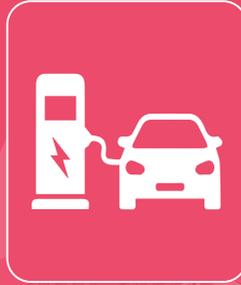




सत्यमेव जयते

Ministry of Housing and Urban Affairs  
Government of India



# Clean Technologies Shared Vehicles

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## TRAINING MANUAL



**ClimateSmart Cities Assessment Framework**  
Mobility and Air Quality





Ministry of Housing and Urban Affairs  
Government of India



# Clean Technologies Shared Vehicles

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## TRAINING MANUAL

ClimateSmart Cities Assessment Framework  
Mobility and Air Quality

**Clean Technologies Shared Vehicle**  
Training Manual

**Developed by:**

Climate Centre for Cities, NIUA in association with RMI

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# Executive Summary

On one hand, cities are a significant contributor of carbon emissions aggravating climate change and on the other, cities are considerably impacted by climate disasters. The recently released Global Climate Risk Index 2021 ranks India as the 7th most affected country from climate related extreme weather events (storms, floods, heatwaves etc.). Further, studies indicate that poor planning and urban management are expected to cost Indian cities somewhere between \$2.6 and \$13 billion annually. Cities are increasingly at the forefront of addressing both urbanization and climate change and to strengthen climate-sensitive urban development, a holistic understanding of the urban development from a climate lens is crucial. The ClimateSmart Cities Assessment Framework (CSCAF) launched in 2019 by the Ministry of Housing and Urban Affairs (MoHUA), Government of India aimed to address this gap. This first-of-its-kind assessment with 28 progressive indicators across 5 thematic areas helps cities to benchmark their development, understand the gaps and further prioritize climate relevant development.

With a focus on building local capacities to develop and adopt climate measures, the Climate Centre for Cities (C-Cube) at the National Institute of Urban Affairs (NIUA) initiated a series of training aligned to the thematic areas of CSCAF - Energy and Green Buildings, Urban Planning, Green Cover & Biodiversity, Mobility and Air Quality, Water Management, Waste Management. The focus of the training is to provide a step-by-step approach of conducting studies, assessments and stakeholder consultations, establishing committees, developing action plans and implementing relevant measures that not only makes the cities climate resilient but also helps them progress across the assessment of CSCAF. The training on the 'Clean Technology Shared Vehicles' under the thematic areas of Mobility and Air Quality in the CSCAF is developed in association with the RMI, India.



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Who is the training manual designed for?



What is the focus of the training manual?



How to make use of this manual?



What are the Learning outcomes of the training?



Scope and limitations of the training

The training manual is designed for city officials from various departments working in the clean and shared mobility space. Officials from urban local bodies (ULBs), state transport undertakings (STUs), city transport departments, regional transport offices (RTOs), city planners, smart city chief executive officers (CEOs), among others, will benefit from this training manual.

Key objectives of this training include is to introduce cities to the clean technologies shared vehicles indicator on the Climate Smart Cities Assessment Framework (CSCAF) 2.0. Educating cities about data collection and analysis to help them calculate their performance on the indicator. Building cities' capacity to plan, identify, and implement strategies to increase the adoption of clean technology shared vehicles.

Guidelines for the users:

- Read all sections of the report and note potential ideas for policies, strategies, and pilots that can be applied to the work of their city and department.
- Make a plan to discuss those ideas with colleagues and supervisors, with a focus on how the same can be customised and implemented.
- Identify one or two concrete actions that they plan to take to enhance their city's score on CSCAF 2.0's clean technology shared vehicles indicator.

Through this training, city officials will enhance their knowledge about clean mobility technologies and shared mobility solutions. Officials will be more able to guide their departments to prioritise near-term strategies for adopting clean technologies and shared vehicles, thereby improving their score on CSCAF 2.0. Moreover, cities will be well-informed to prepare a plan or roadmap of medium- and long-term actions that can continue to improve their score and thus mobility services for their city's citizens.

