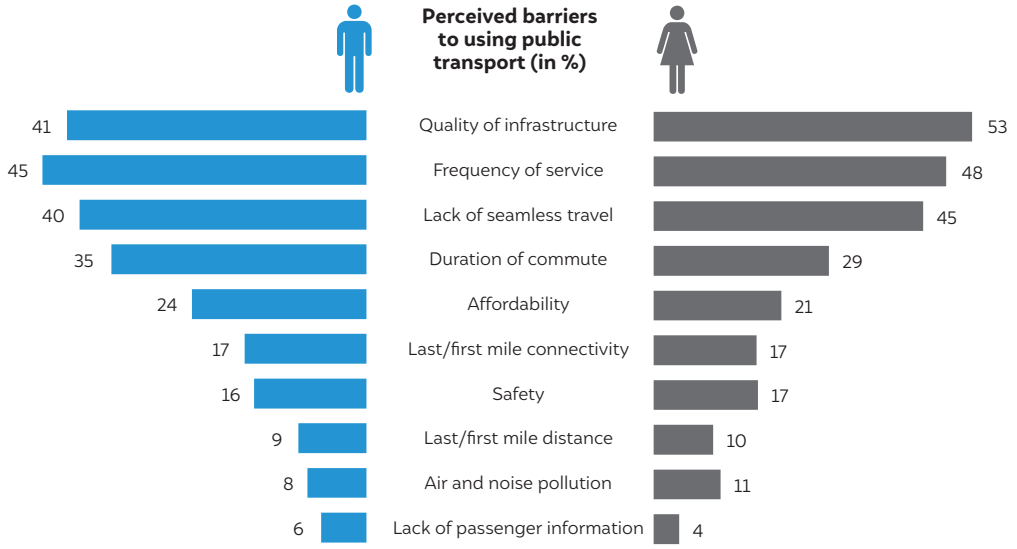


Figure 14
'Frequency of service' and 'quality of infrastructure' are the top barriers to public transport among both men and women

Source: Authors' analysis

When asked which of the two options – public transport or private vehicles – was more economical for daily commuting, 90 per cent of the respondents stated that public transport was indeed the cheaper option.

Respondents who did not use public transport and cited 'last-mile/first-mile connectivity' as a barrier to using public transport were further asked whether the availability of autorickshaws or feeder services and covered footpaths and safe pedestrian crossings would encourage them to use public transport. Their responses are presented in Figure 15. The availability of motorised first- and last-mile connectivity was found to be conducive to encouraging non-users of public transport to make the mode switch.

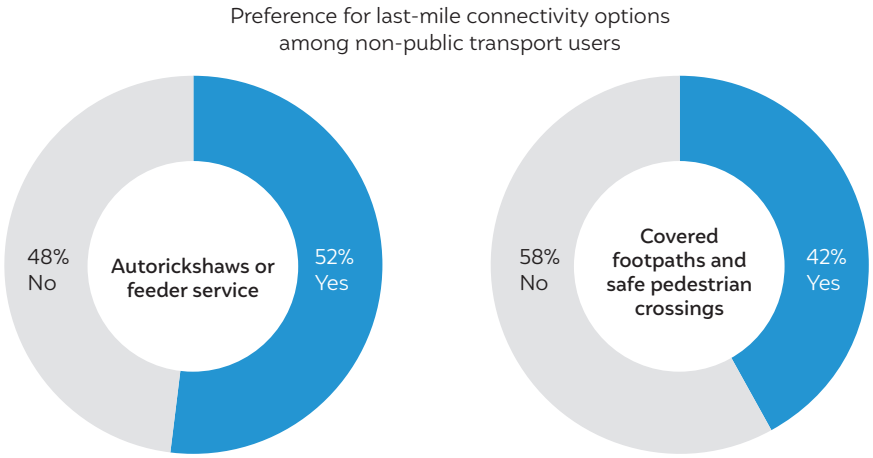


Figure 15
Respondents prefer availability of motorised last mile connectivity over non-motorised for making the mode-switch to public transport.

Source: Authors' analysis

3.5 Private vehicles and externalities

When queried about the factors that influence their purchase decision when buying a car, 'mileage' (fuel economy) was the most frequently stated criteria, closely followed by 'purchase cost', as shown in Figure 16. This effectively means that fuel intensity and, therefore, energy efficiency are strong considerations when purchasing a car, although the driving factors for this criterion may be more economic than environmental concerns.

