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# Administrative Barriers and Managerial Challenges in the Electric Vehicle Manufacturing Sector: A Critical Review

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**Abstract:** *The electric vehicle (EV) manufacturing sector has emerged as the central pillar of the global transition towards low-carbon mobility, and India has positioned itself as an aspiring manufacturing hub through a succession of demand- and supply-side interventions. Yet the pace at which manufacturing capacity, localisation and firm-level profitability have advanced remains uneven and, in several segments, considerably slower than policy targets envisaged. This paper undertakes a critical review of the administrative barriers and managerial challenges that constrain EV manufacturing enterprises, with particular reference to the Indian context. Drawing upon secondary sources including government notifications, scheme documents of the Ministry of Heavy Industries, industry association data, reports of policy research institutions and peer-reviewed scholarship published between 2012 and 2026, the study synthesises the existing evidence into an integrated framework. Administrative barriers are classified into six domains covering policy discontinuity, procedural complexity in subsidy administration, multiplicity of approving authorities, certification bottlenecks, taxation anomalies and centre-state divergence. Managerial challenges are grouped into seven domains covering supply chain and critical-mineral dependence, cost and pricing pressure, technology absorption, skill deficits, quality and after-sales management, distribution and financing constraints, and organisational change. The review argues that these two sets of constraints are not independent; administrative friction is frequently transmitted into managerial cost, and managerial weaknesses in compliance capability in turn amplify administrative delay. The paper concludes that a shift from episodic incentive-led policy towards predictable, rule-based and digitally administered regulation, combined with deliberate managerial investment in supplier development, skill formation and compliance systems, is necessary if the sector is to achieve scale economies. Limitations of the secondary-data design are acknowledged and an agenda for empirical firm-level research is proposed.*

**Keywords:** Electric vehicle manufacturing, administrative barriers, managerial challenges, industrial policy, PM E-DRIVE, production-linked incentive, supply chain, localisation, India.

## I. INTRODUCTION

The automobile industry is undergoing the most significant technological discontinuity since the introduction of the assembly line. The substitution of the internal combustion engine by battery-electric propulsion alters not merely the powertrain but the entire architecture of value creation in the sector: the component base contracts in mechanical complexity while expanding in electrochemical and electronic content, the supplier ecosystem is reconfigured, capital intensity migrates towards cell chemistry and power electronics, and the after-sales revenue model built around periodic mechanical servicing is substantially eroded. For manufacturing firms, therefore, electrification is simultaneously a technological, organisational and commercial transition.

India occupies a distinctive position in this transition. It is among the largest two- and three-wheeler markets in the world, and it is in these segments rather than in passenger cars that electrification has advanced most rapidly. Public

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policy has been an active instrument throughout. The Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) programme, first notified in 2015 and extended as FAME-II in 2019, was succeeded by the short-lived Electric Mobility Promotion Scheme in 2024 and thereafter by the PM Electric Drive Revolution in Innovative Vehicle Enhancement (PM E-DRIVE) scheme notified on 29 September 2024 with an outlay of approximately ₹10,900 crore. On the supply side, the Production Linked Incentive Scheme for Automobile and Auto Components (PLI-Auto), approved in September 2021 with an outlay of ₹25,938 crore, and the National Programme on Advanced Chemistry Cell (ACC) Battery Storage, approved in May 2021 with an outlay of ₹18,100 crore for 50 GWh of cell capacity, were designed to deepen localisation of advanced automotive technology products.

Notwithstanding this dense architecture of support, outcomes have lagged intent in important respects. Reported disbursement under PLI-Auto remained below one-tenth of the sanctioned outlay by early 2026, and under the ACC programme the commissioned cell manufacturing capacity remained a small fraction of the 50 GWh target, with commercial production concentrated in a single beneficiary. The central purchase incentive for electric two-wheelers under PM E-DRIVE lapsed on 31 July 2026, while support for three-wheelers, buses, trucks, ambulances and charging infrastructure continues to March 2028. The gap between announced capacity and operational capacity, and between sanctioned incentive and realised incentive, is precisely the space in which administrative and managerial constraints operate.