The training provides an overview of global and domestic markets for clean and shared mobility, outlines India's institutional and policy framework for the same, and provides potential solutions, case studies, and implementation guidance. There are a few limitations of this training. First, while it discusses a range of powertrain technologies, it focuses on battery electric vehicles considering the country's recent EV policy direction and technology and market developments. Second, the overview of institutions and policies may not be comprehensive. Last, while it provides potential solutions and implementation guidance, particular solutions may not be relevant to some cities and there may be a need to customise some solutions and their implementation.



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## Abbreviations

ACC	Advanced chemistry cell
BEVs	Battery electric vehicles
C-Cube	Climate Centre for Cities
CEO	Chief economic officer
CMVR	Central Motor Vehicle Rules
CNG	Compressed natural gas
CSCAF	Climate Smart Cities Assessment Framework
DIMTS	Delhi Integrated Multi Modal Transit System
FAME	Faster Adoption and Manufacturing of Electric Vehicles
FAQs	Frequently asked questions
FCEVs	Fuel cell electric vehicles
GST	Goods and Services Tax
ITF	International Transport Forum
KMTA	Kochi Metropolitan Transport Authority
LPG	Liquefied petroleum gas
MoRTH	Ministry of Road Transport and Highways
MoHUA	Ministry of Housing and Urban Affairs
Mtoe	Million tonnes of oil equivalent
MVA	Motor Vehicles Act
NIUA	National Institute of Urban Affairs
PHEVs	Plug-in hybrid electric vehicles
PLI	Production-linked incentive
PMC	Pune Municipal Corporation
SMAP	Smart Cities Action Plan
STU	State transport undertakings
ULBs	Urban Local Bodies
USA	United States of America
UMTA	United Metropolitan Transport Authority



# 1

## Introduction

### 1.1 Context

India has emerged as one of the fastest growing economies in the world according to the World Economic Outlook (2020 and 2021).<sup>12,13</sup> The country is also urbanising rapidly, with plans to add 120 million people to cities by 2030 and 400 million by 2050. Cities and towns have been instrumental in driving growth and accommodating urbanisation.

It is observed that India's carbon dioxide (CO<sub>2</sub>) emissions could rise to 50 percent by 2040 due to enhanced growth in industrial activities and transportation.<sup>14</sup> These emissions come from sectors such as transport, industry, buildings, and waste, and contribute to human-caused climate change and its adverse impacts on the environment and public health. This makes Indian cities vulnerable and imposes high risks such as increased water stress, urban heat island effect, and increased severity of extreme weather events such as floods and droughts. India is the fourth most vulnerable country facing extreme weather events as per the latest climate index report.<sup>15</sup>

As 70 percent of the urban infrastructure that India will require by 2030 has not been built yet, there is an extraordinary opportunity for the country's cities to leapfrog traditional technologies.<sup>16</sup> In the transportation sector, where mobility and freight demand are projected to grow severalfold by 2050, accelerating adoption of clean mobility technologies has the potential to lead to meet rising demand with less emissions and pollution and achieve other smart outcomes.

