Localizing the EV Value Chain in Chhatrapati Sambhajinagar

Enabling MSME Readiness for the Automotive Technology Transition

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List of Abbreviations

AAT	Advanced Automotive Technology
ACMs	Auto Component Manufacturers
ACDRI	Auto Cluster Development and Research Institute
AIS	Automotive Industry Standards
APQP	Advanced Product Quality Planning
ARAI	Automotive Research Association of India
ASDC	Automotive Skills Development Council
AURIC	Aurangabad Industrial City
BLDC	Brushless DC
BMS	Battery Management System
BoM	Bill of Materials
CAGR	Compound Annual Growth Rate
CFC	Common Facility Center
CIPET	Central Institute of Petrochemicals Engineering & Technology
CMIA	Chamber of Marathwada Industries & Agriculture
CNC	Computer Numerical Control
CSN	Chhatrapati Sambhajinagar
CTP	Cluster Transition Plan
CY	Calendar Year
DECPL	Deogiri Electronics Cluster Private Limited
DIC	District Industries Centres
DMIC	Delhi Mumbai Industrial Corridor

DVA	Domestic Value Addition
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EMS	Electronics Manufacturing Services
EOL	End-of-Life
EV	Electric Vehicle
FAME	Faster Adoption and Manufacturing Hybrid and Electric Vehicles
FGD	Focused Group Discussions
GDP	Gross Domestic Product
GSDP	Gross State Domestic Product
HV	High Voltage
ICE	Internal Combustion Engine
ISO	International Organization for Standardization
ITI	Industrial Training Institutes
KII	Key Informant Interviews
MAC	Marathwada Auto Cluster
MAGIC	Marathwada Accelerator for Growth and Incubation Council
MIDC	Maharashtra Industrial Development Corporation
MSME	Micro, Small and Medium Enterprises
MSME-DI	Micro, Small and Medium Enterprises- Development Institute
NATRIP	National Automotive Testing and R&D Infrastructure Project
NSIC	National Small Industries Corporation
OEMs	Original Equipment Manufacturers
PPAP	Production Part Approval Process
PCB	Printed Circuit Board
PM E-Drive	PM Electric Drive Revolution in Innovative Vehicle Enhancement
PLI	Production Linked Incentive
PMP	Phased Manufacturing Programme
QC	Quality Control
REESS	Rechargeable Energy Storage System
R&D	Research and Development
SMT	Surface Mount Technology
VDP	Vendor development program

Executive Summary

The Strategic Imperative:

Chhatrapati Sambhajinagar, formerly Aurangabad, stands at a crucial industrial crossroads. As a mature automotive hub hosting over 1,648 micro, small and medium enterprises (MSMEs) and employing a workforce of 30,000+, the region's economic foundation is built on precision engineering for internal combustion engines (ICE). However, the global and national shift toward electric vehicles (EVs) presents a dualistic reality: an existential threat to legacy units heavily dependent on ICE powertrains(where 45-84% of parts face obsolescence) and a transformative opportunity to reindustrialize as India's "EV Capital".

Driven by massive investments in the Aurangabad Industrial City (AURIC), including marquee projects by Toyota, JSW and Ather Energy, the demand for localized EV supply chains is surging. This report outlines a "Just Transition" strategy to bridge the capability gap, ensuring that local MSMEs do not just survive this disruption but emerge as competitive Tier 1 and Tier 2 suppliers in the global EV value chain.

Diagnostic Findings:

Stakeholder consultations and diagnostic studies revealed critical structural barriers inhibiting an immediate transition:

Technological asymmetry:

While Chhatrapati Sambhajinagar excels in mechanical precision (gears, forging), it lacks "mechatronic" capabilities. MSMEs struggle with the Bill of Materials (BoM) shift from moving parts to power electronics and battery systems.

Skills mismatch:

The existing workforce is highly skilled in mechanical operations but critically undertrained in high voltage (HV) safety, battery chemistry and embedded systems.

Infrastructure deficit:

The cluster lacks accessible, affordable testing infrastructure for EV-specific validation (e.g., motor dynamometers, battery cyclers), forcing MSMEs to rely on distant, expensive facilities.

The core of the proposed strategy is the Cluster Transition Plan (CTP), a phased roadmap built on three foundational pillars:

Pillar I:

Workforce technical skilling: Developing a skilled workforce capable of manufacturing, assembling and testing EV components safely and to quality standards

Pillar II:

Market access: Systematically connecting upgraded MSME capabilities with the qualification requirements of OEMs and Tier 1 suppliers through structured vendor development programs (VDPs)

Pillar III:

Common infrastructure: The transformation of the DECPL Common Facility Centre (CFC) into an EV-ready Testing Hub, providing shared access to prototyping and validation equipment, thereby lowering the barrier to entry for innovation

The Phased Transition Roadmap (2025–2030)

This report proposes a high-velocity, three-phase roadmap designed to mobilize the ecosystem and gradually transfer governance to local institutions.

Phase 1:
Immediate actions (0-1 year) - The mobilization phase

- Focus: Diagnostics, Awareness and "Quick Wins"
- Key activities: Conducting "E-BoM Workshops" to map ICE competencies to EV needs; identifying "High Potential" MSMEs; launching financial literacy clinics

Phase 2:
Short-to-medium term (1-3 years) - The operationalization phase

- Focus: Capability building and piloting
- Key activities: Establishing "Micro-Factory" pilot cells for agile manufacturing; upgrading DECPL infrastructure with EV test rigs; executing formal VDPs with Tier 1s

Phase 3:
Medium-to-long term (3-5 years) - The autonomy phase

- Focus: Innovation, scale and global integration
- Key activities: Establishing an indigenous R&D Innovation Center; integrating MSMEs into global export chains; transitioning full governance from knowledge partners to local industry associations (MAC/CMIA)

Conclusion:

This report serves as a blueprint for industrial resilience. By synchronizing policy tailwinds, infrastructure upgrades and targeted skilling, Chhatrapati Sambhajinagar can navigate from a legacy auto hub to a thriving, future-ready EV ecosystem. The success of this plan lies in the collaborative execution by industry, government and knowledge partners and ensures no MSME is left behind.

Chapter 1

Introduction

India's automobile industry is at a turning point, moving from traditional, fossil-fuel-powered vehicles to a more sustainable mobility system. The sector has long supported the industrial growth and economy of the country. In 2023, the automotive sector made up about 7.1% of India's gross domestic product (GDP) and 49% of that of the manufacturing sector.[1]

> **The industry also provides jobs for around 30.7 million people, with 13.7% in direct and 86.3% in indirect jobs across manufacturing, services and supply chains.[2]**

It is the third largest employer in manufacturing, next to food products (11.05%) and textiles (9.64%), accounting for 9.58% of the jobs in the sector.[3]

The Indian automobile industry spans a wide range of segments, including two-wheelers, three-wheelers, passenger vehicles, commercial vehicles and auto components manufacturing. During the period 2015-2025, the industry has grown in both size and technology, fueled by demand at home and abroad.

Electric vehicles (EVs), especially two- and three-wheelers, are becoming more common. By 2024, India had over 5.6 million EVs. In 2023, about 1.6 million EVs were sold in India, and in 2024, sales rose to over 2 million, a 24% increase. In calendar year 2025, EVs accounted for about 8.07% of the vehicle market, an increase from 7.47% in CY2024 and 6.38% in CY2023.[4]

Within this broader national shift, Maharashtra has emerged as one of the most important states in automotive manufacturing. The automobile sector contributes nearly 7% to the gross state domestic product (GSDP) and accounts for over 15% of its industrial output.[5] Maharashtra hosts several established automotive clusters, including Pune, Nashik, Chhatrapati Sambhajinagar, Mumbai and Nagpur. The state also benefits from strong institutional support through organizations such as Automotive Research Association of India (ARAI) and Auto Cluster Development and Research Institute (ACDRI), which play an important role in automotive research and development (R&D), testing, certification and development of micro, small and medium enterprises (MSMEs).[6]

India has set an ambitious target of achieving 30% EV penetration in new vehicle sales by 2030, supported by a combination of demand- and supply-side policy measures.

1. NITI Aayog. (2025). Automotive industry: Powering India's participation in global value chains (Non-confidential version). Government of India. Retrieved from https://www.niti.gov.in/sites/default/files/2025-04/Automotive-Industry-Powering-India-participation-in-GVC_Non-Confidential.pdf
2. Ministry of Statistics and Programme Implementation. (2023). Annual Survey of Industries 2021–22: Volume I. Government of India. Retrieved from https://mospi.gov.in/sites/default/files/publication_reports/ASI%20Volume%20I%202021-22%20%20Final
3. Department of Heavy Industry. (2023). Annual report 2022–23. Ministry of Heavy Industries, Government of India. Retrieved from https://heavyindustries.gov.in/sites/default/files/2023-09/heavy-annual-reports_eng-hindi-web.pdf
4. JM Research & Analytics. (2025). India's electric vehicle sales crossed 2 million in CY2024. Retrieved from https://jmkresearch.com/indias-electric-vehicle-sales-crossed-2-million-in-cy2024/
5. iFOREST. (2024). Navigating the shift: Maharashtra automobile sector (Summary report). Retrieved from https://iforest.global/wp-content/uploads/2024/04/Summary-Navigating-the-shift-Maharashtra-Automobile-Sector.pdf
6. Maharashtra Industry, Trade and Investment Facilitation Cell (MAITRI). (n.d.). Auto and auto component ecosystem. Government of Maharashtra. Retrieved from https://maitri.mahaonline.gov.in/PDF/Auto%20and%20Auto%20Component%20Ecosystem.pdf

Schemes such as Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME I and FAME II) have focused on accelerating consumer adoption, while manufacturing-oriented initiatives such as the production linked incentive (PLI) scheme and phased manufacturing programme (PMP) aim to strengthen domestic EV and auto component production. In parallel, 33 states and union territories have notified or approved EV policies to promote local manufacturing, investment and infrastructure development.

Alongside these domestic policies, broader geopolitical and structural shifts are reshaping global trade and manufacturing patterns. Despite the ongoing uncertainties, global trade is projected to expand, from approximately USD 33 trillion in 2024 to USD 42–45 trillion by 2035.[7] These shifts have had a direct impact on the automotive and auto component industry, with global Original Equipment Manufacturers (OEMs) reassessing supply chains and seeking more resilient and cost-competitive sourcing destinations. In this unstable period, automotive players too are increasingly diversifying their supply chains, creating opportunities for India-led corridors to emerge as resilient global trade routes in the years ahead.

The realignment is already reflected in the performance of India's auto component sector, which has recorded a compound annual growth rate (CAGR) of around 10% over the past five years, driven by both domestic demand and rising exports. Looking ahead, the industry is projected to reach nearly USD 200 billion by 2030.

Two parallel growth drivers are expected to shape this trajectory: first, an estimated USD 20-30 billion export opportunity in internal combustion engine (ICE) components as global markets consolidate the existing supply chains; and second, strong growth in EV components, supported by an estimated 35% CAGR in domestic EV sales, aligned with accelerating global electrification and technology adoption.[8]

Together, these trends create a significant window for Indian auto component manufacturers to strengthen their presence in both domestic and international EV value chains. This shift is also beginning to influence the geography of manufacturing within the country. As EV technology advances, new industrial clusters outside the usual ICE-focused areas are emerging.

7. McKinsey & Company. (2025, June 18). A new trade paradigm: How shifts in trade corridors could affect business. Retrieved from https://www.mckinsey.com/~/media/mckinsey/business%20functions/geopolitics/our%20insights/a%20new%20trade%20paradigm%20how%20shifts%20in%20trade%20corridors%20could%20affect%20business/a-new-trade-paradigm-how-shifts-in-trade-corridors-could-affect-business.pdf?shouldIndex=false

8. Chhibber, B., Dhawan, R., Gupta, S., & Singhal, S. (2025, November 12). Shaping the future of India's auto component industry amid global trade shifts. McKinsey & Company. Retrieved from https://www.mckinsey.com/~/media/mckinsey/industries/automotive%20and%20assembly/our%20insights/shaping%20the%20future%20of%20indias%20auto%20component%20industry%20amid%20global%20trade%20shifts/acma_report.pdf

Both established companies and newcomers are setting up production units in locations such as Chhatrapati Sambhajinagar, Sanand and Hosur, opening new opportunities for the industry and local economies.

MSMEs in the automotive sector are at a critical juncture as the market shifts from ICE vehicles toward EVs. While government incentives, such as PLI schemes and state-level rebate schemes, have stimulated growth in two- and three-wheeler segments, passenger vehicles continue to lag due to higher upfront costs and persistent range anxiety among consumers. The uneven development of charging infrastructure dominated by urban corridors and peri-urban and rural areas being left underserved further exacerbates consumer hesitation, particularly for long-distance travel.

Technology and supply chain issues also pose significant challenges. Most automotive MSMEs lack sufficient funds or R&D expertise to develop EV technologies such as advanced battery management systems and power electronics. Price swings in lithium, cobalt and rare-earth elements, along with global supply risks, make things harder for small suppliers. Depending on a few big battery cell makers also weakens MSMEs' bargaining power and makes them more vulnerable to supply problems.

