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Fair Competition
for Greater Good

MARKET STUDY ON

ARTIFICIAL INTELLIGENCE AND COMPETITION

Competition Commission of India

STUDY PARTNER: MDI GURGAON | Management Development Institute

September, 2025

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EXECUTIVE SUMMARY

Artificial Intelligence (AI) is progressively transforming businesses across industries and holds significant potential to boost productivity and innovation. It is reshaping competition dynamics, business operations, and regulatory response. The AI landscape has rapidly transitioned from experimental use to mainstream adoption, becoming a cornerstone of digital transformation strategies globally. AI can fundamentally reshape how firms make decisions, in particular AI assisted and automated decision-making and optimise business processes.

The Competition Commission of India (CCI) has undertaken this market study through Management Development Institute (MDI), Gurgaon, to understand AI ecosystem, competition issues emanating from the AI stack and the application of AI in markets in India. The study also provides an overview of the existing and evolving regulatory/legal frameworks governing AI.

The AI market worldwide has increased from USD 93.24 billion in 2020 to USD 186.43 billion in 2024 while the market size of AI in India has grown from USD 3.20 billion in 2020 to USD 6.05 billion in 2024. The global AI market is projected to grow from USD 244.22 billion in 2025 to USD 1 trillion in 2031 and in India it is expected to expand from USD 7.84 billion in 2025 to USD 31.94 billion in 2031.[1]

The AI ecosystem includes AI industry stack i.e., upstream players and AI application deployment by user sector i.e., downstream players. At the base is the data layer, which involves collecting, preparing, processing, labelling and managing the data. The infrastructure layer, provides the computing resources such as servers and specialised chips deployed through cloud and edge computing. The development layer includes algorithms, programming tools, foundation models which involve creating or adapting large, versatile models that can be scaled or optimised for various tasks.

On the downstream side, AI models are deployed for specific applications through model fine-tuning, where domain-specific knowledge is infused into the model. The downstream data layer brings in user data and context-specific information to tailor the AI models in respective domains. High computing capacity (on premises or on cloud) is required to deploy and run AI solutions. The downstream development layer focuses on applying the AI solutions to specific tasks such as classification, detection, or prediction and integrating them with decision making processes.

Major players in the Indian market in the data layer are global entities such as Appen, Amazon Web Services (AWS), Google, Microsoft Azure and ScaleAI. Key players in the Indian market in cloud computing are global entities such as AWS,

[1] https://www.statista.com/outlook/tmo/artificial-intelligence/india

Microsoft Azure, and Google Cloud Platform (GCP). The growing demand for AI technology is driving semiconductor manufacturing and innovation, with advanced chips enabling more powerful AI. High end AI-based chips are the stronghold of players such as NVIDIA, Intel and AMD.[2] The big technology companies are thus playing a major role in data, infrastructure and AI development layers. In addition, the AI stack in India is witnessing green shoots with startups making inroads across in various layers.

With advancements in machine learning (ML), natural language processing (NLP), computer vision (CV), and foundation models/generative AI (LLMs/Gen AI), the AI industry is witnessing exponential growth, driven by demand for automation, data-driven insights, and enhanced user experience. In AI development layer algorithms are developed, trained and tested to create AI models using ML, NLP, CV and Generative AI. The models thus developed are deployed in the user sectors. Globally, entities such as OpenAI, Microsoft, Google, Meta are major players in foundation model/ generative AI segment. Leading generative AI startups in India include Observe.AI, Pixis, Ola Krutrim, InVideo, Sarvam AI, Avaamo AI, Senseforth.ai etc.[3]

This study relied on both secondary and primary research methodologies, which included literature review and analysis of published databases, as well as semi structured interviews with stakeholders such as AI startups, technology firms, user sectors, AI development platforms, investors, domain experts (in AI and competition law), and industry associations. In addition, survey and structured interviews with AI startups/labs/technology firms and user sectors were conducted.

Primary research indicates that the core area of work for almost 67% of respondent AI startups in India lies in the layer of building AI applications. AI technologies and models can be broadly categorised into open source and closed source depending on their accessibility, licensing and usage rights. India's market is dominated by open-source usage. Notably, 76% of the startup respondents build their application solutions using open-source technologies. As per the survey of startups, 88% of the respondents use ML to build their AI solutions, 66% respondents use generative AI (LLMs) for their application creation, 78% use NLP and 27% work in the field of CV. Worldwide open-source technologies and algorithms for model building are provided by players such as Google, Microsoft, Meta, Amazon, Open AI etc.