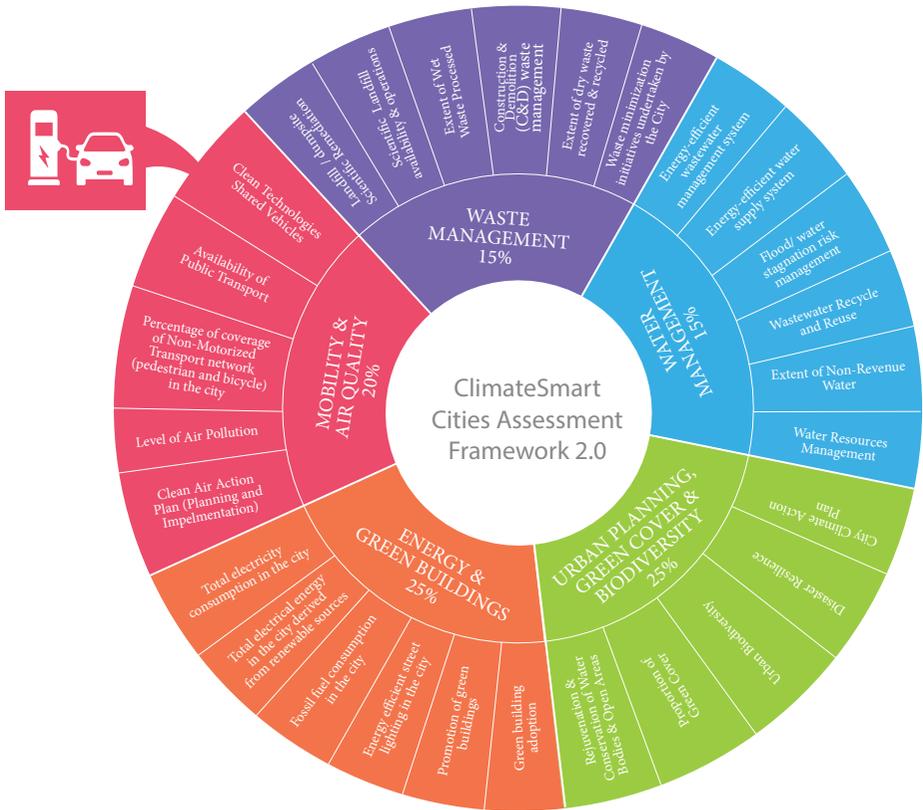


According to NITI Aayog and RMI analysis, a shared, electric, and connected passenger mobility system can save about 800 megatonnes of cumulative CO<sub>2</sub> emissions between 2020 and 2030 and avoid about 300 million tonnes of oil equivalent in fuel imports.<sup>17</sup>

With a goal to improve quality of life and drive economic growth, the Government of India launched the Smart Cities Mission in 2014.<sup>18</sup> Furthermore, to enable climate action across cities, the Ministry of Housing and Urban Affairs (MoHUA) set up the Climate Centre for Cities (C-Cube) within the National Institute of Urban Affairs (NIUA). Urban mobility is a focus area for the Smart Cities Mission and C-Cube.



Figure 1.1. Climate Smart City Assessment Framework 2.0, including five themes and 28 indicators.



This training manual will focus on the Clean Technologies Shared Vehicles indicator under the Mobility and Air Quality theme.

## 1.2 Aligning with CSCAF

### Types of shared vehicles

Shared mobility is broadly defined as any motorised mode of transportation that is shared by users on an as-needed basis. This includes common vehicle types and use cases such as motor taxi two-wheelers, shared autorickshaws, ride-hailing or taxi passenger cars, and public and private buses. Shared mobility can lead to higher load factors, higher utilisation, and better economics. These vehicles operate on a variety of fuels, with petrol and diesel as the most common fuel type across segments.

CSCAF 2.0 has defined clean vehicle technologies as the following fuel types:

1. Compressed natural gas (CNG)
2. Liquefied petroleum gas (LPG)
3. Biofuels
4. Fuel cell electric vehicles (FCEVs)
5. Battery EVs (BEVs)
6. Plug-in hybrid EVs (PHEVs)

### Data collection method

The indicator is the percentage of shared vehicles operating on clean fuels in the city compared to the total number of shared vehicles in the city.

Cities are required to calculate the following:

**Figure 1.2.** Formula for calculating CSCAF clean technologies shared vehicles indicator.

$$\text{Percentage of clean technologies shared vehicles} = \frac{\text{Total number of shared vehicles operating on clean fuels}}{\text{Total number of shared vehicles in the city}} \times 100$$

The calculation of the total number of shared vehicles in the city is the total number of shared vehicles operating on clean technologies plus all other forms of shared vehicles. The unit is percent (%) and the maximum value is 100.

## Performance and analysis

The indicator uses five performance levels to illustrate cities' performance on the indicator. They determine the level of clean technologies adoption by cities in the shared mobility segment.<sup>19</sup>

1. One star: Cities that are in the early stages of development and have not indicated the use of shared vehicles plying on clean fuels.
2. Two stars: Cities that have less than 5 percent of their shared vehicles operating on clean fuels.
3. Three stars: Cities that have 5 to 10 percent of their shared vehicles operating on clean fuels.
4. Four stars: Cities that have 25 percent of their shared vehicles operating on clean fuels.
5. Five stars: Cities that have more than 25 percent of their shared vehicles operating on clean fuels.