The scholarly literature on electric mobility in India has been dominated by studies of consumer adoption behaviour, willingness to pay, charging infrastructure and range anxiety, while the administrative and managerial environment within which manufacturing enterprises operate has received comparatively limited systematic attention. This paper addresses that gap by synthesising the available evidence on the administrative barriers imposed by the regulatory and procedural environment and on the managerial challenges confronted at firm level, and by arguing that the two must be analysed jointly because each conditions the other.

## II. REVIEW OF LITERATURE

Early scholarship on electric mobility approached the subject principally as a problem of consumer diffusion. Egbue and Long (2012) identified cost, range and charging availability as the dominant perceived barriers among technically informed respondents, and observed that perception rather than technical reality frequently governed purchase intention. Sierzchula, Bakker, Maat and van Wee (2014), analysing adoption across thirty countries, found that financial incentives and charging density were significantly associated with market share but explained only a portion of variation, implying that supply-side and institutional factors matter independently. Rezvani, Jansson and Bodin (2015) synthesised the behavioural literature and drew attention to the symbolic and normative determinants of adoption alongside instrumental ones.

A second stream examines the technological and infrastructural dimension. Kumar and Revankar (2017) identified energy density, thermal management and charging standardisation as the principal engineering constraints, while Kumar and Alok (2020), in a systematic review, noted the relative scarcity of research addressing manufacturing capability and industrial organisation. Goel, Sharma and Rathore (2021) reviewed barriers in the Indian setting and emphasised grid readiness and infrastructural coordination.

A third and more recent stream engages directly with barriers to diffusion in emerging economies using multi-criteria decision techniques. Tarei, Chand and Gupta (2021), applying a structured barrier-analysis approach to the Indian market, reported that infrastructural and policy-related barriers exercised greater causal influence than purely economic ones, a finding of direct relevance to the present review because it locates the binding constraint in the institutional rather than the technological domain. Bansal, Kumar, Raj, Dubey and Graham (2021) estimated willingness-to-pay parameters for Indian consumers and found substantial price sensitivity, which in turn constrains the pricing latitude available to manufacturers and transmits cost pressure back into the manufacturing function.

Policy-oriented research organisations have contributed a fourth stream that is largely absent from academic journals but is empirically indispensable. Analyses published by the Institute for Energy Economics and Financial Analysis (2026) and the International Institute for Sustainable Development (2026) document the slow commissioning of incentivised cell capacity, the persistence of import dependence in cells, cathode and anode materials, rare-earth

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permanent magnets and semiconductor components, and the difficulty experienced by beneficiary firms in meeting domestic value addition thresholds. The International Energy Agency's successive Global EV Outlook reports provide comparative context on the concentration of the global battery supply chain.

Two observations follow from this survey. First, the literature is asymmetric: demand-side determinants are extensively theorised and empirically tested, whereas supply-side administrative and managerial determinants are documented mainly in grey literature and remain weakly conceptualised. Second, where institutional barriers are examined, they are typically treated as exogenous constraints on adoption rather than as variables that interact with firm-level managerial capability. The present review responds to both observations.

## III. OBJECTIVES OF THE STUDY

- To identify and classify the principal administrative and regulatory barriers confronting enterprises engaged in electric vehicle and component manufacturing.
- To examine the managerial challenges arising at the functional levels of production, supply chain, finance, human resources and marketing within such enterprises.
- To analyse critically the interaction between administrative barriers and managerial challenges and to develop an integrative conceptual framework.
- To evaluate the adequacy of the existing policy architecture, with particular reference to India, in addressing the identified constraints.
- To offer recommendations for policy makers and for managers, and to identify directions for subsequent empirical research.

## IV. RESEARCH METHODOLOGY

The study is descriptive and analytical in design and is based entirely on secondary sources. It follows the logic of a critical narrative review rather than a statistical meta-analysis, since the underlying studies are heterogeneous in method, unit of analysis and geography and are not amenable to quantitative pooling.

