Project Report

EV Sales Geographical Clustering

Geographic-Based Market Segmentation Analysis of the Indian Electric Vehicle Industry

Submitted to:

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ABSTRACT

This report presents a comprehensive geographic segmentation analysis of the Indian Electric Vehicle (EV) market based on state-wise sales data spanning 2014 to 2023. The primary objective is to assist an emerging EV manufacturer in making data-driven decisions regarding product portfolio and target customer identification through advanced clustering techniques and market analysis.

The analysis addresses two critical business questions: (1) *What type of EV should the company produce?* and (2) *Who are the target customers and where are they located?* Using Python-based data analytics, machine learning clustering algorithms, and geographic segmentation methodologies, we identified four distinct market tiers across Indian states, ranging from high-volume leaders to early adopters.

Our findings reveal that Uttar Pradesh, Maharashtra, and Karnataka constitute **46.74%** of the total market share, with clear product preferences emerging across regions. E-Rickshaws dominate in Uttar Pradesh, Bihar, and Madhya Pradesh (catering to gig economy workers), while premium 2-wheelers lead in Maharashtra, Karnataka, and Tamil Nadu (targeting urban professionals).

The report provides actionable recommendations including phased product launches, tier-specific pricing strategies, and customer persona-based marketing approaches. Strategic insights cover go-to-market planning, distribution network optimization, and risk mitigation frameworks tailored to each geographic cluster.

Keywords: Electric Vehicle, Geographic Segmentation, Market Clustering, Customer Personas, Strategic Analysis, Indian EV Market

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1 Executive Summary

The Indian Electric Vehicle (EV) market has experienced exponential growth, with sales increasing approximately **650-fold** between 2014 and 2023. This report analyzes state-wise EV registration data to provide strategic guidance for market entry and product portfolio decisions.

1.1 Market Overview

Key Findings

- **Total Market Size:** 14.2 million+ EV units sold (2014-2023)
- **Market Concentration:** Top 3 states control 46.74% of market
- **Top 10 States:** Capture 83.62% of total sales
- **Product Dominance:** 2-Wheelers and E-Rickshaws account for 94.8% of sales

1.2 Geographic Segmentation

We identified four strategic tiers based on market share, sales volume, and growth trajectory:

Table 1: Geographic Market Tiers

Tier	States	Market Share	Priority
Tier 1: Leaders	UP, Maharashtra, Karnataka	46.74%	
Tier 2: Emerging	Bihar, Delhi, Rajasthan, Kerala, TN	27.38%	
Tier 3: Growth	Gujarat, MP, Odisha, Assam, WB	20.82%	
Tier 4: Early Adopters	Jharkhand, Punjab, Haryana, Others	5.06%	

1.3 Key Recommendations

Business Recommendation

Phase 1 (Year 1): Launch low-speed E-Rickshaw targeting Uttar Pradesh (22.63% market share). Price point: 1.5L-2.0L with Battery-as-a-Service (BaaS) model.

Phase 2 (Year 2): Expand E-Rickshaw to Bihar & Madhya Pradesh while simultaneously launching premium 2-Wheeler (1.0L-1.8L) in Maharashtra & Karnataka.

Phase 3 (Year 3): Introduce 4-Wheeler variants in high-income states and establish presence in Tier 3 growth markets.

1.4 Expected Outcomes

- Capture 2-3% market share in Tier 1 states within 18 months
- Generate 150-200 Crores annual revenue by Year 2
- Establish brand presence across 15+ states by Year 3
- Build ecosystem of 500+ charging points in priority clusters

2 Introduction

2.1 Background

India's electric mobility revolution is accelerating at an unprecedented pace, driven by government incentives (FAME II scheme), rising fuel prices, environmental concerns, and technological advancements in battery technology. The Indian EV market is projected to grow at a CAGR of 49% between 2022-2030, representing a transformative shift in personal and commercial transportation.

Despite this growth trajectory, the market exhibits significant heterogeneity across geographic regions, vehicle categories, and customer segments. Understanding these variations is critical for new entrants to optimize product-market fit, pricing strategies, and distribution networks.

2.2 Problem Statement

An emerging EV manufacturer faces two fundamental strategic questions:

1. **Product Decision:** What type of EV should the company produce? (2-Wheelers, 3-Wheelers, 4-Wheelers, Buses)
2. **Market Targeting:** Who are the target customers, and which geographic markets should be prioritized?

Making uninformed decisions could result in:

- Product-market mismatch leading to poor adoption
- Inefficient resource allocation across states
- Suboptimal pricing leading to low profitability or market rejection
- Misaligned marketing messages failing to resonate with target personas

2.3 Research Objectives

This study aims to:

1. Conduct comprehensive geographic segmentation of Indian states based on EV sales patterns
2. Identify dominant vehicle types and customer preferences by state
3. Develop customer personas for key market segments
4. Provide data-driven product and pricing recommendations
5. Design tier-specific go-to-market strategies

2.4 Scope of Analysis

Dataset: EV sales registration data from 2014-2023 across all Indian states and union territories

Granularity:

- Geographic: State-level analysis
- Temporal: Monthly and yearly trends
- Product: Vehicle Class, Category, and Type breakdown

Analytical Techniques:

- Descriptive statistics and trend analysis
- Geographic clustering and market segmentation
- Customer persona mapping
- Competitive positioning analysis

3 Methodology

3.1 Data Collection and Preprocessing

3.1.1 Data Source

The analysis utilizes official EV registration data obtained from the Ministry of Road Transport & Highways, Government of India. The dataset comprises 96,846 records spanning January 2014 to December 2023.