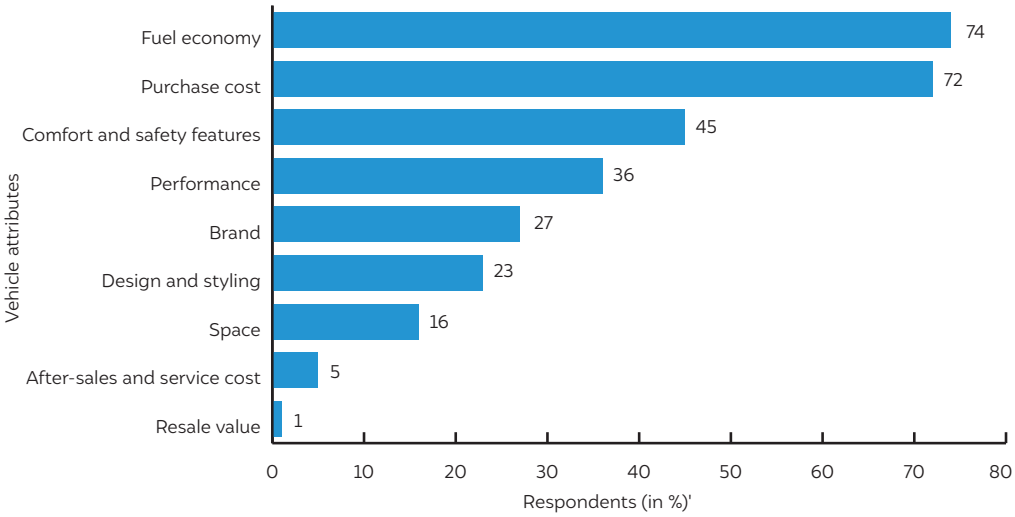


Figure 16
'Fuel economy' and 'purchase cost' are the top factors Respondents consider while purchasing a car

Source: Authors' analysis

Respondents were asked to rate certain externalities associated with commuting within cities as low, medium, or high according to the level of importance. These included impact on climate change, noise pollution, congestion, and local air pollution. 'Congestion' was rated as highly important most frequently; the prioritisation of issues based on their rating is presented in Figure 17. It is to be noted that nearly 60 per cent of the surveyed population rated all the externalities as highly important, highlighting a strong demand for all key externalities to be addressed.

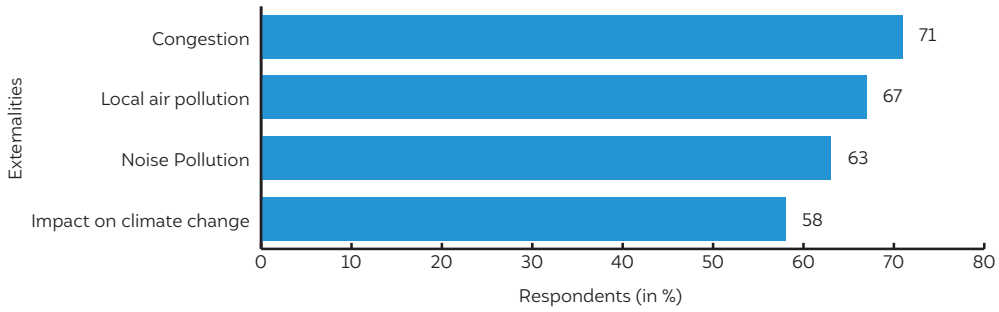


Figure 17
Majority of the respondents rated 'congestion' as the key externality associated with urban commuting

Source: Authors' analysis

Note: The percentage of instances in which each issue was selected to be of 'high importance' is represented here.

3.6 Support for road-use policies

We tested the support for the three road-use policies that are currently being considered in various states in India, which is presented in Table 2. There is strong support for allocating more road space to users of sustainable means of transport, with only 4 per cent of the

population being opposed to such a policy. These responses mirror those from the Ease of Moving Index survey, which found that 76 per cent and 80 per cent of the respondents reported the need for separate cycle lanes and footpaths, respectively (Tiwari and Raman 2018).

While 68 per cent of the population is in support of introducing congestion pricing, 23 per cent of the population is opposed to it. Public support for congestion pricing was a key consideration among policymakers in Singapore and Stockholm (where it has been in place for years) and was found to increase post-implementation. In the current assessment, we see that there is only limited opposition to such a measure; in contrast, a similar survey carried out by World Resources Institute (WRI) in China found that only 19.5 per cent of respondents were supportive of congestion pricing (WRI 2019). Age, gender, occupation, and use of public transport are significant determinants of support for this policy measure. Individuals in the age group 25–44 years are more likely to support congestion pricing than those who are 45 years and older. This is similar to the study carried out in China, which found that young people and public transport users were more likely to support congestion pricing. Further, individuals living in metros and in Northern India show stronger support for this policy compared to those living in Tier 2 cities and in other parts of India. Women and employed individuals were also more likely to support congestion pricing (see Table 7 in the Annexure for detailed regression results). Figures 18–21 provide descriptive insights for some of these significant determinants.