Sources were drawn from four categories: peer-reviewed journal articles published between 2012 and 2026 in energy policy, cleaner production, transportation research and operations management, identified through database searches combining the terms electric vehicle, manufacturing, barriers, policy, supply chain and India; official documents, including gazette notifications and scheme guidelines of the Ministry of Heavy Industries and notifications of the Ministry of Road Transport and Highways; reports of policy research institutions and multilateral agencies; and industry data published by manufacturers' associations together with vehicle registration data in the public domain.

Studies were included where they addressed the supply side of electric mobility, the regulatory environment of manufacturing, or firm-level management in the automotive sector. Purely engineering studies of cell chemistry or power electronics were excluded, as were consumer-behaviour studies that did not draw implications for manufacturers. The evidence was subjected to thematic content analysis: recurring constraints were coded, grouped into categories, and organised into the two-domain framework presented in Sections 6 and 7. As the study relies on published material, no primary data were collected and no ethical clearance was required.

## V. THE POLICY CONTEXT OF ELECTRIC VEHICLE MANUFACTURING IN INDIA

An appreciation of the administrative environment requires a summary of the instruments that constitute it. Table 1 sets out the principal central interventions and their salient features. The pattern that emerges is one of frequent redesign: three distinct demand-incentive regimes have operated within a period of approximately eighteen months, each with revised eligibility criteria, price ceilings, volume caps and localisation conditions.

**Table 1: Principal Central Interventions for Electric Mobility in India**

| Instrument | Period | Focus | Salient features and observed difficulties |
|---|---|---|---|
| FAME-I and FAME-II | 2015–2024 | Demand incentive and pilot projects; | Limited outlay and segment coverage in the first phase; phased manufacturing programme conditions |

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| Instrument | Period | Focus | Salient features and observed difficulties |
|---|---|---|---|
| | | 2W, 3W, 4W and buses | in the second, where disputes over localisation compliance led to withholding and recovery of claims from several manufacturers. |
| EMPS 2024 | Apr–Sep 2024 | Interim support for e-2W and e-3W | Four-month bridging scheme with an outlay of ₹500 crore; subsequently subsumed into PM E-DRIVE. |
| PM E-DRIVE | Oct 2024–Mar 2028 | Demand incentive, charging infrastructure, testing agencies | Outlay of about ₹10,900 crore; e-2W incentive tapered from ₹5,000 to ₹2,500 per kWh and closed on 31 July 2026; support for e-3W, e-trucks, e-buses and infrastructure continues to March 2028; private electric cars excluded. |
| PLI-Auto | FY 2022-23 to FY 2026-27 | Advanced automotive technology products | Outlay of ₹25,938 crore with a 50 per cent domestic value addition threshold; less than one-tenth disbursed by early 2026. |
| PLI-ACC | 2021 onwards | Advanced chemistry cell manufacturing | Outlay of ₹18,100 crore for 50 GWh; commissioning delays; operational capacity a small fraction of target and incentive claims minimal as of 2026. |
| GST treatment | Continuing | Indirect taxation | Concessional 5 per cent rate on electric vehicles against higher rates on conventional vehicles; input taxes on several components at higher rates, producing an inverted duty structure. |

*Source: Compiled by the authors from scheme notifications of the Ministry of Heavy Industries and published policy analyses (2024–2026).*

## VI. ADMINISTRATIVE BARRIERS

Administrative barriers are understood here as constraints originating in the regulatory, procedural and institutional environment external to the firm, which raise the transaction cost of manufacturing, delay investment realisation, or introduce uncertainty into planning horizons. Six domains are distinguished, and their transmission into firm-level consequences is summarised in Table 3.