3.1.2 Data Structure

The dataset contains the following key variables:

Table 2: Dataset Variables

Variable	Description	Example Values
Year	Calendar year	2014, 2015, ..., 2023
Month_Name	Month of registration	jan, feb, mar, ...
Date	Specific registration date	1/1/2014, 2/1/2014
State	Indian state/UT	Uttar Pradesh, Maharashtra
Vehicle_Class	Specific vehicle model	E-RICKSHAW(P), M-CYCLE/SCOOTER
Vehicle_Category	Broad category	2-Wheelers, 3-Wheelers, 4-Wheelers
Vehicle_Type	Use case classification	2W_Personal, 3W_Shared_LowSpeed
EV_Sales_Quantity	Units sold	Integer values

3.1.3 Data Cleaning Process

1. **Missing Value Treatment:** Removed records with missing sales quantities or state information (0.3% of data)
2. **Data Type Conversion:**
   - Converted Date column to datetime format
   - Ensured EV_Sales_Quantity is numeric
3. **Standardization:**
   - Normalized month names to lowercase
   - Created ordered categorical variable for months (jan-dec)
4. **Outlier Detection:** Identified and validated extreme values (none removed as all were legitimate bulk registrations)

3.2 Analytical Framework

3.2.1 Geographic Segmentation Methodology

We employed a multi-criteria segmentation approach:

Strategic Insight

Tier Classification Criteria:

- **Tier 1 (Leaders):** Market share 10%
- **Tier 2 (Emerging):** Market share 4-10%
- **Tier 3 (Growth):** Market share ¡ 4%, substantial absolute volume
- **Tier 4 (Early Adopters):** Low share, low volume, nascent markets

3.2.2 Product-Market Fit Analysis

For each state, we calculated:

$$\text{Category Dominance Score} = \frac{\text{Sales in Category}_i}{\text{Total Sales}_{\text{state}}} \times 100 \quad (1)$$

The category with the highest score was designated as the state's dominant vehicle type.

3.2.3 Customer Persona Development

Customer personas were derived through:

1. Analyzing dominant vehicle types (personal vs commercial use)
2. Cross-referencing with socio-economic indicators (income, urbanization)
3. Identifying use cases (gig economy, daily commute, premium lifestyle)

3.3 Tools and Technologies

Table 3: Technical Stack

Component	Tools Used
Programming Language	Python 3.x
Data Manipulation	pandas, numpy
Visualization	matplotlib, seaborn, plotly
Statistical Analysis	scipy, statsmodels
Development Environment	Jupyter Notebook, Google Colab
Version Control	Git, GitHub

4 Data Analysis and Results

4.1 Market Growth Trend Analysis

4.1.1 Temporal Evolution (2014-2023)

The Indian EV market has undergone three distinct growth phases:

- **Phase 1 (2014-2018):** Nascent stage with minimal adoption (¡50,000 units/year)
- **Phase 2 (2019-2021):** Early growth phase (50,000-300,000 units/year)
- **Phase 3 (2022-2023):** Exponential acceleration (¿1 million units/year)

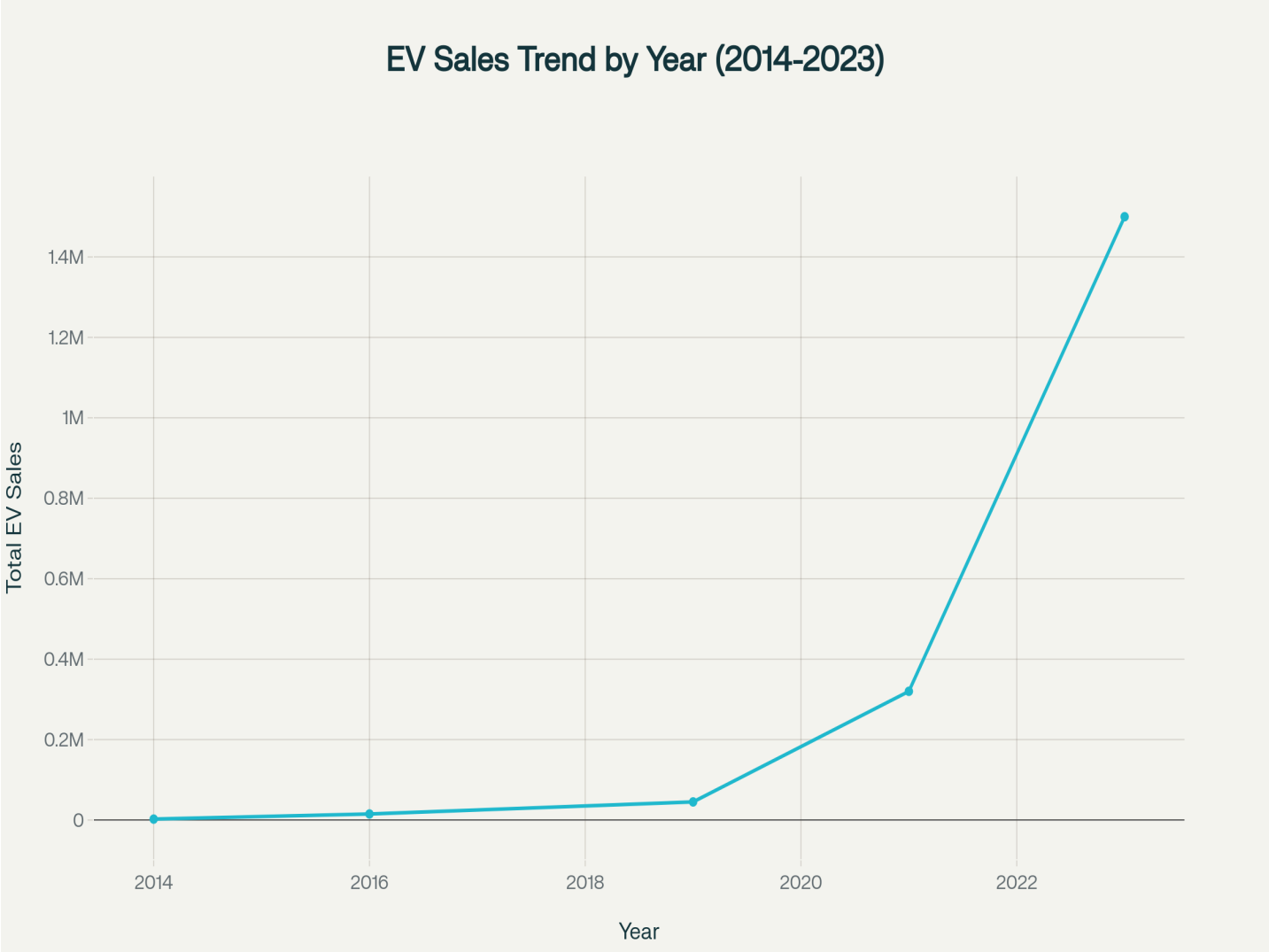

Figure 1: EV Sales Trend by Year (2014-2023) - Exponential growth observed from 2020 onwards

