ACCELERATING BANGALORE'S MOBILITY TRANSITION

INSIGHTS FROM THE BANGALORE URBAN MOBILITY LAB

ABOUT THE AUTHORS

ROCKY MOUNTAIN INSTITUTE (RMI) AND RMI INDIA

Rocky Mountain Institute (RMI) is an independent, apolitical, nonprofit think-and-do tank that transforms global energy use to create a clean, prosperous, and secure low-carbon future. Cofounded by Amory Lovins in 1982, RMI has been a leader in energy efficiency and renewable energy for 35 years. RMI published India Leaps Ahead: Transformative Mobility Solutions for All with NITI Aayog in May 2017, and works with central government agencies like NITI Aayog, Ministry of Housing and Urban Affairs, and Department of Heavy Industries to support India's transition to clean, shared, and connected mobility.

RMI India is an independent non profit organization that works towards accelerating India's transition to a clean, prosperous, and inclusive energy future. We engage with government, industry, and civil-society leaders to design innovative policy frameworks and market solutions to support India's clean energy and mobility transformation in order to enhance lives and livelihoods of all Indians. RMI India takes inspiration from and collaborates with Rocky Mountain Institute (RMI), USA.

MICELIO

Micelio, founded by Shreyas Shibulal, is at the helm of the electric vehicle (EV) revolution in India. It aims to be an enabler of innovation by creating a sustainable mobility ecosystem with a strong EV focus. Micelio has four companies:

- Micelio Fund—invests in EV startups
- Micelio Studio—an incubator with state-of-the-art infrastructure and workshop space
- Lightning Logistics—an EV last-mile delivery firm
- Product Company—building an EV form factor for last-mile solutions

PARTNERS OF THE URBAN MOBILITY LAB IN BANGALORE

DIRECTORATE OF URBAN LAND TRANSPORT (DULT)

DULT has been set up by the Government of Karnataka (GoK) under the Urban Development Department (UDD) with the objective to coordinate planning and implementation of urban transport projects and programs. The Directorate is, in general, responsible for overseeing all the urban land transport initiatives in urban/local planning areas of Karnataka and administers the State Urban Transport Fund (SUTF). DULT's vision is to provide efficient, sustainable, and integrated transportation systems that enhance Karnataka's economic competitiveness and prosperity while preserving the quality of its environment and communities.

DEPARTMENT OF INDUSTRIES AND COMMERCE

The Department of Industries and Commerce acts as a catalyst for the overall development of the industrial sector through effective discharge of developmental and facilitation roles. With a view to promote investment and trade, the Department formulates and implements the state policies. Identification of sectoral advantages of the state and human resource development for sustainable and growth-oriented industrialization have been crucial roles of the Department. Facilitating the takeoff of infrastructure projects that boost industrial growth has also been the Department's forte. The Department helps enhance the competitiveness of domestic industry through modernization, technology upgradation and adoption of best practices.

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ABOUT THIS REPORT

Cities across India are witnessing rapid urbanization and growing mobility demand. Developing and deploying shared, clean, and citizen-centric mobility solutions will be critical to ensure this demand is met in a sustainable manner that provides safe, accessible, and reliable transportation for citizens.

To accelerate the deployment of contextualized mobility solutions, Rocky Mountain Institute (RMI) created the Urban Mobility Lab to support Indian cities in identifying, integrating, and implementing mobility solutions that can transform how people and goods move. The Urban Mobility Lab was launched in 2017 by Rocky Mountain Institute and the Government of India's think tank, NITI Aayog. Since 2017, the Urban Mobility Lab has partnered with and is currently implementing solutions in Pune, Delhi, and Bangalore.

In Bangalore, RMI has partnered with Micelio and Government of Karnataka's departments—the Directorate of Urban Land Transport (DULT), Invest Karnataka Forum, and the Department of Industries and Commerce—to cohost the Urban Mobility Lab. On 19–20 February, 2020, over 150 stakeholders from Bangalore's mobility ecosystem, representing leaders in government, private sector, and civil society, came together in a multi-stakeholder workshop to collaboratively develop solutions to help Bangalore address its key mobility challenges and develop implementable solutions to realize a shared, clean, and citizen-centric mobility future. Together, these participants developed and prioritized more than ten actionable solutions.

This report offers a reflection of the discussions that took place at the 19–20 February workshop and a summary of the prioritized solutions. It aims to share the solution details, including key insights and lessons learned, in order to accelerate the implementation and scaling of mobility solutions in Bangalore and beyond.

> *"A transportation transformation will have many components – better walkability, better public transport, better roads, and better vehicles. Many of these better vehicles are likely to be electric. India is currently putting in place policies that encourage use of electric vehicles and improve urban mobility. While the Central government has indicated that this is the direction in which the country is headed, cities and states have the opportunity to support rapid progress."*
>
> *— Shreyas Shibulal, Founder and Director, Micelio*

TIMELINE OF THE URBAN MOBILITY LAB IN BANGALORE

The Urban Mobility Lab is an ongoing initiative designed to continually provide an open forum for collaborative discussion and action. In Bangalore, work commenced in September 2019 and will continue for several years.

RMI and Micelio are committed to accelerating the deployment of shared, clean, and citizen-centric mobility solutions in Bangalore. As we move forward to implement a portfolio of mobility solutions generated at the 19–20 February workshop, we recognize the evolving crisis of COVID-19 that is currently affecting all of us.

First and foremost, we are wishing for good health and safety of all. We acknowledge that the COVID-19 pandemic brings uncertainty and undoubtedly is changing, for all of us, our priorities and responsibilities. It will require us to adapt, amongst many things, how, when, and on what we work on together. While some of the details and methods of work could evolve, the ultimate goals will remain the same. RMI and Micelio are actively monitoring the situation and will continue our work in a form that is appropriate and acknowledges the new priorities of stakeholders.

We thank the stakeholders involved in the Urban Mobility Lab for their ongoing support and commitment to Bangalore's shared, clean, and citizen-centric mobility future. We look forward to our work together.

SEPEMBER 2019

- Bangalore selected as the third Lighthouse City and host of the Urban Mobility Lab
- Partnership formed between RMI, Micelio, DULT, and Department of Industries and Commerce

NOVEMBER 2019

- RMI and Micelio engaged city stakeholders through a needs assessment process

FEBRUARY 2020

- On 19–20 February, 2020, over 150 stakeholders from Bangalore's mobility ecosystem came together in a multi-stakeholder workshop to collaboratively develop solutions to help Bangalore address its key mobility challenges and develop implementable solutions to realize a shared, clean, and citizen-centric mobility future

APRIL 2020 ONWARDS

- Report, *Accelerating Bangalore's Mobility Transition: Insights from the Bangalore Urban Mobility Lab*, is published
- RMI and Micelio monitor COVID-19 pandemic, advancing work as appropriate given new priorities and responsibilities of stakeholders
- Based on available information, RMI and Micelio re-engage with government agencies and other stakeholders to discuss their priorities and develop next steps and timeline for deploying mobility solutions

CONTEXT

Bangalore, the fifth-largest city in India with a population of 12.3 million (2018 estimate), is known as a hub for technology and entrepreneurship. The city has seen explosive growth in the past several decades. From 2001 to 2011 the population of the Bangalore Metropolitan Area grew by 49.4 percent and continues to grow at a steady rate of about 3 percent per year, as one of the world's top ten fastest growing cities.[1] While the city's economy has boomed as a result, its infrastructure has struggled to keep up with the demands of a growing population. Bangalore now faces some of the worst congestion of any city in the world, and local air quality is worsening as a result of the increasing number of vehicles on the roads.

Vehicle ownership in Bangalore has increased from 419 vehicles per thousand persons in 2011 to 640 in 2018, with the majority being two-wheelers; the number of registered vehicles is growing at a much higher rate than the growth of population, indicating a trend toward increasing private vehicle ownership.[2] At the same time, utilization of public tranport has been declining; for example, the average number of riders on Bengaluru Metropolitan Transport Corporation's (BMTC) bus system has decreased from 51.3 lakh passengers per day in 2015–16 to 44.37 lakh passengers per day in 2017–18.[3] The city has also seen a decline in non-motorized transport mode share as indicated by various studies—decreasing from an estimated 35 percent[4] in 2011 to 27 percent[5] in 2015.