### 6.1 Policy Discontinuity and Incentive Uncertainty

Manufacturing investment in the automotive sector is characterised by long gestation, high fixed cost and multi-year amortisation. Product development cycles typically extend across three to five years and tooling investments are recovered over comparable periods. Incentive regimes with horizons of one to four years, subject to mid-course amendment of rates, price ceilings and volume caps, are structurally mismatched with these planning horizons. The reduction of the per-kilowatt-hour incentive for two-wheelers and its eventual withdrawal illustrate the difficulty: firms that had priced products on the assumption of subsidy support were required to absorb the withdrawal, pass it on in a price-sensitive market, or accept volume contraction. The imposition of aggregate volume caps introduces a further element of uncertainty, since eligibility may terminate before the notified date if the cap is exhausted, converting a policy entitlement into a competitive race.

### 6.2 Procedural Complexity in Claim, Verification and Disbursement

The administration of incentives requires manufacturers to maintain documentation of bill of materials, supplier declarations, value-addition computations, testing certificates and beneficiary verification records. Under FAME-II, disputes over compliance with phased manufacturing programme conditions led to the withholding of claims and demands for recovery from several manufacturers, with working-capital consequences disproportionate to the sums originally at stake. Aadhaar-linked electronic voucher generation under PM E-DRIVE improved beneficiary

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verification but added process at the point of sale. Where disbursement lags claim by several quarters, the incentive functions less as a subsidy than as an involuntary extension of credit by the manufacturer to the exchequer.

**6.3 Multiplicity of Authorities, Land and Environmental Clearances**

Establishing a manufacturing facility requires clearances from authorities operating under different statutes and at different levels of government: industrial land allotment, environmental consent to establish and to operate, factory licensing, fire safety, power connection and load sanction, building approvals and, for cell and pack facilities, hazardous material permissions. Although single-window mechanisms exist in most states, their coverage is frequently partial, functioning as an application portal rather than as an authority empowered to decide. Sequential rather than parallel processing extends project timelines and, where incentive schemes carry fixed commissioning deadlines, converts administrative delay into loss of entitlement.

**6.4 Homologation, Testing and Certification**

Electric vehicles and their components are subject to type approval and conformity of production requirements administered by designated testing agencies. Battery safety standards were substantially tightened following thermal incidents in electric two-wheelers, and successive amendments to the applicable Automotive Industry Standards have required requalification of designs. Testing capacity is concentrated in a small number of agencies, and queueing for slots is a recognised source of delay, particularly for smaller manufacturers. Certification cost is largely fixed and therefore regressive in incidence, bearing more heavily on firms with low production volumes. The extension of support to the upgradation of testing agencies under PM E-DRIVE constitutes a recognition of this constraint.

**6.5 Taxation Anomalies and Trade Measures**

The concessional rate of goods and services tax on finished electric vehicles is a significant demand-side support, but the differential between the output rate and the rates applicable to several inputs, components and job-work services produces an accumulation of input tax credit. For manufacturers operating on thin margins the resulting refund cycle absorbs working capital. Customs duty structures on cells, cell components and capital equipment interact with localisation incentives in ways that are not always mutually consistent, and periodic revision of duty rates alters the landed cost assumptions on which sourcing decisions were based. Export controls imposed by producing countries on rare-earth magnets and certain battery materials constitute a further external barrier over which domestic policy has limited influence.

**6.6 Centre-State Divergence and Charging Infrastructure Approvals**

State electric vehicle policies differ substantially in the quantum of purchase subsidy, road tax and registration waivers, capital subsidy for manufacturing, stamp duty concessions and employment-linked incentives, and they differ also in duration and in the reliability of disbursement. A manufacturer selling nationally must therefore maintain differentiated pricing, documentation and claim processes across states. Charging infrastructure deployment, which conditions demand for the manufacturer's product, requires municipal permissions, distribution company approval for load sanction, and in many cases resolution of questions concerning electricity tariff category and metering, each administered locally. The absence of harmonisation between the central framework and state implementation is among the most frequently cited institutional constraints in the policy literature.