**Table 1.1.** CSCAF progress evaluation framework for clean technologies shared vehicles indicator.

	1	2	3	4	5
Progression levels	No clean technology shared vehicles	Coverage: <5%	Coverage: 5% to <15%	Coverage: 15% to <25%	Coverage: >25%
Score	0	25	50	75	100
Evidence/ Data sources	Registration data from regional transport office (RTO) by fuel type Fleet data from Road Transport Corporation, State Transport Undertaking, private bus and taxi operators, and fleet aggregators				
Responsible departments/ Agencies	State government Municipal Corporation State Transport Undertakings City Development Authorities Smart City SPVs Regional Transport Offices				
Reference documents	Open Government Data Platform ( <a href="https://tinyurl.com/vn7fsg6">https://tinyurl.com/vn7fsg6</a> ) <sup>20</sup> Moving Forward Together: Enabling Shared Mobility in India ( <a href="https://www.niti.gov.in/writereaddata/files/document_publication/Shared-mobility.pdf">https://www.niti.gov.in/writereaddata/files/document_publication/Shared-mobility.pdf</a> ) <sup>21</sup>				



Photo Credits: Udaipur Smart City

# 2

## Institutional framework

### 2.1. Policy and legal background

#### 2.1.1. Central level

Central government policies play a crucial role in India's transition to clean and shared mobility. Many policies focus on fiscal to reduce the cost barrier to EVs and other clean fuels. Among such policies is the second phase of the Faster Adoption and Manufacturing of Electric Vehicles (FAME) Scheme, which was notified in 2019, with an outlay of INR 10,000 crores to subsidise EVs across segments and public charging stations.

Other relevant policies include the production-linked incentive (PLI) scheme for domestic manufacturing of advanced chemistry cell (ACC) batteries, the National Mission on Transformative Mobility and Energy Storage, Ministry of Road Transport and Highways (MoRTH) notifications for states to exempt EVs from registration fees, road taxes, and permits and provide them with green license plates. A range of other central government bodies are complementing these incentives with guidelines and standards for charging infrastructure placement, EV charging tariffs, and building byelaws, as well as reductions in Goods and Services Tax (GST).

Most mobility policies are governed by the Motor Vehicles Act (MVA) and Central Motor Vehicle Rules (CMVR). These focus on vehicle classifications, licensing, permitting, road safety, and other items. MoRTH oversees the MVA and CMVR.

Governance of shared mobility systems requires coordination and combined departmental efforts to implement rules and regulations.

### 2.1.2. Subnational level

Policies at the state and union territory levels are also critical to support the adoption of EVs and other clean fuels. They complement central policies and operationalise guidelines issued by central ministries. To date, 15 states and union territories have notified EV policies and several others are in the process of finalising their drafts.

Guidelines are also being established by cities. For example, Delhi and Pune have mandated certain vehicle segments to switch to CNG.

Transitioning to cleaner fuels must be well planned and based on 1) technical viability to meet the required duty cycle, 2) economics to achieve cost savings, and 3) social benefits to reduce pollution and emissions. Understanding the current shared mobility market trends will help cities devise holistic action plans.

## 2.2. Global and national market trends

### 2.2.1. Electric vehicles and other clean fuels

The future of transport is shared, electric, and connected. EVs have the potential to lead the clean technologies segment due to their growing policy focus, increasing model availability, and improving economics. Global EV sales are on the rise. In 2021, global sales are expected to increase nearly 50 percent compared to 2020 to a record 300 lakh units according to Bloomberg New Energy Finance.<sup>6</sup>

The EV market in India is small, with a stock of about 30 lakh units. Today, EVs account for less than one percent of new vehicle sales. About three in four EVs on the road today are e-rickshaws and about one in four is an electric two-wheeler. The market is poised for growth as forecasts suggest that as many as seven in 10 vehicles sold in the country by 2030 will be EVs.<sup>7</sup>