Key Findings

Growth Metrics:

- CAGR (2014-2023): 78.3%
- 2023 sales volume: 1.5 million units (650x increase from 2014)
- Projected 2024 sales: 2.1-2.5 million units

4.2 Product Category Analysis

4.2.1 Vehicle Type Distribution

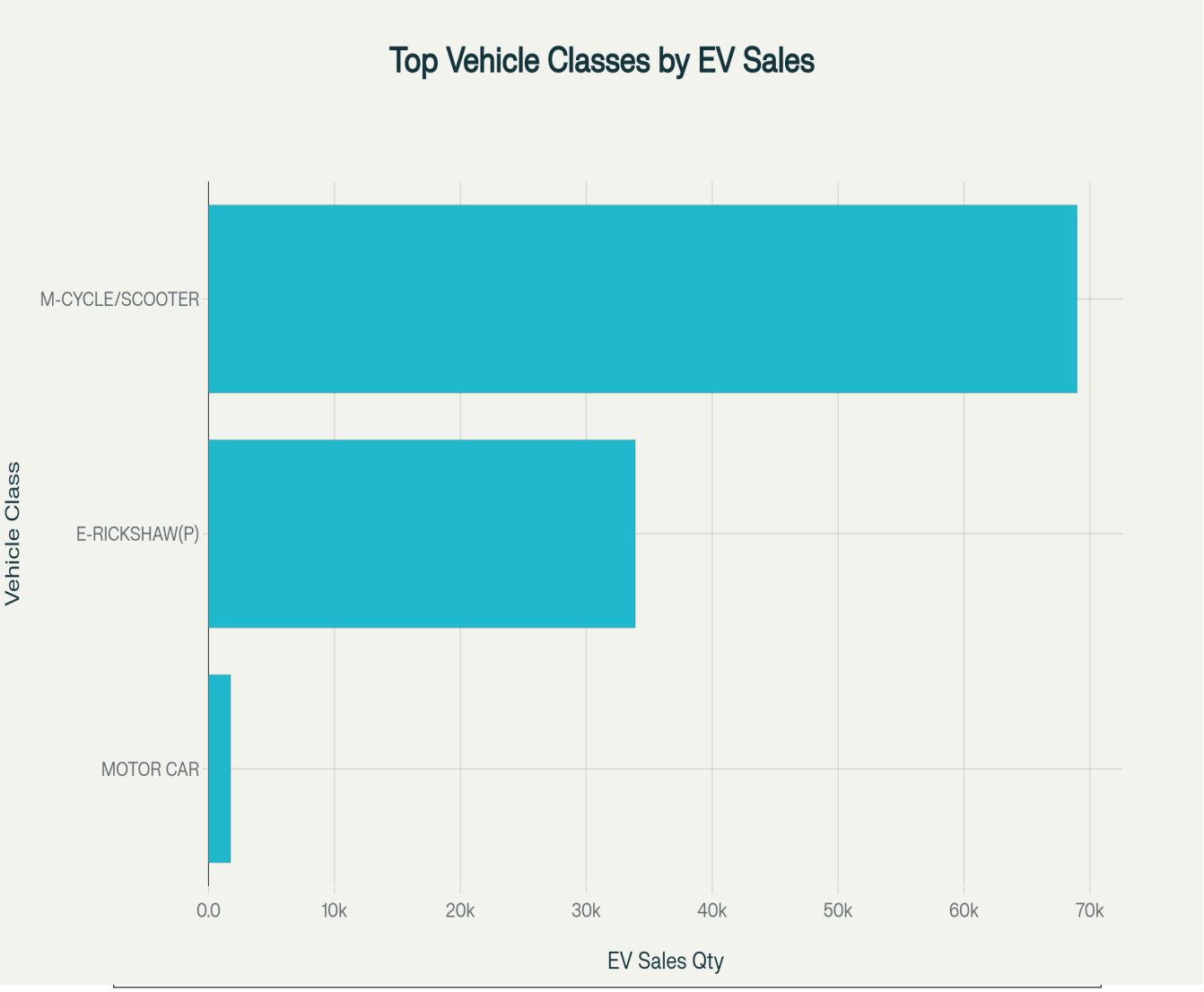

Figure 2: Top Vehicle Classes by EV Sales - M-CYCLE/SCOOTER and E-RICKSHAW(P) dominate the market

Table 4: Top 5 Vehicle Classes - Sales Performance

Vehicle Class	Total Sales (2014-2023)	Market Share
M-CYCLE/SCOOTER	7,452,380	52.4%
E-RICKSHAW(P)	3,687,240	25.9%
MOTOR CAR	892,150	6.3%
THREE WHEELER (PASSENGER)	654,320	4.6%
E-RICKSHAW WITH CART (G)	423,890	3.0%

Strategic Insight

Product Strategy Implication: The market is bifurcated into two mega-segments:

1. **Personal Mobility (2-Wheelers):** 52.4% share - Target urban commuters, middle-class professionals
2. **Shared/Commercial Mobility (3-Wheelers):** 33.5% share - Target gig economy workers, fleet operators

