Responsible AI

Principles

Principle	Definition (per Microsoft)	Mechanical Engineering Example	Implementation Considerations
Fairness	Treat people and groups equitably, mitigating bias	AI quality control in manufacturing	Balanced datasets, audit disparate impact
Reliability and Safety	Operate reliably, safely, and consistently under all conditions	Predictive maintenance for CNC machines	Robust testing, stress scenarios, overrides
Privacy and Security	Uphold strong security and privacy protections for all data and AI behaviors	Digital twins in smart factories	Encryption, access control, anonymization
Inclusiveness	Design to benefit diverse backgrounds and abilities	Adaptive AI robot interfaces	Participatory design, accessibility
Transparency	Systems are understandable; decisions are explainable	Explainable AI for design optimization	Model documentation, XAI toolkits
Accountability	Clear lines of human oversight and recourse for AI outcomes	Audit trails in process control automation	Audit logs, responsible parties, override

FAIRNESS
RELIABLITY AND SAFETY
TRANSPARENCY
RELIABIITY AND SAFETY
TRANSPARMECY
RESPONSIBLE
AI
HUB
PRIVACY AND SECURITY
INCLUSLVEVES
ACCOUNTABLITY

GLOBAL AI GOVERNANCE

CURRENT REGULATORY LANDSCAPE

EUROPEAN UNION

AI Act
Risk-Based
High-Risk AI

UNITED STATES

State-Centic AI
Fonernwack
Algorithm Registration
Content Regulation

UNITED STATES

Executive Order
NIST AI RMF
NIST AI RMF
Sector-Specific Laws

INDIA

AI For All
DPDP Act
Digital India Act
(Proposed)

INDUSTRY EFFORTS

Responsible AI Principles

TOOLS & STANDARDS

INTERNATIONAL INITIATIVES

INDIA'S GLOBAL ROLE

G20 Presidency

GPAI Lead Chair

India AI mission

Seven Pillars of the IndiaAI Mission[49]

Compute capacity	Establish a federated public infrastructure of high-end GPU clusters and launch AIRAWAT (AI Research Analysis and Workbench). As of 15th September 2025, the mission targets deployment of 38k+ GPUs to support national compute requirements
Innovation centre	Develop India-specific foundational models and large language models (LLMs) tailored to Indian languages and domains, advancing IP creation
Datasets platform	Build anonymized, consent-based, interoperable public datasets to fuel model training. This platform underpins innovation, application development, and trusted AI governance
Application development initiative	Build AI solutions for agriculture, healthcare, education, and mobility through targeted pilots and partnerships with industry.
Future skills	Train 50L+ students and professionals through AI curriculum integration, data labs, and new certification programs in higher education
Startup financing	Support 1,000+ AI startups through catalytic funding for deep-tech and AI product innovation
Safe and trusted AI	Create frameworks and toolkits to ensure explainable, ethical, and privacy-preserving AI. This includes audit tools and compliance standards.

Pillars of adoption

Population-Scale Impact

AI failures in payments, healthcare, and citizen services can harm millions simultaneously, requiring robust safeguards and rapid response capabilities.

Trust and Security

CERT-In's requirements for 6-hour incident reporting and supply chain oversight intersect directly with AI model operations and security posture.

Global Competitiveness

ISO 42001 adoption and third-party assurance unlock cross-border trust, international procurement opportunities, and export markets for Indian AI solutions.

Regulatory Interventions

- The approach document Principles for Responsible AI1 notes that various considerations and **risks with AI systems** already find an expression in the Constitution of India and existing laws. Specific rules and regulations may need to be augmented to include the AI/ML-specific risks. In addition, the growth of AI has been relatively recent and approaches to govern AI systems are still evolving in most parts of the world. India has also seen AI-specific regulatory interventions and, in certain cases, existing regulations define the expectations from AI systems.
- The NSAI identified the **lack of ethical regulations** as being a key barrier for AI adoption. For instance, clarity around doctor-patient confidentiality, the informed consent process, explainability standards and liability framework are a few of the areas in which the Government may consider enabling AI innovators in the digital healthcare industry
- Approaches to regulate AI systems must aim to protect individual rights while promoting innovation. A one-size-fits-all approach to AI regulation, by design, is not feasible as the risks depend on the given use case and context in which it is

Policy Making

- Manage and update the Principles for Responsible AI in India
- Research into technical, legal, policy and social aspects of responsible AI in India
- Enable access to data, responsible AI tools and techniques
- Develop India’s (and other emerging economies’) perspectives on responsible AI