Limited financial capacity and workforce constraints continue to slow the transition of MSMEs toward electrification. Banks and formal financial institutions remain wary of financing EV-related investments due to long payback periods and uncertainties associated with relatively new and evolving technologies, including changing product designs, limited performance track records and evolving regulatory and safety standards. As a result, many MSMEs face difficulties in accessing capital for machinery upgrades, testing facilities and process modernization. While big EV startups attract venture capital, smaller suppliers struggle to secure funding for new equipment and training. Retraining workers with ICE backgrounds in high-voltage safety, battery diagnostics and software is both time-consuming and expensive, creating skill gaps that affect after-sales and maintenance services.

Automotive MSMEs also face challenging requirements when setting up and running EV-specific infrastructure. Small businesses often cannot achieve the scale needed to make these investments affordable. For example, cell-testing clusters require costly equipment and must meet strict global standards, such as UN 38.3 and IEC 62133. If these resources are underused, the cost per test can exceed what MSMEs can afford, leading them to rely on external labs rather than conduct tests in-house.

Building a reliable battery management system (BMS) in-house is complex. It requires skills in embedded software to handle cell balancing, thermal modeling, firmware updates and safety protocols that meet ISO 26262 and ISO 21434 standards. Only a few small-sized R&D teams have these abilities. Common Facility Centres (CFCs) are meant to support testing and analysis, but in practice, they often fall short. Complicated booking systems, long calibration times and central locations can create extra costs and paperwork, at times outweighing any benefits from subsidies.

Finally, new and changing regulations, such as fire safety rules, periodic retesting, and recycling requirements, mean MSMEs must continually update their testing methods, data systems and staff skills. This puts a strain on both their finances and people. These combined challenges show that moving from ICE to EV production is not just about changing engines, but about overhauling technical skills, infrastructure and compliance processes.

1.1. Purpose of Cluster Transition Plan

The cluster transition plan (CTP) sets out a practical, phased roadmap to enable MSMEs in the Chhatrapati Sambhajinagar automotive cluster to transition from ICE-centric production to electric mobility value chains, while remaining competitive. This is done by sequencing capability building (skills and quality), compliance readiness (standards and testing) and commercial linkage (vendor development and finance), so that MSMEs can qualify for EV business with nearby buyers and within state/national policy windows.

Three elements make this moment critical. First, EV-oriented industrial infrastructure is expanding next door. The Aurangabad Industrial City (AURIC) Shendra–Bidkin node under Delhi-Mumbai Industrial Corridor (DMIC) explicitly targets EVs/automotives and has begun attracting investments with the promise of plug-and-play facilities and strong logistics, creating a localization pull for components and sub-systems that cluster MSMEs can serve.[9] Second, policy incentives have shifted. FAME II ended on March 31, 2024. EMPS 2024 was implemented as a short bridge for electric two-wheelers/electric three-wheelers (April–July 2024),[10] while in late 2024, the Government of India notified the PM E-DRIVE scheme (a two-year support covering EVs and public charging/testing). Meanwhile, the PLI-AUTO scheme continues to reward advanced automotive technology (AAT) localization. All these together shape demand/supply conditions that favour ready MSMEs.[11] Third, standards are tightening, notably AIS156 and related safety/traceability requirements for L-category EVs and rechargeable energy storage system (REESS) raising the bar on design controls, testing and documentation, which most MSMEs cannot meet on their own and without shared infrastructure and structured upskilling.[12]

Vision:

This report envisions the cluster evolving into a thriving EV ecosystem with modern products, skilled labor and a robust supporting infrastructure. In an ideal future, small manufacturers will co-design EV components and services and workers will benefit from new, higher-value jobs. This is consistent with a "just, equitable and inclusive" EV transition pathway for Maharashtra's MSMEs.[13] To achieve this vision, a transition plan has been developed around three core pillars that leverage the cluster's existing strengths and key stakeholder concerns identified in consultations.

9. National Industrial Corridor Development Corporation (NICDC). (n.d.). Aurangabad Industrial City (AURIC), Maharashtra. Retrieved from https://www.nicdc.in/projects/4-projects-developed/aurangabad-industrial-city-auric-maharashtra
10. The Times of India. (2024, March 31). FAME II e-mobility scheme ends as Rs 500 crore EMPS 2024 kicks off on April 1; segment-wise outlay, benefits. Retrieved from https://timesofindia.indiatimes.com/auto/news/fame-ii-e-mobility-scheme-ends-as-rs-500-crore-emps-2024-kick-starts-on-april-1-segment-wise-outlay-benefits/articleshow/108939731.cms
11. Department of Heavy Industry. (n.d.). PLI scheme for automobile and auto component industry. Ministry of Heavy Industries, Government of India. Retrieved from https://www.heavyindustries.gov.in/pli-scheme-automobile-and-auto-component-industry
12. Ministry of Road Transport and Highways. (n.d.). AIS-156: Automotive industry standard for electric powertrain vehicles—Battery safety requirements. Retrieved from https://morth.nic.in/sites/default/files/ASI/AIS-156.pdf
13. WRI India. (n.d.). Pune convening highlights strategies for an equitable EV transition in Maharashtra's auto sector. Retrieved from https://wri-india.org/news/pune-convening-highlights-strategies-equitable-ev-transition-maharashtras-auto-sector

1.2.Core Pillars

Pillar 1:

Technical Skilling (Capability)

Objective:

Build a stacked skilling pathway from foundational EV awareness to advanced modules, so MSME shops can safely manufacture, assemble and test EV powertrain components, including various sub-systems, while adhering to EV-specific quality and safety standards. The curricula will be informed by identified shifts in technical competencies between ICE and EV roles and the emergence of new job profiles and will be co-developed with various agencies, including Automotive Skills Development Council (ASDC), Industrial Training Institutes (ITIs) and polytechnics. Delivery will be anchored through work-integrated apprenticeships in collaboration with anchor manufacturing plants in the region.[14,15]

What changes on the shop floor: Operators and quality control (QC) staff learn battery/REESS safety, traceability and BMS protections; maintenance teams learn high-voltage safety and diagnostics; supervisors integrate process controls that anticipate AIS156 audits; and production planners embed defect prevention and documentation practices aligned with buyer qualification.[16,17]

Pillar-2:

Market Access (Commerce)

Objective:

Convert upgraded capabilities into orders by synchronizing MSME readiness with buyer qualification gates and policy windows. The CTP will develop a "Chhatrapati Sambhajinagar EV Demand & Qualification Map" to know what sub assemblies/components are being sourced by nearby OEMs/Tier 1s and new AURIC investors, what PPAP/IATF pathways and audit expectations apply and where PLI AUTO or state EV incentives nudge localization decisions.

This will inform vendor development clinics (RFQ readiness, Advanced Product Quality Planning (APQP), Production Part Approval Process (PPAP), audit prep) and a "digital capabilities catalogue" that will reduce search costs for buyers.[18]

Finance readiness is integrated: MSMEs are coached to align capital expenditure (CapEx)/operating expenditure (OpEx) plans with PLI eligibility (Advanced Automotive Technology (AAT) focus, Domestic Value Addition (DVA) criteria) and to time upgrades alongside PM E-DRIVE testing/charging support where applicable, so that compliance investments are bankable and time to business is minimized.[19,20]

14. Vasudha Foundation. (2024). Skilling the workforce for EV transition. Retrieved from https://www.vasudha-foundation.org/wp-content/uploads/Skilling-the-Workforce-for-EV-Transition.pdf
15. The CSR Universe. (2024, May 3). GoI and Maharashtra Govt partner with ASDC and industry stakeholders to empower 50,000 women under Solar2EV initiative. Retrieved from https://thecsruniverse.com/articles/goi-and-maharashtra-govt-partner-with-asdc-and-industry-stakeholders-to-empower-50-000-women-under-solar2ev-initiative
16. Ministry of Road Transport and Highways. (2022). Specific requirements for L, M and N categories of electric power train vehicles with regard to measurement of electrical energy consumption (AIS-156). Government of India. Retrieved from https://morth.nic.in/sites/default/files/ASI/AIS-156.pdf
17. EVreporter. (2022, November 23). Battery safety standards in India by ARAI. Retrieved from https://evreporter.com/battery-safety-standards-in-india-by-arai/
18. Ministry of Heavy Industries. (n.d.). PLI scheme for automobile and auto component industry. Government of India. Retrieved from https://pliauto.in/
19. Department of Heavy Industry. (n.d.). PLI scheme for automobile and auto component industry. Retrieved from https://www.heavyindustries.gov.in/pli-scheme-automobile-and-auto-component-industry
20. Ministry of Heavy Industries. (2025, February 13). FAME Phase-II Scheme. Press Information Bureau. Retrieved from https://www.pib.gov.in/PressReleasePage.aspx?PRID=2102782

Pillar-3:

Cluster Development (Compliance & shared services)

Objective:

Lower performance costs of compliance and accelerate qualification by pooling essential infrastructure and services at the cluster level. Priority is a shared testing and compliance ecosystem aligned to AIS156/related safety norms, thermal propagation tests, traceability/serialization support, BMS-related checks and selected EMI/EMC tests, where relevant, so MSMEs can validate faster and document better for audits.[21]

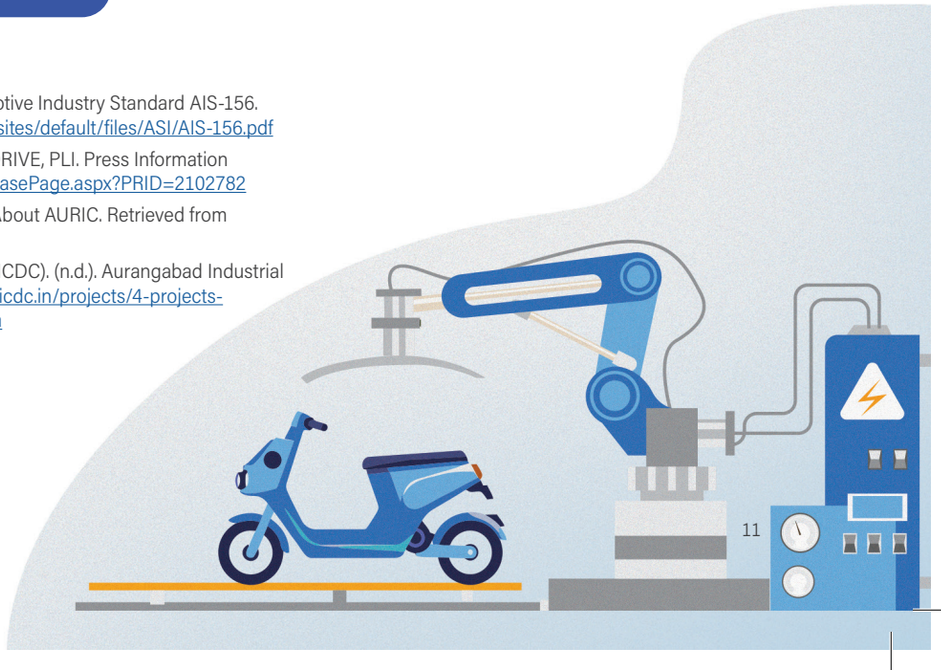
A cluster-level, EV-focused CFC will function as a single window support mechanism for standards guidance, scheme navigation (e.g., Maharashtra EV Policy 2021, PLI-AUTO, PM E-DRIVE), and buyer qualification support, ensuring MSMEs do not miss policy cycles or documentation milestones.[22] To sustain improvements, the CTP establishes supplier upgrading networks (quality circles, peer benchmarking, Gemba exchanges) that diffuse good practices across Waluj/Chikalthana/Shendra, linking back to skilling modules, so learning loops remain active.[23] [24]

1.3. Significance of Tailored Cluster Plan for Chhatrapati Sambhajinagar

For Chhatrapati Sambhajinagar, the CTP is the mechanism that ties the existing industrial base and emerging EV infrastructure to concrete MSME outcomes. With AURIC having nearly sold out in Phase 1 and courting EV/auto investments, the buyer side of the market is within trucking distance, reducing onboarding friction for first orders and enabling short learning cycles. Meanwhile, policy tailwinds, including Maharashtra's EV Policy 2021 on the state side and schemes specific to manufacturing from the side of the central government, create a time-bound window in which localization and standards compliance can be converted into revenue if MSMEs are prepared.

However, consultations with industry associations and MSMEs have highlighted a critical aspect for this transition, which is the need for stronger localization signals within state-level EV policy implementation. While several new EV OEMs are establishing manufacturing facilities in the Chhatrapati Sambhajinagar region, there is a risk that these investments may rely predominantly on pre-existing or external supplier networks, limiting spillover benefits for local MSMEs.