## VII. MANAGERIAL CHALLENGES

Managerial challenges are understood as constraints internal to the enterprise, arising from the requirements of the electric powertrain and the competitive conditions of the market, and addressable in principle through managerial decision. Seven domains are distinguished and are summarised in Table 2.

**7.1 Supply Chain Configuration and Critical Mineral Dependence**

The battery pack accounts for a substantial share of vehicle cost, and the cell within it is the component in which import dependence is most acute. Cathode and anode active materials, separators, electrolytes, rare-earth permanent magnets and automotive-grade semiconductors are produced in a small number of geographies, and the concentration of refining capacity exposes manufacturers to price volatility, allocation risk and geopolitical disruption. The managerial task is therefore to design a supply chain that balances cost against security: dual sourcing, long-term offtake contracts, strategic inventory, upstream participation and design-level substitution of constrained materials are the available

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instruments, each carrying a cost that is difficult to justify in a period of price competition. Supplier development is a related and often underestimated task, since the tier-two and tier-three base possesses mechanical rather than electrochemical and electronic competence and requires substantial technical assistance to qualify.

**7.2 Cost Structure, Pricing and Margin Management**

Electric vehicle manufacturing exhibits a cost structure in which variable material cost is high relative to conventional vehicles, while volumes remain insufficient to realise the scale economies that would reduce it. Where part of the retail price has been supported by public incentive, the withdrawal of that support confronts management with an unattractive set of alternatives, since price-sensitive demand, documented in willingness-to-pay studies of the Indian market, limits the extent to which cost can be passed forward. The result in several firms has been sustained operating losses financed by equity raised on the expectation of future scale, and a preoccupation with volume growth that may be inconsistent with margin discipline. Total cost of ownership arguments, though favourable to the electric vehicle, are imperfectly understood by buyers and are therefore weak instruments of price defence.

**7.3 Technology Absorption and Research and Development Capability**

The competencies required for electric vehicle manufacture—cell chemistry and pack engineering, battery management systems, power electronics, thermal management, embedded software and vehicle connectivity—differ fundamentally from those accumulated in the internal combustion tradition. Firms have addressed the gap through licensing, joint ventures, acquisition of technology partners and in-house development, each with a distinct profile of cost, speed and dependence. Reliance on licensed technology accelerates entry but leaves the licensee vulnerable where schemes impose domestic value addition or intellectual property conditions. Research intensity in the Indian automotive sector has historically been modest by international comparison, and the transition requires a step change in expenditure at a time when operating cash flows are constrained.

**7.4 Human Resource and Skill Deficits**

The transition alters the composition of labour demand. Requirements for high-voltage systems engineers, battery and cell process technicians, embedded software developers, power electronics designers and data engineers expand, while requirements associated with engine and transmission manufacture contract. Existing technical education curricula have adapted unevenly, and the resulting scarcity of qualified personnel raises compensation costs and attrition, particularly for smaller firms competing with better-capitalised entrants and with the electronics and software sectors more generally. Equally significant is the reskilling obligation towards the incumbent workforce, which raises questions of industrial relations, redeployment and organisational equity that are managerial rather than technical in character. Service technicians additionally require certification in high-voltage safety, and failure to develop this capability at the pace of vehicle deployment produces service failures that damage brand reputation.

**7.5 Quality, Safety and After-Sales Management**

Battery thermal events in electric two-wheelers received considerable public attention and prompted regulatory tightening. For management, product safety in an electrochemical product is a systemic rather than a component question, requiring traceability from cell batch through pack assembly to the individual vehicle, disciplined supplier quality assurance, over-the-air diagnostic capability and rapid field-action processes. Warranty provisioning is complicated by limited field data on battery degradation under Indian conditions of ambient temperature, road surface and charging behaviour. The after-sales model itself must be reconstructed: revenue from periodic mechanical servicing declines, while the network must acquire diagnostic and high-voltage capability, and residual value uncertainty in the used-vehicle market feeds back into new-vehicle demand.