Procurement

- Initiatives like having model documents have greatly eased the procurement process, especially in the infrastructure sector. The **Government e-Marketplace (GEM) portal** has further helped in enhancing the transparency in the procurement system, thereby, establishing groundwork for trust mechanisms.
- Initiatives like evolving model procurement mechanisms and documents need to be pursued proactively to guide the overall process of procurement and ensure that the interventions are transparent and unambiguous. The issue of liabilities if AI is used in violation of the principles must also be addressed in procurement documents. 3.45. Depending on use case and deployment specifics of the proposed AI (or emerging technology) project, an institutional mechanism, similar to expert advisory committees that are constituted for complex projects, may be formulated to ensure that proposed projects are designed, developed and operated in adherence to the responsible AI principles. The composition of this body may include experts relevant for the use case- such as computer science, data science and machine learning experts, domain experts, legal experts, social science experts

Awareness and capacity building

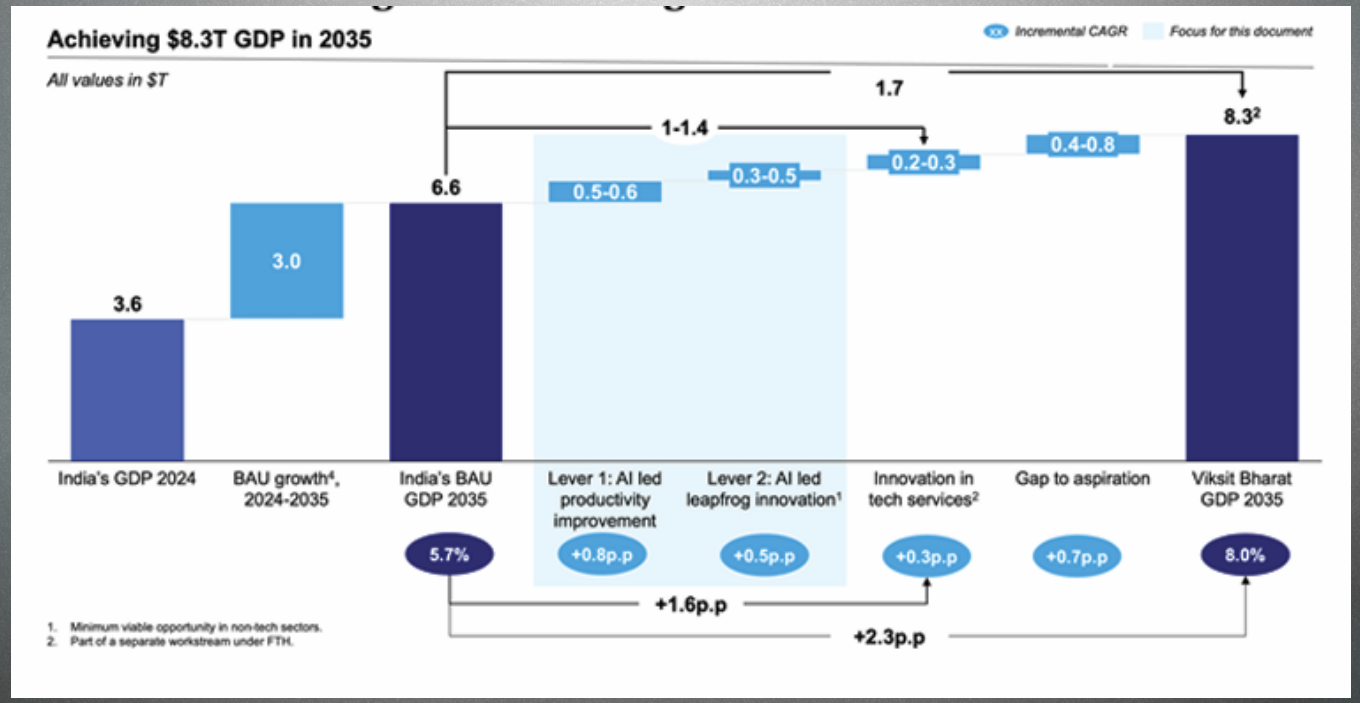
- Government may curate awareness initiatives on AI not only to provide perspectives on the capabilities but also highlight the weaknesses of AI systems and the need for responsible AI practices. Academic experts, industry bodies and independent organizations may be leveraged for needs assessment, development of training curriculum and conduct training programs for public sector officials.
- The objectives of these programs may include: Raising awareness of capabilities of AI in order to ensure that the expectations from AI are practical and the supporting factors for the success of AI initiatives are well understood Underlining the need for responsible AI for promoting investment into responsible AI practices Showcasing industry practices for responsible AI, including governance systems, tools and processes Identifying and facilitating the availability of datasets, policy measures and other instruments needed to enable responsible AI in India Reducing information asymmetry, trust issues and apprehensions of AI systems and develop skills to identify and think through ethical problems