Should pedestrians, cyclists, and public transport users be allocated more road space than car users?	
Oppose	4%
Neutral	6%
Support	90%
A potential approach to reduce congestion in cities is to charge a fee to all private vehicles for using certain roads during peak hours. To what extent do you agree with such a measure?	
Oppose	23%
Neutral	10%
Support	68%
Parking on the street takes up valuable road space and adds to congestion on roads. Having dedicated parking areas and levying a parking fee can free up space and raise funds for building cycle lanes and footpaths. To what extent do you agree with such a measure?	
Oppose	4%
Neutral	7%
Support	90%

Table 2
Summary of responses to questions on road-use policies

Source: Authors' analysis

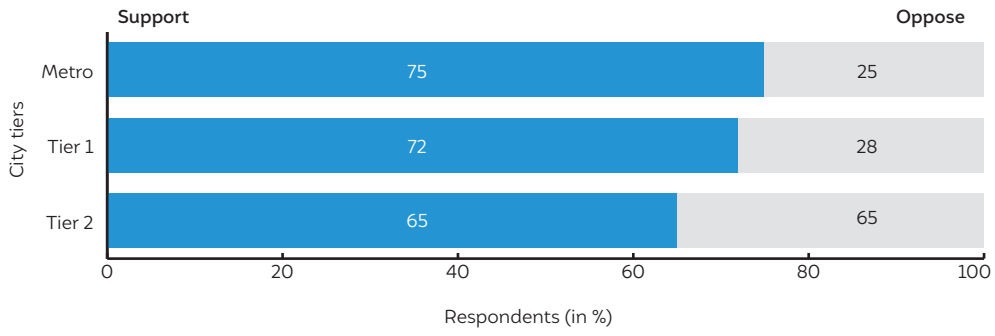


Figure 18
A majority of people living in metros support the congestion pricing policy to curb congestion

Source: Authors' analysis

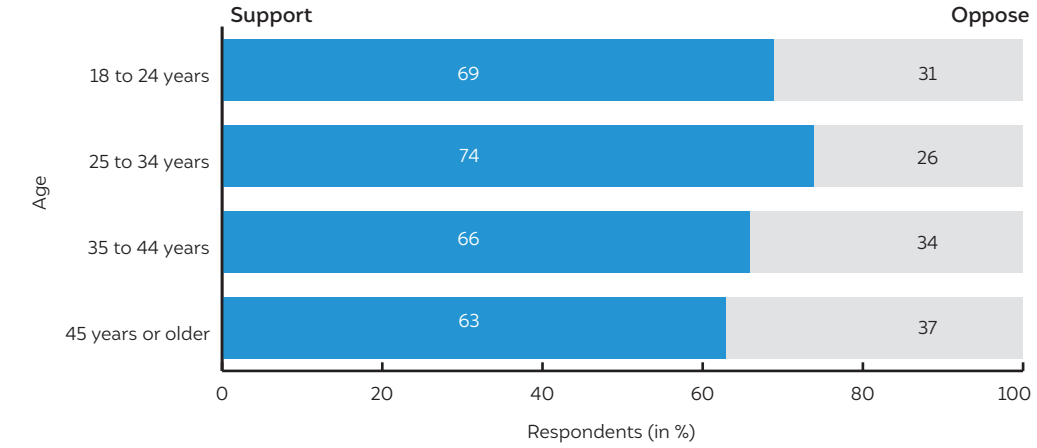


Figure 19
A majority of people in the age group 18–34 years support the congestion pricing policy to curb congestion

Source: Authors' analysis

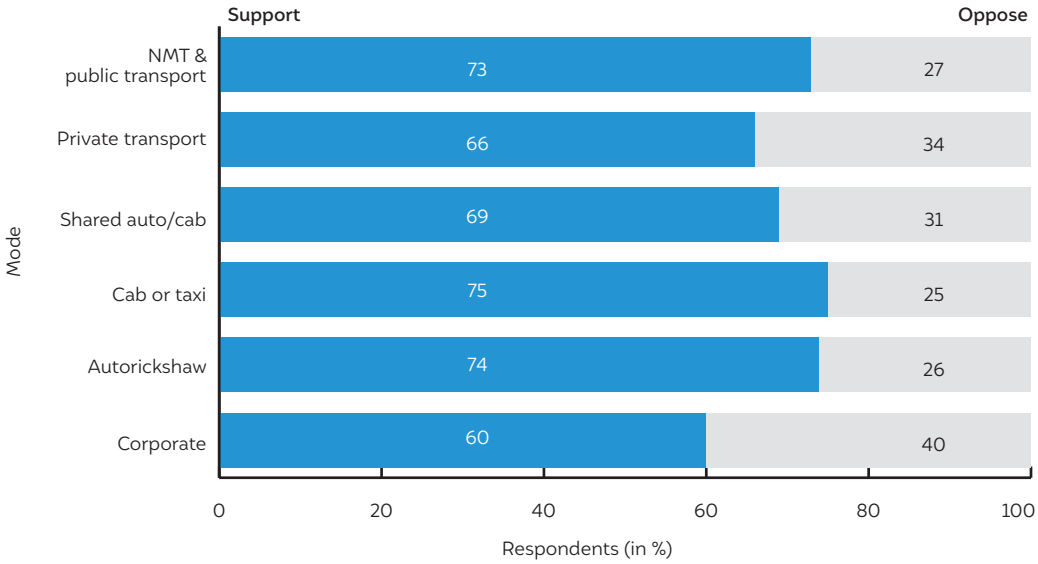


Figure 20
A majority of the patrons of NMT and public transport support the congestion pricing policy to curb congestion