Policies such as FAME II, the PLI scheme, and other measures can support India in realising EV sales penetrations of 30 percent for private cars, 70 percent for commercial cars, 40 percent for buses, and 80 percent for two- and three-wheelers by 2030.<sup>8</sup>

### 2.2.2. Shared mobility

Global demand for shared mobility was growing significantly prior to the pandemic. In the three largest markets—China, Europe, and the United States of America (USA)—the shared mobility market is valued at INR 4.5 lakh crores.<sup>9</sup> By 2025, shared mobility will account for 6 percent of passenger vehicle kilometer travelled (VKT) globally. This number could grow to as high as 35 percent by 2040.<sup>10</sup> Shared mobility's share of VKT in India likely will be higher than other major countries because sharing is already common.<sup>1</sup>

In India, the shared mobility market was valued at INR 7,600 crores in 2019. It is expected to grow at a rate of more than 55 percent per year until 2025.<sup>11</sup>

However, the pandemic has impacted demand for shared mobility severely across geographies. Private modes of transport have become more attractive for consumers during this period. While public transport and ride-hailing demand were affected, they are seeing a slow recovery in countries that are relaxing COVID-19 restrictions.

In light of these growing international and domestic trends, Indian cities must set goals for adoptions of EVs and shared mobility and identify targeted implementation strategies.

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<sup>1</sup>Shared vehicle category data includes conventional taxis, carsharing, ride-sharing.



Photo Credits: Marwan Ahmed on Unsplash

# 3

## Implementation strategies

### 3.1 Strategic measures

Cities in India and around the world have tested strategic measures that can increase the adoption of clean vehicle technologies and shared mobility solutions. A subset of strategic measures is included in Table 2 below. City officials could adopt one or more of the strategic measures highlighted in the table below to improve their scores on the CSCAF 2.0 indicator for clean technologies shared vehicles. By devising several strategic measures, cities can create actions plans to bolster adoption. Action plans should have clear and concise goals, with adequate resources to implement them.

**Table 3.1.** A subset of strategic measures that cities can adopt to improve their performance on the CSCAF 2.0 indicator for clean technologies shared vehicles.

Definition	Objective	Steps cities can take	Example
<b>Overarching Implementation Body</b>	Support integration across agencies governing urban mobility infrastructure and services	Create a United Metropolitan Transport Authority (UMTA) MoHUA outlined an operations document for creating an UMTA: <a href="https://bit.ly/2TlvB4S3">https://bit.ly/2TlvB4S3</a> . UMTA can include a secretariat, officers from key urban local bodies such as municipal corporations, transport authorities, unions, civil society organisations.	Kerala govt set up the Kochi Metropolitan Transport Authority (KMTA) after a law was notified in 2019.  KMTA will be responsible for creating plans to support all forms of transport – metro rail, buses, autos, boats, feeder buses, taxis, cycle lanes, walkways.

Definition	Objective	Steps cities can take	Example
<b>Electrification Targets</b>	Fastrack shared clean technologies adoption in cities	Set a fleet electrification target for ride-hailing vehicles and/or ICE registration caps. The targets can be aligned with respective state's transition targets: E.g., X% of ride-hailing fleets must be electric by 2025 or only X ICE vehicles for Y segment can be registered by 2025 Cities could consider registration restrictions/caps in specific RTO district	Pune has been recognised among top '50 champion cities' by Bloomberg Philanthropies: <a href="https://bit.ly/3zd6bWq4">https://bit.ly/3zd6bWq4</a> .  Pune Municipal Corporation (PMC) created an EV readiness plan and established a dedicated fund to adopt EVs.
<b>Shared Mobility Action Plan</b>	Draft and implement a Shared Mobility Action Plan (SMAP)	Secretariat/UMTA could create a SMAP after consulting relevant stakeholders. SMAP could benchmark status of clean technology shared vehicles by including a vision, goals, and strategies. Goals and strategies could focus on mode share targets, modal integration, data sharing protocol, coordination across agencies, etc.	Minneapolis-St. Paul, United States regions created a Shared Mobility Action Plan that suggests removing 50,000 on road private cars in the Twin Cities over next 10 years.  Objective is to ensure that shared mobility programs serve the same broad user base that makes up public transportation ridership region-wide.