As private vehicle use has increased and public transport mode share has decreased, the city has witnessed significant congestion and vehicular-based air pollution. As the most congested city in the world[6], at peak hours, drivers experience speeds of less than 17 kilometers per hour.[7] Vehicle emissions, including exhaust and resuspension of on-road dust account for the majority (56 percent) of PM2.5 emissions in the city.[8]

Bangalore's transit agencies, urban local bodies, and entrepreneurs have been taking steps to address these challenges and implement solutions so that the transportation system better meets the needs of the growing urban population. For example, the recently released draft Comprehensive Mobility Plan outlines ten strategies aiming to increase mode share of public transport, regain road infrastructure as a public good, and reduce transport sector contributions to air pollution and greenhouse gas emissions.

These strategies include measures such as improving the operational efficiency of public transport systems, enabling multimodal mobility, and promoting transit-oriented development. At the same time, many private sector companies have been developing innovative ways to move people around the city more efficiently, from shared rides to micro-mobility options such as dockless scooters and bikeshares.

Bangalore and Karnataka have also signaled their leadership in India's electric mobility transition. India's first electric bus was launched in Bangalore in 2014, and Karnataka became the first Indian state to launch an electric vehicle (EV) policy in 2017. The policy aims to make Karnataka a manufacturing hub for EVs by promoting a conducive manufacturing ecosystem in collaboration with industry and developing the required human capital.

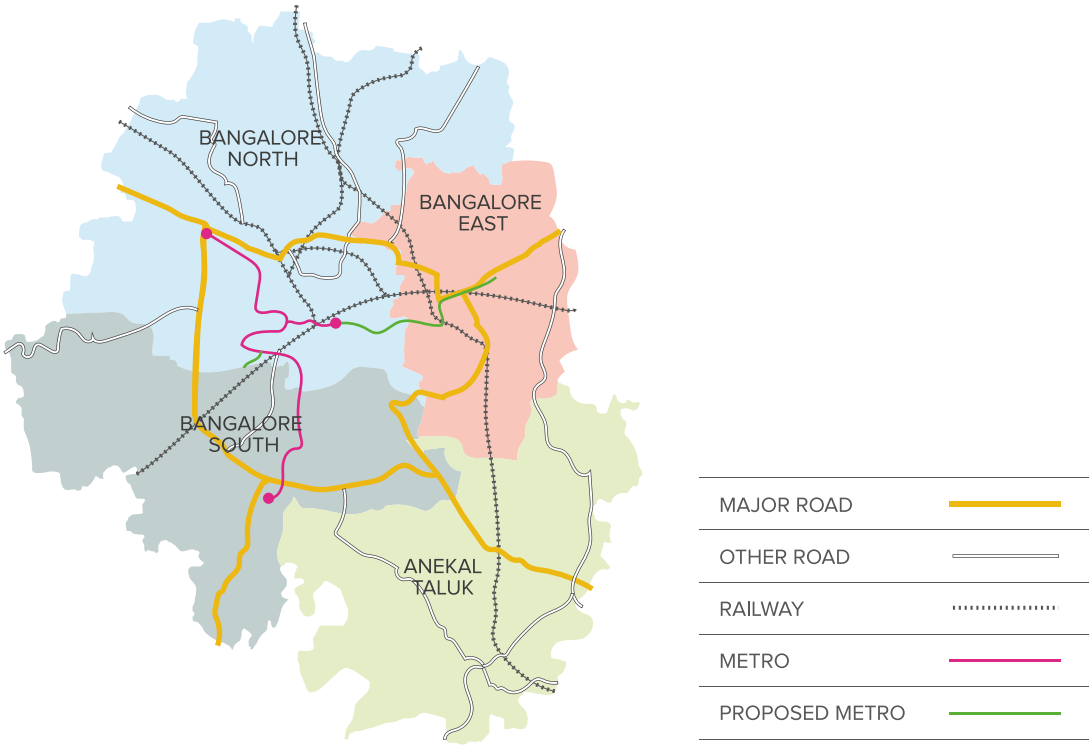
Given the vibrant stakeholder ecosystem and persistent mobility challenges, Rocky Mountain Institute and Micelio saw an opportunity to build on existing efforts and harness Bangalore's information technology (IT) and entrepreneurship prowess by bringing together a diverse set of stakeholders to collaboratively brainstorm solutions in key areas of Bangalore's transportation system.

> *"We need to have pooling of data, we need to have pooling of different modes of transport, and then to ensure a seamless experience for the end user. Bangalore is the best place to be in if you are talking about new technologies and enterprises such as electric vehicles because of the open enterprise that has thrived here."*
>
> *— Gaurav Gupta, Principal Secretary, Government of Karnataka - Commerce and Industries*

BOX 1

Facts about Bangalore's mobility system[9]

BANGALORE DISTRICT



- Land area: 1294 km^2 (Bangalore Metropolitan Area)
- Population: 12.3 million (2018 estimate)
- Average household income: Rs. 32,374 per month
- Modal split (2015):
  - 31.7% Public Transit (Bus, Mini Bus, School/Charter Bus)
  - 27.1% Two-wheeler
  - 26.5% Walk
  - 7% Car
  - 6.6% Autorickshaw
  - 0.7% Cycle
  - 0.2% Metro
  - 0.1% Taxi
  - 0.1% Shared Taxi/Tavera/Innova
- Total road length in Bangalore: 14,000 km
- Total registered vehicles in Bangalore: 74 lakh
  - Registered cars: 14 lakh
  - Registered two-wheelers: 51 lakh
- Car ownership per 1,000 population: 122
- Two-wheeler ownership per 1,000 population: 442
- Total service length of Bangalore metro: 42.3 km
  - Average daily ridership: 4.05 lakh
  - Total bus fleet size: 6,143 buses (2018)
  - Average daily ridership: 44.37 lakh (2017–18)

TABLE 1
Bangalore's mobility policies

OVERVIEW OF SELECT POLICIES IN BANGALORE AND KARNATAKA	
Karnataka Electric Vehicle and Energy Storage Policy (2017)	The Karnataka Electric Vehicle and Energy Storage Policy, published by the Commerce and Industries Department in September 2017, aims to make Karnataka a preferred investment destination for manufacturing of EVs by promoting a conducive manufacturing ecosystem in collaboration with industry and developing the required human capital. The policy's goals include achieving 100 percent electrification of fleet vehicles and three- and four-wheelers for goods transport by 2030 and introduction of 1,000 electric buses by BMTC, Karnataka State Road Transport Corporation (KSRTC), North Western Karnataka Road Transport Corporation (NWKRTC), and North Eastern Karnataka Road Transport Corporation (NEKRTC). Policy incentives include an investment subsidy for the first 100 fast chargers, tax exemptions for EVs, and numerous subsidies, exemptions, and land acquisition benefits for manufacturing.
Bangalore Master Plan (2015)	The Bangalore Master Plan, published by the Bangalore Development Authority and revised in 2015, proposes land use plans for the 47 planning districts in Bangalore. The Master Plan includes a circulation plan of roads, metros, and railways.
Bangalore Comprehensive Mobility Plan (draft form, 2019)	The draft Comprehensive Mobility Plan (CMP), published by the Bangalore Metro Rail Corporation Ltd. (BMRCL) and DULT, lays out a vision and strategy for creating efficient and sustainable transportation for all. The mission of the draft CMP is to build a multimodal transport system for equitable mobility access and minimized negative externalities. The goals of the plan include increasing mode share of public transport, regaining road infrastructure as a public good, and reducing emissions from the transport sector.
Comprehensive Traffic and Transportation Plan for Bengaluru (2011)	The action plan, published by the Karnataka Urban Infrastructure Development and Finance Corporation in 2011, outlines a number of proposals to bolster Bangalore's transportation system in order to support the projected increase in travel demand through 2025. The plan includes proposals related to mass transport, city bus system, integrated multimodal transit centers, transport system management measures, pedestrian/non-motorized transportation facilities, road development, parking facilities, and integrated freight complexes.