21. Ministry of Road Transport and Highways. (2022). Automotive Industry Standard AIS-156. Government of India. Retrieved from https://morth.nic.in/sites/default/files/ASI/AIS-156.pdf
22. Ministry of Heavy Industries. (2025, February 13). PM E-DRIVE, PLI. Press Information Bureau. Retrieved from https://www.pib.gov.in/PressReleasePage.aspx?PRID=2102782
23. Aurangabad Industrial Township Limited (AURIC). (n.d.). About AURIC. Retrieved from https://www.auric.city/content/about
24. National Industrial Corridor Development Corporation (NICDC). (n.d.). Aurangabad Industrial City (AURIC), Maharashtra. Retrieved from https://www.nicdc.in/projects/4-projects-developed/aurangabad-industrial-city-auric-maharashtra



Stakeholders, therefore, have highlighted the importance of creating enabling conditions that support greater localization within the EV ecosystem. While policy signals can play a role in encouraging OEMs to engage with local suppliers, consultations underscore that sustainable localization cannot rely on policy measures alone. For cluster-based MSMEs to be meaningfully integrated into OEM supply chains, parallel efforts are required to upgrade their technical capabilities, quality systems and delivery readiness.

Strengthening manufacturing processes, reducing turnaround times and achieving consistent quality and cost competitiveness would make local sourcing commercially attractive for OEMs operating in AURIC, particularly when compared to sourcing components from distant locations. Together, alignment between supportive policy frameworks and targeted capability development within the cluster is essential to ensure that EV investments translate into long-term enterprise growth, job creation and industrial strengthening in the region.

Crucially, the workforce transition with material divergence between ICE and EV competencies and new job roles can be managed proactively through modular skilling, apprenticeships and quality culture embedded in day-to-day operations, thus ensuring the transition is just and inclusive rather than disruptive. Paired with cluster-level testing and traceability services that meet the emerging compliance expectations, MSMEs gain the confidence and evidence buyers now require, closing the loop from training to compliance to purchase orders.

1.4. Methodology and Stakeholder Engagement

The project adopted a mixed-methods approach, combining primary and secondary data sources. Primary data collection was undertaken using structured questionnaires for MSMEs, which were administered through key informant interviews (KIIs), and focused group discussions (FGDs). In addition, secondary data was reviewed to support various stages of the research and analysis. Both qualitative and quantitative data were collected.

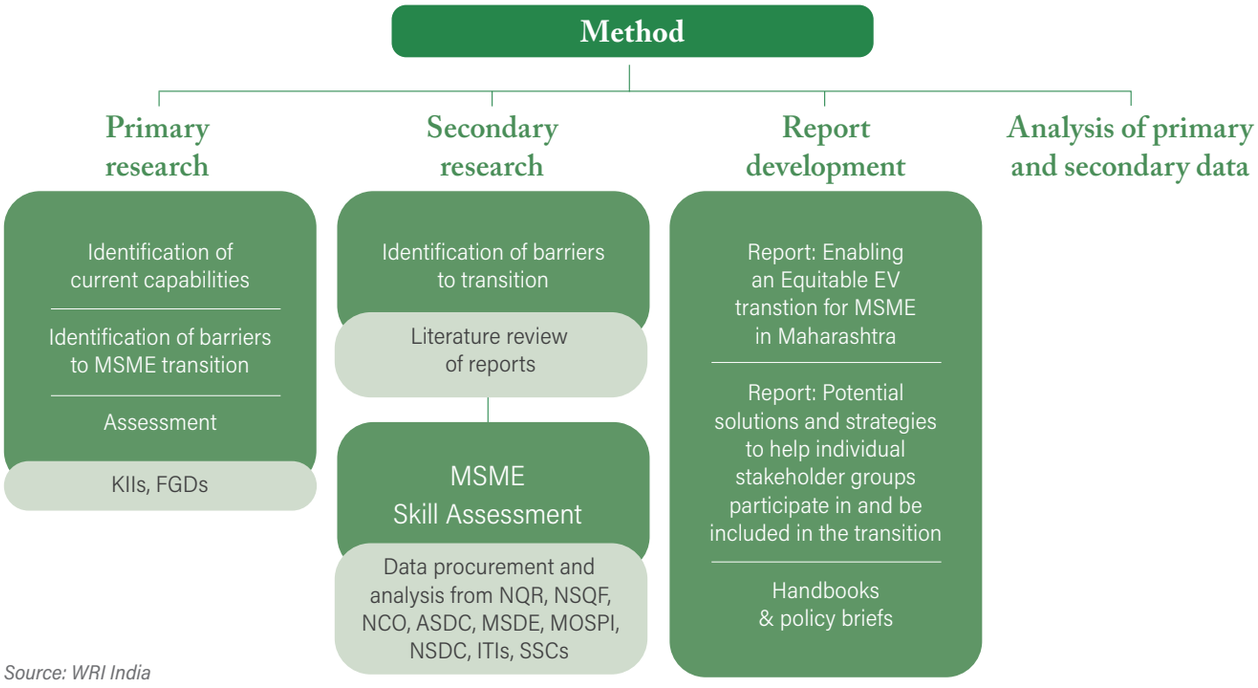
The methodology enabled triangulation across stakeholder consultations, survey responses and secondary data. Accordingly, the final analysis draws on insights from both primary and secondary data sources, providing a comprehensive understanding of the cluster's status and transition needs.

Data sources: KIIs and FGDs

Consultations with industry associations, the government, technical experts, skilling institutes and academia

Process flowchart: Steps in the methodology and stakeholder map

Figure 1: Methods of primary and secondary research and data collection:



Source: WRI India

Strategy for sampling and data collection for the survey

The strategy for the survey was to focus on securing representation from all stakeholder groups (across the value chains) and priority industrial clusters, such as Deogiri Electronics Cluster Private Limited (DEPCL), Maharashtra Industrial Development Corporation (MIDC) Waluj. Purposive, snowball sampling was conducted across various stakeholders to capture a wide range of perspectives on MSME progress towards EV.

Purposive sampling:

This was done across stakeholder categories (MSME owner, association, skilling institute, consultations, government agency, etc.). Various industrial associations, such as Marathwada Auto Cluster (MAC), DECPL, Chamber of Marathwada Industries & Agriculture (CMIA), and Marathwada Accelerator for Growth and Incubation Council (MAGIC), too were part of the sample.

Snowball sampling:

Initial respondents were engaged who then referred to additional stakeholders critical to the EV transition within their networks. Thus, referrals ensured that a wide range of stakeholder categories were embraced to capture a varied array of insights.

Table 1: Key Performance Indicator

S.No.	Description	Examples of Target Stakeholders	Target	Current Status
1	KIIs	MSME owners	30	31
2	FGDs	MSME owners, industry associations, skilling centres	1	1
3	Capacity Building Workshop	MSMEs, startups, government representatives, skilling centres	1	1
4	Cluster Development	MSME, startups, government representatives, skilling centres	1	1

Chapter 2

Cluster Profiling - Chhatrapati Sambhajinagar as an Emerging EV Hub

Chhatrapati Sambhajinagar (formerly Aurangabad) is fast becoming one of India's most promising industrial hubs, particularly in auto and EV component manufacturing. The region's industrial journey started in the 1980s with the arrival of Bajaj Auto's plant in Waluj MIDC, which triggered a wave of industrialization and the growth of ancillary units. Over time, Waluj and Shendra MIDC have developed into dense industrial clusters, attracting national and international firms, such as Varroc Engineering, Endurance Technologies, NRB Bearings and Škoda Auto.[25]

What makes Chhatrapati Sambhajinagar stand out is its **strategic central location** that offers smooth connectivity via highways, the Samruddhi Mahamarg and its proximity to ports. The city also draws strength from a pool of skilled and semi-skilled workers graduating from Industrial Training Institutes (ITIs), Indo-German Tool Room (IGTR) and local engineering institutes. These factors have laid the foundation for a strong cluster, now gearing up for the EV transition.

Maharashtra is the country's leading automobile hub, with **over 16,600 enterprises**, including **26 OEMs and 16,576 auto component manufacturers (ACMs)**. The ecosystem is highly MSME-driven, with **97% of enterprises classified as MSMEs**, and geographically concentrated across the five major clusters Pune, Mumbai, Nashik, Nagpur and Chhatrapati Sambhajinagar. This gives Maharashtra both scale advantages and transition challenges, as MSMEs remain the backbone of the auto value chain.

Within this landscape, Chhatrapati Sambhajinagar holds a critical position. The cluster hosts **2 OEMs and 1,648 ACMs**, supporting more than **30,000 formal jobs**.[26] Its ecosystem has evolved from a legacy auto base into a diversified industrial hub, increasingly linked to EV opportunities. Recent large-scale investments reinforce this shift. **Toyota Kirloskar's proposed**

25. Maharashtra Industry, Trade and Investment Facilitation Cell (MAITRI). (n.d.). One District One Product – Auto component (Chhatrapati Sambhajinagar). Government of Maharashtra. Retrieved from https://maitri.mahaonline.gov.in/HTMLTemplate/Chhatrapati-Sambhajinagar-Region/Chh-Sambhaji-Nagar-ODOP-AutoComponent.html

26. iFOREST. (2024). Navigating the shift: A just transition roadmap for Maharashtra's automobile sector. Retrieved from https://iforest.global/wp-content/uploads/2025/08/Navigating-the-shift-A-Just-Transition-Roadmap-for-Maharashtras-Automobile-Sector.pdf

₹25,000 crore plant is expected to produce up to **4 lakh vehicles annually** and generate around **24,000 jobs**,[27] while **JSW Green Mobility's ₹27,000 crore project** aims to manufacture both electric passenger and commercial vehicles.[28] **Ather Energy's** entry further strengthens the EV footprint. These developments are supported by Maharashtra's progressive EV policy and the **Shendra-Bidkin Industrial Park** under the DMIC, which has earmarked over 8,000 acres for industrial growth.[29]

Chhatrapati Sambhajinagar is therefore, not simply a legacy auto hub. It is evolving into a **forward-looking industrial city**, with the right mix of infrastructure, policy support, employee competencies and capital investments to lead India's clean mobility transition.

2.1.SWOT Analysis

The Chhatrapati Sambhajinagar cluster's transition readiness is shaped by a mix of structural strengths, capability gaps, new prospects and external risks. A SWOT analysis helps capture these conditions holistically, guiding the design of interventions under CTP.

Strengths

Established auto ecosystem:

The cluster has a well-developed auto component base. Raw materials and machine resources are readily available, and major OEMs (e.g. Bajaj Auto) operate locally, providing a steady vendor workload.

Infrastructure:

There is a well-established industrial infrastructure (land, water and power), making the business environment adaptive and integrative.

Government-supported facilities:

A state-backed CFC (Marathwada Auto Cluster) is already operational, offering MSMEs shared tooling, metrology and production services. This cluster facility is a PPP venture of the central and state governments and industry bodies, boosting productivity. In addition, local support institutions (Micro, Small and Medium Enterprises-Development Institute (MSME-DI), District Industries Centers (DIC), National Small Industries Corporation (NSIC)) and universities (Dr. Babasaheb Ambedkar Marathwada University (BAMU), etc.) provide advisory, finance and training, strengthening the industrial support system.

27. The Times of India. (2024, July 31). Toyota to invest ₹25,000 crore in new automobile plant in Sambhajinagar, Maharashtra. Retrieved from https://timesofindia.indiatimes.com/city/mumbai/toyota-to-invest-25000-crore-in-new-automobile-plant-in-sambhajinagar-maharashtra/articleshow/112149748.cms
28. News18. (2024, December 5). JSW Group to launch its own electric vehicle brand in India. Retrieved from https://www.news18.com/auto/jsw-group-to-launch-its-own-electric-vehicle-brand-in-india-9145776.html
29. Devdiscourse. (2025). Chhatrapati Sambhajinagar emerging industrial powerhouse. Retrieved from https://www.devdiscourse.com/article/science-environment/3361164-chhatrapati-sambhajinagar-emerging-industrial-powerhouse

Strategic connectivity and investment:

Chhatrapati Sambhajinagar benefits from major transport links (the Samruddhi highway and the Delhi–Mumbai Industrial Corridor), making it an attractive site for industry. The Aurangabad Industrial City (AURIC) has already drawn ~₹71,000 crore in investment and hosts multiple EV manufacturers, demonstrating solid regional commitment to EV production.[30]

Weaknesses

EV knowledge/skills gap:

Local MSMEs generally lack EV-specific expertise. Discussions at workshops revealed many firms are unaware of the differences in the EV Bill of Materials (BoM), denoting a steep learning curve for component transition. The cluster also has a smaller number of dedicated R&D or training institutes for EV technology, resulting in a shortage of skilled manpower for new EV processes.

Technology and quality deficiencies:

Most MSMEs continue to use traditional (ICE-oriented) technologies. There are very few modern R&D/testing labs in the cluster, and technology upgradation efforts lag. In practice, partnership among SMEs is low and quality-control processes are weak. This could hinder fast response to EV component standards.

Emerging infrastructure shortfalls:

EV-related infrastructure is still in its early stages. For example, Chhatrapati Sambhajinagar planned around 200 public charging points by 2022, so charging networks remain thin.[31] Similarly, there is no large-scale EV battery manufacturing or recycling facility in the region yet, implying that local producers must rely on external battery supply.

Opportunities

New industry investments:

Major EV OEMs and suppliers are moving and setting up their production plant in the cluster. Ather Energy is setting up a large electric scooter factory in the region, and component-maker Uno Minda is investing more than ₹210 crore in an EV-casting plant here.[32] These projects (alongside AURIC developments) open new Tier 1/ Tier 2 supply opportunities for local MSMEs.