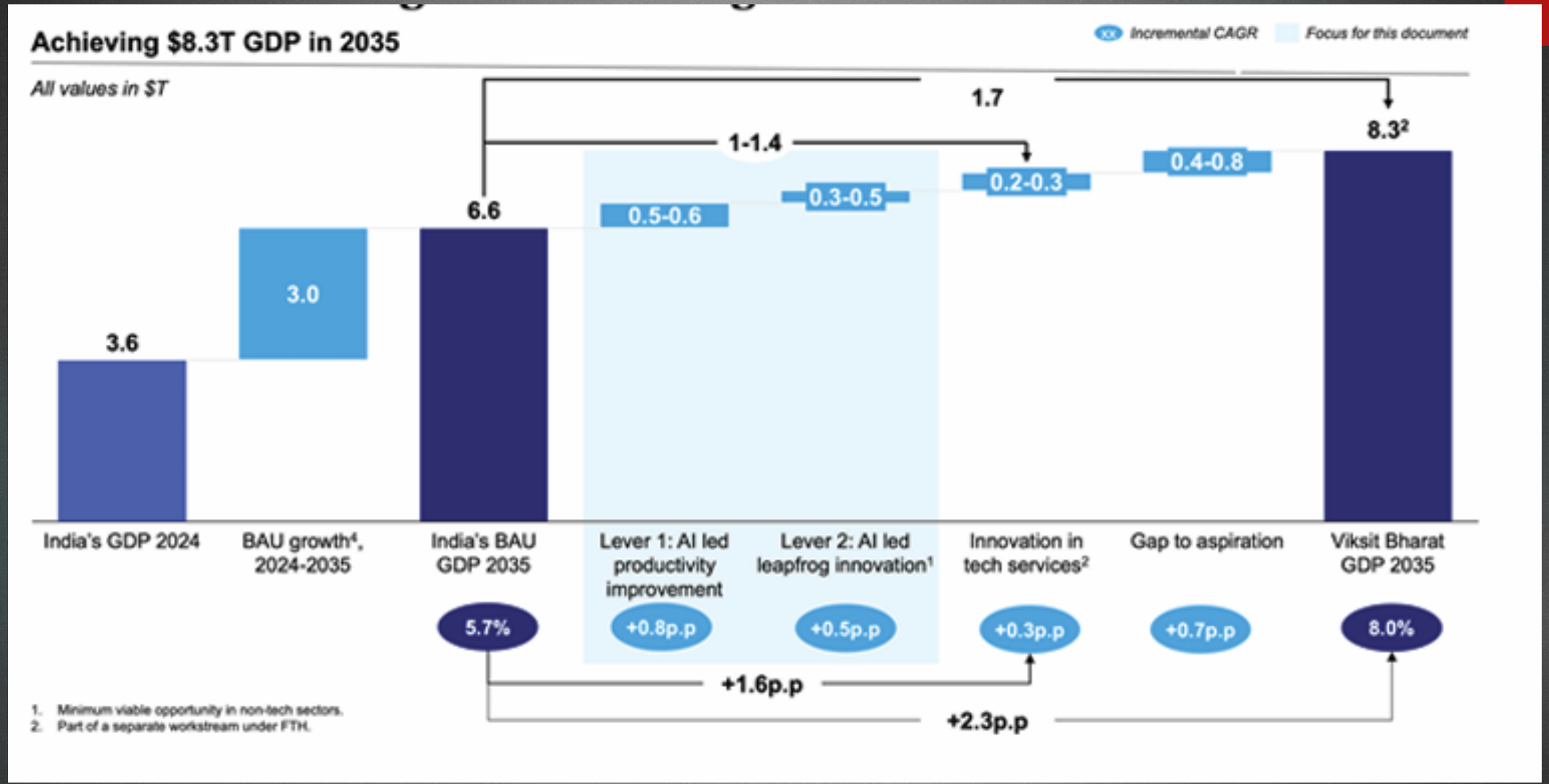
AI for Viksit Bharat

- Artificial Intelligence (AI) systems have gained prominence over the last decade due to their vast potential to unlock economic value and help mitigate social challenge.
- It is estimated that AI has the potential to add USD 957 billion, or 15 percent of current gross value added to India's economy in 20351. It is projected, that the AI software market will reach USD 126 billion by 2025, up from USD 10.1 billion in 2018.
- The cornerstone of AI implementation at Mahakumbh 2025 is an extensive surveillance network comprising over 2,700 CCTV cameras, with approximately 500 AI-enabled cameras specifically designed for real-time crowd analytics. This represents the first time artificial intelligence has been used for crowd management at such a massive scale globally.
- At its current growth rate of 5.7%, India's GDP is projected to reach $6.6T by 2035. However, under the aspirational 8% growth trajectory outlined in the government's vision for the nation known as Viksit Bharat, India's GDP could increase to $8.3T, representing an incremental $1.7T compared with the current growth path.