CONTINUED

Photo from the panel discussion at the Urban Mobility Lab February 2020 workshop (from left to right): 1. Pramod Varma, Chief Technical Officer, EkStep Foundation, 2. S.D. Shibulal, Infosys and Axilor Ventures Cofounder, 3. Mr. V. Ponnuraj, Commissioner, Directorate of Urban Land Transport, 4. Mr. Gaurav Gupta, Principal Secretary, Transport and Commerce and Industries, 5. Mr. Ajay Seth, Managing Director, Bangalore Metro Rail Corporation Limited, 6. Mr. Bhaskar Rao, Commissioner of Police, Bangalore City Police, 7. Ms. C. Shikha, Managing Director, Bengaluru Metropolitan Transport Corporation, 8. Mr. Tejasvi Surya, Member of Parliament.

CONTINUED

OVERVIEW OF SELECT POLICIES IN BANGALORE AND KARNATAKA

Parking Policy for Bangalore Metropolitan Region (2008)	This document, published by the DULT, is a draft policy outlining different strategies to reduce the parking demand, relieve the congestion on roads, and promote safe parking in Bangalore. It proposes the creation of organized and regulated parking spaces, promotion of private participation in the establishment of public parking facilities, and inclusion of parking in building development plans in order to eliminate unregulated parking and reduce congestion.
Guidelines for Planning and Implementation of Pedestrian Infrastructure (2014)	This document, published by DULT, provides guidelines for agencies to follow when planning, designing, or implementing a pedestrian facility. It emphasizes providing safe and convenient pedestrian facilities to promote walking for people of all age groups.

ABOUT THE URBAN MOBILITY LAB

Background and Context

Rocky Mountain Institute (RMI) created the Urban Mobility Lab to help Indian cities identify, integrate, and implement mobility solutions to transform how people and goods move. The Urban Mobility Lab was jointly launched as an initiative by NITI Aayog and RMI in November 2017. Since 2017, RMI has partnered with the Pune Municipal Corporation and Delhi Government to cohost the Urban Mobility Lab in these cities.

For each city, RMI and its partner(s) conduct a process that includes an assessment of the city's mobility needs and opportunities, the identification and shortlisting of participants that have the expertise to develop solutions to meet those needs and opportunities, an inaugural workshop to support the development of mobility solutions, and follow-up support for implementation of solutions. You can read more about this process in *Transforming Mobility in Indian Cities: Insights from India's First Urban Mobility Lab in Pune.*[10]

urban mobility lab
19-20 FEBRUARY 2020
BANGALORE

FIGURE 1
The Urban Mobility Lab process

	CITY NEEDS ASSESSMENT	SOLUTION IDENTIFICATION	SOLUTIONS WORKSHOP	IMPLEMENTATION SUPPORT
Overview	Identify needs and opportunities in the city's mobility system	Shortlist potential solutions providers to meet city's needs	Co-develop mobility solutions with the city during a facilitated workshop	Support the public and private sectors in implementing solutions from the workshop
Activities	• Review existing plans, policies, and projects • Interview key stakeholders • Document the findings for the city	• Identify solutions providers to meet city's needs • Shortlist finalists • Invite and prepare solutions providers for the workshop	• Develop a custom workshop agenda • Host a multi-day workshop • Host facilitated discussions with participants	• Coordinate between the city and the solution providers • Offer guidance on implementation • Collect and share lessons learned

A key component of the Urban Mobility Lab process is the inaugural workshop. Convening critical stakeholders under one roof and providing an open forum for collaborative discussion and action provides an opportunity to accelerate work on existing and new solutions.

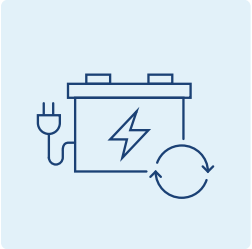
The Urban Mobility Lab in Bangalore

Urban Mobility Lab work commenced in Bangalore in September 2019. In Bangalore, RMI is partnered with Micelio and Government of Karnataka's departments — the Directorate of Urban Land Transport (DULT), Invest Karnataka Forum, and the Department of Industries and Commerce—to host the Urban Mobility Lab.

In the leadup to the inaugural workshop, the RMI and Micelio teams spoke with stakeholders representing key aspects of Bangalore's mobility system to understand key needs and challenges in the city's transportation system. The teams also reviewed key policies and plans already in place.

Photos from the Bangalore Urban Mobility Lab February 2020 workshop.

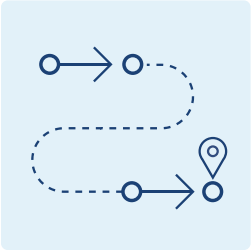
Based on this needs assessment process, six themes were identified as focus areas for the Urban Mobility Lab:



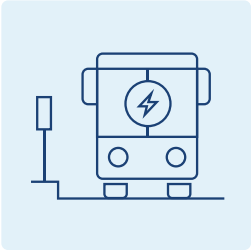
CHARGING & BATTERY SWAPPING INFRASTRUCTURE

DATA-BASED SOLUTIONS

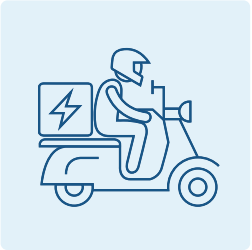
MANUFACTURING & SUPPLY CHAIN



FIRST- AND LAST-MILE CONNECTIVITY



PUBLIC TRANSPORT



URBAN FINAL-MILE DELIVERY

To inaugurate the Lab, RMI and Micelio hosted a multi-stakeholder facilitated workshop on 19–20 February 2020. The objectives of the workshop were to build shared understanding and alignment, advance work on solutions to system-level challenges and implementation plans for mobility solutions, create commitment and strategies to support implementation work, and generate learnings to guide scaling in Bangalore and beyond.

Over 150 participants from more than 70 organizations participated in the workshop. The participants represented critical stakeholders in Bangalore's mobility ecosystem, including state- and city-level government agencies, private sector companies (including start-ups and established players), and civil society organizations.

The participants were organized into multi-stakeholder working groups around the six thematic areas identified through the needs assessment process.

The facilitated process adopted for the workshop provided an approach to achieve the objectives.

The process involved four key components:

- **Solution development:** working groups developed and advanced their solutions from ideas to implementable projects through a carefully designed, facilitated process.
- **Coaching and feedback through coaching clinics:** city- and state-level public agencies and subject matter experts provided coaching and feedback to the working groups on how to make their solutions relevant to the city's needs and how to address the barriers and challenges expected during implementation.
- **Peer-to-peer learning and collaboration through integration clinics:** working groups engaged with each other to identify system-level barriers that can benefit from collaborative action and explored potential points of integration.
- **Vision-setting:** policymakers from state and city government agencies provided a vision and a call for action for transformative mobility solutions that can accelerate the deployment of clean, shared, and citizen-centric mobility solutions for Bangalore.

WORKSHOP AT A GLANCE

Date: 19–20 February 2020, **Location:** Bangalore International Centre

Convening purpose

- Further accelerate Bangalore's transition to shared, clean, and citizen-centric mobility by collaboratively developing solutions to system-level challenges and implementation plans for mobility projects.

Objectives

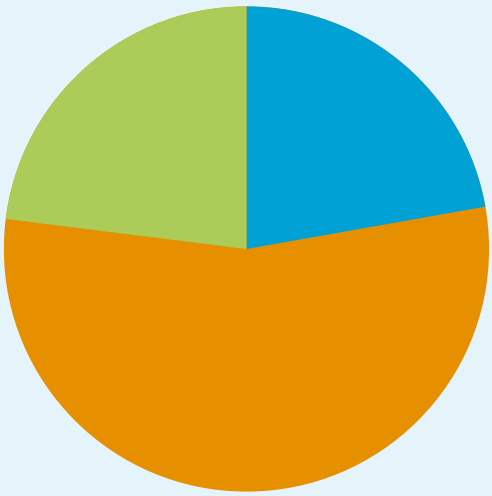
- Build shared understanding and alignment.
- Advance work on solutions to system-level challenges and implementation plans for mobility solutions.
- Create commitment and strategies to support implementation work.
- Generate learnings to guide scaling in Bangalore and beyond.

