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## THE SOVEREIGN EDGE: ARCHITECTING THE NEXT DECADE OF AGENTIC INTELLIGENCE FOR INDIA'S MSME ECOSYSTEM

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**Abstract:** This paper explores the emergence of agentic artificial intelligence and sovereign AI models in transforming India's MSME ecosystem. It analyzes the transition from traditional AI systems to decentralized, cost-effective architectures such as small language models and multi-agent systems. The study examines real-world applications including supply chain optimization, financial inclusion, regulatory compliance, and sustainability. Furthermore, it highlights the role of digital public infrastructure such as ONDC and Bhashini in democratizing access to AI. The research concludes that agentic and sovereign AI frameworks can significantly enhance productivity, reduce operational costs, and enable inclusive economic growth for MSMEs in India.

**Index Terms** - Artificial Intelligence, MSME, Agentic AI, India, Automation

### I. INTRODUCTION

The Indian economic trajectory is undergoing a profound structural realignment as the nation pursues its ambition to become a \$7 trillion economy by 2030 and a \$30 trillion powerhouse by 2047 [1]. Central to this transformation is the micro, small, and medium enterprise (MSME) sector, which contributes approximately 30% to GDP, accounts for nearly 46% of exports, and employs over 230 million individuals [3]. Despite this systemic importance, MSMEs remain constrained by a low-productivity trap characterized by volatile input costs, limited access to formal credit, lack of skilled labor, and insufficient technological adoption [6]. The emergence of Artificial Intelligence (AI) in 2026 represents a decisive opportunity to overcome these challenges, with the potential to unlock over \$500 billion in economic value for the sector [3]. However, the current landscape reflects a shift away from centralized, cloud-heavy Large Language Models (LLMs) toward localized, sovereign, and agentic AI systems that are more suitable for cost-sensitive and resource-constrained MSMEs [9].

### II. EVOLUTION OF AI: FROM LLMs TO SOVEREIGN SLMs

#### The Computational Efficiency Crisis and the Pivot to Sovereign Small Language Models

The adoption of artificial intelligence within the MSME ecosystem has reached a critical inflection point in 2026, driven by what is termed the "computational efficiency crisis" [11]. While the previous phase of AI development focused on the massive scaling of parameters in models such as GPT-4, the resource requirements of such architectures—demanding tens of thousands of high-end GPUs and hundreds of gigabytes of memory per replica—created an insurmountable barrier for mid-market and resource-constrained organizations [11]. This led to a three-tier market dynamic where Tier 1 enterprises with unlimited budgets could deploy massive LLMs, while Tier 3 firms remained effectively excluded from the AI revolution until the maturation of Small Language Models (SLMs) [11].

Small Language Models, typically ranging from 1 to 13 billion parameters, have emerged as the practical backbone for India's multilingual and cost-sensitive applications [10]. These models fit within roughly 14 to 26 GB of GPU memory and, in many specialized benchmarks, reach 80% to 95% of the performance of their larger counterparts on language, coding, and reasoning tasks [11]. For Indian MSMEs, this shift is not merely technological but strategic; it enables the transition from a "pay-per-query" model that can cost between \$10 and \$60 per million tokens in the cloud to a localized deployment where the marginal cost of a query is primarily the electricity for hardware already in operation [12].

#### Comparative Performance and Infrastructure Benchmarks for 2026

Table 1: Comparative Performance of AI Models (2026)

Model Attribute	Large Language Models (LLMs)	Small Language Models (SLMs)	Indian Sovereign Models (Sarvam/Krutrim)
Parameter Scale	100B – 1.7T+	1B – 15B	2B – 105B (MoE)
Memory Footprint	Hundreds of GBs	14 – 26 GB	1 – 15 GB (Optimized)
Latency (Token/s)	15 – 25	200 – 250	High (Voice-optimized)
Core Infrastructure	Centralized Data Centers	On-premise/Edge Devices	Sovereign AI Clusters
Primary Advantage	General Reasoning	Speed, Control, Cost	Multilingual/Vernacular

The development of indigenous models like Sarvam's 30B and 105B parameter Large Language Models, which were launched in early 2026, signifies a move toward "Sovereign AI" [10]. These models are purpose-built for India's multilingual ecosystem, having been trained on 16 trillion tokens across 22 Indian languages [13].