Source: Authors' analysis

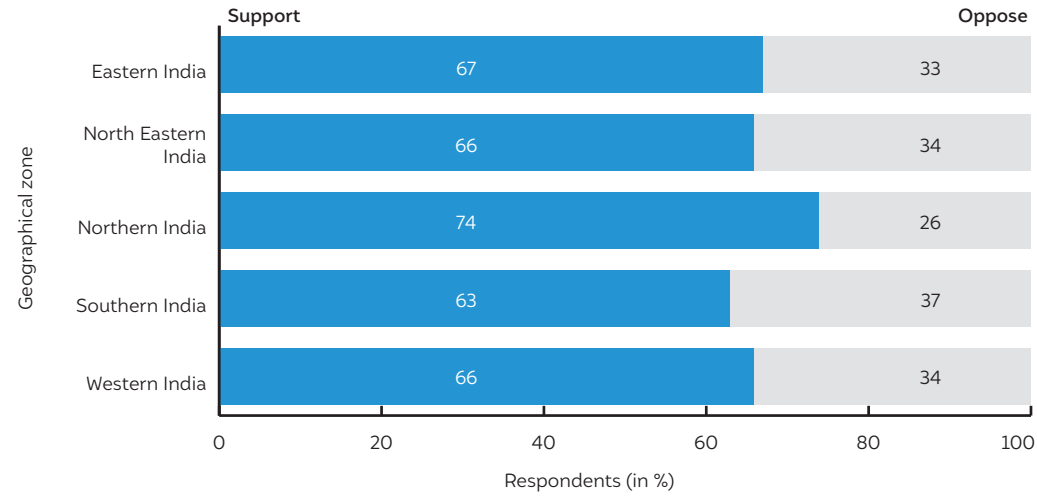


Figure 21
Respondents in Northern India were more supportive of the congestion pricing policy compared to the rest of India

Source: Authors' analysis

Finally, a majority of the respondents favoured the introduction of parking fees as a means to tackle congestion. Public opposition to parking fees, particularly from interest groups representing motorists, has posed an impenetrable barrier to implementation in Indian cities (Economic Times 2019; Pillai 2017). The views reported in this study indicate that this opposition is limited to a minority. The Delhi government recently notified its parking policy, which prescribes the elimination of free parking (Government of Delhi 2019). The adoption of such policies to formalise parking fees by more states is needed to tackle parking and its contribution to the congestion in cities.

3.7 Electric vehicles

Eighty-seven per cent of the surveyed population stated that they were familiar with EVs. For the remaining respondents, a short description of an EV and how it is different from an ICE vehicle was presented before asking further questions.

A significant majority (71 per cent) of the respondents said that their next vehicle would likely be an EV and even greater share of surveyed population (93 per cent) was in favour of central and state governments providing incentives and subsidies for EVs.

Further, we sought their views on the various advantages and disadvantages of using EVs (which were read out to them) by requiring them to assign a level of importance to each. When quizzed about the benefits derived from EVs, most respondents cited reduction in air pollution as 'highly important' over climate change and lower fuel and maintenance costs (see Figure 22). As mentioned earlier, mileage (and by extension fuel cost per km) is a key consideration for respondents when deciding to purchase a new car; however, lower fuel and maintenance costs were not considered key advantages. Messages about the benefits of EVs should, therefore, focus on fuel costs per kilometre to promote greater uptake. At the same time, the lack of adequate charging infrastructure was stated as a drawback of opting for EVs over other issues such as the limited choice of EVs, charging times, and the high upfront cost (see Figure 23). Despite purchase cost being the next big priority after mileage, 'high upfront cost' was chosen least frequently as an important disadvantage for EVs.

The median round-trip commute distance by car and 2W is about 20 km and 16 km, respectively, as shown in Figure 6; EVs (2W and four-wheelers [4Ws]) available in India