Definition	Objective	Steps cities can take	Example
<b>Data Management</b>	Enhance data availability, sharing, and modal integration	Officials can appoint a transport data champion who can drive data collection processes and more importantly prevent data misuse. Align transport data use cases with the city's goals and challenges. Create awareness about mass transit/shared vehicles through mass awareness programmes/ stakeholder consultations at regular intervals.	Beijing, China's license plate lottery reduced license plate issuances from 700,000 in 2010 to 240,000 in 2011: <a href="https://bit.ly/3eGGHc65">https://bit.ly/3eGGHc65</a> .
<b>Clean and/or Shared Mobility Fund</b>	Raise and allocate funds for clean and/or shared mobility projects	Create a separate fund for promoting shared mobility. State funds can be utilised at appropriate junctures. Green cess on polluting vehicles and other revenue streams can be explored.	Delhi Government funds a proportion of its EV incentives through a feebate-style concept, where inefficient polluting vehicles incur a surcharge (fee) while efficient ones receive a rebate (bate).  Funding for the various incentives being offered under the Delhi EV Policy is obtained from several sources and aggregated under an umbrella, non-lapsable 'State EV Fund'.

## 3.2 Timeline for action plans

City authorities should consider forming a strong governance structure to ensure their Shared Mobility Action Plans (SMAPs) are achievable in the agreed-upon timeframe. Once that governance structure is in place, they can create an action plan and initiate actions in a timebound manner. The figure below gives a proposed timeline to develop and implement a SMAP over a 12-month timeline.

Figure 3.2. A proposed timeline to develop and implement a SMAP over a 12-month timeline.

### 1 Month

Identify, structure, and formally approve a cell or secretariat or UMTA, including its members and responsibilities

### 3 Months

Host consultations with key stakeholders (i.e., departments, industry, civil society, residents, etc.) to collect their inputs, focusing on current projects, perceived challenges, and potential solutions

### 6 Months

Shortlist a set of strategic measures for promotion of clean and/or shared mobility and draft a plan outlining the measures and specific steps and stakeholders required to operationalise them.

### 12 Months

Publish and notify the EV readiness plan or SMAP

### Continuous

Monitor progress through data analysis and stakeholder consultations; engage in adaptive regulation and measures

# 4

## Training and exercise

What are the benefits of EVs?

01 Lower fuel cost

02 Zero tailpipe emissions

03 Lower CO2

04 Purchase incentives/  
subsidies from national/  
state governments

05 All of the above

**Prioritize the challenges in promoting clean and shared mobility in your city.**

Challenges	Priority 1	Priority 2
Absence of charging infrastructure for EVs		
High upfront cost of EVs		
Poor road infrastructure		
Lack of dealerships and service providers		
Lack of consumer demand		
Others		

**Prioritize the benefits of clean and shared mobility in your city.**

Challenges	Priority 1	Priority 2
Better air quality		
Reduction in traffic congestion		
Improved vehicle utilisation		
Job creation		
Others		

**Map the related department for each of the shared vehicle in your city.**

Data sources	Public buses	Private buses	App based cabs	App based 2-wheelers	Ferries	Autos	E-rickshaws
Regional Transport Department							
Road Transport Corporation							
State Transport Undertaking							
Private Operators							
Aggregators							
Others							
Missing data/ unsure of the data							

**Prioritize the steps your city can take to promote clean and shared mobility.**

Steps	Priority 1	Priority 2
Streamline data collection process		
Set electrification targets		
Convert existing government fleet to electric		
Create a shared mobility plan		
Implement the shared mobility plan		
Create an overarching body such as UMTA		
Create awareness about economic and health benefits of clean shared mobility		
Identify funding sources for deploying clean shared mobility		



Photo Credits: Indore Smart City

# 5

## Case Studies

### 5.1 Bus clusters

Delhi introduced a cluster model called Delhi Integrated Multi Modal Transit System (DIMTS) to operate private stage carriers in 2006.<sup>1</sup> DIMTS has evolved over the years and a network of about 650 routes was initially converted into 17 clusters. Delhi's network currently has 2,700 cluster buses deployed on 250 city routes. This system has enabled transport authorities and providers to maintain a level of uniformity across bus services offered in Delhi.