High-level agenda

Day 1	Day 2
Opening session • Introductions, agenda, and workshop approach • Context setting and inspiring action **Working sessions** Facilitated sessions to support solution development. Each working group discusses: • System-level barriers • Potential intervention points to overcome barriers • Factors and activities supporting or opposing progress on intervention points • Potential solutions **Integration clinic** Peer-to-peer learning and collaboration—sharing insights across working groups and seeking feedback on drafts of potential solutions	**Working sessions** Further developing solutions, including: • Detailing action plans • Preparing for the coaching clinic with government officials and experts **Coaching clinic** Government officials and experts work with working groups to discuss their action plans, receive feedback and input on roadmaps, and address barriers related to implementation of plans **Presentations and panel discussion** Working groups present to government officials and other stakeholders; government officials offer additional guidance and input to solutions

Participants

Over 150 participants from more than 70 organizations participated in the 19–20 February 2020 workshop.



Breakdown of participants by sector; sector sizes based on number of organizations. A full list of organizations at the workshop can be found in the Appendix.

Several special roles existed at the workshop to help support the four key components of the lab: solution development, coaching and feedback, peer-to-peer learning and collaboration, and vision setting. These roles included:

Coaches	Co-chairs
City- and state-level public agencies and subject matter experts provided coaching and feedback to the working groups. • Bangalore City Police • Bangalore Development Authority • Bangalore Electricity Supply Company Limited • Bangalore Metro Rail Corporation Limited • Bengaluru Metropolitan Transport Corporation • Commerce and Industries • Directorate of Urban Land Transport • Karnataka State Road Transport Corporation	*Several subject matter experts supported working groups, offering an expert perspective on the thematic area and playing an important role in encouraging group discussion and ideation.* • Sujith Nair, Chief Executive Office and Cofounder, Beckn Mobility • Revathy Ashok, Managing Trustee and Chief Executive Officer, Bangalore Political Action Committee • Ravi Gadepalli, Mobility Expert and Consultant, Union Internationale des Transports • Mr. Ravichandar, Mobility Expert • Dave Mullaney, Principal, Rocky Mountain Institute • Anand Ganapathy Chennira, Chief Operating Officer, Micelio

Photo from the panel discussion at the Urban Mobility Lab February 2020 workshop (from left to right): S.D. Shibulal, Infosys and Axilor Ventures Cofounder, Mr. V. Ponnuraj, Commissioner, Directorate of Urban Land Transport, Mr. Gaurav Gupta, Principal Secretary, Transport and Commerce and Industries.

Description

Opening session speakers	Panel discussion
Mobility experts and entrepreneurs offered context on mobility in Bangalore and shared remarks to inspire collaboration, experimentation, and action.	*Government leaders listened to presentations of all working groups and offered reflections on proposed solutions from an implementation perspective.*
• Mr. Shreyas Shibulal, Founder and Director, Micelio • Mr. Ravichandar, Mobility Expert • Mr. R.K. Misra, Scholar at Carnegie India and Cofounder of YULU Bikes • Ms. Aneesha Nayak, Motivational Speaker	• Mr. Ajay Seth, Managing Director, Bangalore Metro Rail Corporation Limited • Mr. Tejasvi Surya, Member of Parliament • Mr. Bhaskar Rao, Commissioner of Police, Bangalore City Police • Mr. Gaurav Gupta, Principal Secretary, Transport and Commerce and Industries • Mr. V. Ponnuraj, Commissioner, Directorate of Urban Land Transport • Ms. C. Shikha, Managing Director, Bengaluru Metropolitan Transport Corporation • Shreyas Shibulal, Founder and Director, Micelio • S.D. Shibulal, Infosys and Axilor Ventures Cofounder • Pramod Varma, Chief Technical Officer, EkStep Foundation

Outcomes of the workshop

- A set of participants generated and prioritized action plans that can be taken forward by stakeholders
- Stakeholder commitment to advance work on the action plans

SHARED.
CLEAN.
CITIZEN
CENTRIC.
SHARED.
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PROPOSED SOLUTIONS

Over the course of the two-day workshop, each of the six working groups developed and prioritized several solutions. These solutions (listed in Table 2) reflect the collective knowledge and insight of the diverse set of participants in each working group. Many of the solutions across working groups have interrelated themes and goals, which participants had the opportunity to discuss during integration clinics and informal discussion periods. In particular, the importance of data collection, sharing, and analysis emerged as a key cross-cutting theme across many working groups. As Micelio and RMI move forward in supporting the development of these solutions, consideration will be given to how some of these solutions may be combined or sequenced to support the development of the whole mobility system.

This section outlines each of the solutions—including context, key activities and timeline, outcomes, and key insights—organized by working groups.

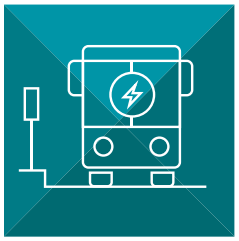
> *"We need to move faster, safer, and we need to do it in a sustainable way. Government needs to have a policy that allows entrepreneurs, innovators and civil society to operate in the ecosystem and deliver."*
>
> *— Mr. Ravichandar, Mobility Expert*

TABLE 2

Summary table of proposed solutions by thematic area

Public transport	**1.** Develop, implement, and monitor public transport service contracts (public transport service obligation).
First- and last-mile connectivity	**1.** Promote first- and last-mile connectivity in high density corridors of the city. **2.** Design and amend policy and regulations to promote new modes of first- and last-mile connectivity.
Data-based solutions (including hardware and software) to enable new mobility and technologies	**1.** Implement a data governance and technology framework.
Charging and battery swapping infrastructure	**1.** Implement an EV charging and swapping data collection and sharing program. **2.** Establish an EV infrastructure pilot for multiple vehicle use cases.
Electric vehicle manufacturing and supply chain	**1.** Develop an ecosystem through a supply-side policy framework. **2.** Establish a common parts platform.
Urban final-mile delivery	**1.** Improve charging and swapping infrastructure for final-mile delivery. **2.** Enable use of EVs for final-mile delivery through small and medium enterprises (SMEs) acting as micro-hubs for storing EVs and goods.

PUBLIC TRANSPORT



Public transport is an important mode of transportation for citizens in urban environments as it typically provides accessible, and affordable mobility option. Public transport holds the majority mode share in Bangalore, accounting for approximately 48 percent of motorized trips in 2015.[11] However, Bangalore's public transport system is facing several challenges due to short-term contracts that inhibit long-term planning and, consequently, quality of service.

The public transport working group explored opportunities for enhancing Bangalore's public transportation system, focusing in particular on service-level agreements that support long-term planning and consistent funding based on service-level benchmarks. Developing service-level benchmarks will ensure that the service provided for citizens is affordable, safe, and reliable, as well as consistent. In addition to the service contract solution, the working group also recommended leveraging data-based solutions to increase the overall transparency of the system for stakeholders, aid in the monitoring and evaluation of public transport performance, and enable seamless integration with other modes of transport.

DEVELOP, IMPLEMENT, AND MONITOR PUBLIC TRANSPORT SERVICE CONTRACTS (PUBLIC TRANSPORT SERVICE OBLIGATION)

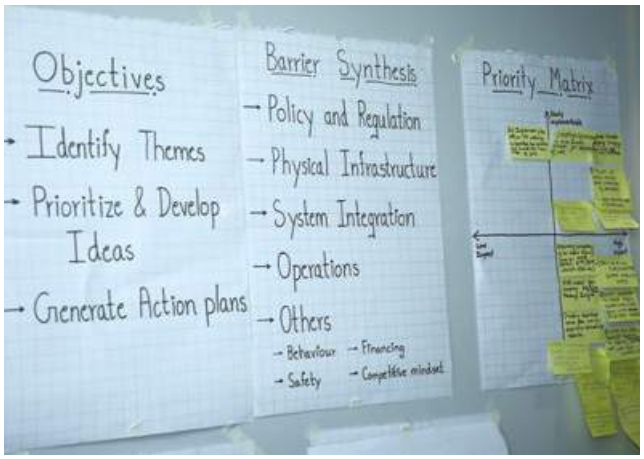
Develop and implement public transport service contracts between the city public transport (PT) authority and operator that clearly define the long-term framework and obligations for safe, efficient, and high-quality PT services. To help set service benchmarks and aid in monitoring and evaluation of services, an open access data platform should be developed.