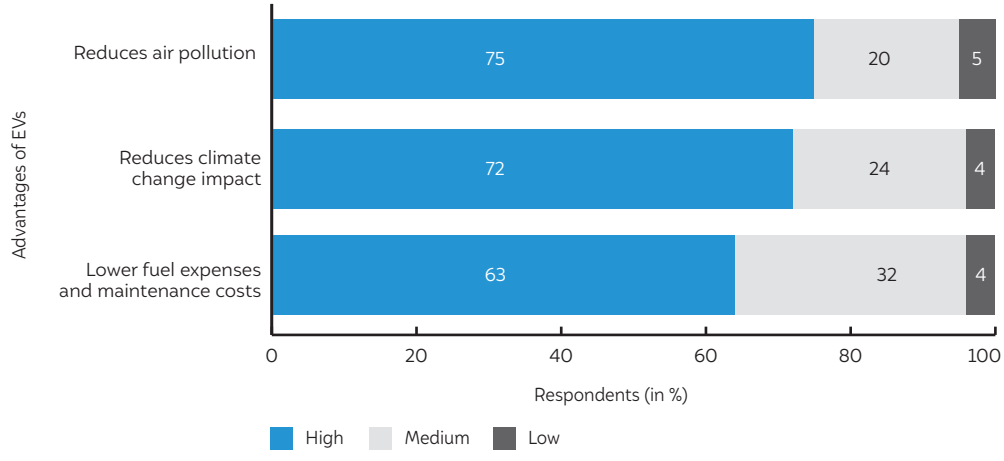


Figure 22
Respondents believe that one of the top advantages of an EV is that it 'reduces air pollution'

Source: Authors' analysis

today offer a range of 70–100 km. Hence, 'range anxiety' and the need for public charging infrastructure for private vehicle use seem to be more of a psychological issue than a manifest one. That said, there is certainly a case for investing in charging infrastructure for commercial-use vehicles that cover much larger distances. Awareness generation must therefore address these misconceptions that may be preventing more individuals from opting for EVs.

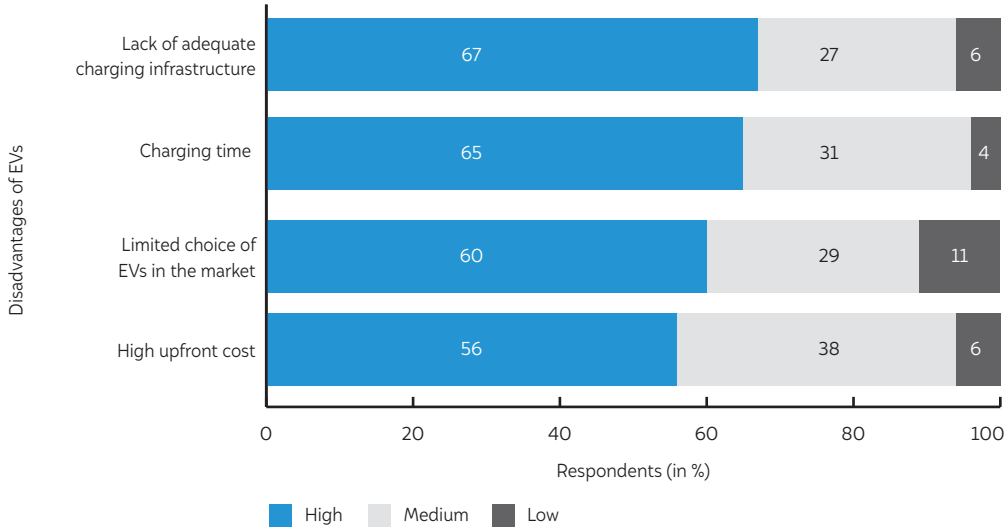


Figure 23
Respondents believe that the 'lack of adequate charging infrastructure' is the top disadvantage of an electric vehicle

Source: Authors' analysis

3.8 Shared mobility

About 55 per cent of respondents claimed that car ownership is important to them. Regression results show that there is a strong association between independent variables such as location and preferred mode of transport with valuing car ownership. It was also found that respondents who think private transport is cheaper than public transport are more likely to value car ownership. Detailed regression results have been tabulated in Table 8 in the Annexure.

Increasing the adoption of shared mobility models such as car clubs, car subscriptions, and ride sharing services in favour of car ownership will require a mindset change away from valuing car ownership. While effecting such a change in preference cannot be achieved

through messaging and awareness generation alone, there is still a case for signalling through incentives and libertarian paternalism approaches.

Further, private car users were asked if they had considered using shared mobility services such as UberPool, Ola Share, or Shuttl, to which the vast majority (72 per cent) responded that they had not (see Figure 24). This may be due to the limited availability of such services across cities in India today. The majority of those who had considered ride sharing were willing to do so regularly. This same subset were also asked if they had considered carpooling with their colleagues, and half the respondents answered that they had (see Figure 25). Given this high preference, promotion of carpooling would be a suitable first step towards encouraging car users to switch to more sustainable alternatives.