To monitor operations, DIMTS authorities have created a performance incentive mechanism to reward or penalise operators. Parameters include:

1. Service reliability and frequency
2. Bus accessibility
3. Vehicle cleanliness and presentability
4. Access to route and travel information

### 5.2 E-rickshaws

E-rickshaw pilot in Udaipur and studies from Siliguri and Delhi show that their adoption rate is high despite lack of adequate regulations and registration process.

The Udaipur pilot and studies in Siliguri and Delhi were organised under the CapaCITIES project funded by the Swiss Agency for Development and Cooperation. Major takeaways from the research highlighted that despite a popular perception, e-rickshaws are not illegal but unregulated. Moreover, they are emerging as a popular mode of last-mile connectivity as they are economical and environment friendly.

However, traffic rules are difficult to impose in the absence of regulations. Studies suggest that a national policy on e-rickshaws and route planning can help regularise the sector.

### 5.3 App for modal integration

Helsinki, Finland is at the forefront of adopting shared mobility through tech-savvy measures. Helsinki has set an ambitious target of making private vehicles obsolete by 2025 by integrating shared and public transport into a single linked network and offer digital payment options.

A study by the International Transport Forum (ITF) found that shifting to shared mobility in Helsinki could reduce CO<sub>2</sub> emissions by 34 percent and congestion by 37 percent. Also, it will increase rail and metro ridership between 15 and 23 percent.

To achieve its target, Helsinki deployed the Whim app developed by MaaS Global.<sup>2</sup> The app is emerging as an example of a one stop shop for shared mobility users. It offers users access to several modes, including bikes, taxis, car rentals, and public transit on pay as you go and monthly subscriptions. Based on user preferences and trip details, the app provides routing by mode so that users can visualise transit options and compare cost and time estimates simultaneously.

# 6

## List of Additional Materials

### 6.1. Knowledge repository

This section provides a list of readings for city officials to gain a 360-degree perspective on clean technologies shared vehicles.

1. NITI Aayog, Rocky Mountain Institute, and Observer Research Foundation. Moving Forward Together: Enabling Shared Mobility in India. 2018. [http://niti.gov.in/writereaddata/files/document\\_publication/Shared-mobility.pdf](http://niti.gov.in/writereaddata/files/document_publication/Shared-mobility.pdf)
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## 6.2. Data collection support

To facilitate data collection for CSCAF 2.0, there are various resources compiled on the website <https://smartnet.niua.org/csc/index.html>.

They range from inputs for data to evidence templates, reference documents and frequently asked questions (FAQs).

### 6.2.1. Evidence templates

Cities will find these helpful in uploading their data on the portal. There are separate templates for all indicators listed under the thematic areas of the framework. They can be accessed at <https://smartnet.niua.org/csc/evidence-templates.html>.

### 6.2.2. Frequently asked questions

The FAQs can support cities clarify any doubts related to populating the assessment form in the portal. They can be accessed at <https://smartnet.niua.org/csc/faqs.html>

### 6.2.3. Training videos

These videos can help cities navigate the portal for filling data and reading the technical document. They are available at: <https://smartnet.niua.org/csc/general-faqs.html>

### 6.2.4. Help desk

A national help-desk has been set up which will be operational throughout the assessment period. You can reach C-Cube at: 011-411-86699 from Monday to Friday, 9am to 5pm. Cities can also send an email at [climate-smartcities@gov.in](mailto:climate-smartcities@gov.in) for assistance.

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Ministry of Housing and Urban Affairs  
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CLEAN TECHNOLOGIES SHARED VEHICLES