### III. AGENTIC AI AND AUTONOMOUS SYSTEMS

#### Agentic AI: The Transition from Passive Analytics to Autonomous Orchestration

Agentic AI represents a fundamental shift from traditional analytics and generative AI toward autonomous systems capable of making decisions and executing workflows across business operations [14]. Unlike conventional systems that provide recommendations, agentic AI actively pursues defined business outcomes by coordinating planning, procurement, and execution processes. In the context of MSMEs, this capability significantly reduces decision latency from days to seconds and enhances responsiveness to dynamic market conditions [16]. For example, AI agents in supply chain management can monitor inventory levels in real time, predict demand fluctuations, and automatically trigger procurement decisions or suggest alternative suppliers, thereby minimizing disruptions and improving efficiency [18]. Additionally, these systems act as an augmented workforce, compensating for skill shortages and enabling MSMEs to manage complex operations with limited human resources. This is particularly relevant in the context of workforce transitions, where experienced personnel are retiring and AI systems help preserve institutional knowledge and operational continuity [16].

#### Industrial Agentic AI Use Cases and Projected Outcomes

Table 2: Industrial Agentic AI Use Cases and ROI

Functional Area	Agentic Workflow	Quantifiable Impact (ROI)
Quality Control	Computer vision cameras detect defects instantly on the line; agents automatically route defective items for rework [6]	50% reduction in manufacturing defects[20].
Maintenance	Agents analyze sensor data to predict equipment failure and schedule maintenance during planned downtime [6]	40% decrease in equipment failure frequency[20].
Supply Chain	Agents monitor parcel movement, detect anomalies, and proactively trigger exception handling[16]	50% fewer inventory shortages; double-digit efficiency gains[16]
Logistics	Dynamic pricing agents analyze market demand and shipment volume to generate rapid bids[15].	15% reduction in operational costs[15]

#### IV. DIGITAL PUBLIC INFRASTRUCTURE (ONDC & BHASHINI)

##### Digital Public Infrastructure and the Democratization of Commerce

India's Digital Public Infrastructure (DPI), particularly platforms such as ONDC and Bhashini, plays a transformative role in democratizing access to AI and digital technologies for MSMEs [22]. ONDC, as an open and interoperable digital commerce network, reduces dependency on centralized e-commerce platforms and enables small businesses to access wider markets with lower transaction costs [24]. By facilitating interoperability among buyers, sellers, and logistics providers, ONDC enhances market efficiency and promotes inclusivity. Simultaneously, the Bhashini initiative enables multilingual and voice-based interactions, allowing users to engage with digital platforms in their native languages [23]. This is especially significant in a country like India, where linguistic diversity can act as a barrier to digital adoption. Voice-enabled AI systems further reduce the need for digital literacy, enabling even non-literate users to participate in the digital economy, thereby expanding the reach and impact of MSMEs across rural and semi-urban regions [22].

ONDC Ecosystem Metrics and Commercial Advantages in 2026

Table 3: ONDC vs Traditional E-Commerce Comparison

Feature	Traditional E-Commerce	ONDC Open Network
Seller Commission	15% – 35%	3% – 12% [26]
Seller Autonomy	Restricted by platform terms	Full control over listings and pricing[28]
Logistics	Platform-controlled only	Multiple third-party interoperable partners[25]
Market Reach	Siloed within the app	Discoverable across all buyer-side apps[24]
Linguistic Support	Predominantly English	Vernacular (Hindi, Bengali, Marathi, etc.)[4]

## V. REGULATORY FRAMEWORK AND COMPLIANCE (DPDP ACT)

### Regulatory Compliance in the Age of the DPDP Act

The introduction of the Digital Personal Data Protection (DPDP) Act marks a significant shift in data governance and regulatory compliance for MSMEs [32]. The Act mandates strict requirements for data protection, including consent management, data localization, and timely breach reporting, which can pose operational challenges for small enterprises. AI-based Regulatory Technology (RegTech) solutions address these challenges by automating compliance processes, such as monitoring data usage, managing consent, and generating audit trails [33]. These systems not only reduce compliance costs but also enhance accuracy and efficiency, enabling MSMEs to meet regulatory standards without significant manual effort. Furthermore, the deployment of AI-powered compliance agents on local infrastructure ensures data security and aligns with regulatory requirements, providing a scalable and cost-effective solution for MSMEs operating in regulated environments [34].