Potential AI opportunities in India

- Accelerating AI adoption across industries to improve productivity and efficiency, potentially bridging 30–35% of the gap.
- Transforming R&D, through generative AI, could help India leapfrog into innovation driven global opportunities, bridging a minimum 20–30% of the gap.
- Innovation in technology services, strengthening India's reputation as a technology services leader, contributing another 15-20% to the step up.




Achieving $8.3T GDP in 2035
Incremental CAGR
Focus for this document
All values in $T
1.7
1-1.4
8.3²
0.4-0.8
0.2-0.3
0.3-0.5
0.5-0.6
6.6
3.0
3.6
India's GDP 2024
BAU growth⁴, 2024-2035
India's BAU GDP 2035
Lever 1: AI led productivity improvement
Lever 2: AI led leapfrog innovation¹
Innovation in tech services²
Gap to aspiration
Viksit Bharat GDP 2035
5.7%
+0.8p.p
+0.5p.p
+0.3p.p
+0.7p.p
8.0%
+1.6p.p
+2.3p.p
1. Minimum viable opportunity in non-tech sectors.
2. Part of a separate workstream under FTH.

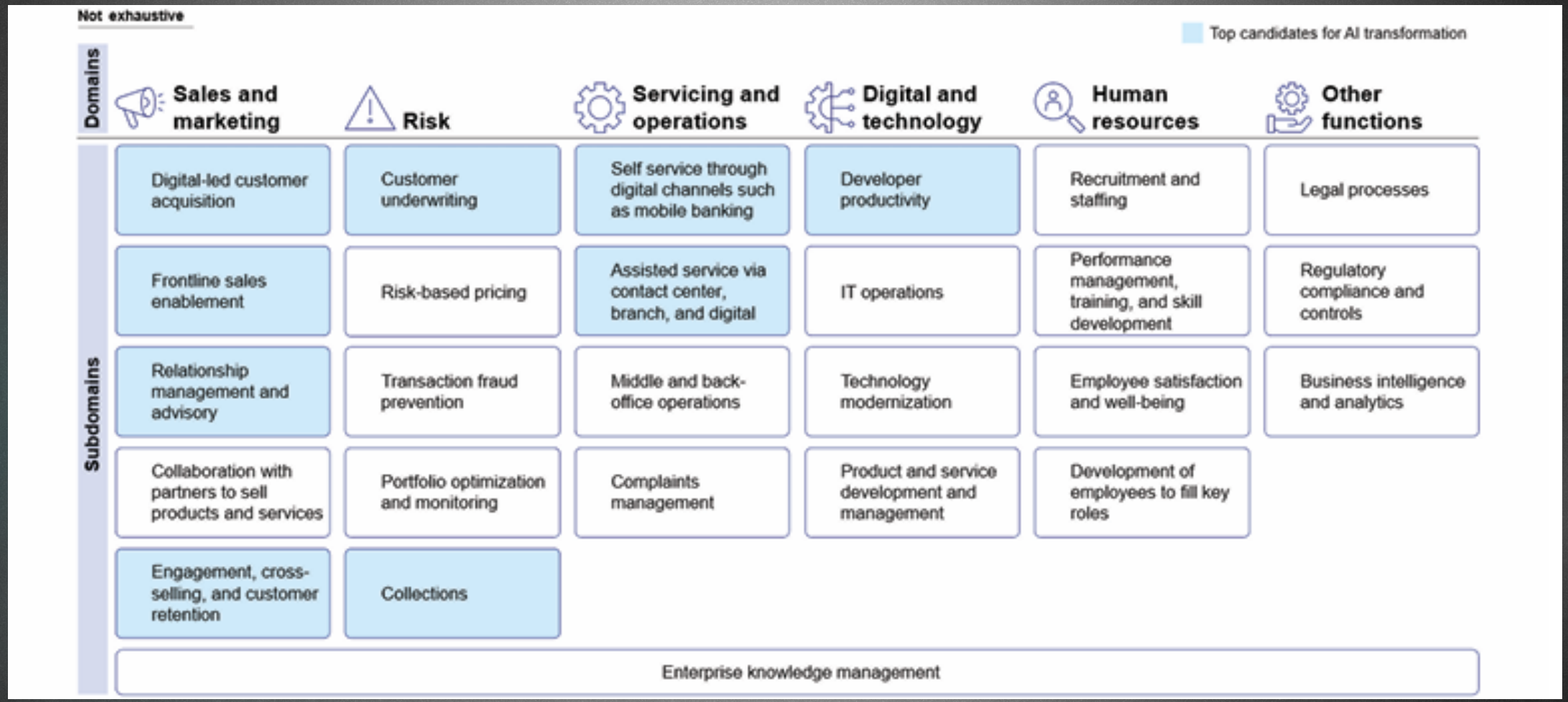
Strategic Enablers

- Access to critical AI infrastructure such as **cloud platforms, compute, and foundational datasets** could help strengthen India's sovereign AI capabilities. At the same time, robust AI governance frameworks, including ethics guidelines and risk controls, could ensure responsible and secure deployment.
- The private sector can lead the scaling of AI adoption by embedding AI into **core industry processes**. This includes driving model validation, secure deployment, and AI powered decision-making, while maintaining resilience and accountability at leadership levels. Reskilling senior executives and upskilling the broader workforce would be key to enabling this transformation.
- Academia can be vital in anchoring **research and supporting** large-scale workforce transformation. The creation of AI testing sandboxes can further enable safety and scale.
- To ensure inclusive growth, it is essential to provide **equitable acces**s to AI resources and opportunities, particularly for **MSMEs** and economically

ACCELERATING AI ADOPTION ACROSS INDUSTRIES

- Baseline employment and GDP data: Used 2022 as the baseline year for both employment and real GDP, sourced from IHS. Calculated productivity as GDP per worker to set the reference point for future projections
- AI adoption rates for 2035: Estimated sector-level AI adoption rates using McKinsey Global Institute's (MGI) model, covering about 850 occupations and 2,100 activities with sectoral nuances. Applied these AI adoption rates to baseline employment to determine workforce segments likely to be automated
- Growth rates across different scenarios: Augmented workforce calculated by redeploying the automated workforce at current productivity levels. New GDP projected by applying 2022 productivity to the augmented workforce. This yielded GDP CAGR over 2022–2035, forming the basis of Lever 1 sectoral projections

Banking


Not exhaustive
Top candidates for AI transformation
Domains
Subdomains
Sales and marketing
Risk
Servicing and operations
Digital and technology
Human resources
Other functions
Digital-led customer acquisition
Frontline sales enablement
Relationship management and advisory
Collaboration with partners to sell products and services
Engagement, cross-selling, and customer retention
Customer underwriting
Risk-based pricing
Transaction fraud prevention
Portfolio optimization and monitoring
Collections
Self service through digital channels such as mobile banking
Assisted service via contact center, branch, and digital
Middle and back-office operations