ACTIONS

- **Develop a five-year business plan** that accounts for the city-wide movement of people and the expected level of service to be provided. In developing the plan:
  - Service levels and performance metrics should be defined. These can be established at the agency level.
  - The costs associated with providing the appropriate level of service and the potential revenue gaps should be identified.
  - A funding plan should be developed.
- **Develop a one-year action plan** based on the five-year business plan. Prepare a resource mobilization plan for the 2021 budget.
- **Develop a political engagement strategy** to build political support and legislative backing. Engage with the offices of the Chief Minister, the Deputy Chief Minister, the Transport Department Minister, and the Urban Development Department Minister.
- **Draft legislation** that mandates performance and promotes integrated planning. A revived Bangalore Metropolitan Land Transport Authority (BMLTA) can act as a coordinating agency, breaking silos amongst government departments and merging transportation and land use planning.
- **Create an integrated traffic and transport data command and control center** to collect transportation data. The data can help set service level benchmarks and aid in monitoring and evaluation of performance. The data should be open access to promote transparency and integration between modes.

OUTCOMES

- High quality public transport that is service-oriented.
- Contracts with stable long-term frameworks, reliable funding, and clear service levels.
- Integrated planning of public transportation with a dedicated nodal agency.



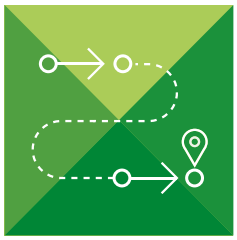
Key takeaways & insights from the working group

- An empowered BMLTA, or a similar coordinating body, can provide an important coordinating function that enables integrated planning for public transportation and also coordinates transportation and land use planning.
- Data is an important enabler of public transportation service-level contracts as it can aid the development of service benchmarks and the monitoring and evaluation of performance. Open data can increase transparency in the public transportation system, supporting dynamic scheduling and routing, integrated planning and operation of different modes, and data-driven decision making for all stakeholders.

"To reduce the congestion on the road, it is very important that end to end transport is given. Towards that [BMTC] is happy to collaborate with such non-motorized transport and other modes of transport. For that it is very important that we do not compete against each other and that we complement each other."

— Ms. C Shikha, Managing Director, Bengaluru Metropolitan Transport Corporation

FIRST- AND LAST-MILE CONNECTIVITY



As Bangalore expands its public transport system, citizens will increasingly be looking for options to commute from their homes to the nearest transit stops and from the transit stops to their final destinations. Hence, the development of first-and last-mile connectivity options in Bangalore is becoming increasingly important for maintaining high usage of public transport systems.

This working group focused on identifying current challenges, on-going efforts, and potential opportunities to improve first- and last-mile mobility solutions. The working group—comprised of stakeholders from private sector, government, nonprofits, and academia—worked together on drafting multiple solutions across different domains.

1. PROMOTE FIRST- AND LAST-MILE CONNECTIVITY IN HIGH-DENSITY CORRIDORS OF THE CITY

Pilot first- and last-mile connectivity solutions in high-density corridors of the city.

ACTIONS

- **Identify high-density corridors:** Identify high-density corridors in the city with the help of different stakeholders, including private stakeholders (operators, real estate owners, tech-park owners, corporates, etc.) and government stakeholders (BMTC, BMRCL, etc.). Select one high-density corridor for the pilot.
- **Vehicle form factor decision:** work with original equipment manufacturers (OEMs), operators and real-estate owners to develop optimal vehicle form factors (i.e. three-wheelers, four-wheelers, non-motorized transport options, etc.) for first- and last-mile connectivity best suited to that high-density corridor.
- **Designing a pilot:** Design a pilot to test the feasibility and viability of the first- and last-mile connectivity in that corridor. Identify a constituency in Bangalore in association with government departments such as BMTC and BMRCL to ensure that pickup and drop-off locations and the data points (average time of travel, utilization of the vehicle, etc.) are shared among and by various stakeholders in the process.
- **Implementation of pilot:** run the pilot for approximately three months; the learnings from the pilot project would be used to further enhance the first- and last-mile connectivity of that corridor.
- **Scaling up:** the learnings from the pilot process will be used as the foundation for wide-scale implementation of similar projects in high-density corridors across the city.

OUTCOMES

- Improved options for first- and last-mile connectivity, creating a better experience for public transport riders.
- Increased public transport use and decrease in private vehicle use.

2. DESIGN AND AMEND POLICY AND REGULATIONS TO PROMOTE NEW MODES OF FIRST- AND LAST- MILE CONNECTIVITY

Design and amend the policies and regulations to enhance the use of new clean and shared first- and last-mile connectivity modes for transportation.

ACTIONS

- **Perform a needs assessment:** Consult stakeholders in an interactive format (e.g., a convening) to identify needs and opportunities for updating existing and developing new policies and regulations that create a supportive ecosystem for shared mobility modes (e.g., pooled ride-hailing services, carpooling, bikesharing, etc.), bringing them into the legal fold when operating in the city. Include key private players such as OEMs and fleet operators and government stakeholders such as BMTC, BMRCL and DULT in the discussion. Through the needs assessment, stakeholders should also discuss key operating parameters, such as fare structure, operating areas, safety, and other general rules for operating in Bangalore.
- **Develop a clean mobility cell:** Develop a cell across government organizations, including those involved in public transport operation and transport policy making. Activities/roles of the cell should include:
  - Developing and implementing policy recommendations and operating guidelines identified in the needs assessment convening and other stakeholder consultation.
  - Serving as a central hub for information on shared mobility—providing a resource for operators to seek information on how to operate legally.
  - Engaging stakeholders to routinely seek feedback on policy and regulations.
  - With appropriate authority, providing guidance and support to private players seeking to obtain operating permits, commercial vehicle registration, parking permits, etc.

OUTCOMES

- Policy guidelines for issues related to legalizing of shared mobility services (bikes and cars) across Bangalore.
- Formation of a clean mobility cell in Bangalore.

Key takeaways & insights from the working group

- There are new services of first- and last-mile connectivity being developed, but they are operating in an ambiguous policy space. Addressing this is a critical step to see their expansion in-line with the sustainable mobility goals of the city and state.
- Collaboration between public and private stakeholders is essential to developing a comprehensive first- and last-mile mobility system in Bangalore. Stakeholders will need to work closely together throughout the process of pilot design, implementation, and scaling. Data sharing and transparency between stakeholders will also be essential to developing an optimized mobility system.

DATA-BASED SOLUTIONS TO ENABLE NEW MOBILITY AND TECHNOLOGIES

Data is a key enabler of optimally planned, efficiently delivered, and well-governed mobility systems for citizens and goods. As Bangalore continues to grow, data will become an increasingly critical component in ensuring that the transportation system meets the needs of the growing population while minimizing negative effects such as congestion and pollution. To this end, the data working group aimed to explore opportunities to use mobility data in manner that improves the mobility choices and experience of citizens. Within this larger theme, the group decided to focus on the sub-question: *How can we unlock mobility data's potential for enabling shared multimodal transportation, particularly as a means of increasing ridership on shared services (including public tranport)?* The group developed and prioritized a set of actions aimed at developing the technical and governance infrastructure to support data sharing across modes of transport, as a means of achieving a significant increase in public and shared mobility ridership in Bangalore.

"Collaboration also requires data. It creates data, as well as requires data because that creates transparency, that creates trust, that creates objectivity to decision making."

— S.D. Shibulal, Infosys and Axilor Ventures Cofounder

IMPLEMENT A DATA GOVERNANCE AND TECHNOLOGY FRAMEWORK

Develop the technical and governance infrastructure to support data sharing across modes of transport.