### DPDP Compliance Automation Workflow for MSMEs

The process of managing personal data in a regulated fintech or retail MSME involves a multi-stage workflow handled by specialized AI agents:

1. **Continuous Monitoring:** The agent compares every data processing event against the firm's consent records to flag processing that lacks a valid basis or falls outside the permitted purpose [34].
2. **DSR Handling:** Upon receiving a data subject request for access or erasure, the agent verifies the individual's identity, locates the relevant data across disparate internal systems (ERP, CRM, databases), and generates a structured response [34].
3. **Automated Auditing:** The system generates immutable logs for every action taken by the AI, providing a defensible audit trail for regulatory inspections by the Data Protection Board [34].

## VI. AI IN FINANCIAL INCLUSION

### Financial Inclusion 2.0: AI and the Credit Frontier

AI-driven credit scoring models are transforming financial inclusion in the MSME sector by leveraging alternative data sources such as transaction histories, digital payments, and behavioral patterns [8]. Traditional credit evaluation methods often exclude MSMEs due to the lack of formal financial records, resulting in a significant credit gap. AI-based models address this issue by analyzing diverse data points to assess creditworthiness more accurately, reducing bias and improving access to financial services. These systems enable faster loan approvals and support the growth of MSMEs by providing timely access to capital, thereby contributing to economic development and financial inclusion [8], [36].

### AI-Driven Credit Evaluation Metrics

Creditworthiness Index =  $\Sigma$  (GST Compliance + Cash Flow + Transaction History + Repayment Behavior)

Lenders now utilize anomaly detection techniques to flag irregular transaction volumes or inconsistencies in declared income, strengthening fraud monitoring without slowing down genuine approvals [27]. Secondary evidence from 2026 studies suggests that AI-based scoring can reduce default rates significantly by identifying early warning signals that traditional heuristic systems overlook [8]. This shift supports the goal of raising MSME contributions to manufacturing gross value added (GVA) from 35.4% to 50% by 2047 [7].

## VII. AI FOR SUSTAINABILITY AND GREEN TRANSITION

### The Green Transition: Sustainability as a Competitive Leverage

AI technologies play a critical role in advancing sustainability by optimizing resource utilization, reducing waste, and improving energy efficiency [21]. In manufacturing, AI-driven predictive maintenance reduces equipment failures and minimizes energy consumption, while in logistics, route optimization algorithms reduce fuel usage and carbon emissions [38]. Additionally, AI supports the integration of renewable energy sources by improving forecasting and grid management, contributing to India's environmental goals. These applications demonstrate how AI can simultaneously enhance operational efficiency and promote sustainable practices within MSMEs [21], [37].

## Sustainability ROI and Technical Interventions for MSMEs

Table 4: Sustainability ROI and AI Interventions

Sustainability Lever	AI Application	Documented Outcome
<b>Energy Optimization</b>	Genetic algorithms minimize consumption through optimal scheduling[21].	9% reduction in energy consumption; 69% reduction in computation time[21].
<b>Waste Reduction</b>	AI-enabled sorting machines distinguish recyclable materials with high precision[37].	85% reduction in contamination rates during recycling[37].
<b>Route Optimization</b>	Green logistics models minimize "empty miles" and fuel usage[38].	15% - 30% reduction in carbon emissions from delivery fleets[38].
<b>Agriculture</b>	Precision farming uses satellite imagery and IoT to optimize water and pesticide use[37].	Significant conservation of freshwater resources (78% of total use)[37].

## VIII. COST-BENEFIT ANALYSIS OF AI SYSTEMS

## Cost-Benefit Dynamics: TCO and ROI of Localized AI Systems

The adoption of AI in MSMEs is influenced by the Total Cost of Ownership (TCO) and the expected Return on Investment (ROI) [40]. Cloud-based AI systems offer flexibility but involve recurring costs that can become significant with increased usage. In contrast, localized deployment of SLMs requires initial investment in hardware but reduces long-term operational costs by eliminating per-query fees [12]. Studies indicate that MSMEs can achieve ROI within 6 to 18 months through improvements in efficiency, reduction in defects, and enhanced decision-making capabilities. These benefits extend beyond financial gains, including improved employee productivity and better utilization of resources [45].

