India's Technological Moment: Emerging Technologies, State Capacity, and the Long Road to Strategic Autonomy

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ABSTRACT

This article examines India's evolving technological strategy at a critical juncture where emerging technologies are central to the country's economic and strategic aspirations. It highlights a perceptible shift in policy discourse from reactive technological adoption toward proactive capability building, with sectors such as semiconductors, artificial intelligence (AI), robotics, automation, electric mobility, and advanced energy storage increasingly prioritized as strategic imperatives. The narrative underscores the complex interplay between technological development and national power, noting that innovations in these domains shape not only productivity and social delivery but also diplomatic alignments and global competitiveness. Emphasis is placed on pragmatic state-led initiatives blending incentives, public-private collaboration, and institutional learning aiming to reduce vulnerability to external dependencies while leveraging globalization through diversified partnerships. The article also addresses structural challenges, including uneven institutional capacity, skill gaps, and social implications of automation, advocating for nuanced policy calibration to sustain momentum. Ultimately, it situates India's technological ambitions within a broader framework of strategic autonomy, exploring how sustained commitment, execution capabilities, and adaptive governance will determine whether this technological moment translates into long-term national capacity.

Keywords: Emerging technologies; Strategic autonomy; State capacity; Semiconductors

ARTICLE

There is a quiet but unmistakable shift underway in how India talks about technology. Not long ago, policy conversations around innovation felt reactive. Imported hardware, outsourced software, and a lingering comfort with technological dependence shaped much of the debate. Today, the tone is different. Semiconductor fabs, artificial intelligence platforms, electric mobility corridors, and advanced battery ecosystems are no longer abstract ambitions. They appear in cabinet notes, budget speeches, and state-level industrial policies. Still, enthusiasm alone does not amount to transformation. The harder question is whether India's technological push reflects a coherent long-term vision or merely a collection of well-branded

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initiatives. Perhaps the truth lies somewhere in between. What is certain is that emerging technologies have moved to the center of India's developmental imagination, not as luxury sectors, but as strategic necessities.

Technology and the Changing Nature of Power

Technology today is not just about productivity gains or consumer convenience. It shapes power. Semiconductor supply chains influence diplomatic alignments. Artificial intelligence affects military planning, welfare delivery, and labor markets at the same time. Battery storage capacity increasingly determines energy security.

India's policymakers appear acutely aware of this shift. The emphasis on strategic autonomy, often framed through Atmanirbhar Bharat, is less about isolation and more about reducing vulnerability. Dependence on a narrow set of global suppliers, as the pandemic and recent geopolitical conflicts revealed, carries real costs. Therefore, India's technology vision must be read not only as economic policy but also as a response to an unstable global order.

Semiconductors: From Aspiration to Institutional Experiment

Few sectors capture India's ambition and anxiety quite like semiconductors. For decades, India stayed at the periphery of chip manufacturing, strong in design talent yet absent from fabrication. The recent push to build domestic semiconductor manufacturing facilities marks a significant departure from that pattern.

However, semiconductor ecosystems are notoriously unforgiving. Capital intensity is extreme. Technological cycles are short. Even countries with deep industrial histories struggle to stay competitive. India's approach, therefore, seems pragmatic rather than heroic. Instead of claiming instant leadership, policy has focused on incentives, risk-sharing, and gradual capability building.

Whether this experiment succeeds will depend less on press releases and more on execution. Skilled technicians, stable power supply, water management, and patient capital matter as much as policy intent. The vision is credible, but the road ahead remains steep.

Artificial Intelligence and the Question of Scale

Artificial intelligence occupies a different space in India's technology discourse. Unlike semiconductors, AI builds on existing strengths. India already possesses a vast digital public infrastructure, from Aadhaar to UPI, that generates scale few countries can match.

The government's emphasis on AI for governance, healthcare diagnostics, agricultural forecasting, and language translation reflects an attempt to align innovation with social needs. This is notable. Rather than chasing frontier AI purely for prestige, the focus appears to be on applied intelligence.