ACTIONS

- **Form a mobility data council:** This steering committee (mostly provisional in nature) would include representatives from government entities such as DULT, Bangalore Metro Rail Corporation Limited, BMTC, and the Regional Transport Office; private operators; tech enablers; and mobility/data experts. It could be a part of a taskforce or steering committee headed by senior officials of DULT/Smart City initiative in order to ensure interdepartmental coordination. Eventually this council should become institutionalized in a more sustainable way, such as a Section 8 organization.
- **Publish a concept paper:** stakeholders (participants of the data-based solutions group, in collaboration with RMI) would develop a concept/white paper on the required framework for Bangalore's mobility data strategy to present to the Mobility Data Council.
- **Design a pilot:** Design a pilot to test the data sharing framework. Identify a constituency in Bangalore in association with government departments such as BMTC/BMRCL so as to ensure that data points (trip

CONTINUED

CONTINUED

ACTIONS

distance, trip-purpose, average time of travel, origin and destination data) are shared among and by various stakeholders in the process.

- **Implement and test:** run the pilot for approximately six months; the learnings from the pilot project would be used to bolster the framework for Bangalore's mobility data strategy.
- **Create an "open digital infrastructure":** This infrastructure would be created by feeding information and data points from mobility operators such as public transport services (BMTC, BMRCL, Sub-Urban Rails), private services (OLA, Uber, Lithium Urban Technologies, Rapido, Byker, etc.) and other micro-mobility services (YULU, bicycle sharing). The open digital infrastructure would also consume information about charging infrastructures/stations, parking lots, traffic signals and information from Central Business Districts (CBDs) or high footfall areas.

OUTCOMES

- A legally-enshrined policy on data sharing for Bangalore City.
- An institutional body (which could eventually become an industry association or section 8 organization) for maintaining mobility data policy and infrastructure in the long-term.
- The technical infrastructure to enable seamless creation and sharing of data.

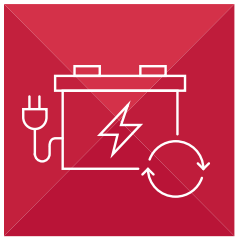
Key takeaways & insights from the working group

- There is a need to move away from the mindset of mobility as a "zero sum" game; there is an opportunity for mobility providers to both collaborate and cooperate. By sharing data and enabling multimodal mobility, the total market for rides can expand for everyone. Providers can generate more rides collectively than by trying to outcompete one another in siloes.
- Instead of focusing on data collection and sharing, there is an opportunity to shift the paradigm to creating an open platform where data is naturally emitted, similar to the Unified Payment Interface.
- Every mobility company (including public transport) needs to consider themselves a data company.

"Data can actually help us plan [land zoning and transportation] – why do people move from one place to another place. If that data can be real-time data and we can build the timeseries for a few years, we can definitely figure out why this travel happens, and should we continue the travel or should we look at different ways of facilitating it...With that we can figure out and try to bring in an ecosystem which can promote need for lesser mobility...If [mobility] needs to happen, we can do it through PT driven, transit-oriented development aspects, then we would come out with a better PT share and better mobility in Bangalore."

— V. Ponnuraj, Commissioner, Directorate of Urban Land Transport

CHARGING AND BATTERY SWAPPING INFRASTRUCTURE



Promoting the adoption of EVs in Bangalore will require the development of a robust battery charging and swapping network. At present, very few charging points exist in Bangalore for use by the public—for example, BESCOM has just recently deployed its first 80 charging stations with 126 charging units.[12] This working group explored how to streamline and scale the deployment of charging and swapping infrastructure in Bangalore. Six key challenges were identified by working group members: lack of industry alignment on standardization of various technology aspects, limited land availability, limited information to support siting of infrastructure, uncertain rate of EV adoption, potentially high capital expenses for grid upgrades, and limited coordination and awareness among various stakeholders. The group prioritized two solutions to address key challenges.

1. CREATE AN ELECTRIC VEHICLE CHARGING AND SWAPPING DATA COLLECTION AND SHARING PROGRAM

Create a standard data collection process to collect EV charging and swapping (public and captive infrastructure for both passenger and goods vehicles) data in a standard format. A third-party nodal agency can aggregate and process the data to understand the optimal planning for charging and swapping network expansion over time. Data can be anonymized to help all stakeholders understand how chargers are used by various use cases and customer classes and where charging is required. Understanding where and how chargers are and will be used in the future helps both the distribution utility and the EV infrastructure providers plan for expansion in a data-driven way.

ACTIONS

- **Identify a nodal agency** who will facilitate the data program. BESCOM is already a nodal agency for collecting data and has the potential to also be the agency for processing and sharing data.
- **Create a working group** of all data providers and users, including organizations with public and captive infrastructure. The working group will be responsible for determining what data can and will be shared and what will remain intellectual property; how the data can and will be used; and designing the data sharing program. The working group should collaborate with the BESCOM EV working group.
- **Create a multi-functional team** as part of the working group to organize and design the pilot; include policy, technology, and legal experts.
- **Design and implement a standard protocol** for data collection in charging infrastructure and create a centralized, secure data management platform that all parties trust.
- **Launch the program** and use the BESCOM-mandated data collection (to get an EV tariff) to ensure all parties participate and that all parties benefit equally.
- **Run the first year of data collection** and begin using key insights from data collection to inform system planning for land use, power sector, fleet operator planning, etc.

OUTCOMES

- Demonstrate how data sharing and transparency can help mitigate business and investment risk across all stakeholders.
- Generate information that will support better land use and DISCOM planning.
- Improve the quality of products and services offered for EV charging and battery swapping.
- Foster collaboration and communication between all stakeholders.

2. ESTABLISH AN ELECTRIC VEHICLE INFRASTRUCTURE PILOT FOR MULTIPLE VEHICLE USE CASES

Create a use case-differentiated pilot of charging and swapping stations for upwards of 1,000 EVs, with a focus on electric two-wheelers (shared, fleet, and delivery), three-wheelers (fleet and delivery), and four-wheelers (fleet).

ACTIONS

- **Constitute a high-powered nodal body** to coordinate. BESCOM is the nodal body for all charging infrastructure activities; work with this body and empower it.
- **Work with nodal body to review and potentially revise tariffs** to create a supportive and equal playing field for charging and battery swapping. Allow demand aggregation for charging and swapping station providers to allow them to avail open access (wholesale) for renewables if they meet the requirements. Coordinate with the Karnataka Electricity Regulatory Commission (KERC).
- **Undertake land allocation and planning measures** such as selecting green zones; utilizing lands outside public spaces like universities, building complexes, IT parks, etc.; enabling charging and swapping infrastructure at underutilized land at metro stations, distribution utility outlets, bus stands, etc.
- **Incentivize entrepreneurs** through university-led education and incubation spaces, government/private sector-driven seed and early-stage funding, collaboration and communication space and sharing of resources among entrepreneurs, etc.
- **Ease regulation on transportation of charged batteries** to enable experimentation with a “hub and spoke” model for battery swapping stations.
- **Ease regulations around efficiency of transformers** to reduce the costs of transformers.

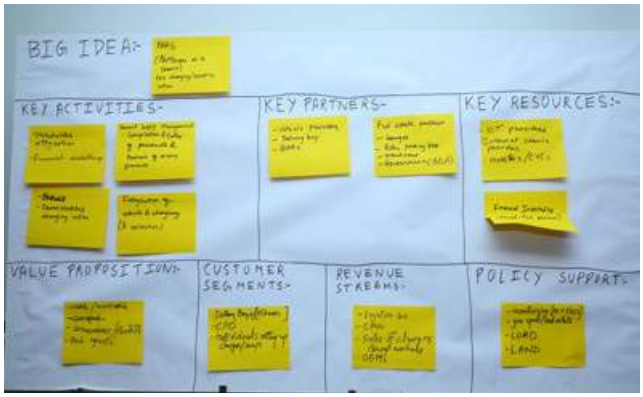
OUTCOMES

- Improve the quality of products and services by testing user experience with different charging and swapping options.
- Generate information required for urban planning; data sharing between charging and swapping service providers will help optimize siting and co-location of infrastructure.
- Generate information required for power system planner. Assess potential feeder level impact on grid of new infrastructure and how to optimize.
- Assess ways to optimize the use of infrastructure and land especially within the Bangalore context.