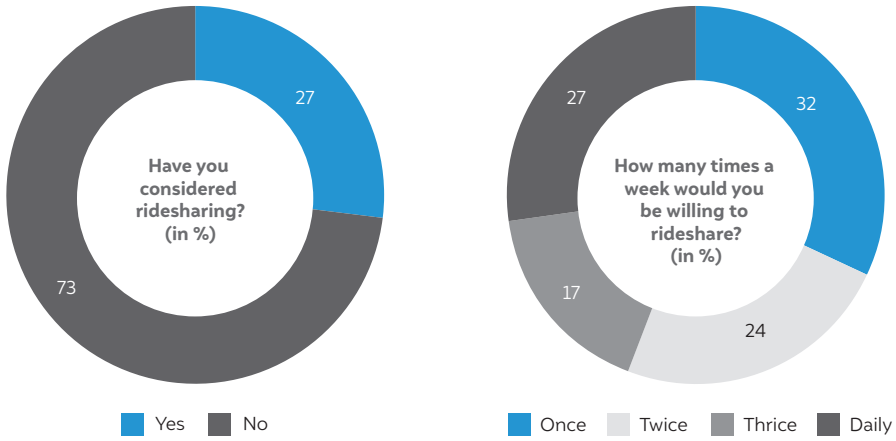


Figure 24
Only a quarter of the respondents had considered ride sharing for their commute

Source: Authors' analysis

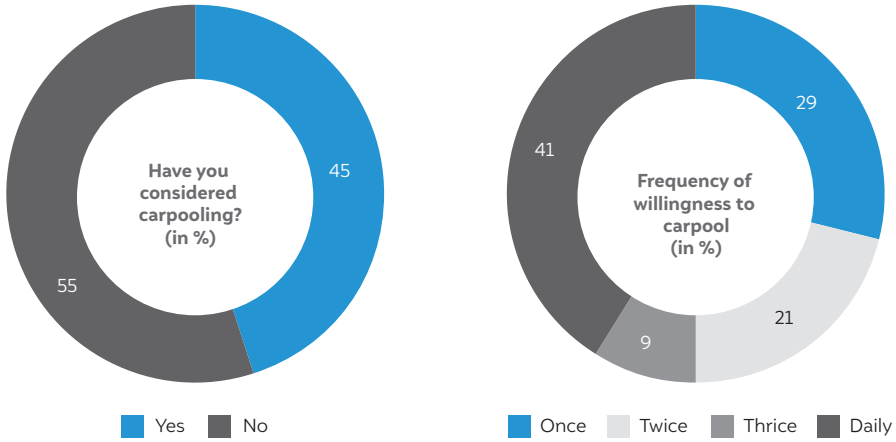


Figure 25
About 45 per cent of the respondents had considered carpooling to work

Source: Authors' analysis

An assessment of gender-specific transportation needs of women through focused data collection is needed.

Image: iStock

4. Conclusion and recommendations

There is strong public support for a whole range of measures and policies that facilitate the transition to clean fuels and clean vehicle alternatives. This not only indicates the likely support for existing and additional policies that seek to manage pollution-related externalities but also the strong public demand to address these issues. Measures to address these issues must now be evaluated based on their likely impact as well as their economic and social costs.

The availability of motorised first- and last-mile connectivity can potentially increase public transit patronage

Walking and public transport are the dominant modes of transportation, which mirrors findings from earlier surveys both at the national and regional levels. Previous studies limited mode choice to a single mode, which is not reflective of the multi-modal nature of an individual's travel during a week, and the fact that different trips entail different modes. For instance, a significant share of private vehicle users were found to use NMT and public transport when given the option to state all the modes they used during a week. However, it is to be noted that the share of motorbike use is quite high (59 per cent), which means that it is critical to introduce measures that will cause a mode shift to public transit and non-motorised modes among bike users. The availability of motorised first- and last-mile connectivity can potentially increase public transit patronage, and this points to the need for a multi-modal approach to transport planning.

The prolonged underinvestment in widely used and sustainable modes of transport is not justified, and there is an urgent need to assess and reorient investments towards NMT and public transport services. Support for such policies, as assessed through this survey, is also strong; this indicates that public opposition is not a barrier that needs to be overcome. Instead, perennial governance issues such as the limited devolution of powers and finances towards ULBs and local governments engaged in transport planning are more pertinent maladies that require treatment. Further, given that women are more likely to use NMT, public transport, and shared mobility, it is critical to assess and cater to gender-specific needs through focused data collection and gender budgeting.

The fact that only 26 per cent of the urban population uses personal cars for their travel needs is an advantage, since studies in other countries have shown that car dependency is hard to overcome. However, with rising income levels, the share of private car trips is likely to increase. Concerted efforts are needed to provide adequate right of way and infrastructure for NMT and public transport while introducing measures to curb the growth of private vehicle use such as congestion pricing and parking fees. Public support for such measures was found to be high.

There is a reasonable appetite for EVs, with urban dwellers in metros and those belonging to the 18–24-year age group showing a stronger inclination to acquire EVs. There is also broad-based support for various policies that promote EVs. In addition to fiscal incentives, the promotion of EVs will require awareness generation among the public. While a majority of respondents reported familiarity with EVs, their assessment of the advantages and disadvantages of using EVs seems to indicate a limited understanding of this new technology.

A significant portion of the population today values car ownership, and the proportion of shared mobility users is limited. Awareness generation around the economic, environmental, and social benefits of shared mobility and shared ownership of mobility assets is needed to increase preferences for these alternatives. Libertarian paternalism approaches may also be employed to increase the preference for shared mobility over car ownership.