**7.6 Distribution, Financing and Working Capital**

Dealers accustomed to conventional vehicles face a compressed service revenue stream and are therefore reluctant to invest in the facilities and training that electric vehicles require, which has induced several manufacturers to adopt company-owned or agency distribution models. On the financing side, lenders have applied conservative loan-to-value ratios and higher interest rates to electric vehicles owing to uncertainty concerning residual values and, in the case of fleet operators, concerning the creditworthiness of the counterparty. Manufacturers have accordingly been drawn into providing buy-back assurances, residual value guarantees or captive financing, thereby assuming risks that lie outside

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their traditional operating scope. Delayed incentive receipts, input tax credit accumulation and inventory carried against uncertain scheme timelines combine to place working capital management at the centre of the managerial agenda.

### 7.7 Organisational Change and Strategic Management

For established manufacturers the transition is an instance of the classic problem of managing an emerging business alongside a profitable legacy one: capital, managerial attention and talent must be directed towards a segment that is loss-making in the near term while the legacy segment generates the cash that funds it. Internal resistance, ambiguity of performance metrics and the question of whether the electric business should be housed in a separate entity are recurring themes. New entrants face the mirror-image problem, possessing technological focus and agility but lacking manufacturing discipline, supplier relationships, distribution reach and process maturity. Neither configuration is unambiguously advantaged, and the managerial task in each case is the deliberate acquisition of the capability that the firm's origin did not provide.

**Table 2: Managerial Challenges, Underlying Causes and Available Managerial Responses**

| Functional area | Underlying cause | Available managerial response |
|---|---|---|
| Supply chain | Geographic concentration of cells, materials, magnets and semiconductors | Dual sourcing; long-term contracts; supplier development; design substitution; upstream participation |
| Cost and pricing | High material content; sub-scale volumes; withdrawal of demand incentives | Platform commonisation; value engineering; disciplined product portfolio; total cost of ownership communication |
| Technology and R&D | Competence base rooted in mechanical engineering | Selective in-house development; joint ventures; academic collaboration; sustained R&D provision |
| Human resources | Scarcity of high-voltage, software and electrochemical skills | Structured reskilling; institutional partnerships; certification of service technicians; retention design |
| Quality and after-sales | Systemic safety risk; limited field degradation data | Batch traceability; supplier quality assurance; telematics-based diagnostics; warranty analytics |
| Distribution and finance | Reduced service revenue; conservative lending; incentive receivables | Alternative retail formats; captive or partnered financing; residual value programmes; working capital discipline |
| Organisation and strategy | Coexistence of legacy and emerging businesses | Ring-fenced units; differentiated performance metrics; explicit transition roadmap; change communication |

*Source: Authors' compilation.*

## VIII. CRITICAL DISCUSSION: THE INTERACTION OF ADMINISTRATIVE AND MANAGERIAL CONSTRAINTS

The principal analytical claim advanced in this review is that administrative barriers and managerial challenges are not parallel and independent lists but a coupled system. Three mechanisms of transmission may be identified.

The first is the conversion of administrative uncertainty into managerial risk premium. Where incentive horizons are short and subject to revision, management applies a higher discount rate to capacity investment, defers commitment, and prefers reversible configurations such as assembly from imported kits to irreversible ones such as integrated cell manufacture. The pattern of announced but uncommissioned capacity under the advanced chemistry cell programme is consistent with this mechanism: the announcement is a low-cost option and the commissioning an irreversible

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commitment, and the interval between them is a function of perceived policy stability as much as of engineering timelines.

The second is the conversion of procedural friction into working capital cost. Documentation intensity, verification disputes and disbursement lag are administrative phenomena, but their incidence is financial and falls on the firm's balance sheet. Because working capital constraints bind more tightly on smaller firms, procedural friction has a distributive consequence: it favours large, well-capitalised incumbents and disadvantages precisely the smaller suppliers whose participation localisation policy seeks to encourage. A policy instrument intended to broaden the manufacturing base may thus, through its administrative design, narrow it.