Complaints management
Developer productivity
IT operations
Technology modernization
Product and service development and management
Recruitment and staffing
Performance management, training, and skill development
Employee satisfaction and well-being
Development of employees to fill key roles
Legal processes
Regulatory compliance and controls
Business intelligence and analytics
Enterprise knowledge management

Banking

- Financial services companies' front, middle and back offices are expected to be transformed by machine learning and agentic AI. While the map represents important opportunities across domains, areas with potentially the highest ROI have been highlighted
- In the back office, AI could power automated compliance, fraud detection, and risk management through advanced anomaly detection techniques and privacy-preserving analytics such as secure multi-party computation and federated learning
- In the middle office, AI-enabled systems can reshape credit decisioning, collections, and portfolio management. By leveraging alternative data sources, banks can make more accurate, dynamic, and inclusive lending decisions
- In the front office, virtual relationship managers can deliver hyper-personalized customer experiences. Using real-time behavioral predictions, these AI agents can offer tailored financial advice, timely product recommendations, and proactive outreach, helping deepen customer engagement and improve satisfaction across segments

Manufacturing

- AI can unlock productivity and efficiency across multiple dimensions by lowering the cost of production, improving output yields through enhanced process efficiency, and increasing throughput via predictive maintenance on the shop floor. It can also enable the production of higher-quality goods at similar prices by powering intelligent product design, real-time quality control, and mass customization. To fully realize these benefits and build a future ready, competitive industrial base, upskilling India's manufacturing workforce in AI tools will be essential.
- In manufacturing, $85–100B could be driven by AI-led productivity and efficiency improvement over and above India's current growth by 2035. The National Manufacturing Mission outlines f ive key pillars15: Ease of Doing Business, Future-ready Workforce, Vibrant MSME Sector, Availability of Technology, and Quality Products, of which AI will have a high impact on three: Availability of Technology, Future-ready Workforce, and Vibrant MSME Sector.

Highly impacted by AI

5 key pillars that will drive manufacturing growth for India

Ease and cost of doing business

Simplifies regulations and reduces costs, making India more attractive for global manufacturing investments

Future-ready workforce

Equips workers with modern skills to meet evolving demands of high-tech manufacturing industries

Vibrant and dynamic MSME sector

Empowers small businesses with finance, technology, and market access to drive local manufacturing growth

Availability of technology

Promotes innovation and adoption of advanced technologies to boost productivity and global competitiveness

Quality products

Ensures Indian goods meet global standards, enhancing exports and trust in "Made in India" products

AI impact across three key pillars

A Producing the same goods at a lower price

- Automating repetitive tasks and optimizing labor through predictive maintenance and robotics
- Enhancing production efficiency with real-time analytics and AI-driven scheduling
- Streamlining MSME operations via AI-enabled supply chain and demand forecasting