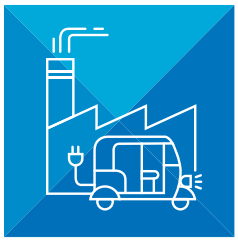
Key takeaways & insights from the working group

- There is a need to further discuss and come to a consensus on the role DISCOMs will play in various vehicle charging use cases (e.g., tracking EV registrations, paying for various grid upgrade requirements, providing data to charging network operators). How proactive or reactive should DISCOMs be as vehicle charging load increases?
- Data will become very valuable as it becomes available, and is a key theme and requirement across many working groups. It will be critical for the entire ecosystem to work together to put in place the framework to collect, share, and utilize that data.
- BESCOM as a nodal agency for all matters related to charging means that there can be a good channel to streamline implementation of projects.

> *"The convergence of new business models, new technologies, and India's state of development present an opportunity for a new system to take hold."*
>
> *— Shreyas Shibulal, Founder and Director, Micelio*



ELECTRIC VEHICLE MANUFACTURING AND SUPPLY CHAIN



Electric vehicles are a relatively nascent and rapidly evolving industry. Although the total number of components in an EV are far fewer than in a traditional internal combustion engine vehicle, the capability to design, develop, manufacture, and scale EV production is at an early stage. At present, many firms are skipping research and development in favor of importing EV components, which is stagnating innovation and resulting in EVs that are not always well-suited to Indian needs and conditions.

Developing local manufacturing capabilities and supply chain will be critical for India and Karnataka to see significant adoption rates of EVs and could establish export opportunities both for vehicles and components. The working group explored policy- and market-led opportunities across both supply and demand sides to promote the development of EV manufacturing and a supply chain in Karnataka.

1. DEVELOP AN ECOSYSTEM THROUGH A SUPPLY-SIDE POLICY FRAMEWORK

Supply-side policy frameworks can support innovation and ease of doing business in the EV ecosystem for both startups and established players. These frameworks can be designed to complement the provisions in the Karnataka Electric Vehicle and Energy Storage Policy of 2017.

ACTIONS

Policies to support pre-operations
Including research and development and manufacturing policy

- **Implement single window clearance** to expedite approval and permission processes for manufacturing facility setup. Aim for 15 days to 3 months turnaround.
- **Fund research at the university level** to support innovation in the EV ecosystem. Offer research grants for universities and other organizations to focus on research and development (R&D). For example, the group recommended creating a Rs 20-crore fund, where Rs 1 crore grants can be awarded to 20 universities on an annual basis.
- **Implement skilling and re-skilling programs,** aiming for 10,000 industry-ready engineers across mechanical, electrical, and digital technology in two years.

Policies to support mid-operations
Including mechanisms to foster a startup ecosystem

- **Consider incentive allocations** to foster a startup ecosystem in addition to established players in a way that manages the investment risk for government.

Policies to support post-operations
Including battery second life and supporting policies

- **Create a battery end-of-life policy** that includes provisions for recycling, reusing, repurposing, and second life requirements, as well as penalties for dumping and disposal.

OUTCOMES

- Karnataka as an EV manufacturing hub: improving the performance of vehicles to accelerate adoption.
- Karnataka as a technology hub for electric mobility: creation of a services industry for diagnostics, analytics, after-market applications (leveraging existing IT infrastructure and talent).
- Increased availability of EV models that compete with internal combustion engine (ICE) vehicles, offering consumers choice and hence increasing demand for EVs.

2. ESTABLISH A COMMON PARTS PLATFORM

Align on common, simple, and potentially non-competitive parts of sub-systems which can be agreed upon by a section of the EV community.

ACTIONS

- **Develop an open source catalog** for sharing non-competitive EV parts and processes amongst the EV startup community. This can be managed by EV startups and other participating organizations.
- **Promote joint development of technology** and agree on using common parts in small volunteer groups. These small groups of volunteers can combine in the future to represent the majority of the EV community, paving the way for a democratic standardization of parts and sub-systems made in India.
- **To further foster a startup ecosystem in Bangalore, consider the following:**
  - Developing shared spaces for offices and component/vehicle manufacturing and testing.
  - Allowing for a consortium of startups to apply to a tender together. Their collective experience, knowledge, and volume could meet tender requirements.
  - Prove the concept through a pilot—for example, a consortium of startups can operate 500 scooters at BMRCL metro stops.

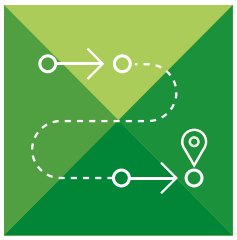
OUTCOMES

- Achieve minimum common specifications (similar to Android phone, for example).
- Domestically produced and available EV parts.
- Create increased demand and acceptance of EVs, leading to the overall growth of India's EV ecosystem.
- Reduce cost through aggregated demand.

Key takeaways & insights from the working group

- Karnataka's current EV policy is supportive of manufacturing of EVs and components. An opportunity exists to build on this policy foundation to support innovation through the startup ecosystem and create a balance of local manufacturing measures with local demand creation measures. A positive outcome would be vehicles manufactured in Karnataka being operated both within and beyond Karnataka.
- Bangalore's existing IT prowess and spirit of innovation make it well-suited to developing a robust R&D ecosystem for EVs.

URBAN FINAL-MILE DELIVERY



Freight transport—the movement of goods—is a critical component of the overall transportation ecosystem. In the movement of goods from their source of production to an individual consumer, the last miles of this process is called final-mile delivery—i.e., delivering from a transportation hub to a final destination. Final-mile delivery is a primary contributor to congestion and local air pollution in urban environments. Final-mile delivery—including use cases like food and parcel delivery—is critical to a healthy economy and will become increasingly so as India's online retail market grows. Bangalore in particular is a hub for the e-commerce market. This working group focused on opportunities for promoting the electrification of last-mile urban deliveries in Bangalore. The group prioritized two solution areas that can accelerate this transition: deployment of charging infrastructure and innovative business models.

1. IMPROVE CHARGING AND SWAPPING INFRASTRUCTURE FOR FINAL-MILE DELIVERY

Improve battery charging and swapping (physical and technical) infrastructure by integrating EV routing and performance with charging and swapping infrastructure and developing a digital platform that compiles locations and specifications of available charging and swapping stations in the city.

ACTIONS

EV charging information aggregation

- **Compile reviews of products:** review all available charging infrastructure products on the market and compile a comprehensive database as a resource for customers looking to install charging infrastructure.
- **Review existing services/ infrastructure:** map and review all existing charging and battery swapping infrastructure, including information such as type of infrastructure, number of charge points, etc.
- **Aggregate information on a single platform:** create an easy-to-use and access platform (e.g., an app) aggregating the information on charging products and existing charger locations to allow drivers and consumers to more easily make decisions around what products to install and locate nearby charging points.

Improving battery swapping infrastructure

- **Analyze routes:** use vehicle telematics data to understand current behavior patterns of last-mile goods transport vehicles.
- **Map demand hotspots:** based on vehicle patterns, analyze the optimal locations for the placement of battery swapping stations (e.g., at frequent drop-off locations such as warehouses, where vehicles would be spending time unloading goods).
- **Assess vehicle performance:** monitor battery performance characteristics (e.g., range, efficiency, etc.) in vehicles to determine optimal specifications for batteries available at the swapping stations, as well as how many spare batteries are needed at the swapping stations.

OUTCOMES

- A comprehensive catalogue of charging infrastructure products and existing locations in Bangalore.
- An optimized network of battery swapping infrastructure based on system needs.
- Reduced range anxiety and increased vehicle utilization.

2. ENABLE USE OF EVs FOR FINAL-MILE DELIVERY THROUGH SMALL AND MEDIUM ENTERPRISES (SMEs) ACTING AS MICRO-HUBS FOR STORING EVs AND GOODS

Enable individual delivery drivers to switch to EVs by addressing the barrier of the high upfront cost. A franchiser would lease or buy EVs, partner with logistics providers and e-commerce companies interested in reducing warehouse costs, partner with SMEs to store the vehicles and goods, provide charging station access, and recruit drivers to rent the vehicles on a per-day basis for making deliveries.