Battery and charging projects:

Plans for EV batteries and stations are underway. The state government approved an EV/battery production project for Pune and Chhatrapati Sambhajinagar, involving Gogoro (investment of ₹12,482 crore) to build EV battery plants and 12,000 battery-swap stations across Maharashtra.[33] Moreover, the EV policy and MoUs with oil companies will equip more than 60–70% of fuel pumps and all bus depots in the state with chargers.[34] This expanding infrastructure will stimulate demand for charging and battery-related components.

30. The Economic Times Auto. (2025, September 18). Chhatrapati Sambhajinagar emerges as India's EV manufacturing hub, declares Maharashtra CM Fadnavis. Retrieved from https://auto.economictimes.indiatimes.com/news/industry/chhatrapati-sambhajinagar-emerges-as-indias-ev-manufacturing-hub-declares-maharashtra-cm-fadnavis/123961856
31. The Times of India. (2022, February 17). Maha: 200 EV charging stations to be set up in Aurangabad by year-end. Retrieved from https://timesofindia.indiatimes.com/maha-200-ev-charging-stations-to-be-set-up-in-aurangabad-by-year-end/articleshow/89630820.cms
32. The Economic Times. (2025, June 19). Uno Minda to invest Rs 210 cr on new facility for EV casting parts. Retrieved from https://economictimes.indiatimes.com/industry/renewables/uno-minda-to-invest-rs-210-cr-on-new-facility-for-ev-casting-parts/articleshow/121950489.cms
33. Energetica India. (2023, June 29). EV plant and battery manufacturing plant to establish in Pune and Aurangabad, says Maharashtra CM Eknath Shinde. Retrieved from https://www.energetica-india.net/news/ev-plant-and-battery-manufacturing-plant-to-establish-in-pune-and-aurangabad-says-maharashtra-cm-eknath-shinde
34. Business Standard. (2025, April 29). Maharashtra EV policy 2025 aims to boost charging infrastructure. Retrieved from https://www.business-standard.com/economy/news/maharashtra-ev-policy-2025-aims-to-boost-charging-infrastructure-125042901254_1.html

Market growth and diversification:

Rising demand (both domestic and export) for EVs and Bharat Stage VI (BS-VI) vehicles will require new parts. The government's push for EV indigenization gives MSMEs a chance to diversify into controllers, electric motors (e-motors), thermal management and related areas, expanding beyond traditional ICE job-work. As OEMs adopt more vendor manufacturing, MSMEs in the cluster can leverage existing capacity to become Tier 1/ Tier 2 suppliers in the EV value chain.

Threats

Intense competition and outsourcing:

Low-cost global competitors (e.g. China, Taiwan) threaten to undercut local suppliers. There is also speculation that major OEMs could outsource high-precision components overseas, depriving the cluster MSME base of work.

Technological disruption:

Emerging powertrain technologies (such as fuel cells and hydrogen) could render some current products obsolete. If MSMEs cannot adjust rapidly to new EV architectures, they may lose relevance.

Capacity/utilization risks:

Some local firms already have idle manufacturing capacity. If EV orders ramp up slower than expected, or if smaller MSMEs fail to shift product lines, these underused plants could become uneconomical.

Fragmented access to transition finance:

MSMEs face challenges in accessing affordable and phased financing required for different stages of EV transition, including technology upgrade testing and validation infrastructure, workforce skilling and capital investments.

The cluster's strength lies in its legacy automotive base, industrial infrastructure and skilled workforce, which together provide a solid foundation for EV integration. However, fundamental deficiencies, such as MSMEs dependent on ICE, limited EV-specific testing facilities and low R&D intensity, pose real challenges. On the opportunity side, large-scale EV investments, supportive state and central policies and the possibility of shared facilities offer a clear pathway for transformation. Yet, rapid technology shifts, competitive pressure from other hubs and concerns about policy or supply chain issues continue to pose major risks. Dealing with these through concentrated skilling, compliance infrastructure and vendor development will be critical for a just and competitive transition.

2.2. Key Takeaways from Research and Stakeholder Consultations

With a total of 31 KIIs were conducted with MSMEs across the automotive supply chain. These interviews revealed that the cluster was undergoing a gradual, uneven transition toward electric mobility. Roughly one-quarter of the enterprises interviewed, particularly those already engaged in electrical assemblies, wiring harnesses or lightweight aluminum forgings reported viewing the EV transition as a growth opportunity.

At the same time, nearly half of the interviewed MSMEs were found to remain strongly anchored to ICE-linked products. Importantly, this group does not perceive the EV transition as an immediate threat. Instead, consultations indicate a cautious, wait-and-watch approach, shaped by expectations that ICE and hybrid demand will continue alongside EV growth in the near to medium term. Many firms in this segment indicated that diversification decisions are largely dependent on clearer sourcing signals from Tier 1 suppliers and OEMs, rather than being driven internally.

The remaining one-quarter of enterprises fall into the exploratory category. These firms recognize the long-term direction of the market but lack clarity on feasible entry points into the EV value chain. Their hesitation stems less from resistance and more from limited technical understanding of EV systems, uncertainty around buyer requirements and concerns regarding investment risk.

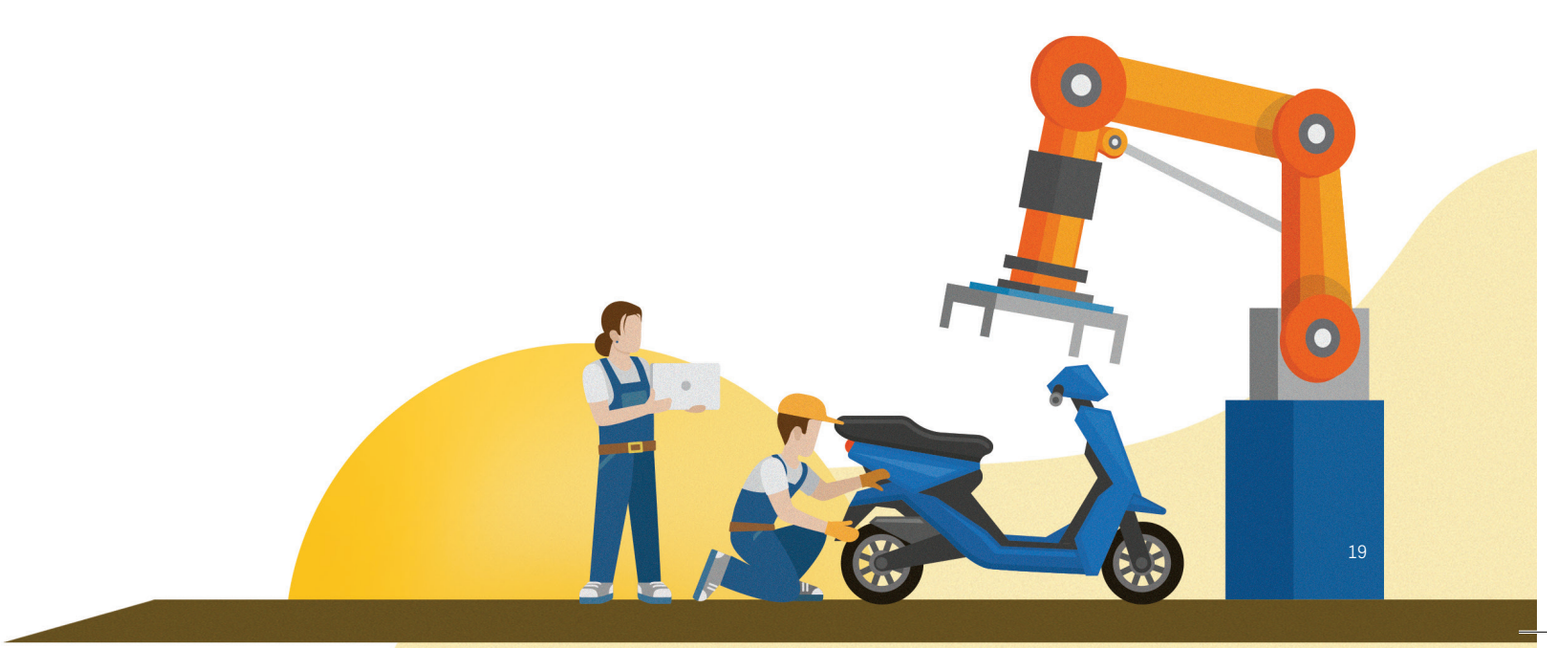
Overall, MSMEs in Chhatrapati Sambhajinagar show high durability and responsiveness, with none reporting closures due to EV disruptions. Instead, they view the transition as an incremental process where hybrid and ICE-linked demand will coexist with EV opportunities in the near term. Firms have already begun pursuing new opportunities, ranging from EV gear housings to electric lighting assemblies, while others remain in exploratory stages, awaiting clearer signals from Tier 1 vendors and OEMs.

A recurrent theme is the lack of in-house R&D capacity: most firms rely heavily on upstream buyers, such as Varroc and Endurance, for product design inputs. Skilling too remains unstructured, mainly on-the-job, with limited exposure to structured EV-specific training. Finance emerges as a mixed picture. While medium-tier firms report manageable access to capital, micro and Tier 3 suppliers highlight difficulties financing new equipment or diversifying. Encouragingly, several enterprises already employ a significant proportion of women on the shop floor, though leadership representation is minimal. This indicates potential for gender-sensitive skilling and leadership development interventions as part of the transition.

Table 2: lists data collected on some of the key themes in the survey:

Sl.No	Theme	Information/ Data from interviews with MSMEs
1.	Diversification & EV readiness	Firms such as LAPL Automotive and Advantech are proactively investing in EV components (lighting, gear housings, motors). Others such as Bhagwat Industries and Amap Press remain ICE-dependent, with diversification yet to begin.
2.	R&D and technology	Most MSMEs lack in-house R&D; new product designs are supplied by Tier 1 vendors. There are a few exceptions (Cast 4 Aluminium, LAPL) that are setting up their own R&D/testing wings.
3.	Skilling	Training is mostly on-the-job; structured EV skilling is absent. Prioritization is required among the following: wiring harness assembly, motor winding/testing, aluminium casting & machining and basic power electronics/BMS awareness.
4.	Finance and capital	Medium enterprises generally report no major financing bottlenecks; micro and Tier 3 firms face difficulties in accessing credit for diversification. For machinery upgrades, investment needs are in the range ₹50 Lakh–5 Crore.
5.	Gender and workforce	Some firms (Tesla Transconnections, E-Motion Motors, Sangameshwar Precision) report 40–90% women in operational roles, but women are absent in leadership/ decision-making positions.
6.	Cluster support needs	There is a strong demand for shared testing labs, validation centers and tool rooms. There is a demand for quick operationalization of a new CFC focused on EV technology and vendor development (as emphasized by S.S. Controls).
7.	Supply chain dynamics	Tier 3 firms are dependent on Tiers 1/ Tier 2 diversification decisions: the risk of exclusion, if upstream transitions faster. Firms highlighted the importance of being linked into new OEM investments (Toyota, Ather, JSW).

In essence, while the MSME base in Chhatrapati Sambhajinagar faces capability and resource gaps, the combination of new OEM investments, policy incentives and shared infrastructure development provides a timely window of opportunity to reposition the cluster as a competitive EV manufacturing hub. The difficulty rests in ensuring that these opportunities are reasonably accessible across the spectrum of firms, so that smaller businesses are not left behind in the transition.



Chapter 3

Technology Readiness and Product Diversification

The following table presents a snapshot of the Chhatrapati Sambhajinagar cluster's current technology readiness and its potential pathways for product diversification into EV components. It summarizes the key strengths, emerging opportunities and priority needs identified through research and stakeholder consultations.

 Strengths	 Opportunities	 Needs
Strong legacy capabilities in automotive precision engineering, including machining, casting, stamping, forgings and sub-assemblies	Rising demand for EV components driven by new OEM and Tier 1 investments in and around the Chhatrapati Sambhajinagar region	Targeted upgrading of MSME capabilities, from ICE-focused manufacturing to EV-aligned processes
Presence of a large and experienced automotive MSME ecosystem, with established OEM and Tier 1 linkages	Scope for MSMEs to diversify into EV-adjacent components aligned with existing capabilities (e.g., motor housings, brackets, enclosures, structural parts)	Access to EV-specific testing, validation and certification infrastructure at the cluster level
Existing industrial infrastructure and proximity to AURIC and emerging EV manufacturing plants	Potential to leverage shared facilities, such as DECPL, for prototyping and early-stage product development	Structured technical guidance on EV product architectures, standards and qualification pathways
Early presence of firms engaged in electrical assemblies and lightweight materials	Opportunity to move from build-to-print manufacturing, toward higher-value sub-assemblies and system-level integration	Strengthening of in-house R&D and design support mechanisms
Established workforce with strong shop floor manufacturing experience	Increasing interest from domestic and global EV supply chains seeking cost-competitive and reliable suppliers	Focused skilling in EV-specific manufacturing, safety and quality systems

3.1. Existing Technological Capabilities of MSMEs in the Cluster

The Chhatrapati Sambhajinagar automotive cluster represents one of Maharashtra's more mature manufacturing ecosystems, with a long-standing base of MSMEs engaged in automotive component production. Historically anchored around ICE vehicle supply chains, the cluster has developed strong engineering proficiencies in high-precision engineering, mechanical manufacturing and selected areas of electrical and electronic assembly. These capabilities form a critical foundation for any future progress towards EV component manufacturing. The existing technological expertise of MSMEs in the Chhatrapati Sambhajinagar cluster can be divided into multiple key domains:

a) Precision engineering and mechanical manufacturing

A defining strength of the Chhatrapati Sambhajinagar cluster resides in its well-established expertise in precision engineering and machining. Over several decades, MSMEs in the cluster have built competence in:

- Computer Numerical Control (CNC) turning, milling, drilling and grinding operations
- Sheet metal forming, stamping and fabrication
- Heat treatment, surface finishing and precision assembly

These capabilities have enabled local firms to supply a wide range of automotive ICE components, including engine mounts, transmission housings, shafts, brackets, gear components, sheet-metal parts and structural sub-assemblies.