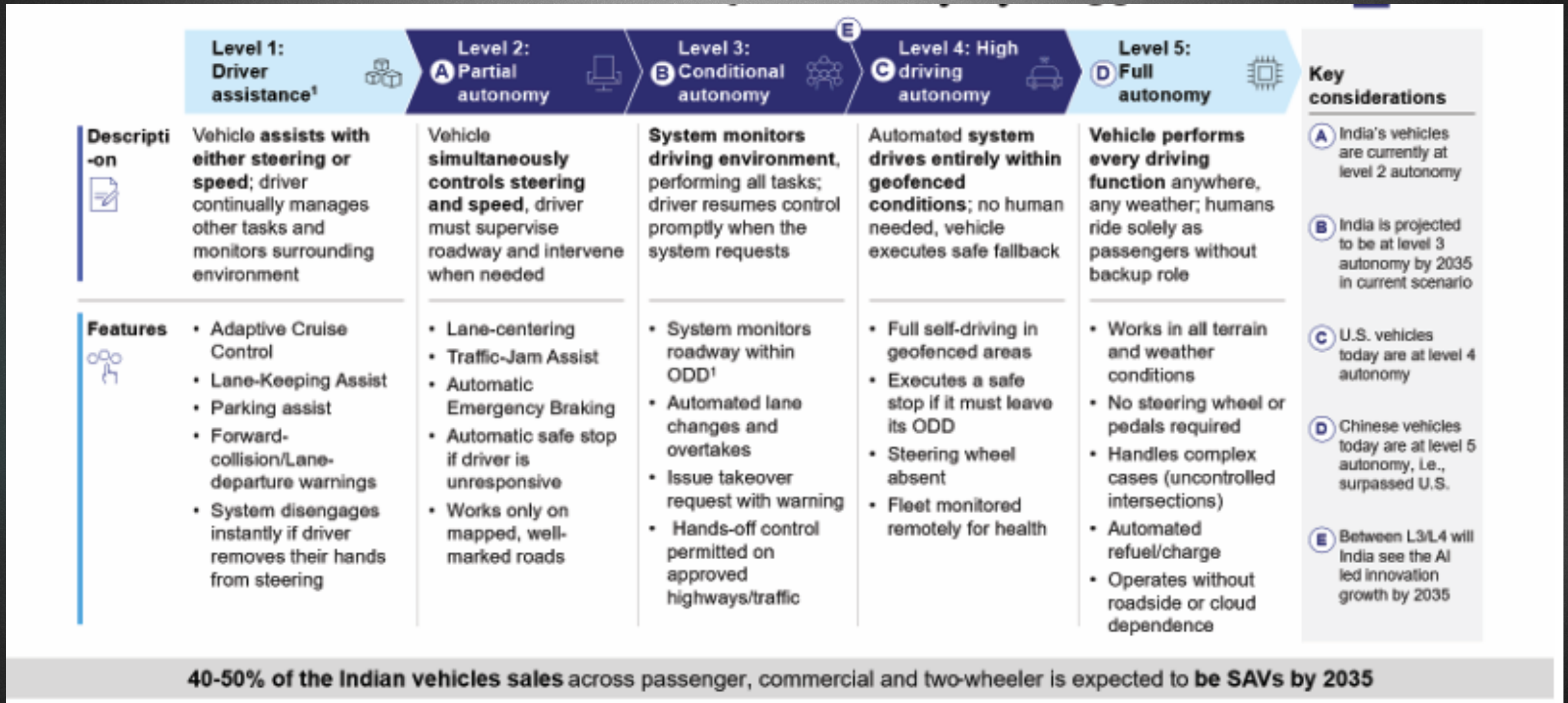
B Producing better goods at the same price

- Enabling intelligent design and quality control systems that detect defects in real time
- Supporting MSMEs in adopting AI tools for product development and customization
- Skilling workforce in AI tools and techniques to support high-tech products

Source: Press Information Bureau, Government of India. "'National Manufacturing Mission' to cover small, medium and large ind ustries for furthering 'Make in India' announced in Union Budget 2025 -26." February 1, 2025