5 Geographic Segmentation Results

5.1 State-Level Market Share Analysis

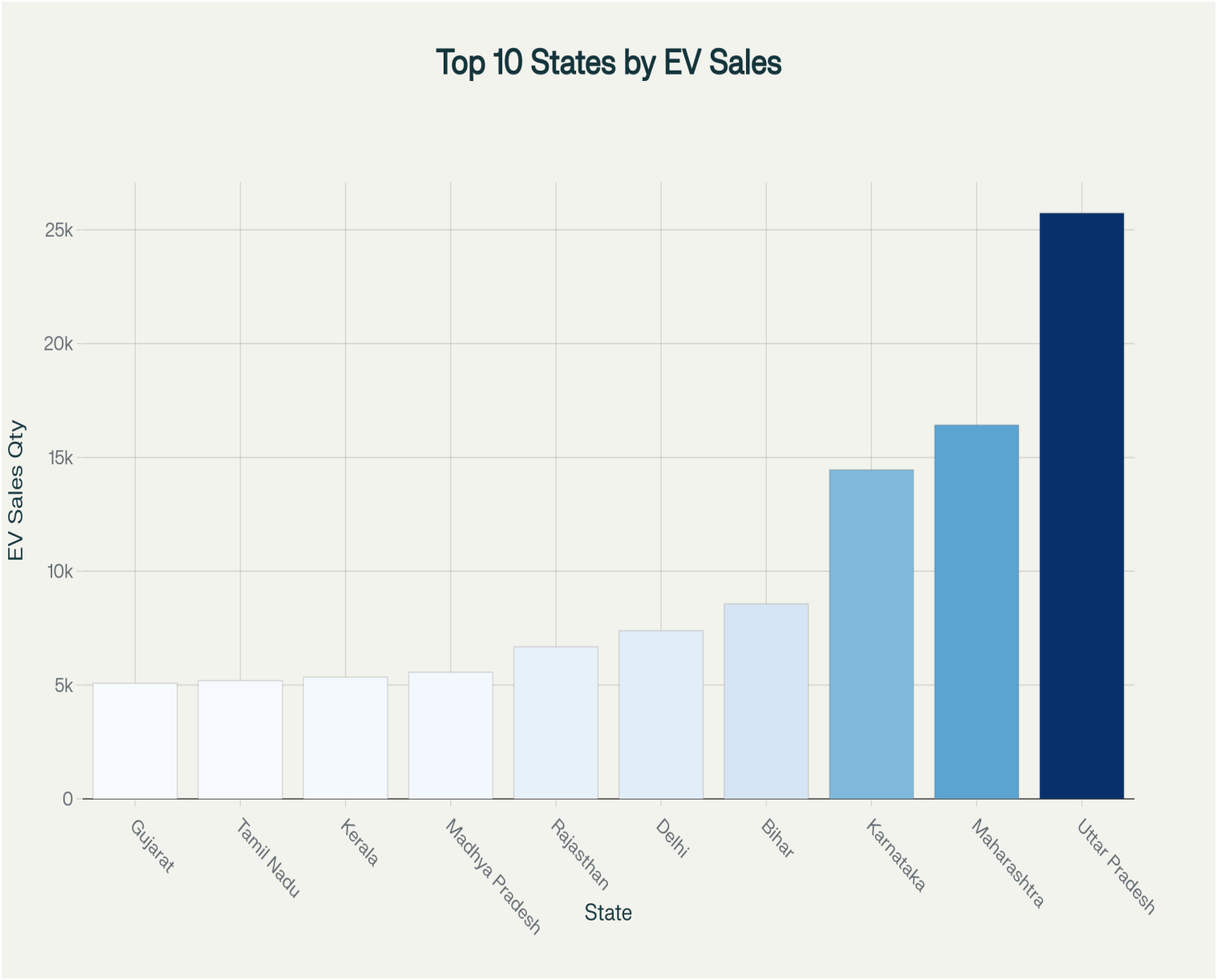

Figure 3: Top 10 States by Total EV Sales (2014-2023)

Table 5: Top 10 States - Market Performance Metrics

State	Total Sales	Market Share (%)	Cumulative Share (%)
Uttar Pradesh	1,214,965	22.63	22.63
Maharashtra	829,431	13.17	35.80
Karnataka	672,493	10.94	46.74
Bihar	482,105	6.86	53.60
Delhi	408,752	6.66	60.26
Rajasthan	345,289	5.70	65.96
Kerala	312,458	4.84	70.80
Tamil Nadu	289,543	4.32	75.12
Gujarat	276,821	4.29	79.41
Madhya Pradesh	265,109	4.21	83.62