The presence of tool rooms and die-manufacturing units supported by shared infrastructure at the Marathwada Auto Cluster (MAC) has further strengthened the cluster's ability to produce high-precision tools, dies and moulds required for automotive grade manufacturing.

From a transition perspective, these mechanical capabilities are directly relevant to EV component manufacturing, particularly for motor housings, battery pack enclosures, structural parts, thermal management components and other mechanically intensive EV sub-assemblies.

b) Electrical and electronics manufacturing capabilities

Beyond mechanical manufacturing, Chhatrapati Sambhajinagar has developed a niche capability in electronics manufacturing services (EMS), anchored by Deogiri Electronics Cluster Private Limited (DECPL) and a set of private EMS firms operating in the region. The key technological capabilities include:

- Surface Mount Technology (SMT) assembly using automated pick-and-place machines
- Wave soldering and selective soldering lines
- Through-hole and mixed-technology printed circuit board (PCB) assembly

Some MSMEs in the cluster are also engaged in PCB prototyping and low-to-medium volume manufacturing, with capabilities such as CNC drilling, electroplating and surface finishing. While current production is primarily oriented towards consumer electronics, industrial electronics and power supplies, selected firms have already begun manufacturing automotive-relevant electronics, such as EV charger PCBs, LED drivers and power conversion modules.

Although electronics design and embedded software development remain limited (addressed in the chapter 6 of this report), the existing EMS infrastructure provides a valuable manufacturing base that can be incrementally upgraded to support EV power electronics assembly and testing.

c) Plastics, lightweighting and advanced materials

The presence of the Central Institute of Petrochemicals Engineering and Technology (CIPET) in the region has contributed to the development of plastics processing and polymer engineering capabilities within the cluster. MSMEs have access to:

- Injection moulding and plastic component manufacturing
- Tooling and mould development for automotive plastics
- CAD/CAM/CAE facilities supporting component design and simulation

In recent years, some firms have also begun transitioning to aluminium forging and lightweight material processing, driven by OEM demand for weight reduction and improved vehicle efficiency. These capabilities are highly relevant for EV applications, where lightweighting plays a critical role in extending vehicle range and improving performance. Applicable uses include battery casings, interior components, cooling system parts and structural brackets.

d) Automotive electrical systems and sub-assemblies

Several MSMEs in the cluster have developed competencies beyond basic part manufacturing and are engaged in more complex automotive sub-assemblies, including:

- Wiring harnesses and cable assemblies
- Automotive lighting products, such as headlamps and indicators
- Starter motors, alternator-related components and electromechanical assemblies

Notably, a small number of firms have begun manufacturing Brushless DC (BLDC) motors, Permanent Magnet Synchronous (PMS) induction systems and drivetrain components for electric two-wheelers, electric bicycles and light electric mobility applications. Although these initiatives continue to be limited in scale, they indicate early experimentation and learning within the cluster that can be leveraged for large-scale EV diversification.

e) Shared infrastructure, testing and prototyping support

The technological readiness of individual MSMEs in the cluster is reinforced by the availability of shared infrastructure through CFCs.

- Mechanical and environmental testing facilities at Marathwada Auto Cluster (MAC) for validation of automotive components
- Prototyping infrastructure at Deogiri Electronics Cluster Private Limited (DECPL), including CNC turret punching, fibre laser cutting and mechanical prototyping zones
- Incubation and technical mentoring support through institutions such as MAGIC

These shared assets reduce entry barriers for MSMEs seeking to develop or test new automotive products, particularly in early prototyping and validation stages.

f) Limitations of current capability

While the Chhatrapati Sambhajinagar cluster demonstrates substantial technological depth in conventional automotive manufacturing, most MSMEs remain oriented toward build-to-print manufacturing models. In-house R&D and product design capabilities are limited, and firms largely depend on designs and specifications provided by OEMs or Tier 1 suppliers.

Capabilities related to embedded software, battery systems, high-voltage safety and advanced systems integration are currently underdeveloped and unevenly distributed across the cluster. Nevertheless, the existing base of mechanical, electrical, plastics and assembly capabilities provides a credible starting point from which targeted investments in skills, testing infrastructure and systems engineering can enable MSMEs to progressively move up the EV component value chain.

3.2. Barriers to EV Technology Adoption

Despite the Chhatrapati Sambhajinagar cluster's established legacy in precision engineering and traditional manufacturing, local MSMEs confront significant hurdles in EV adoption resulting from a shortage of specialized technical and software skills, the prohibitive capital costs of EV-aligned infrastructure, institutional gaps in vendor development programs (VDPs) and a deep market dependency on OEM-driven design and supply chains.

Gaps in technical skill and software

The cluster's historical focus on ICE supply chains has produced deep mechanical competencies; however, there is a limited number of EV-specific competencies as well:

Knowledge deficit:

There is a lack of expertise in BMS, power electronics and electric drivetrain technology.

Software proficiency:

Unlike ICE vehicles, EVs are heavily dependent on software. Local MSMEs currently lack proficiency in embedded systems, automotive software development, calibration and telematics.

Training mismatch:

The existing skilling providers (MAC, Central Institute of Petrochemicals Engineering & Technology (CIPET)) offer relevant base capabilities. Programs uniquely designed for EV roles, such as charging infrastructure installation, BMS diagnostics or battery recycling, are not yet widely available or customized to MSME needs.

Workforce composition:

Shop floor personnel are predominantly trained in machining, fabrication and analogue electrical assembly; cross-disciplinary system integration skills are scarce.

Limitations in testing, validation and research infrastructure

While the cluster hosts CFCs and prototyping infrastructure, these assets currently do not meet the complete testing, validation and R&D needs of EV component development:

Equipment mismatch:

The existing CFC assets (prototyping, steel/plastic tooling, PCB assembly) lack EV-specific capabilities, such as cell cyclers, motor dynamometers, high-voltage insulation testers, EMC benches and magnetization rigs.

Under utilization by automotive MSMEs:

Many automotive suppliers do not use local CFCs for EV work either because the equipment is not relevant and accessible, or confidentiality concerns persist or outputs are perceived as insufficient for OEM qualification.

Validation bottlenecks:

Regional homologation and validation infrastructure (including vehicle-level testing tracks and labs accredited for EV standards) is limited; firms must look outside the region for certification, incurring time and cost penalties.

Financial and capital constraints

Monetary considerations shape the pace and scope of MSME responses to EV demand:

- **High initial outlay:** EV production requires unfamiliar, high-value equipment (e.g., battery test benches, dynamometer rigs, automated winding machines) that many small firms cannot absorb.
- **Revenue risk:** For several firms (e.g., Dhananjay Technologies), a large share of revenue reported up to 55% still derives from ICE powertrain work; shifting capital to EV lines threatens to weaken core cash flows.
- **Credit limitations:** MSMEs face difficulty accessing specialized credit lines or tailored financing for EV transition assets; conventional lenders remain conservative about newer, electronics-heavy CapEx.

Dependence on OEM/Tier 1 supply chains and design reliance

MSMEs in this cluster frequently function as "followers" rather than leaders in design, leaving them at the risk of decisions made by larger players.

- **Design dependence:** Most MSMEs lack in-house R&D and rely on OEMs or Tier 1 buyers for product specifications, limiting their ability to innovate or propose EV product variants.
- **Supplier displacement risk:** The entry of large OEMs or established EV players into the region raises the risk that these buyers will bring with them established vendor networks, narrowing opportunities for local firms.
- **Limited vendor development pathways:** There are currently no clear VDPs that help local MSMEs integrate explicitly with the EV value chain.

Market access, certification and commercial barriers

Commercial dynamics present practical obstacles to entry:

- **Demand uncertainty:** EV order books are concentrated among a few OEMs, with long qualification cycles and pilot volumes that may be insufficient to justify MSME investment.
- **Certification complexity and cost:** Meeting EV-specific standards, homologation requirements and supplier quality validations is expensive and administratively complex for small producers.
- **Existing ICE dependence:** Continued ICE demand reduces the commercial impetus to retool for EVs, leading to a tendency toward incremental product changes rather than wholesale capability shifts.

Barriers to information and awareness

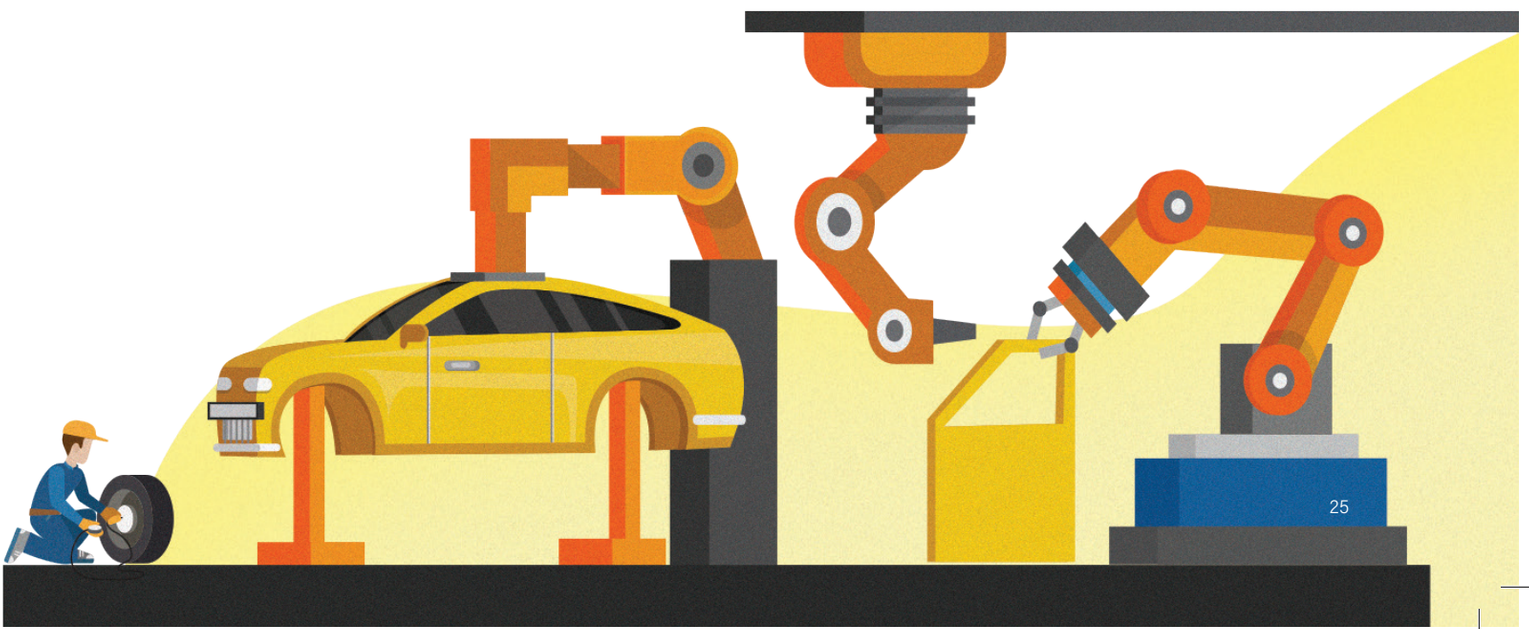
A subset of MSMEs lacks clarity on where, how and when to engage with EV opportunities:

- **Market intelligence:** During consultations, smaller firms pointed out that they encounter ambiguity in identifying viable technical entry points into the EV value chain and lack clarity on realistic product niches they can competitively pursue.
- **Policy and scheme awareness:** Tier 3 microenterprises often remain unaware of government schemes, financing programs or training incentives that could support a transition.
- **Perception issues:** EV markets are, at times, seen as distant, highly technical and accessible only to large firms, thereby reducing exploratory activity by MSMEs.

Safety, regulatory and circularity constraints

New regulatory and environmental requirements create additional entry barriers:

- **High voltage safety:** Several MSMEs are unfamiliar with safe handling, storage and assembly procedures for systems and lithium-ion cells and would require procedural and capital adjustments.
- **Regulatory compliance load:** Emerging safety standards and environmental regulations (battery End-of-Life EOL, hazardous waste handling) impose administrative and cost burdens on small producers.
- **Absence of local EOL/recycling infrastructure:** Limited capacity of battery recycling and electronic waste (e-waste) management in the region undermines lifecycle planning for EV components and raises environmental compliance concerns.