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Annexure

Logistic regression was carried out on the dependent variables with independent variables such as occupation, gender, age, geographical zone, and city tier. The results of the regression analysis have been tabulated below. Please note that the tables below indicate statistically significant variables only (p-value > 0.05).

'Co-efficient' represents the regression coefficients value. Here, the regression coefficients explain the change in log(odds) of the dependent variable for one-unit change in the independent variable.

'Standard error' represents the standard error associated with the regression coefficients.

Asterisks in the tables below indicate significance levels:

***	-	0.001
**	-	0.01
*	-	0.05

'Reference category' is the reference level against which the different levels of the categorical independent variables have been compared in the regression analysis.

Table 3 **Regression results for users of NMT and public transport**

Dependent variable	Independent variable		Coefficient	Standard error	z value	p-value		Reference category
NMT & public transport user	Occupation	Self-employed	-0.7441	0.1522	–4.8880	1.02E-06	***	Employed
		Unemployed	0.7847	0.2037	3.8520	1.17E-04	***	Employed
		Student	0.6021	0.1200	5.0200	5.18E-07	***	Employed
	Gender	Female	0.5919	0.0943	6.2770	3.46E-10	***	Male
	Age	18–24 years	0.8736	0.1869	4.6740	2.96E-06	***	45 or older
		25–34 years	0.5313	0.1599	3.3230	0.000891	***	45 or older
	Zone	Eastern	0.4821	0.1215	3.9670	7.27E-05	***	Northern
		North Eastern	0.5035	0.1443	3.4890	0.000484	***	Northern
	Tier	Tier 2	-0.3759	0.1151	-3.2650	0.001094	**	Metro

Source: Authors' analysis

Table 4 Regression results for users of private transport

Dependent variable	Independent variable		Coefficient	Standard error	z value	p-value		Reference category
Private transport user	Occupation	Homemaker	−0.5855	0.1488	−3.9350	8.33E-05	***	Employed
		Self-employed	0.7945	0.1471	5.4010	6.63E-08	***	Employed
		Unemployed	−0.6673	0.2025	−3.2960	9.80E-04	***	Employed
		Student	−0.4747	0.1196	−3.9700	7.18E-05	***	Employed
	Gender	Female	−0.6961	0.0928	−7.5050	6.14E-14	***	Male
	Age	18–24 years	−0.7257	0.1783	−4.0710	4.68E-05	***	45 or older
		25–34 years	−0.3361	0.1494	−2.2500	2.44E-02	*	45 or older
	Zone	Eastern	−0.5136	0.1198	−4.2880	1.80E-05	***	Northern
		North Eastern	−0.5846	0.1424	−4.1060	4.02E-05	***	Northern
		Southern	−0.2374	0.1092	−2.1750	2.97E-02	*	Northern
		Western	−0.2934	0.1198	−2.4490	1.43E-02	*	Northern
	Tier	Tier 2	0.4716	0.1132	4.1670	3.08E-05	***	Metro

Source: Authors' analysis

Table 5 Regression results for users of shared modes of transport

Dependent variable	Independent variable		Coefficient	Standard error	z value	p-value		Reference category
Shared auto and cab user	Occupation	Self-employed	−0.7083	0.3401	−2.0830	3.73E-02	*	Employed
		Student	0.7748	0.2177	3.5600	3.71E-04	***	Employed
	Gender	Female	0.7692	0.1718	4.4780	7.52E-06	***	Male
	Zone	North Eastern	0.6288	0.2744	2.2910	0.02196	*	Northern
	Tier	Tier 2	-0.4450	0.2146	−2.0740	3.81E-02	*	Metro

Source: Authors' analysis

Table 6 **Regression results for responses on the top barriers to using public transport**