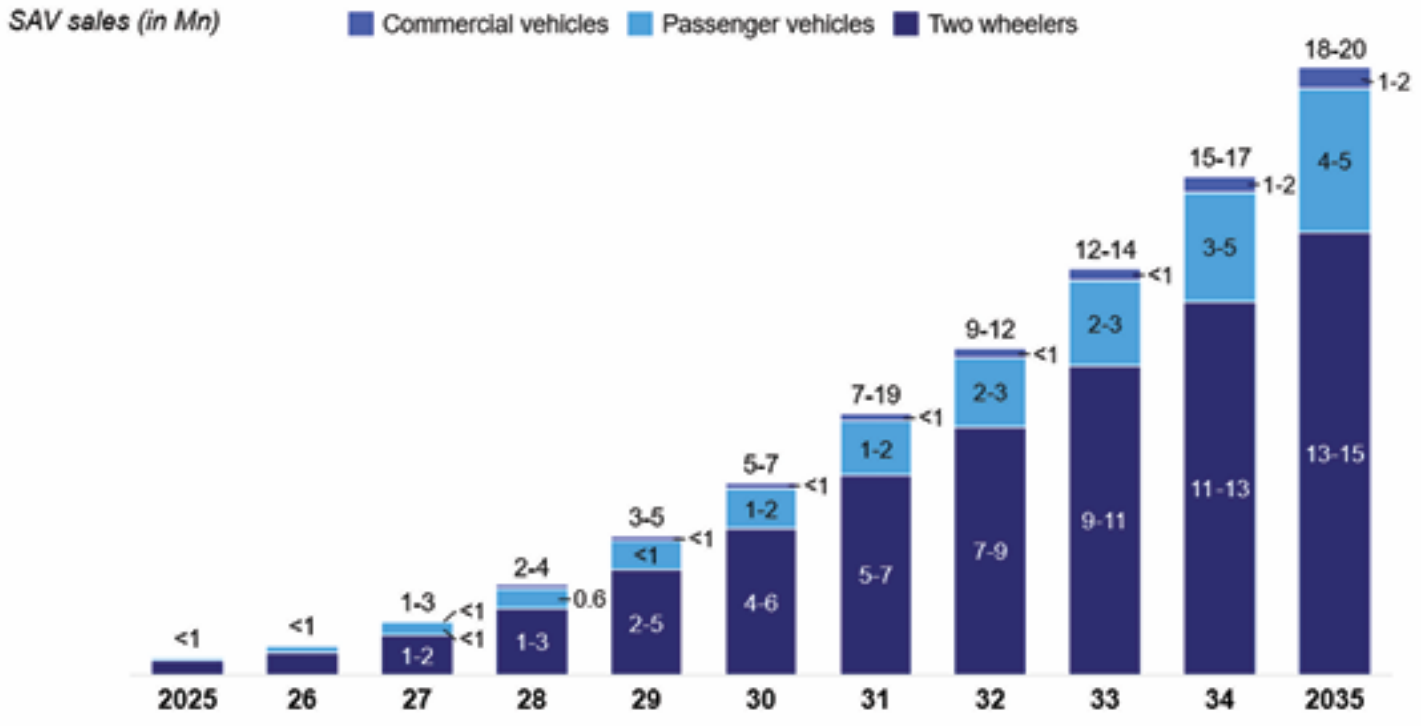
Software assisted vehicles

- Software-Assisted Vehicles (SAVs) represent the next generation of automobiles, where core functionalities are increasingly driven by software rather than hardware-intensive systems.
- SAVs operate across five defined levels of autonomy, as per the Society of Automotive Engineers (SAE) International.
- The automotive industry in India is presently concentrating its efforts on progressing from Level 2, which features partial vehicle autonomy, towards achieving Level 4, characterized by highly autonomous driving capabilities.
- These vehicles rely on flexible electronic architectures, connected systems, and over-the-air (OTA) updates to minimize human intervention. India is expected to reach Level 3 by 2035, with its AI-led automotive inflection point between Levels 3 and 4.
- As India emerges as a major SAV consumer market and global production hub, this shift offers a key opportunity for domestic value creation and global competitiveness.
- By 2035, 40-50% of the total 40-45M vehicle market, i.e. 18-20M units, would be enabled via software (Exhibit 12). These will be split across passenger vehicles at 4-5M, commercial vehicles at 1-2 M and two-wheelers at 13-15M. India could unlock



40-50% of the Indian vehicles sales across passenger, commercial and two-wheeler is expected to **be SAVs by 2035**

YoY value generation for SAVs



Value capture ($B)	2025	26	27	28	29	30	31	32	33	34	2035
	-	-	0-0.1	0.1-0.2	0.2-0.3	0.3-0.5	0.6-0.8	0.8-1.1	1.1-1.5	1.3-1.7	1.5-2