3.3.Technology Maturity Matrix

Technology Domain	Chhatrapati Sambhajinagar Cluster – Current Capability	Maturity Level	Position vs India / Global Benchmarks
Precision engineering & machining	1,600+ MSMEs engaged in CNC machining, heat treatment, gearboxes, shafts, metal stamping and precision assemblies for automotive applications	**Level 4** Optimized (World Class)	Globally competitive: Matches international standards; components exported to Europe, USA, and Southeast Asia
Electronics Manufacturing Services (EMS)	Dedicated electronics ecosystem (DECPL) with SMT lines, automatic wave soldering, motorized insertion and PCB prototyping	**Level 3** Defined (National Lead)	National leader: Ahead of most Indian clusters; however, lacks high-power electronics depth and large-scale SMT capacity seen in global Tier 1 hubs
Plastics, lightweighting & materials	Advanced injection molding and tooling supported by CIPET; early shift towards aluminium forging and lightweight materials for EV applications	**Level 3** Defined (National Lead)	Strong national position: Competitive within India; transitioning toward EV-oriented lightweighting but behind global composite and advanced material ecosystems
Testing & validation infrastructure	Shared testing at MAC and DECPL for mechanical, fatigue and environmental tests; limited EV-specific testing	**Level 2** Managed (Emerging)	India benchmark: Comparable to Indian Tier 2 clusters; lacks EV homologation labs, HV testing and regional test tracks found in global EV hubs
R&D, design & embedded software	Predominantly build-to-print manufacturing; minimal in-house R&D; limited embedded software and systems engineering capability	**Level 1** Initial (Developing)	Significant gap: Lags Indian EV hubs (Pune, Bengaluru) and global suppliers that integrate software, electronics and design ownership
Battery systems & EV powertrain	Small-scale BLDC motor manufacturing, wiring harnesses, basic electromechanical assemblies; negligible battery pack and BMS capability	**Level 1** Initial (Developing)	Transitioning: Behind national leaders in battery chemistry, BMS, and integrated powertrain systems; far from global benchmarks.

Maturity level definitions:

To provide analytical clarity and enable consistent interpretation of the Technology Maturity Matrix, the four levels applied in this chapter are defined in the legend below.

- **Level 1 (Initial):** High reliance upon external designs; early phases of technology adoption
- **Level 2 (Managed):** Basic infrastructure exists but requires specific upgrades for the EV sector
- **Level 3 (Defined):** Strong regional presence with standardized processes and dedicated facility centers
- **Level 4 (Optimized):** Mature ecosystem with high efficiency, quality and global export competitiveness

The cluster is a world-class hub for mechanical precision, but it currently sits at the initial-to-managed level for high-value EV electronics and software. The transition strategy centers on leveraging legacy mechanical strengths to support new EV-specific domains, such as lightweighting and motor housing.

3.4. Scope for Product Diversification into EV Components

The cluster has strong legacy capabilities in precision engineering (CNC machining, metal stamping/forging) and electronics assembly. Local MSMEs excel in CNC machining, stamping and precision assembly, and many have sophisticated EMS lines (SMT machines, PCB fabrication) that produce items such as LED drivers and even EV charger PCBs. Several firms already make automotive wiring harnesses, headlamps and starter motors, and some have expanded into BLDC motors and induction-drive systems for e-bikes. The CIPET center supports plastic moulding well, and a few companies are forging aluminium for lighter EV parts.

Component-level diversification opportunities

Based on the Technology Maturity Matrix, the cluster possesses a dual-layered scope for product diversification. While its high-maturity mechanical base allows for immediate "low-hanging fruit" transitions, its emerging electronics and plastics sectors provide the foundation for high-value EV component manufacturing.

Current Capability

ICE Gear/Shaft Machining	Sheet-Metal / Welding
Traditional Forging	Plastic Moulding
PCB Assembly (SMT)	

Potential EV Product

EV Motor Shafts & Housings	Battery Packs / EV Chassis
Aluminium Lightweighting	Battery Enclosures
EV Charger / BMS Hardware	

Ease of Transition

High (Same machinery)	High (Structural focus)
Moderate (Material shift)	Moderate (Design focus)
High (Standard EMS lines)	

A thorough analysis of the scope for diversification into EV components, categorized by existing technical capabilities, is presented below:

High-maturity pivot: Precision engineering and machining

The MSMEs currently operating in precision machining can diversify with minimal capital expenditure by shifting from ICE engine parts to EV structural and drivetrain components.

Existing capability: Manufacturing gear blanks, transmission shafts and engine mounts for two-wheelers and passenger cars

Diversification scope:

- EV transmission & gearbox housing: Transitioning from ICE gearboxes to EV-specific gear housing (already being done by firms like Advantech Group)
- EV motor shafts: Utilizing specialized skills in transmission shafts and pivot pins to produce high-precision shafts for EV motors (e.g., Phoenix Engineering supplying to MATTER Motor)
- Aluminum forging: Shifting from heavy steel forging to aluminum forged products for vehicle lightweighting, which is critical for extending EV battery range

Moderate-maturity pivot: Electronics & electrical assembly

Firms having maturity in electronics can leverage their existing Surface Mount Technology (SMT) and PCB assembly lines to enter the "brains" of the EV.

Existing capability: Production of lighting (headlamps/indicators), transformers and consumer electronics PCBs

Diversification scope:

- EV charger electronics: Manufacturing PCBs for EV chargers and onboard charging units (e.g., Manu Electricals had already produced EV charger PCBs)
- Vehicle lighting & indicators: Transitioning existing lighting product lines for the EV segment with identical manufacturing processes
- Wiring harnesses: Leveraging manual assembly expertise to produce specialized wire harnesses and lead coils for electric rickshaws (e-rickshaws) and electric bicycles (e-bicycles)

Defined pivot: Plastics & lightweighting

The cluster's well-established expertise in plastics, supported by CIPET, allows MSMEs to address the critical need for weight reduction in EVs.

Existing capability: High-end plastic molding for automotive interiors and engine parts

Diversification scope:

- Battery enclosures & casings: Designing and manufacturing lightweight, durable plastic casings for battery packs to replace traditional metal housings
- Thermal management components: Utilizing CIPET's CAD/CAM/CAE labs to design plastic components that manage heat within the battery and motor systems

Transitioning pivot: Fabrication & welding

MSMEs in sheet-metal work and fabrication can pivot toward the structural architecture required by new EV OEMs.

Existing capability: Sheet-metal press parts, chassis frames and resistance welding

Diversification scope:

- EV chassis frames: Adapting two-wheeler and three-wheeler chassis frames for electric powertrains
- Battery tab welding: Utilizing the existing expertise in resistance welding to manufacture specialized welding machines and controllers for battery module assembly
- Non-powertrain assemblies: Diversifying into side-stand brackets and body assemblies for EVs to reduce dependence on ICE engine components (e.g., Dhananjay Technologies)

Emerging pivot: Powertrain & motors

A small number of early stages, specialized MSMEs have begun positioning the cluster as an emerging regional hub for electric propulsion technologies.

Existing capability: Experience in manufacturing BLDC motors for applications such as fans, e-bicycles and induction-based systems

Diversification scope:

- BLDC and PMSM motors: Scaling from bicycle motors to high-performance BLDC motors for electric two-wheelers and industrial applications
- Software platforms: Integrating software with hardware to provide customizable technology platforms for EV drivetrain management

Chapter 4

Workforce Development & Technical Skilling

The transition of the Chhatrapati Sambhajinagar automotive cluster toward EV manufacturing signifies not merely a technological and infrastructural shift but a foundational transformation of the region's workforce. Although Chhatrapati Sambhajinagar is widely recognized as a powerhouse of precision engineering, supported by a large base of skilled workers shaped through decades of participation in ICE-oriented automotive value chains, this legacy of expertise is not fully aligned with the technical, digital and organizational demands of EV manufacturing.

As electric mobility introduces new requirements in electronics, software, systems integration and safety, a clear workforce-readiness gap has emerged. Filling this void will be critical for MSMEs in the cluster to remain competitive and participate meaningfully in emerging EV value chains.

A snapshot summary is presented below:

Existing workforce capabilities

- The cluster benefits from an experienced shop-floor workforce with skills in machining, fabrication, welding, assembly operations, and basic electrical work. Supervisors and engineers possess strong knowledge of production planning, quality systems, and mechanical processes.
- Institutional capacity is supported by ITIs, technical institutes and cluster facilities such as MAC, CIPET and DECPL.

Emerging skill gaps

- EV manufacturing demands competencies that are currently limited within the cluster. These include high-voltage and low-voltage safety, battery-pack processes, EV diagnostics and power electronics at the technician level, as well as embedded systems, testing and validation knowledge at the engineering level.
- MSME owners and managers have good experience in production planning and supplier relationships but have reported limited understanding of EV product architectures, E-BOMs, and investment planning for EV changeover.

Priority workforce development needs

- The transition requires targeted realignment of existing skills rather than replacement of the workforce. Practical, EV-specific training modules, industry-aligned curricula and work-integrated apprenticeship models are needed to bridge the current gaps.

- Strengthening institutional capacity and linking skilling efforts with infrastructure and market interventions will be essential for enabling an inclusive and sustainable workforce transition.

This chapter, therefore, examines the existing skill profile of the workforce in Chhatrapati Sambhajinagar, identifies the key gaps constraining MSME transition, reviews the adequacy of the current training infrastructure and outlines the need for targeted, cluster-specific skilling and leadership development interventions.

4.1. Current Skill Gaps in Chhatrapati Sambhajinagar's Workforce

MSMEs in the cluster employ a workforce proficient in conventional automotive manufacturing processes, including CNC machining, metal stamping, fabrication, heat treatment, welding and basic electrical assembly. These competencies have enabled firms to remain competitive within ICE supply chains and to deliver consistent quality for mechanical and low-complexity components.

However, the EV transition exposes an apparent mismatch between these legacy skills and the requirements of EV component manufacturing. EVs are system-intensive products that combine mechanical structures with power electronics, embedded software, thermal management and high-voltage safety systems. Across the cluster, workforce exposure to such integrated systems remains limited.

Technical skill gaps

At the shop-floor and technician level, there is a pronounced shortage of EV-specific technical skills. Workers generally lack hands-on experience with battery pack assembly, battery management systems (BMS), high-voltage wiring, power electronics, and EV-specific testing and validation. While a few MSMEs have experience manufacturing BLDC motors for applications such as fans, electric bicycles, and induction systems, this experience has yet to be translated into workforce readiness for automotive-grade EV propulsion systems.

Equally significant is the absence of software and embedded systems capabilities. EV manufacturing increasingly relies on firmware, diagnostics, calibration, and system integration. Yet most technicians and engineers in CSN have little exposure to embedded software, control algorithms, or digital diagnostic tools.

As a result, MSMEs remain dependent on external designs and specifications, limiting their ability to move beyond build-to-print manufacturing models.

Quality, testing, and certification skills also remain underdeveloped. Awareness of EV-specific standards, safety protocols, and homologation requirements is low, and workers are rarely trained in high-voltage safety, insulation testing, or thermal and electrical validation processes.

Leadership and managerialcapability gaps

Skill gaps in Chhatrapati Sambhajinagar are not confined to the shop floor. MSME owners and senior managers also encounter constraints in understanding EV technologies, product architectures and market entry pathways. Consultations and FGDs revealed limited familiarity with EV subsystem structures, e-bills of materials, cost modelling for EV components and OEM qualification processes.

This constrains tactical decision-making. Many MSMEs continue to approach EV diversification cautiously, focusing on incremental mechanical components rather than planning structured transitions into higher-value EV assemblies. In several cases, firms expressed uncertainty about where they could realistically "plug into" the EV value chain, leading to delayed investments and ad hoc workforce decisions.

Workforce composition and retention challenges

The Chhatrapati Sambhajinagar workforce is characterized by a high proportion of unskilled and semi-skilled workers, with limited opportunities for structured upskilling. Informal, on-the-job learning remains the dominant training mode. Awareness of EV-specific training pathways is low among workers, reinforcing dependence on legacy skills.

MSMEs also encounter ongoing retention challenges. Firms reported that trained workers often migrate to larger firms that offer higher wages and more evident career progression. This discourages smaller firms from investing in deeper skilling and contributes to a pattern of underinvestment in workforce training.

4.2.Training Infrastructure and Programs in the Chhatrapati Sambhajinagar Cluster

Chhatrapati Sambhajinagar hosts a relatively strong institutional ecosystem for training and capacity building, including the MAC, CIPET, ITIs, engineering colleges and DECPL. These institutions provide classrooms, workshops and basic laboratory infrastructure and have historically supported skills development for conventional automotive manufacturing.

However, findings from consultations and FGDs consistently indicate that the existing trainings are not well in line with the requirements of EV manufacturing. While physical infrastructure exists, curricula remain largely generic and ICE-oriented. Trainer exposure to EV technologies is limited, and practical, hands-on EV training modules are scarce.

Industry-academia linkages are also weak. MSMEs reported limited interaction with training institutes on EV-specific requirements, and few programs are co-designed with OEMs or Tier 1 suppliers. As a result, training outcomes are frequently seen as insufficiently relevant to real production environments, leading to under-utilization of training facilities and common infrastructure.