ACTIONS

- **Identify partner SMEs:** Select locations, such as shops or restaurants, which would be optimal hubs to support final-mile delivery patterns. Pitch the benefits of the program in bringing increased foot traffic to stores. SMEs would be asked to store vehicles in front of the stores as well as a small amount of goods for delivery.
- **Lease or buy vehicles from OEMs:** pilot will focus on two-wheeler because of ease of storage and faster charging times, with the possibility of expanding to additional vehicle types.
- **Partner with logistics providers and e-commerce companies:** Logistics providers and e-commerce companies will provide routes to the individual drivers for making deliveries. Pitch the benefits to e-commerce and logistics companies of reducing warehouse costs by using SMEs to stage deliveries.
- **Promote program to individual drivers:** Work with logistics providers and driver aggregation platforms and target independent delivery drivers who use their own vehicles for goods delivery. Highlight the benefits of reduced operational costs by using EVs.

OUTCOMES

- Individual delivery drivers are able to switch to EVs because of reduced upfront investment.
- Reduced per-kilometer operational costs for drivers (relative to internal combustion engine vehicles).
- Increased revenue for SMEs due to increased foot traffic.
- Reduced warehousing costs for e-commerce and logistics companies.

"Sharing data can have a whole lot of advantages in terms of operational integration."

— Ajay Seth, Managing Director, Bangalore Metro Rail Corporation

Key takeaways & insights from the working group

- There is a need to develop affordable, fit-for-purpose vehicles designed specifically for last-mile deliveries in Indian cities.
- There is a need for new and improved business models for last-mile delivery, including better financing models, more comprehensive and flexible leasing models, and increased investment in innovative technologies.
- The transition to electrified last-mile delivery depends on the development of an affordable and accessible charging and battery swapping network.

"Electric vehicles should be encouraged for transporting goods...We need to see that our OEMs now start looking at goods vehicles in electric mode. Small and large delivery trucks will play an important role. Technology for high storage electricity and goods vehicles ought to be the need of the hour."

— Bhaskar Rao, Commissioner, Bangalore City Police

Organizers, partners, and panelists from the Bangalore Urban Mobility Lab February 2020 workshop.

THE PATH FORWARD

The Urban Mobility Lab is an ongoing initiative designed to continually provide an open forum for collaborative discussion and action. The critical discussions that took place on 19–20 February 2020 and the solutions that were developed and prioritized by working groups are an initial step in the Urban Mobility Lab process, with the long-term goal of establishing Bangalore as a leader in shared, clean, and citizen-centric mobility.

Moving forward, RMI and Micelio, in consultation with the government departments will work with stakeholders to help advance a select portfolio of the mobility solutions generated on 19–20 February 2020. RMI and Micelio are committed to helping Bangalore deploy mobility solutions such as these through actions including:

> **Supporting policy, process, and project development:** RMI, in collaboration with partners and other stakeholders, will work to support ongoing policy development, process improvement, and project deployment to accelerate the implementation of mobility solutions.

> **Hosting follow-up convenings:** to engage stakeholders in reviewing/designing new processes and action plans, collecting feedback on policies, and educating stakeholders about new developments, RMI and partners will continue to host stakeholder consultations related to shared, clean, and citizen-centric mobility.

> **Supporting the implementation of mobility solutions:** RMI and partners will support stakeholders in coordinating with relevant agencies and each other with respect to implementation activities.

> **Tracking and reporting on progress:** RMI will collect data related to the deployment of solutions and progress towards a shared, clean, and citizen-centric mobility to share the learnings with a broader city network beyond Bangalore.

> **Documenting and sharing lessons learned:** Regular updates with insights related to solution implementation will help stakeholders track progress, understand what is working well, and adjust where appropriate. This will also allow for the eventual scaling of solutions beyond Bangalore.

Realizing India's potential for accessible, reliable, and citizen-centric transportation while minimizing externalities such as air pollution and congestion will take continued commitment and engagement on the part of all stakeholders in the ecosystem. The inaugural workshop of the Urban Mobility Lab in Bangalore demonstrated the enthusiasm and dedication of Bangalore's transportation stakeholders to this cause; the effective implementation of these and other mobility solutions will require the continued commitment and collaboration of many stakeholders. Through the activities outlined above, mobility solutions can be deployed and scaled in Bangalore, leading to safe, reliable, and efficient transportation for citizens and further elevating Bangalore as an example for other cities to follow in their mobility transitions.

"We need to prioritize who gets the right of way first – people or vehicles. We are trying to focus on the concept of moving people rather than vehicles."

— V. Ponnuraj, Commissioner, Directorate of Urban Land Transport

Do you want to learn more about the Urban Mobility Lab or get involved? Please contact RMI India at info.india@rmi.org.

APPENDIX

Workshop participants

Opening session speakers

- Mr. Shreyas Shibulal, Founder and Director, Micelio
- Mr. Ravichandar, Mobility Expert
- Mr. R.K. Misra, Scholar at Carnegie India and Cofounder, YULU Bike
- Ms. Aneesha Nayak, Motivational speaker

Government organizations whose members provided real-time coaching and feedback for working groups

- Bangalore City Police
- Bangalore Development Authority
- Bangalore Electricity Supply Company Limited
- Bangalore Metro Rail Corporation Limited
- Bengaluru Metropolitan Transport Corporation
- Commerce and Industries
- Directorate of Urban Land Transport
- Karnataka State Road Transport Corporation

Closing session panel

- Mr. Ajay Seth, Managing Director, Bangalore Metro Rail Corporation Limited
- Mr. Tejasvi Surya, Member of Parliament
- Mr. Bhaskar Rao, Commissioner of Police, Bangalore City Police
- Mr. Gaurav Gupta, Principal Secretary, Transport and Commerce and Industries
- Mr. V. Ponnuraj, Commissioner, Directorate of Urban Land Transport
- Ms. C. Shikha, Managing Director, Bengaluru Metropolitan Transport Corporation
- Shreyas Shibulal, Founder and Director, Micelio
- S.D. Shibulal, Infosys and Axilor Ventures Cofounder
- Pramod Varma, Chief Technical Officer, EkStep Foundation

Organizations

- Aapti Institute
- Adarin Engineering Technologies Private Limited
- AEEE
- All India Federation
- Altigreen Propulsion Labs Private Limited
- Autovert Technologies Private Limited
- Azoen Ventures
- Bangalore Political Action Committee
- Beckn Mobility
- Bounce
- BTP
- BuymyEV Technology Private Limited
- Bykerr
- C40
- Calam
- Chalo
- Chara Technologies Private Limited
- Chargezone
- Citizens for Bangalore
- Climate Policy Initiative
- Center for Study of Science, Technology and Policy
- Elements Energy
- Energy Efficiency Services Limited
- Energy Systems Catapult Ltd.
- Ezy Mov Solutions Private Limited
- Fosun RZ Capital
- GIZ (Deutsche Gesellschaft Fur Internationale Zusammenarbeit)

- Global Strategic Communications Council
- Hero Electric Vehicles Pvt. Ltd
- Indian Institute of Science - Center for infrastructure, Sustainable Transportation & Urban Planning
- JBM Renewables Pvt. Ltd.
- Kongsberg Digital India
- Lithium Urban Technologies
- Mahindra Electric Mobility Limited
- Micelio Mobility Private Limited
- MobilityData
- Nilekani Philanthropies
- Numocity Technologies Private Limited
- Ola Electric Mobility
- Ola Mobility Institute
- Pepride Travel Solutions Private Limited
- PHYTEC
- Quick Ride
- Rapido Technologies Private Limited
- Replus Engitech Private Limited
- Revos Auto Tech
- Shigan Evoltz Limited
- Shuttl
- Smartshift Technologies Private Limited
- SUN Mobility
- Swiggy
- Swissnex India – Consulate General of Switzerland
- Tata Motors Limited
- Tata Trusts
- The British Petroleum Company
- The Climate Group
- The Energy and Resources Institute
- Transportation Research Group of India
- TresMoto
- Truck Easy
- Union Internationale des Transports Publics
- UrbanMorph
- V2 Advisory group
- ValetEZ services Private Limited
- Vidyutm Mobility
- World Business Council for Sustainable Development
- World Resources Institute
- Yulu Bikes Private Limited
- Zoomcar India Private Limited

ENDNOTES

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