Estimated Development and Operational Costs for AI Agents in 2026 (INR/USD)

Table 5: Cost Analysis of AI Systems for MSMEs (2026)

Agent Complexity	Initial Build Cost (Est. INR)	Monthly Operational Cost (Est. INR)
<b>Simple FAQ Chatbot</b>	₹2.5 Lakh – ₹4 Lakh	₹40,000 – ₹1.6 Lakh
<b>LLM-Powered Task Agent</b>	₹40 Lakh – ₹1 Crore	₹1.6 Lakh – ₹5 Lakh
<b>RAG-Based Knowledge Agent</b>	₹65 Lakh – ₹1.5 Crore	₹2.5 Lakh – ₹7.5 Lakh

<b>Multi-Agent Orchestration</b>	₹1.2 Crore – ₹3.3 Crore+	₹6.5 Lakh – ₹16 Lakh+
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## IX. IMPLEMENTATION STRATEGY AND ROADMAP

### Implementation Roadmap: From Playbook to Pilot to Scale

The successful implementation of AI in MSMEs requires a structured and phased approach, including assessment, pilot implementation, and scaling [1]. The assessment phase involves identifying key business challenges and defining measurable objectives, while the pilot phase focuses on testing AI solutions in controlled environments. Once successful, these solutions can be scaled across the organization, ensuring integration with existing systems and continuous monitoring of performance. This approach minimizes risks and ensures that AI adoption delivers tangible business value [1], [45].

## X. CASE STUDY: ANDHRA PRADESH AI MODEL

### State-Level Strategic Initiatives: The Andhra Pradesh Model

Andhra Pradesh has emerged as a leading example of AI adoption through government-led initiatives focused on infrastructure, education, and innovation [46]. Strategic partnerships with industry and academic institutions have enabled the development of AI ecosystems that support skill development, research, and practical implementation. These initiatives demonstrate the importance of policy support and collaborative efforts in driving digital transformation and enabling MSMEs to leverage advanced technologies effectively [46], [47].

## XI. GOVERNMENT AND INDUSTRY CONVERGENCE

### The Convergence of Governance and Industry

The convergence of government schemes and digital platforms plays a crucial role in enhancing MSME efficiency and accessibility [48]. By integrating multiple support programs into centralized digital systems, the government can streamline processes, reduce duplication, and improve resource allocation. These efforts enable MSMEs to access financial services, compliance support, and market opportunities more effectively, fostering growth and innovation within the sector [48].

## XII. FUTURE SCOPE

Future research can focus on real-time implementation of agentic AI systems in MSMEs across different sectors such as manufacturing, logistics, and fintech. Further studies may explore the integration of AI with emerging technologies like IoT and blockchain to enhance automation and transparency. Additionally, evaluating the long-term socio-economic impact of sovereign AI models on rural and semi-urban MSMEs can provide deeper insights into inclusive digital growth in India.

## XIII. RESULTS AND DISCUSSION

The analysis indicates that the adoption of agentic and sovereign artificial intelligence has significant potential to transform the MSME ecosystem in India. The shift from large centralized AI models to small, efficient, and localized systems enables cost-effective deployment, making AI accessible to small and medium enterprises.

The study highlights that AI-driven automation improves operational efficiency, reduces decision-making time, and enhances productivity across sectors such as manufacturing, logistics, and finance. Additionally, digital public infrastructure platforms like ONDC and Bhashini play a crucial role in democratizing access to digital technologies, enabling MSMEs to expand their market reach and improve customer engagement.

Furthermore, AI-based financial models improve credit accessibility for MSMEs by leveraging alternative data sources, thereby supporting financial inclusion. The integration of AI in sustainability initiatives also contributes to resource optimization and environmental conservation.

Overall, the findings suggest that the combined impact of agentic AI, sovereign models, and digital infrastructure can drive inclusive growth and strengthen the competitiveness of MSMEs in India.

#### XIV. CONCLUSION

##### Synthesizing the 2026 Outlook: A Path to Inclusive Growth

The transition toward agentic and sovereign AI represents a transformative opportunity for MSMEs in India [3]. By leveraging localized AI systems, digital infrastructure, and autonomous technologies, MSMEs can overcome traditional barriers related to cost, scalability, and accessibility. A structured implementation strategy, supported by government initiatives and technological advancements, will enable MSMEs to achieve sustainable and inclusive growth. This transformation is critical for realizing India's long-term economic vision and establishing a competitive and resilient MSME ecosystem [2].

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