4.3.Need for Specialized Training Programs

The analysis in section 4.1 and 4.2 highlights the need for focused EV skilling interventions that go beyond generic training and address the specific realities of MSMEs in the Chhatrapati Sambhajinagar cluster.

Stakeholder consultations and FGDs underscored the need for specialized training in the following areas:

- Battery pack assembly, testing and safety
- BMS fundamentals and diagnostics
- Motor winding, motor and controller testing
- Power electronics and charger assemblies
- High voltage safety, validation and certification
- CNC/CAM upskilling for aluminium and lightweight components

Participants emphasized that training must be modular, hands-on and closely linked to actual EV job roles. Short, intensive modules that can be stacked over time were identified as particularly suitable for MSMEs that cannot afford long workforce absences.

MSME-led workforce development initiatives

There is also a clear need to strengthen MSME leadership capabilities alongside technical skilling. Workforce development decisions in MSMEs are closely tied to the confidence of owners and managers. Without exposure to EV technologies, business trends and buyer expectations, firms are unlikely to invest meaningfully in workforce transition.

In this context, **WRI India is implementing an EV Skilling and Leadership Development Program explicitly tailored to the** Chhatrapati Sambhajinagar **cluster**. The intervention is designed as a practical, MSME-centric initiative that integrates the following:

- Leadership bootcamps focused on EV transition planning and decision-making
- Modular technical training aligned with cluster-relevant EV components
- Hands-on exposure through common facilities and testing infrastructure
- Mentorship and peer learning to translate skills into unit-level transition plans

The program prioritizes EV components that build on Chhatrapati Sambhajinagar's existing strengths, such as wiring harnesses, motor sub-assemblies, power electronics housings and lightweight mechanical parts, while methodically tackling the skill gaps that constrain progression into higher-value EV segments.

The workforce challenge in the Chhatrapati Sambhajinagar automotive cluster is not a lack of manufacturing capability but a structural lag in EV-specific skills, systems thinking and leadership preparedness. The existing training infrastructure provides a strong foundation, but a lack of focused, cluster-specific interventions leads to the risk of MSMEs remaining confined to low-value roles in the changing EV ecosystem. Dealing with these gaps through focused workforce development and technical skilling is, therefore, central to enabling a credible, inclusive and competitive EV transition for MSMEs in the Chhatrapati Sambhajinagar cluster.

Chapter 5:

Market Access (B2B)

The Chhatrapati Sambhajinagar cluster, traditionally a powerhouse of precision engineering for ICE vehicles, is currently facing a major realignment as global and domestic EV OEMs enter the region. Transitioning into the EV market requires more than purely technical capability; it requires a systematic reconstruction of B2B market linkages and a shift in supply chain approaches to move MSMEs from "built-to-print" subcontractors aimed at strategic partners in the EV value chain.

Market access for MSMEs in an EV era is not automatic. OEMs and Tier 1s buy against precise specifications, qualification regimes and volume forecasts; they are risk-averse of new suppliers for safety-critical assemblies.

The Chhatrapati Sambhajinagar cluster offers two complementary advantages (deep precision-machining capacity and an emerging electronics ecosystem) but lacks three market ingredients buyers require — verified testing/certification, supplier dossiers demonstrating capability and quality systems and predictable delivery capacity for pilot→scale runs. The Bill of Material (BoM) workshop, FGDs and the DECPL study consistently reinforce that narrowing these three gaps is the shortest route to B2B orders for EV components.

5.1.B2B Market Linkages

The table presents a macro view of the effective market access that MSMEs in the EV landscape require. It outlines the key needs, the broad direction of action, and the institutional actors involved. This framework is intended to offer an at-a-glance understanding of the market-access challenge. The subsequent sections in this chapter elaborate each element in detail, including practical mechanisms, institutional arrangements and implementation pathways.

What MSMEs need	What must happen	Who plays a role
 Access to EV buyers	Structured engagement with OEMs and Tier 1 suppliers	OEMs, Tier 1s, cluster institutions
 Clarity on EV specifications	Early sharing of drawings, tolerance and qualification expectations	OEMs, technical partners
 Validation and testing support	Common facilities used for prototyping, testing and first articles	DECPL / MAC/CFCs
 Entry-level EV opportunities	Pilot orders and co-development pathways	OEMs, Tier 1s
 Pathway from parts to assemblies	Vendor development and cohort-based progression	Cluster body, WRI, training partners

5.1.1. Collaboration with OEMs & Tier-1 Suppliers

Why direct collaboration matters?

OEMs and Tier 1s set technical standards and volume schedules. Early interaction allows MSMEs to (i) identify which parts are localizable, (ii) align tolerance and testing expectations and (iii) design pilot runs that meet buyer acceptance criteria. FGDs and the BoM workshop documented MSMEs' repeated request for OEM specification sharing and co-development clinics. During the discussions, the participants had emphasized that "alignment is everything" and that without clarity on specifications and Production Part Approval Process (PPAP)/qualification requirements, firms cannot cost, test or qualify parts effectively.

Practical ways to structure collaboration

OEM-MSME Technical Clinics

Regular, short (half-day) deep dives can be organized where OEM engineers present target part drawings, critical tolerances, acceptance tests and expected volumes. These clinics can be hosted at DECPL/CFCs so MSMEs see test rigs and validation methods in person. The DECPL study recommended such industry-anchored validation workshops to shorten qualification cycles.

Pilot Purchase & Co-Development Agreements

OEMs provide limited pilot purchase commitments (small volumes) in exchange for joint development and supplier support. This de-risk early supplier investment and enable MSMEs to invest in necessary tooling or testing hours. The BoM workshop identified buyer-led pilots as the most realistic path to early local sourcing.

Embedded Mentor Programs:

Senior engineers from OEMs/ Tier 1s (or technical partners) are seconded for short stints to mentor MSMEs during prototype and qualification stages, documented as a high-impact, low-cost match in stakeholder consultations.

Expected outcomes from strengthened collaboration

Faster PPAP-style qualification and reduced rework cycles

Clear identification of localizable components (e.g., housings, enclosures, harnesses, secondary assemblies) that match Chhatrapati Sambhajinagar strengths

Creation of “first article” local suppliers who can graduate into regular production

5.1.2. Setting up Vendor Development Programs for EV Parts (OEMs)

Why a formal VDP is necessary?

Open calls and ad hoc supplier searches rarely yield sustained local sourcing. A structured VDP lets OEMs sequence qualification (awareness → capability building → trial → scale) and lets the cluster organize cohorts of MSMEs prepared for each stage. FGDs recommended cohort approaches and unit-level action plans as workable formats.

Practical VDP design

Stage 0
Scoping & product selection: Use BoM outcomes to list 10-15 target parts that are technically feasible for MSMEs (e.g., battery enclosures, harnesses, housings, busbars, small structural parts) and that have strategic demand from OEMs/Tier 1s. The BoM workshop produced an initial list and validated it with participants.

Stage 1
Capability diagnostics & cohort formation: Use rapid diagnostics (equipment, Quality Assurance QA systems, workforce skills) to shortlist 20-30 MSME candidates into a cohort. WRI's skilling cohort approach is directly applicable here.

Stage 2
Supplier development sprint (8–12 weeks): Technical improvements (jigs, process sheets), access to CFC test hours (DECPL EV rigs), and a shared mentorship plan.

Stage 3
Pilot orders & quality monitoring: Pilot orders are issued in small batches and governed by predefined acceptance criteria, with results documented in supplier dossiers including control plans and first-article inspection reports. The BoM workshop participants emphasized that pilots, not promises, convert to scale.

Stage 4
Scale & contracting: On successful pilots, MSMEs sign long-term supply contracts with staged volumes and incentives for meeting on-time quality metrics.

Operational considerations and governance

The VDP should be run as a public-private partnership with the OEM/Tier 1 as demand lead, the cluster body (MAC/CMIA) as coordinator and DECPL/MAGIC/CFC as the technical backbone. Evidence from FGDs and the DECPL study reveal that these institutional roles are already accepted in Chhatrapati Sambhajinagar.

5.2. MSME Supply Chain

5.2.1 Opportunities for MSMEs in Tier 1 & Tier 2

Realistic product entry points (near term)

Electrical enclosures and housings (battery trays, inverter boxes):

It present a strong fit with the cluster's existing sheet-metal and plastic tooling capabilities and require relatively low incremental tooling investment compared with battery cell assembly.

Wiring harnesses and connectors (EV-grade):

Processes (crimping, bundling, sealing) map directly to existing harness lines; only HV-grade insulation and test regimes need to be added.

PCB assemblies (chargers, controllers) and small power modules:

DECPL's SMT and PCB prototyping strengths are a clear asset; MSMEs can scale to module assembly for on-board chargers or DC-DC converters. The DECPL study specifically cites electronics assembly as a cluster strength.

Motor housings, covers and winding services:

While full motor manufacturing is more complex, providing housings, casings and winding services (for BLDC/PMSM) is a medium-term pathway.

Medium-term and higher-value opportunities

Battery module assembly (non-cell operations):

Enclosures, busbars and module integration (not cell manufacturing) can be localized with CFC support and OEM pilot buys. DECPL study lists module-level tooling needs and phased investments.

Sub-assemblies for motor and gearbox integration (e-drives):

This would require staged capability build, systems testing and stronger OEM ties and be suitable for MSMEs that move from parts to assembly. This is a multi-year pathway supported by cohort development and VDPs.

5.2.2. Supply Chain Strategies for Diversification into EV Parts

A practical diversification playbook for MSMEs

Start with component fit, not product prestige:

Prioritize those parts that require minimal change to process (e.g., enclosures, harnesses, busbars) and have immediate local demand; this reduces CapEx risk and creates cash flow for deeper investments. This "start simple, scale smart" guidance emerged clearly at the BoM workshop.

Bundle capabilities across micro clusters:

Where single MSMEs cannot offer complete assemblies, form small consortia (e.g., enclosure maker + harness shop + PCB assembler) to bid for a complete subsystem, an approach discussed in the BoM workshop as a pragmatic route to capturing larger orders.

Use CFCs as risk-sharing platforms:

Access DECPL's recommended EV toolset for prototyping and first-article tests rather than buying expensive rigs. This was a core recommendation of the DECPL study.

Adopt staged investments:

Sequence upgrades (tooling → process control → low-vol pilot → scale) using pilot funds or shared leasing models to manage cash exposure. The DECPL equipment roadmap recommends a phased procurement schedule for exactly this reason.

Document quality early:

Build supplier dossiers (material certificates, process flow charts, first-article reports) during pilot runs so buyers can assess risk quickly.

Chapter 6

Cluster Development & Infrastructure

Chhatrapati Sambhajinagar has matured into one of Maharashtra's foremost precision engineering hubs. The cluster hosts 1,648 registered auto component manufacturers, supports a formal workforce of over 30,600 skilled employees and is anchored by legacy OEMs such as Bajaj Auto and Škoda Auto, as well as Tier 1 suppliers such as Endurance Technologies, Varroc, Rucha Engineers, NRB Bearings, Badve Engineering, Aurangabad Electricals and Greaves Cotton. Over decades, this ecosystem has developed deep expertise in CNC machining, metal stamping, heat treatment and precision assembly — capabilities that serve as the basis for the cluster's competitiveness in ICE supply chains.

However, the electrification of the automotive sector requires a decisive evolution in the cluster's institutional and infrastructure backbone. While Chhatrapati Sambhajinagar possesses strong manufacturing depth, stakeholder interactions often underscored that the existing common infrastructure is not aligned with the requirements of EV component manufacturing, particularly for powertrain, battery systems and high-voltage electronics.

6.1. Institutional Strengthening and Cluster Coordination

As the cluster transitions from ICE-centric manufacturing toward EVs, institutional coordination becomes a critical enabler. Chhatrapati Sambhajinagar already benefits from industry bodies such as MAC, CMIA and MASSIA, as well as institutions such as CIPET and MAGIC. What is now required is a more deliberate, EV-focused coordination mechanism to align MSMEs, OEMs, testing bodies, incubators and government stakeholders around a shared transition pathway. Stakeholder interactions during this engagement stressed the need for local EV forums and structured knowledge sharing mechanisms to disseminate market intelligence, OEM expectations, standards updates and technology trends. Such platforms are essential for reducing information asymmetry for MSMEs and for translating large-scale EV investments in the region into concrete supplier opportunities.

6.2. Common Infrastructure & Resource Pooling: The Case for an EV-focused CFC

One of the most consistent findings from primary interviews with MSMEs, startups and suppliers was the **absence of a dedicated CFC for auto-EV manufacturing in** Chhatrapati Sambhajinagar. While the cluster hosts **DECPL**, a well-established CFC for electronics manufacturing, its current configuration primarily supports general electronics and EMS activities. The facility fails to adequately address the automotive EV value chain, particularly battery packs, traction motors and power electronics testing.

Recognizing this critical gap, WRI India undertook a focused research study titled "**Accelerating EV Transition: Enabling an EV-ready Facility at DECPL, Chhatrapati Sambhajinagar**". The study was initiated in response to stakeholder comments and designed to provide a technically rigorous, market-aligned roadmap for upgrading DECPL into a **plug-and-play EV-ready CFC**.