Yet, concerns remain. Data quality, algorithmic bias, and uneven institutional capacity pose real challenges. Moreover, private sector dominance in AI development raises questions about accountability. India's AI vision is promising, but its success will depend on regulatory maturity

and ethical clarity, not just computational power.

Robotics, Automation, and the Employment Puzzle

Robotics and automation present a more complicated picture. On one hand, automation is essential for manufacturing competitiveness. On the other, India's labor market is vast and fragile.

Policy narratives often suggest that automation and employment can grow together, and perhaps they can. But the transition is unlikely to be smooth. Robotics in logistics, electronics assembly, and precision manufacturing will reshape skill demands. Without parallel investment in vocational training and reskilling, technological progress may deepen inequality.

To the government's credit, skilling initiatives have expanded. Still, the scale of the challenge is immense. Robotics is not merely a technological upgrade. It is a social transformation, and India is only at the early stages of grappling with its implications.

Electric Vehicles and the Energy Transition

Electric vehicles sit at the intersection of technology, climate policy, and industrial strategy. India's EV push reflects multiple objectives at once: reducing oil imports, addressing urban pollution, and building new manufacturing capacity.

Unlike earlier industrial efforts, EV policy has benefited from coordination across ministries and states. Incentives for manufacturers, charging infrastructure expansion, and public transport electrification suggest a systems-level approach.

That said, adoption remains uneven. Two-wheelers and fleet vehicles dominate, while private passenger cars lag. Range anxiety, charging access, and upfront costs continue to shape consumer behavior. EVs are not a silver bullet, but they represent a meaningful step toward a cleaner and more resilient mobility ecosystem.

Batteries, Storage, and the Infrastructure Gap

Batteries rarely attract public attention, yet they underpin much of India's technological future. Renewable energy integration, EV adoption, and grid stability all depend on storage solutions.

India's policy focus on advanced chemistry cell manufacturing indicates an understanding of this reality. However, battery supply chains involve critical minerals, many of which India lacks domestically. Securing access through international partnerships, recycling technologies, and alternative chemistries will be essential.

Here, again, vision meets constraint. India's battery strategy is forward-looking, but its success will hinge on sustained investment and diplomatic coordination.

State Capacity and Policy Learning

A recurring theme across these sectors is the expanding role of the state. The government is no longer a passive regulator. It is an investor, coordinator, and sometimes a risk-taker. This shift deserves attention.

Yet, state capacity is uneven. Some institutions adapt quickly; others

struggle. Policy learning, feedback mechanisms, and course correction will determine outcomes. Technology policy is not static. It demands humility and revision.

Perhaps the most encouraging sign is the willingness to experiment. Pilot projects, phased incentives, and public-private collaboration suggest a learning state rather than a rigid one.

Global Integration Without Dependency

India's technology vision does not reject globalization. Instead, it seeks a recalibrated engagement. Partnerships with the United States, Europe, Japan, and emerging economies play a crucial role in technology transfer and supply chain diversification.

At the same time, India remains cautious about overdependence. This balancing act is difficult. Too much protection stifles innovation. Too much openness risks vulnerability. Navigating this tension will define India's technological trajectory in the coming decade.

Path Ahead

India stands at an interesting, perhaps uncomfortable, technological moment. The ambitions are large. The policy architecture is evolving. The intent, at least, appears serious. Emerging technologies are no longer treated as optional upgrades but as foundational to national capacity.

Still, success is far from guaranteed. Technology does not bend easily to political timelines. It demands patience, institutional depth, and honest assessment of failures. India's vision, therefore, should be judged not by declarations but by sustained commitment.

If the current momentum is matched with realism, adaptability, and social sensitivity, India may well convert this moment into long-term capability. If not, the risk is familiar: impressive beginnings followed by uneven outcomes. The difference, this time, will lie in whether learning outpaces rhetoric.

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