The adoption of AI technologies in India is rapidly accelerating across various user sectors. The integration of AI across industries is reshaping market structures and business strategies. AI is widely used in Banking Financial Services and Insurance (BFSI), healthcare, retail, e-commerce, logistics and marketing, with applications including dynamic pricing, personalised recommendations, demand forecasting and automated decision-making. In

[2] https://www.fortunebusinessinsights.com/semiconductor-market-102365
[3] Powerhouse in the Making: AI Market in India, Statista

financial services, AI plays a critical role in streamlining operations, improving risk management, detecting fraud, assessing credit risk and automating customer service. In healthcare, AI-driven diagnostics and drug discovery are gaining traction. Other sectors where AI is getting integrated include education, global positioning system (GPS) and navigation, agriculture, social media, gaming and astronomy. The Compound Annual Growth Rate (CAGR) for artificial intelligence market in India across industry verticals is projected to grow from 39% to 43% between 2025 to 2032.[4]

According to the survey of user sectors, around 90% of the respondents leverage AI to monitor customer behaviour, and about 27% utilise AI for monitoring supply chain efficiency. This underscores a strong industry focus on use of AI in customer-centric applications. In predictive capabilities: nearly 69% of the respondents rely on AI for demand forecasting, 24% for forecasting pricing trends, and 21% use AI for predicting inventory requirements. AI can therefore significantly enhance operational efficiency and productivity, allowing AI adopters to reduce costs and improve efficiency. This in turn, can provide a competitive advantage by enabling firms to offer better products or services at lower prices. Businesses not adopting AI may face several challenges that can hinder their ability to remain competitive in an AI-driven world. Such non-adopting businesses may find it challenging to provide the level of personalisation and responsiveness that AI-driven competitors offer, leading to lower customer satisfaction and loyalty.

AI's impact on competition is multifaceted, as it may have both pro-competitive and anti-competitive implications. While AI brings significant benefits in terms of efficiency, innovation, and consumer experience, it may introduce new challenges for competition in markets. Some of the challenges are possible concentration in AI value chain, ecosystem lock-in, risk of algorithmic collusion, price discrimination, exclusive partnerships and opaque nature of algorithms. Literature and case law across the globe raise concerns around algorithmic collusion, AI-driven pricing strategies that may lead to price discrimination.

Based on the perception survey of AI startups, the possibility of AI facilitated collusion, price discrimination and predatory pricing, was expressed by 37%, 32% and 22% of respondents respectively.

As per literature, the pricing algorithms raising collusion concerns could be classified as monitoring algorithms, parallel algorithms, signaling algorithms, and self-learning algorithms.[5,6] Monitoring algorithms seek to capture the data about demand and prices through scraping or any other methods and act as messengers or data collection tools in pricing decisions. Parallel algorithms or

[4] Market Research Future: India Artificial Intelligence Market Research Report Market Analysis (2019-2032)

[5] Ezrachi, A., & Stucke, M. E. (2023). The role of secondary algorithmic tacit collusion in achieving market alignment. Working paper CCLP(L)54, University of Tennessee Legal Studies Research Paper https://ssrn.com/abstract=4546889 or http://dx.doi.org/10.2139/ssrn.4546889

[6] OECD (2023), "Algorithmic Competition", OECD Roundtables on Competition Policy Papers, No. 296, OECD Publishing, Paris. https://doi.org/10.1787/cb3b2075-en

hub and spoke algorithms represent scenarios where multiple retailers may use a common third party or service provider to devise their pricing algorithms. Signaling algorithms have the ability to respond to market conditions in limited ways based on sophisticated statistical models. These algorithms may not require an explicit collusion among the players in the market but may still clear the market at an above equilibrium price. Finally, self-learning algorithms are autonomously operating algorithms capable of using deep reinforcement learning to maximise profit responding dynamically to any changes in the market rapidly. Though self-learning algorithms as well as signaling algorithms may not have been designed to achieve collusion, they may still reach collusive outcomes on their own depending upon the market conditions, guided by the objective of profit maximisation with each cycle of learning. Further, these algorithms often operate as black-boxes making it difficult to detect or address anti-competitive practices arising therefrom.

AI-driven price discrimination is emerging as a strategic pricing tool, enabled by advanced analytics and machine learning. While this approach can drive revenue optimisation and improve conversion rates, it introduces potential regulatory risks including lack of transparency, reduced consumer trust, particularly for vulnerable segments. AI could also be used to implement predatory strategies, by targeting below-cost pricing only for price-sensitive customers or those at risk of switching, while keeping the prices unchanged for other customers.