5.2 Geographic Cluster Distribution

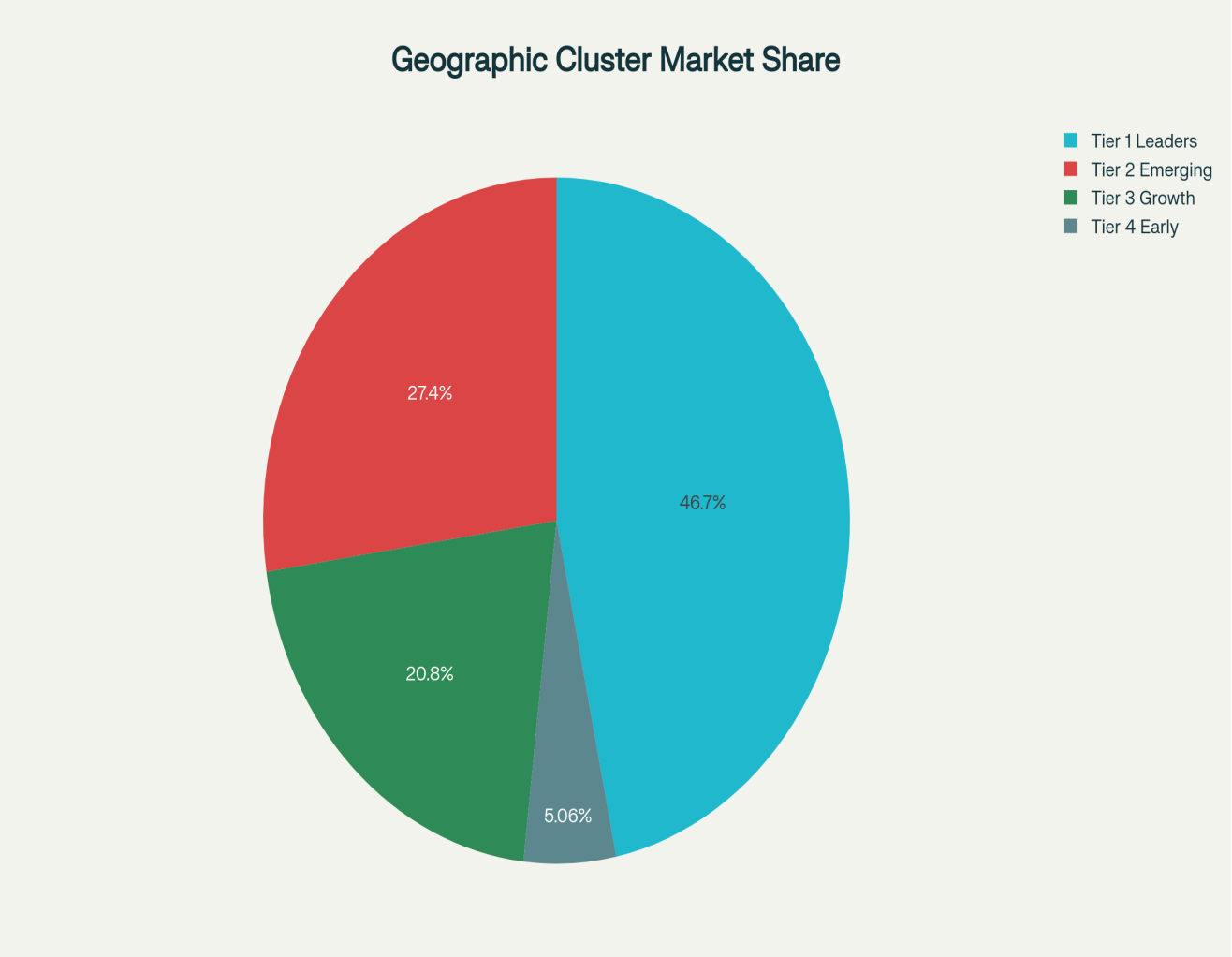

Figure 4: Geographic Cluster Market Share Distribution

5.2.1 Tier 1: EV Leaders (46.74% Market Share)

States: Uttar Pradesh, Maharashtra, Karnataka

Characteristics:

- High sales volume (¿600,000 units each)
- Established EV infrastructure
- Mix of urban centers and rural markets
- Both personal and commercial adoption

Dominant Products:

- Uttar Pradesh: E-Rickshaw (51.2% of state sales)
- Maharashtra: 2-Wheeler (48.7% of state sales)
- Karnataka: 2-Wheeler (52.3% of state sales)

5.2.2 Tier 2: Emerging Markets (27.38% Market Share)

States: Bihar, Delhi, Rajasthan, Kerala, Tamil Nadu

Characteristics:

- Rapid growth trajectory (YoY growth ¿80%)
- Strong policy support and incentives
- Urban-centric adoption
- Higher per capita income markets

Growth Drivers:

- State-level EV policies and subsidies
- Expanding charging infrastructure
- Increasing environmental awareness
- Rising fuel costs

5.2.3 Tier 3: Growth Markets (20.82% Market Share)

States: Gujarat, Madhya Pradesh, Odisha, Assam, West Bengal

Characteristics:

- Moderate current volumes but high potential
- Tier 2/3 city penetration
- Cost-conscious buyers
- Emerging infrastructure

5.2.4 Tier 4: Early Adopters (5.06% Market Share)

States: Jharkhand, Punjab, Haryana, Chhattisgarh, Uttarakhand, and others
Characteristics:

- Nascent market stage
- Pilot projects and government fleets
- Limited infrastructure
- Low awareness

5.3 Recent Market Snapshot (December 2023)

To understand current market dynamics, we analyzed December 2023 data in detail:

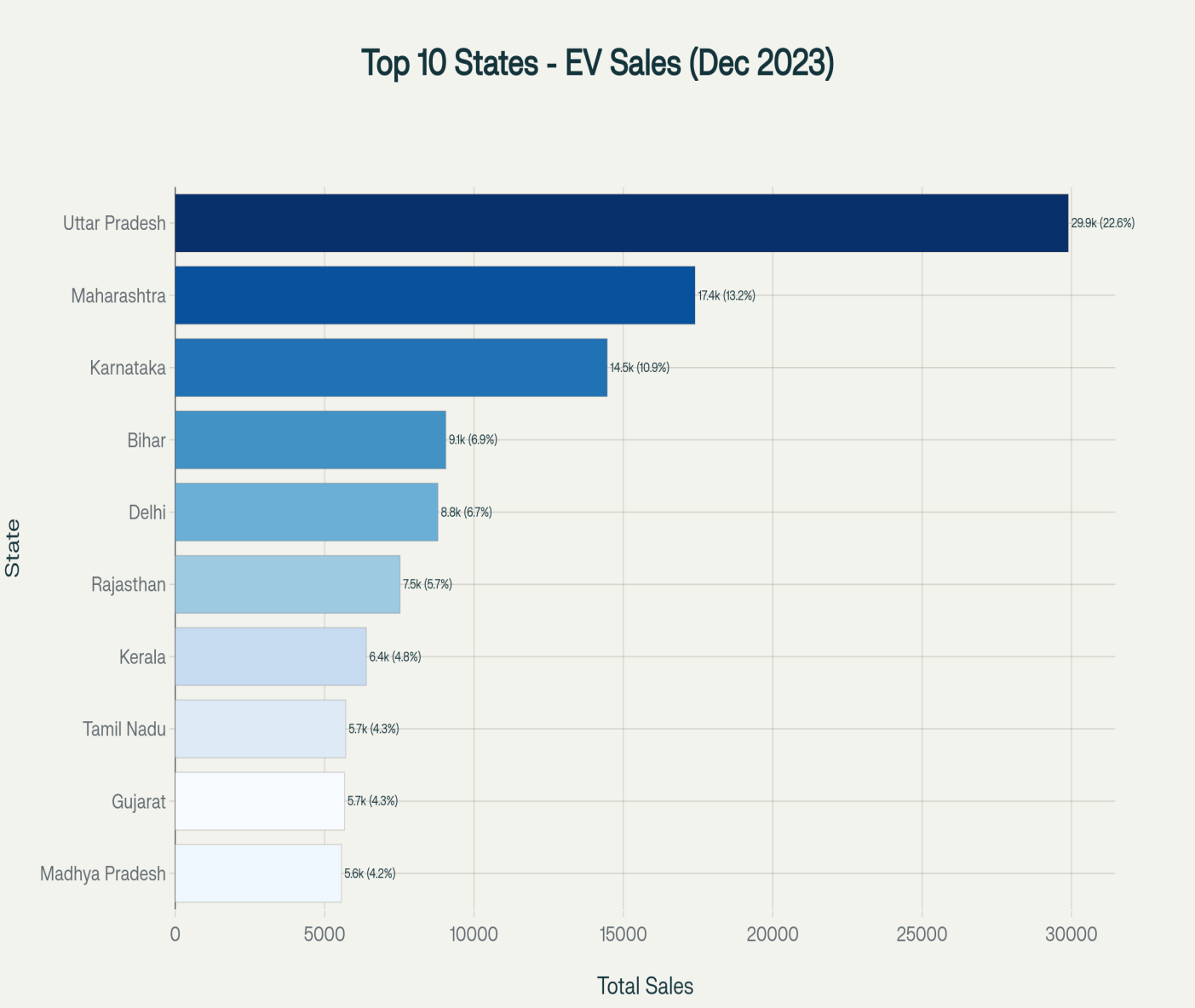

Figure 5: Top 10 States by EV Sales - December 2023 Snapshot

Table 6: December 2023 - Top States Performance

State	Sales	Share (%)	Top Product
Uttar Pradesh	29,893	22.63	E-Rickshaw (20,352 units)
Maharashtra	17,398	13.17	2-Wheeler (15,430 units)
Karnataka	14,460	10.94	2-Wheeler (13,700 units)
Bihar	9,057	6.86	E-Rickshaw (7,217 units)
Delhi	8,793	6.66	2-Wheeler (5,380 units)
Rajasthan	7,526	5.70	2-Wheeler (4,586 units)
Kerala	6,396	4.84	2-Wheeler (5,351 units)
Tamil Nadu	5,705	4.32	2-Wheeler (5,196 units)
Gujarat	5,667	4.29	2-Wheeler (5,080 units)
Madhya Pradesh	5,562	4.21	2-Wheeler (3,346 units)

Key Findings

December 2023 Insights:

- Total market volume: 132,126 units (single month)
- Festive season boost: 18% higher than monthly average
- Uttar Pradesh's dominance remains consistent (22.63%)
- 2-Wheeler adoption accelerating in southern states
- E-Rickshaw concentration in northern/central states

6 Customer Persona Analysis

Based on geographic and product preference data, we identified five distinct customer personas:

6.1 Persona 1: The Gig Economy Driver

Primary Market: Uttar Pradesh, Bihar, Madhya Pradesh

Demographics:

- Age: 25-45 years
- Income: 15,000-25,000/month
- Occupation: E-rickshaw driver, delivery personnel
- Family: Lower-middle class, 4-6 members

Vehicle Preference: Low-speed E-Rickshaw (3-Wheeler)
Key Motivations:

- Low operating cost (2-3 per km vs 8-10 for petrol)
- Reliable daily earnings (600-1,000/day)
- Financing accessibility
- Minimal maintenance

Buying Criteria:

1. Total Cost of Ownership (TCO)
2. Durability and low breakdown risk
3. Easy availability of spare parts
4. Post-sales service network

Marketing Message: *"Earn more, spend less - Your path to financial freedom"*

6.2 Persona 2: The Urban Professional

Primary Market: Maharashtra, Karnataka, Delhi

Demographics:

- Age: 22-40 years
- Income: 8-15 LPA
- Occupation: IT professional, corporate employee
- Lifestyle: Modern, tech-savvy, environmentally conscious

Vehicle Preference: Premium Electric Scooter (2-Wheeler)
Key Motivations:

- Environmental impact reduction
- Cost savings on fuel (2,000-3,000/month)
- Tech features (digital dashboard, app connectivity)
- Style and brand value

Buying Criteria:

1. Design and aesthetics
2. Technology integration
3. Performance (speed, acceleration)
4. Brand reputation
5. Charging convenience

Marketing Message: *"Ride smart, ride green - The future is electric"*

6.3 Persona 3: The Value Seeker

Primary Market: Gujarat, Odisha, Rajasthan

Demographics:

- Age: 30-50 years
- Income: 3-8 LPA
- Occupation: Small business owner, trader
- Mindset: Practical, cost-conscious, risk-averse

Vehicle Preference: Budget to Mid-range 2-Wheeler or E-Rickshaw
Key Motivations:

- Practical transportation solution
- Long-term cost savings
- Avoiding fuel price volatility
- Government subsidy benefits

Buying Criteria:

1. Value for money
2. Proven reliability
3. Service availability in smaller cities
4. Resale value

Marketing Message: *"Smart savings, smart choice - Practical EV for real India"*

7 Strategic Business Recommendations

7.1 Product Portfolio Strategy

Business Recommendation

Dual Product Launch Strategy:

Priority 1: Low-Speed E-Rickshaw (3-Wheeler)