6-8

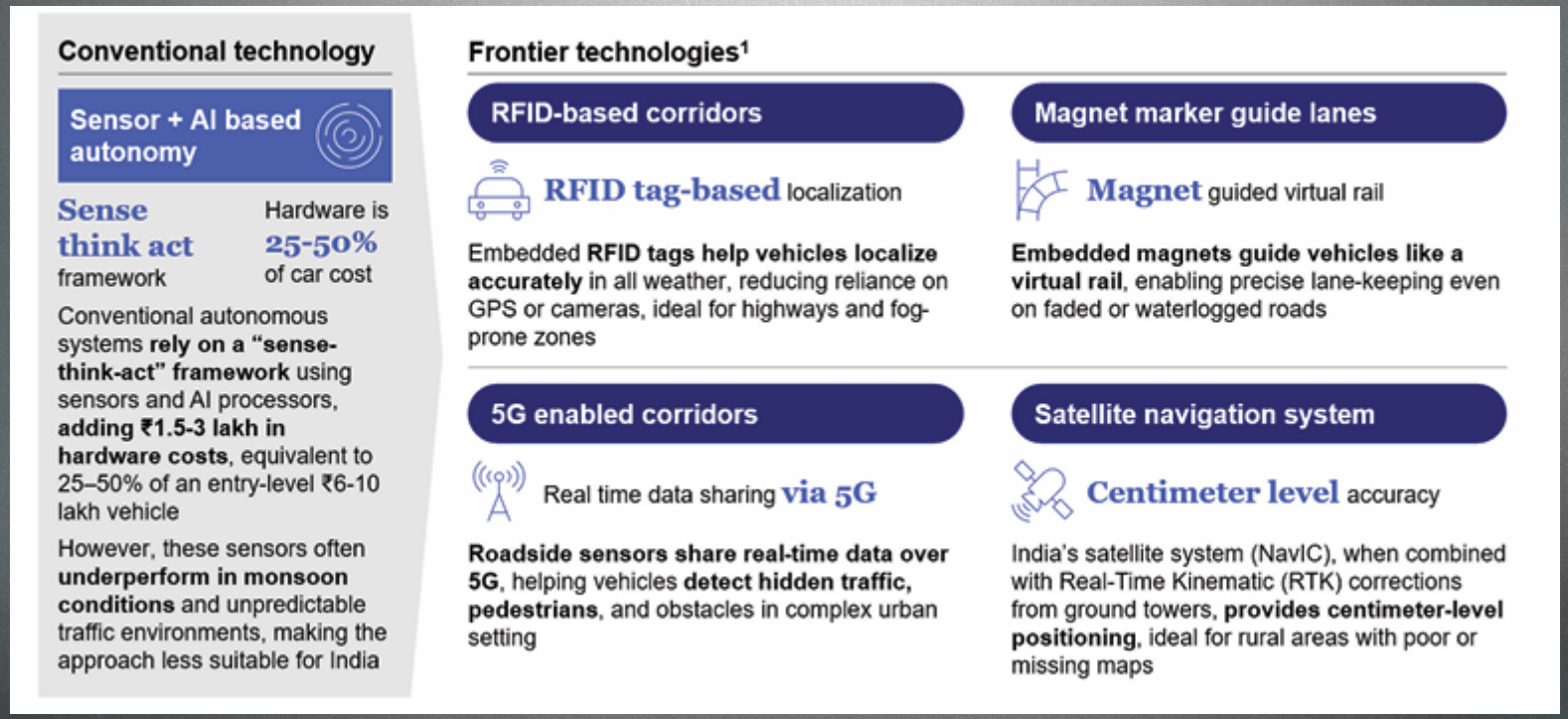
1. Frontier Tech Hub Expert Committee, NITI Aayog

Key considerations

- To achieve the **aspirational value capture of $6-8B** by 2035[1], the **Indian automotive sector can aim to invest in enablers,** incl. supplier ecosystem, infrastructure, talent development, policy changes, data and in-house AI models

- Moreover, there are **potential risks to take into consideration** that may hinder **India's ability to achieve the target of 18-20M SAVs by 2035**

Unlocking opportunities beyond conventional technologies

- Conventional autonomous driving relies on costly on-board sensors like LiDAR, cameras, and radars combined with real-time AI processing to navigate roads without human input. However, such systems may face challenges in India due to weather or traffic conditions and poor road markings.
- India can explore alternate, infrastructure-assisted approaches to enable affordable and reliable autonomy, including:
  - RFID-based corridors that help vehicles localize accurately in all weather, reducing reliance on GPS or cameras
  - Magnet marker guides lanes, which act like a virtual rail, enabling lane-keeping, even on waterlogged roads
  - 5 G-enabled corridors that share real-time data over 5G, helping vehicles detect hidden traffic in urban settings
  - Satellite navigation system in combination with real-time kinematic from ground towers provides centimeter-level accuracy ideal for remote area

- To unlock $6-8B in SAV value over the next decade, AI can help accelerate engineering capability building and faster time to market for software-enabled automotive products at reduced costs. **AI copilots or custom LLMs** trained on AUTOSAR/ vehicle OS documents can cut learning time by 30–50%. AI-powered model-based design can reduce design cycle times by 20–30%, while AI-led bug detection and regression testing can lower validation costs by up to 40%. Additionally, AI vision and reinforcement learning cn optimize component assembly and reduce Electronic Control Unit (ECU) testing costs.