The third mechanism operates in the reverse direction. Weak managerial systems—incomplete costing data, poor supplier documentation, absent traceability—render compliance with localisation and safety requirements difficult to demonstrate, which in turn provokes greater administrative scrutiny, longer verification and further delay. Administrative burden is therefore partly endogenous to managerial capability, and improvements in enterprise systems reduce it. This observation qualifies the common industry position that the difficulty is entirely one of regulatory overreach.

A further consideration concerns the design of incentives themselves. Demand-side purchase subsidies are politically visible and produce measurable adoption, but they are inherently temporary and their withdrawal produces the discontinuity documented above. Supply-side incentives conditioned on domestic value addition address structural capability but require sophisticated verification and impose thresholds that firms with immature supplier bases cannot immediately meet, which explains the low disbursement ratios under both production-linked schemes. Neither instrument substitutes for the durable determinants of manufacturing competitiveness: predictable regulation, reliable infrastructure, contract enforcement, availability of skills, and the cost and quality of logistics and power. The critical conclusion of this review is that the marginal return to further incentive expenditure is likely to be lower than the marginal return to improvement in administrative process and factor markets.

**Table 3: Integrative Framework Linking Administrative Barriers to Managerial Consequences**

| Administrative barrier | Transmission mechanism | Managerial consequence and required response |
|---|---|---|
| Short and revisable scheme horizons | Elevated risk premium on irreversible investment | Deferred capacity commitment; scenario-based capital budgeting; modular plant design |
| Disbursement lag and claim disputes | Conversion of entitlement into receivable | Working capital strain; strengthened documentation systems; conservative provisioning |
| Localisation thresholds | Compliance conditioned on supplier maturity | Investment in supplier development; verification of value-addition computation |
| Certification bottlenecks | Fixed cost and queueing incidence | Front-loaded design validation; staged launch planning; shared testing arrangements |
| Inverted duty structure | Input credit accumulation | Refund management; sourcing and job-work structuring |
| Centre-state divergence | Fragmentation of pricing and compliance | Region-specific commercial planning; centralised compliance function |

*Source: Developed by the authors.*

## IX. MAJOR FINDINGS

- The binding constraint on electric vehicle manufacturing in the Indian context is institutional rather than technological. Vehicle and component technology is available through development, licensing or partnership,

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whereas policy predictability, procedural efficiency and factor market depth are not readily procurable by the firm.

- Policy discontinuity is the most consequential administrative barrier, because it interacts with the long amortisation horizon of manufacturing investment and cannot be hedged by the firm through ordinary commercial means.
- Low disbursement ratios under supply-side incentive schemes reflect a combination of commissioning delay, difficulty in meeting domestic value addition thresholds and verification complexity, rather than an absence of investor interest.
- Administrative procedural burden is regressive in incidence, bearing disproportionately upon smaller enterprises and thereby working against the stated objective of broadening the domestic supplier base; it is also partly endogenous to managerial capability, since deficient internal systems provoke additional scrutiny.
- Supply chain dependence on imported cells, cathode and anode materials, rare-earth magnets and automotive semiconductors remains the dominant managerial risk, and it is only partially amenable to firm-level mitigation.
- Skill scarcity in high-voltage systems, embedded software and electrochemical process engineering functions as a constraint on the rate at which capacity can be effectively utilised, independently of the availability of capital.
- The withdrawal of demand incentives in the two-wheeler segment has shifted competitive advantage towards firms with lower cost structures and greater vertical integration, and is likely to accelerate consolidation.

## X. SUGGESTIONS AND POLICY IMPLICATIONS

### 10.1 For Policy Makers and Administrators

A stable, rule-based and multi-year framework should replace the sequence of episodic schemes. A published tapering trajectory, announced well in advance and insulated from mid-course revision, would allow manufacturers to price and plan with confidence even as support diminishes. Where volume caps are unavoidable, real-time public disclosure of utilisation would reduce the informational asymmetry that presently makes eligibility unpredictable.