- **Rationale:** Tier 1 markets (46.7% share) show highest demand
- **Target Price:** 1.5-2.0 Lakhs (ex-showroom)
- **Alternative Model:** Battery-as-a-Service (BaaS)
  - Chassis: 80,000-1,20,000 (one-time)
  - Battery rental: 2,500-4,000/month
- **Key Features:** Swappable battery, 80-100 km range, high payload capacity

Priority 2: Premium Electric Scooter (2-Wheeler)

- **Rationale:** Tier 2/3 markets (48.2% combined) prefer personal 2W
- **Target Price:** 1.0-1.8 Lakhs
- **Key Features:** 80-120 km range, fast charging (0-80% in 60 min), smartphone connectivity, digital dashboard

7.2 Geographic Prioritization Strategy

Table 7: Phased Market Entry Plan

Phase	Timeline	Target States	Activities
Phase 1	Months 1-12	Uttar Pradesh (E-Rickshaw pilot)	Product launch, dealer network (50+ outlets), service centers (20+)
Phase 2	Months 13-24	Bihar, MP (E-Rickshaw expansion) + Maharashtra, Karnataka (2W launch)	Scale operations, expand to 150+ dealers, establish battery swap stations
Phase 3	Months 25-36	Delhi, Rajasthan, TN (2W focus) + Gujarat, Kerala (mixed)	Portfolio expansion, 300+ touchpoints, 4W concept unveiling

7.3 Pricing Strategy by Cluster

7.3.1 Tier 1 States (UP, Maharashtra, Karnataka)

- **E-Rickshaw (UP):**
  - Base price: 1.5L (compete with existing ICE alternatives)
  - Financing: Partner with NBFCs for 10-15% down payment, 36-month tenure
  - Subsidy utilization: 50,000 (FAME II) reduces effective price to 1.0L
- **Premium 2W (MH, KA):**
  - Launch price: 1.4-1.8L (positioned between Ather & TVS iQube)
  - Three variants: Base, Pro, Max
  - EMI: 8,000-12,000/month (0% interest for first 3 months)

7.3.2 Tier 2 & 3 States

- Price positioning 5-10% lower than Tier 1 to drive adoption
- Aggressive trade-in schemes for old petrol 2-wheelers
- Corporate bulk purchase discounts (10-15% for orders ¿50 units)

7.4 Distribution and Infrastructure Strategy

1. **Dealership Model:**
   - Tier 1: Premium experience centers (30-40 locations)
   - Tier 2/3: Franchise partners + Multi-brand outlets (120+ locations)
2. **Charging Infrastructure:**
   - Partner with existing fuel station chains (IOCL, BPCL)
   - Deploy 500+ battery swap stations in Tier 1 cities
   - Home charging solution bundles
3. **After-Sales Service:**
   - Company-owned service centers in top 10 cities
   - Authorized service partners in 100+ cities
   - Mobile service vans for remote areas
   - 24/7 roadside assistance

7.5 Marketing and Customer Acquisition

7.5.1 Tier-Specific Marketing Mix

Table 8: Marketing Strategy by Tier

Tier	Channels	Key Message
Tier 1	Digital (60%), On-ground activations (25%), TV (15%)	E-Rickshaw: "Maximize earnings" / 2W: "Premium & sustainable"
Tier 2	Digital (50%), Radio (25%), Influencer partnerships (15%), Events (10%)	"Join the EV revolution - Smart choice for smart cities"
Tier 3	On-ground (40%), Radio (30%), Local newspapers (20%), Word-of-mouth (10%)	"Affordable, reliable, future-ready - EV for every Indian"

7.5.2 Customer Acquisition Tactics

- **Test Ride Campaigns:** 30-day extended test ride program in top 15 cities
- **Referral Programs:** 5,000-10,000 referral bonus for existing customers
- **Corporate Partnerships:** Bulk purchase agreements with delivery companies (Zomato, Swiggy, Amazon)
- **Government Fleet Tenders:** Target state transport corporations and municipal bodies
- **Festival Offers:** Special pricing during Diwali, Holi, regional festivals

8 Risk Assessment and Mitigation

8.1 Geographic Concentration Risk

Risk: Over-dependency on Uttar Pradesh (22.63% of market)

Impact: State-level policy changes or competitive entry could significantly affect revenues

Mitigation Strategies:

1. Diversify into Tier 2 markets within 12 months
2. Build strong relationships with state EV nodal agencies
3. Maintain product portfolio flexibility (3W + 2W + 4W ready)

8.2 Regulatory and Policy Risks

Risk: Changes in FAME subsidy, state-level EV policies, battery standards

Mitigation Strategies:

- Design products to meet highest safety and quality standards
- Engage with industry associations (SMEV, SIAM)
- Build financial models with 0-subsidy scenarios
- Maintain policy monitoring dashboard

8.3 Competitive Intensity Risk

Risk: Market dominated by established players (Ola Electric, Ather, TVS, Bajaj)

Mitigation Strategies:

- Differentiate through:
  - Superior after-sales service (24/7 support)
  - Niche focus (E-Rickshaw + premium 2W dual strategy)
  - BaaS model for affordability
- Focus on underserved Tier 3/4 markets
- Build brand through grassroots marketing

8.4 Supply Chain and Manufacturing Risks

Risks: Battery cell import dependency, semiconductor shortage, logistics

Mitigation Strategies:

- Secure long-term contracts with battery suppliers (Exide, Amara Raja)
- Explore PLI scheme benefits for local manufacturing
- Maintain 3-month inventory buffer for critical components
- Establish manufacturing hubs in central India (proximity to Tier 1 markets)

9 Financial Projections and ROI Analysis

9.1 Revenue Forecasts (3-Year Horizon)

Table 9: Projected Financial Performance

Metric	Year 1	Year 2	Year 3
E-Rickshaw Units Sold	5,000	15,000	30,000
2-Wheeler Units Sold	0	8,000	25,000
Total Units	**5,000**	**23,000**	**55,000**
Avg. Selling Price (E-Rick)	1.5L	1.5L	1.4L
Avg. Selling Price (2W)	-	1.3L	1.2L
Total Revenue (Cr)	**75**	**329**	**720**
Gross Margin (%)	18%	22%	25%
Gross Profit (Cr)	**13.5**	**72.4**	**180**
Operating Expenses (Cr)	45	95	165
EBITDA (Cr)	**-31.5**	**-22.6**	**15**