Dependent variable	Independent variable		Coefficient	Standard error	z value	p-value		Reference category
Quality of infrastructure	Occupation	Homemaker	0.6814	0.1592	4.2800	1.86E-05	***	Employed
		Self-employed	0.2238	0.1055	2.1200	0.033973	*	Employed
		Student	0.3318	0.1219	2.7220	0.00648	**	Employed
	Gender	Female	0.3581	0.0925	3.8740	1.07E-04	***	Male
	Zone	Eastern	-0.2479	0.1064	−2.3290	1.99E-02	*	Northern
		North Eastern	0.7140	0.1346	5.3050	1.12E-07	***	Northern
		Southern	−0.6486	0.0975	−6.6490	2.95E-11	***	Northern
		Western	0.3516	0.1062	3.3110	0.00093	***	Northern
	Mode	NMT & public transport	1.0650	0.2365	4.5020	6.73E-06	***	
		Private 2W/car	0.6615	0.2394	2.7630	5.73E-03	**	
		Hire Uber, Ola, or taxi	0.5860	0.2196	2.6680	0.00763	**	
Frequency of service	Occupation	Self-employed	0.2879	0.1027	2.8030	0.00506	**	Employed
	Zone	Southern	−0.2311	0.0943	−2.4510	0.01426	*	Northern
	Tier	Tier 2	−0.2572	0.1071	−2.4020	0.01629	**	Metro
	Mode	NMT & public transport	−0.5119	0.2148	−2.3830	0.01719	*	
Lack of seamless travel	Zone	Eastern	−0.3921	0.1098	−3.5710	0.000356	***	Northern
		North Eastern	−0.2750	0.1333	−2.0640	0.03903	*	Northern
		Southern	0.3471	0.0948	3.6610	0.000251	***	Northern
		Western	0.2294	0.1054	2.1770	0.029486	*	Northern
	Tier	Tier 2	0.2624	0.1108	2.3680	0.017899	*	Metro
	Mode	Hire Uber, Ola, or taxi	−0.7632	0.2248	−3.3950	0.000687	***	
		Corporate/ company transport	0.5260	0.2236	2.3520	0.018669	*	
		Shared auto/ cab	0.4620	0.1707	2.7070	0.006785	**	

Source: Authors' analysis

Table 7 Regression results for the support to road-use policies

Dependent variable	Independent variable		Coefficient	Standard error	z value	p-value		Reference category
Road-use policy: road space	Occupation	Student	−0.6243	0.1934	−3.2280	0.001248	**	Employed
	Tier	Tier 1	0.6499	0.1927	3.3730	7.43E-04	***	Metro
		Tier 2	0.7248	0.1638	4.4250	9.63E-06	***	Metro
	Mode	Hire Uber, Ola or taxi	−1.1215	0.2855	−3.9280	8.55E-05	***	
		Shared auto/ cab	0.7279	0.3535	2.0590	0.039492	*	
Road-use policy: congestion pricing	Occupation	Homemaker	−0.3315	0.1673	−1.9820	0.04748	*	Employed
	Gender	Female	0.2812	0.1037	2.7120	0.00668	**	Male
	Age	25–34 years	0.5679	0.1280	4.4350	9.19E-06	***	45 or older
		35–44 years	0.3627	0.1391	2.6070	0.00914	**	45 or older
	Zone	Eastern	−0.3317	0.1179	−2.8140	0.0049	**	Northern
		Southern	−0.7652	0.1051	−7.2830	3.26E-13	***	Northern
		Western	−0.2689	0.1199	−2.2430	2.49E-02	*	Northern
	Tier	Tier 2	−0.3036	0.1192	−2.5470	1.09E-02	*	Metro
	Mode	NMT & public transport	0.6388	0.2273	2.8110	4.94E-03	**	
Road-use policy: parking policy	Zone	Southern	−0.7118	0.1579	−4.5070	6.58E-06	***	Northern
	Mode	Hire Uber, Ola or taxi	−0.6754	0.3086	−2.1890	0.0286	*	
		Shared auto/ cab	0.8999	0.3528	2.5510	0.0108	*	

Source: Authors' analysis

Note: 'Road space' indicates the level of support to the question – 'Should pedestrians, cyclists, and public transport users be allocated more road space than car users?'

'Congestion pricing' indicates the level of support to the question – 'A potential approach to reduce congestion in cities is to charge a fee to all private vehicles for using certain roads during peak hours. To what extent do you agree with such a measure?'

'Parking policy' indicates the level of support to the question – 'Parking on the street takes up valuable road space and adds to congestion on road. Having dedicated parking areas and levying a parking fee can free up space and raise funds for building cycle lanes and footpaths. To what extent do you agree with such a measure?'

Table 8 **Regression results for responses to questions on the importance of 'valuing car ownership'**

Dependent variable	Independent variable		Coefficient	Standard error	z value	p-value		Reference category
Value of car ownership	Occupation	Homemaker	−0.5707	0.1562	−3.6530	0.00026	***	Employed
		Self-employed	−0.4838	0.1055	−4.5850	4.53E-06	***	Employed
		Unemployed	−0.3951	0.2015	−1.9610	0.049892	*	Employed
	Age	18–24 years	−0.4550	0.1640	−2.7750	5.52E-03	**	45 or older
	Zone	Eastern	−0.5642	0.1097	−5.1450	2.67E-07	***	Northern
		North Eastern	−0.7489	0.1341	−5.5840	2.35E-08	***	Northern
		Southern	−0.3494	0.0990	−3.5290	0.000417	***	Northern
		Western	−0.7258	0.1095	−6.6310	3.35E-11	***	Northern
	Mode	Private 2W/car	0.7635	0.2300	3.3200	0.000902	***	
		Shared auto/cab	0.9927	0.1744	5.6930	1.25E-08	***	
		Corporate/company transport	0.8035	0.2309	3.4790	0.000503	***	
		Private transport is cheaper	−0.4444	0.1193	−3.7240	0.000196	***	

Source: Authors' analysis


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