Claim processing should be brought within a defined service-level framework with automated, data-linked verification drawing on vehicle registration and tax records rather than manual documentation, and a time-bound appellate mechanism for compliance disputes would prevent technical disagreements from escalating into prolonged withholding of dues. Empowered single-window authorities with statutory deemed-approval provisions, as distinct from portals that merely receive applications, would compress project timelines materially. Testing and certification capacity requires expansion and regional distribution, and standards revision should follow a published calendar with adequate transition periods. Rationalisation of the duty structure to eliminate credit accumulation, and harmonisation of state policies through a model framework, would reduce compliance fragmentation.

### 10.2 For Managers of Manufacturing Enterprises

Managerial strategy should proceed on the assumption that public support is transitional. Cost structures must therefore be viable at unsubsidised prices, through platform commonisation, value engineering and disciplined portfolio management rather than volume pursued at negative contribution. Supplier development deserves treatment as a strategic investment rather than a procurement activity, since the qualification of domestic tier-two and tier-three suppliers is a precondition both of localisation compliance and of supply security. Deliberate capability building in pack engineering, power electronics and embedded software is preferable to indefinite reliance on licensed designs, and human resource planning should anticipate the changing composition of skill demand and invest in reskilling in advance of need. Finally, compliance should be organised as a managed function with integrated traceability and costing systems, because well-documented firms experience materially lower administrative friction.

## XI. CONCLUSION

The transition to electric mobility is now irreversible in direction, though uncertain in pace. This review has argued that the difficulties confronting electric vehicle manufacturing enterprises are best understood as a coupled system rather than as two separate agendas. Administrative barriers—policy discontinuity, procedural complexity in the administration of incentives, multiplicity of approving authorities, certification bottlenecks, taxation anomalies and

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centre-state divergence—raise the cost and risk of manufacturing investment and are transmitted into the firm as risk premia and working-capital burdens. Managerial challenges—supply chain dependence, adverse cost structures, technological gaps, skill scarcity, after-sales reconstruction, financing constraints and organisational change—determine the firm's capacity to absorb those burdens and, reciprocally, influence the scrutiny it attracts.

The evidence assembled here suggests that the Indian policy architecture has been generous in intent and substantial in outlay, but that its effectiveness has been diminished by discontinuity and procedural complexity. Low disbursement under production-linked schemes and the slow commissioning of incentivised cell capacity indicate that the constraint lies at the point of execution rather than of announcement. The most productive direction of reform is therefore not further incentive expenditure but improvement in the predictability and administration of the existing framework, coupled with sustained attention to skills, testing infrastructure and supplier capability. For managers, the corresponding imperative is to build enterprises that can compete without subsidy, since the durable sources of advantage in manufacturing—cost discipline, supplier depth, technological capability and organisational quality—are precisely those that no incentive can supply.

## XII. LIMITATIONS AND SCOPE FOR FURTHER RESEARCH

The study is based exclusively on secondary sources and therefore reflects the coverage and the biases of the published record; constraints experienced by firms but not publicly documented are necessarily absent from it. The analysis is weighted towards the Indian context and its conclusions should be extended to other jurisdictions with caution. Policy in this field changes rapidly, and the scheme parameters cited are those obtaining at the time of writing in 2026. The framework proposed in Section 8 is conceptual and has not been empirically validated.

Several directions for subsequent research follow. Primary survey research among manufacturers and component suppliers would permit measurement of the relative severity of the barriers identified and would test the proposed transmission mechanisms, while structural techniques such as interpretive structural modelling or decision-making trial and evaluation laboratory analysis could establish their hierarchy and causal direction. Comparative study of firms that have and have not commissioned incentivised capacity would illuminate the managerial determinants of execution, and longitudinal study of the two-wheeler segment after the withdrawal of the central purchase incentive would yield evidence on demand elasticity and industry consolidation. The incidence of administrative burden on smaller enterprises also merits dedicated empirical attention.

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