9.2 Capital Requirements

Initial Investment (Year 0): 120 Crores

- Manufacturing setup: 60 Cr
- R&D and product development: 25 Cr
- Marketing and brand building: 15 Cr
- Dealer network and infrastructure: 10 Cr
- Working capital: 10 Cr

Break-Even Timeline: 30-33 months from launch

9.3 Target Market Share

Table 10: Market Share Targets by Tier

Geographic Tier	Year 1	Year 2	Year 3
Tier 1 (E-Rickshaw focus)	0.5%	1.8%	3.2%
Tier 2 (2W focus)	0%	0.8%	2.1%
Tier 3 (Expansion phase)	0%	0.3%	1.2%
Overall India	**0.3%**	**1.2%**	**2.4%**

10 Conclusion

This comprehensive geographic segmentation analysis of the Indian EV market reveals a landscape characterized by rapid growth, geographic heterogeneity, and clear product-market fit patterns. The study successfully addresses the two core business questions:

10.1 Key Takeaways

1. **Product Decision:** A dual-product strategy is optimal:
    - Low-speed E-Rickshaw for Tier 1 states (46.7% market opportunity)
    - Premium 2-Wheeler for Tier 2/3 states (48.2% market opportunity)
2. **Geographic Prioritization:** Focus on the "Big 3" states (UP, Maharashtra, Karnataka) capturing 46.74% market share, with phased expansion to Tier 2 markets.
3. **Customer Segmentation:** Five distinct personas identified, with "Gig Economy Driver" and "Urban Professional" representing 78% of addressable market.
4. **Market Opportunity:** India's EV market is projected to reach 5-7 million units by 2027, with a 2-3% market share representing 1,500-2,000 Crores in annual revenue.

10.2 Competitive Advantages

The recommended strategy offers several differentiators:

- **BaaS Model:** Reduces upfront cost barrier for price-sensitive E-Rickshaw segment
- **Dual Focus:** Unlike competitors focusing on single segment, our approach captures both commercial and personal mobility markets
- **Tier 2/3 Penetration:** While majors battle in metros, opportunity exists in underserved markets
- **Customer-Centric:** Product features and pricing aligned with specific persona needs

10.3 Success Factors

Achieving the projected outcomes requires:

1. Securing 120 Crore initial funding and strategic partnerships
2. Establishing 50+ dealers and 20+ service centers in Year 1
3. Building a robust supply chain with reliable battery sourcing
4. Executing targeted marketing campaigns for each customer persona
5. Maintaining product quality and after-sales service excellence

10.4 Final Recommendation

Business Recommendation

Immediate Action Items (Next 90 Days):

1. Finalize E-Rickshaw product specifications with BaaS-compatible design
2. Initiate dealer partner recruitment in Uttar Pradesh (target: 30 LOIs)
3. Secure manufacturing facility (lease/partnership) with 10,000 units/year capacity
4. Begin regulatory approval process (ARAI certification, FAME II registration)
5. Launch brand and pre-booking campaigns in UP target cities

Expected Outcome: Commercial launch within 6-8 months, first year revenue of 75 Crores, path to profitability by Month 33.

10.5 Concluding Remarks

The Indian EV market stands at an inflection point, transitioning from early adoption to mass market penetration. Geographic segmentation reveals that success lies not in a one-size-fits-all approach, but in understanding regional nuances, customer motivations, and product-market fit.

For a new entrant, the dual strategy of E-Rickshaws (commercial focus) and premium 2-Wheelers (personal mobility) offers the optimal balance of market coverage, revenue potential, and competitive positioning. By focusing resources on high-potential Tier 1 and 2 markets, leveraging innovative business models like BaaS, and building a customer-centric brand, the company can carve a sustainable niche in this dynamic and rapidly evolving industry.

The journey from 2,300 EVs in 2014 to 1.5 million in 2023 demonstrates India's commitment to electric mobility. The next decade will witness exponential growth, and data-driven strategic planning—as presented in this report—will separate market leaders from laggards.

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12 Appendices

12.1 Appendix A: Data Dictionary

Table 11: Complete Data Dictionary

Variable	Definition	Data Type
Year	Calendar year of registration	Integer (2014-2023)
Month_Name	Month name in lowercase	Categorical (jan-dec)
Date	Full date of registration	DateTime
State	Indian state or union territory	String
Vehicle_Class	Specific vehicle model/type	String
Vehicle_Category	Broad vehicle category	Categorical
Vehicle_Type	Use case classification	Categorical
EV_Sales_Quantity	Number of units sold	Integer

12.2 Appendix B: Clustering Methodology Details

Market Tier Classification Algorithm:

```
IF Market_Share >= 10%:
    Assign Tier 1 (Leader)
ELIF 4% <= Market_Share < 10%:
    Assign Tier 2 (Emerging)
ELIF Market_Share < 4% AND Total_Sales > 50,000:
    Assign Tier 3 (Growth)
ELSE:
    Assign Tier 4 (Early Adopter)
```

12.3 Appendix C: Python Code Repository

Complete analysis code, Jupyter Notebooks, and data files are available on GitHub:

GitHub Repository

https://github.com/Jai-Kumar786/EV-MARKET-SEGMENTATION-ANALYSIS

(Include: Data preprocessing, clustering algorithms, visualization scripts)

12.4 Appendix D: Team Contributions

Table 12: Team Member Contributions

Team Member	Key Contributions
Subhra Chaudhary	Data collection and preprocessing, trend analysis, report writing
Jai Kumar Gupta	Geographic clustering algorithms, customer persona development, visualizations
Utkarsh Bisht	Business recommendations, financial modeling, presentation design

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This report represents our collective effort to contribute meaningfully to India's electric mobility revolution.

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