Approach and methodology

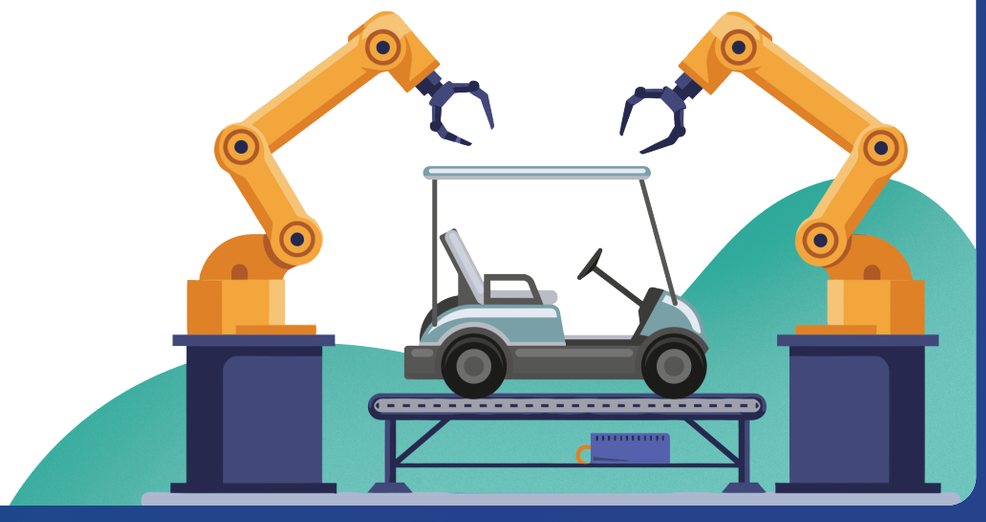
The study adopted a multi-pronged methodology combining:

Secondary research to map EV powertrain manufacturing requirements and benchmark global CFC models.

Primary consultations with DECPL members, prospective MSMEs, EV startups and domain experts from leading EV manufacturers

Key outputs and significance

The study delivered a module-wise equipment and tool mapping covering electric motor systems, battery-pack assembly and control electronics, along with indicative costs, lead times, skill requirements and a phased procurement strategy. Importantly, it moved beyond generic infrastructure recommendations and provided DECPL with a practical, implementation-ready blueprint for bridging the existing shortcomings in infrastructure.



This intervention directly supports the study objective by:

translating MSME needs into specific, shared assets rather than firm-level CapEx.

enabling local prototyping, testing and validation of EV components; and

reducing dependence on distant testing facilities, which currently increases cost and lead time for MSMEs.

For comprehensive insights, access the report **Accelerating EV Transition: Enabling an EV-Ready Facility at DECPL, Chhatrapati Sambhajinagar**

6.3. Leveraging AURIC and MAGIC for EV Innovation and Prototyping

The relevance of this CFC upgradation becomes even more significant in the context of AURIC, the 10,000-acre greenfield industrial city under the DMIC framework. AURIC has already attracted large EV and advanced manufacturing investments, including:

Reliance Infrastructure's
₹14,377 Crore EV project

Ather Energy's
₹2,000 Crore two-wheeler plant

JSW Green Mobility's proposed
₹27,200 Crore facility

Toyota Kirloskar's
₹20,000 Crore investment.

These projects will generate a demand for precision-electrical sub-assemblies, such as motors, inverters, and battery modules, alongside mechanical components. To ensure local MSMEs' participation in these supply chains, Chhatrapati Sambhajinagar requires accessible prototyping and testing infrastructure.

In this context, MAGIC plays a complementary role by supporting EV startups and MSME-led R&D. An EV-ready DECPL CFC, combined with MAGIC's incubation and mentoring capabilities, creates a local innovation loop where innovations can be prototyped, tested, refined and scaled within the cluster.

6.4. Testing, Certification and Quality Assurance

EV manufacturing places stringent demands on testing, safety and certification. Stakeholders highlighted limited local access to facilities for BIS/AIS compliance, high-voltage safety testing and EV-specific validation. While national facilities exist, their distance poses cost and time barriers for MSMEs.

The DECPL upgradation study addresses this gap by identifying testing and validation equipment that can be housed locally and systematically linked to national certification and homologation pathways. However, as EV technologies mature and product complexity increases, component-level testing alone is no longer sufficient. There is a clear and complementary opportunity to establish physical EV test track infrastructure in the Chhatrapati Sambhajinagar region, enabling real-world performance validation alongside laboratory-based testing.

A regional test track designed for acceleration, braking, gradient, handling assessments and incorporating urban, highway and rural simulation zones would significantly strengthen MSME and startup access to end-to-end validation support.

When integrated with in-house inspection, component testing and certification services aligned with AIS, BIS and ICAT norms, such infrastructure would reduce testing turnaround time, lower compliance costs and accelerate time-to-market.

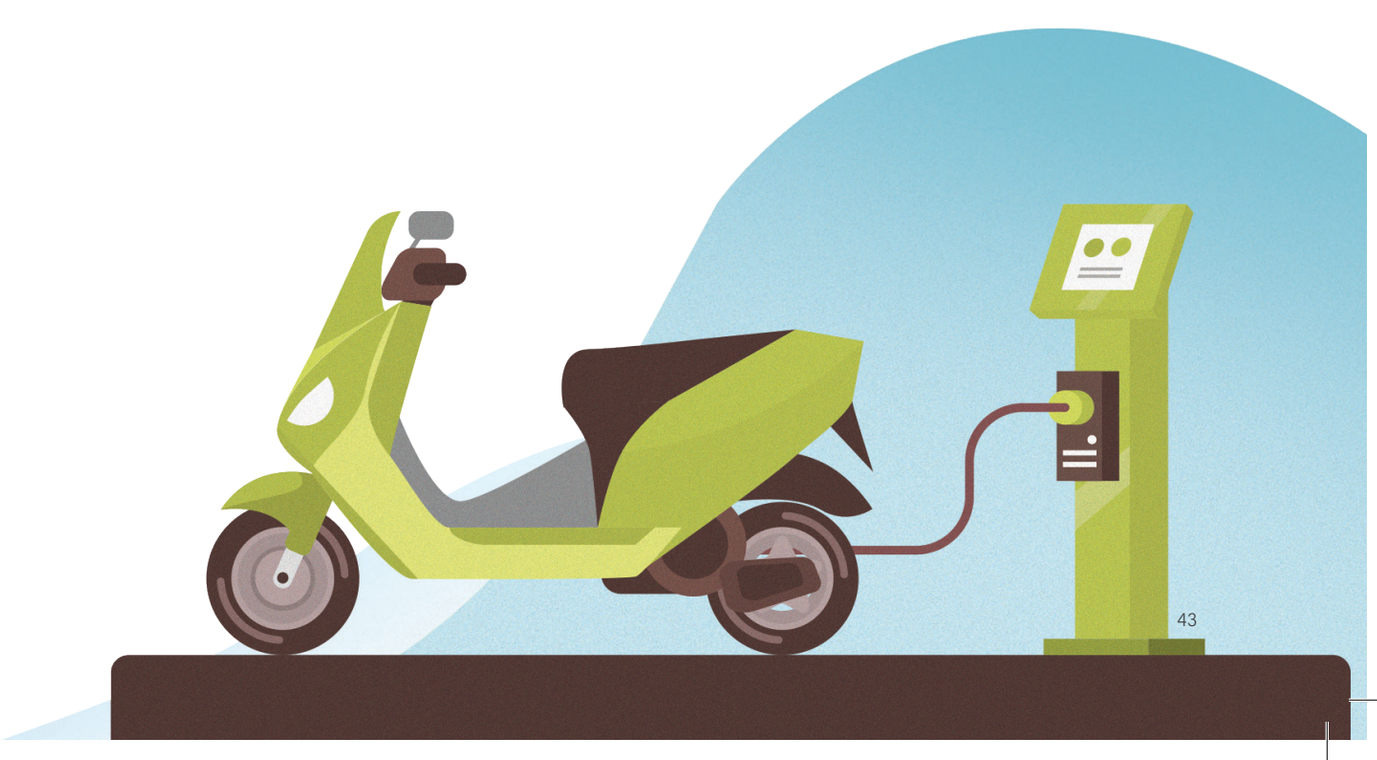
For MSMEs targeting both domestic and export markets, where standards assurance and regulatory compliance are non-negotiable, the combined availability of an EV-ready CFC at DECPL and a regional physical test track would create a comprehensive, locally accessible validation ecosystem, positioning Chhatrapati Sambhajinagar as a credible hub for EV development, testing and certification.[35]

Overall significance for cluster transition

The DECPL EV-ready CFC study represents a key foundation infrastructure intervention within Chhatrapati Sambhajinagar's EV transition journey. It acts as a connector to the gap between high-level cluster vision and on-ground MSME capability by anchoring transition efforts in shared, accessible infrastructure instead of isolated firm-level investments.

By aligning institutional coordination, common infrastructure, incubation support and testing access, this effort positions the cluster not only to absorb upcoming EV investments but also to proactively influence and lead India's electric mobility manufacturing ecosystem while preserving the cluster's legacy strengths in high-precision manufacturing.

35 Accelerating EV Transition: Enabling EV-Ready facility at Chhatrapati Sambhajinagar



Chapter 7

Cluster Transition Strategy & Roadmap

The cluster transition strategy for Chhatrapati Sambhajinagar is designed as a phased, inclusive and MSME-centric roadmap that builds progressively from awareness and preparedness to full adoption into EV value chains. The approach recognizes Chhatrapati Sambhajinagar's strong legacy while addressing the gaps in EV technology adoption, workforce skills, market access and common infrastructure. Governance is anchored in partnership among industry associations, MSMEs, OEMs, knowledge partners and government agencies.

Pillar/Component	Immediate Actions (0-1 Year) What can start now
Technology Adoption	Awareness workshops on EV BoM, component architectures, manufacturing processes, safety standards and OEM expectations **Lead:** WRI India Handover begins: Industry associations
Workforce Skilling & Capacity Building	Launch EV-focused skilling and leadership development cohorts for MSME owners, engineers and supervisors (battery basics, motors, power electronics, testing) **Lead:** WRI India and skilling partners
Market Access (B2B)	OEM-MSME interaction clinics and buyer-seller meets to expose MSMEs to EV sourcing requirements and pilot opportunities **Lead:** Industry associations Support: WRI India
Financing & Investment Readiness	Financial literacy sessions covering EV transition costs, phased investment planning and risk management **Lead:** WRI India / Associations
Common Infrastructure & Resource Pooling	Dissemination of findings from the DECPL EV-ready CFC study; awareness on shared testing, prototyping and validation pathways for MSMEs **Lead:** WRI India / DECPL
Governance & Coordination	Formation of an interim cluster coordination mechanism to steer early actions **Lead:** WRI India (facilitation)

The cluster's EV transition is visualized as a step-by-step progression, from awareness to capability, from pilots to scale and from local relevance to global competitiveness. By coordinating skilling, infrastructure, financing and market access within a coherent roadmap, Chhatrapati Sambhajinagar can leverage its legacy to become a leading node in India's electric mobility manufacturing ecosystem.

Short-medium Term (1–3 Years) What requires preparation & scaling	Medium- long Term 3-5 Years) What sustains the transition
Operationalization of an EV-focused VDP with OEMs and Tier 1s, including pilot orders and co-development support **Lead:** Industry associations / OEMs	Integration of capable MSMEs into stable EV supply chains and higher-value sub-assemblies **Lead:** OEMs / Tier 1s
Advanced technical training modules linked to live pilot projects (motor testing, BMS diagnostics, HV safety, quality and compliance systems), institutionalization through ITIs and technical institutes **Lead:** Training institutions	Establishment of a dedicated EV skilling and certification centre aligned with evolving industry standards **Lead:** State skill ecosystem
Institutionalization of an annual or bi-annual EV buyer-seller forum in Chhatrapati Sambhajinagar to showcase MSME capabilities and attract sustained OEM engagement **Lead:** Industry associations	Integration of Chhatrapati Sambhajinagar MSMEs into national and global EV supply chains through Tier 1 sourcing and export linkages **Lead:** OEMs / Export bodies **Support:** Industry associations
EV Transition facilitation support to help MSMEs access blended finance, leasing and shared equipment models **Lead:** State agencies / financial institutions	Creation of a dedicated EV Technology Adoption / Innovation Fund to support scale-up and advanced capability building of MSMEs **Lead:** State government / SIDBI
Phased upgradation of DECPL into an EV-ready CFC, based on the study covering motors, battery packs, power electronics and testing equipment **Lead:** DECPL / State government	Expansion into a fully integrated EV CFC with advanced testing, homologation, and export-quality certification facilities. **Lead:** DECPL / State agencies
Transition of coordination responsibilities to industry associations and local institutions **Lead:** Industry bodies	Long-term governance embedded within cluster institutions and state-led mechanisms **Lead:** Industry, Government

Notes

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Authors:
Mr. Ashish Garde, Director, MAC
Mr. Suresh Todkar, Director, DECPL
Mr. Prasad Kokil, Director, MAGIC

Contributor:
Saket Singh, WRI India