Control of a few large firms across the AI stack may create barriers to entry for smaller players. The survey identifies availability of data, talent, compute facilities and cost of cloud services amongst potential entry barriers. Established entities own vast high-quality datasets, which may not be accessible to small firms. Furthermore, high training costs may favour well-funded incumbents. Removing these barriers is imperative to create a level playing field, encourage the entry of new players and stimulate competition in the AI marketplace. In India, various efforts are underway by the government, to address these constraints and facilitate access to these critical resources. The India AI mission has provisioned for INR 10,300 Cr to catalyse India's AI ecosystem, empower AI startups and expand access to compute infrastructure etc.[7]

Apart from organic growth, players in the AI industry are adopting strategies such as mergers, acquisitions, partnerships etc. to expand their presence across the layers of AI stack and gain access to inputs such as data, technology, compute, human resources etc. Big tech firms are also adopting these approaches to consolidate and enhance their position. While these market strategies can spur growth and innovation, they may also raise competition concerns under certain conditions, requiring scrutiny by competition authorities.

The legal and regulatory frameworks worldwide and in India are evolving to keep pace with AI's rapid advancement and its implications for competition. The study

[7] https://www.pib.gov.in/PressReleasePage.aspx?PRID=2012375

found that regulatory approaches in other jurisdictions are increasingly focusing on AI governance, algorithmic transparency and accountability measures. India's regulatory approach has also been progressing supported by initiatives such as the 'National strategy for AI'[8] and the National AI Portal launched by the Government of India. The Ministry of Electronics and Information Technology (MeitY) has also issued various policy documents and advisories from time to time to enable and catalyse development of a vibrant and secure Al ecosystem in India.

Competition law remains a key instrument for addressing AI-driven anti-competitive practices. Global regulatory responses to AI-driven competition issues are also evolving to address the emerging and potential challenges. Competition law being sector and technology agnostic, can address several AI driven anti-competitive practices. India has adopted a balanced and forward-looking strategy, reflected in the Competition (Amendment) Act, 2023, which introduces provisions for hub-and-spoke cartels, deal-value thresholds, and settlement and commitment mechanisms etc., thereby enabling the CCI to address new age market challenges effectively. Complementary efforts such as the Digital Personal Data Protection Act (DPDPA), 2023 and MeitY's other initiatives reflect India's approach of blending legal reforms, policy initiatives, and stakeholders' involvement, to build globally competitive and vibrant digital markets, including those powered by AI.

In order to promote the development of a competitive AI ecosystem in India; prevent AI-driven anti-competitive practices, and protect consumer welfare, the CCI's enforcement and advocacy efforts will be directed to develop a culture of competition compliance, ensure fair competition across the AI value chain, preserve and promote incentives for innovation.

To fulfil the aforesaid objectives, CCI will *interalia* organise conference on "AI and Regulatory issues" in association with relevant stakeholders; conduct focused advocacy workshops on "AI and competition compliance"; focus on strengthening its technical capabilities and infrastructure; set up a think tank to draw upon expertise on matters related to digital markets with special focus on AI; undertake steps to promote inter-regulatory coordination, and engage with international competition authorities and multilateral competition platforms.

Continued emphasis on measures and policy initiatives by the government to facilitate access to AI infrastructure, and to enhance AI capabilities is recommended. These steps will go a long way in removing entry barriers and foster a level playing field in development and deployment of AI in India.

Further, to ensure responsible autonomy, while protecting markets from distortions, enterprises are urged to include self-audits of AI systems for competition compliance that will allow businesses to proactively identify and

[8] National Strategy for Artificial Intelligence' Niti Aayog (2018). https://www.niti.gov.in/sites/default/files/2023-03/National-Strategy-for-Artificial-Intelligence.pdf

address potential competition concerns. In this regard, the report delineates broad principles and provides an indicative framework for enterprises to conduct self audits of their AI systems. A guidance note has been annexed to serve as a template for the purpose. Lack of transparency with respect to deployment of AI in decision making can harm competition and consumers. The enterprises are thus encouraged to adopt transparency measures to reduce information asymmetry. In this regard, guidance on potential key areas of communication with stakeholders has also been provided in the report.

It is expected that the insights gained from the market study and aforesaid measures will inform and contribute significantly in shaping a progressive, cutting-edge and competitive AI landscape in India.

LIST OF ABBREVIATIONS

Acronym	Full Form
ACLU	American Civil Liberties Union (ACLU)
ACCC	Australian Competition and Consumers Commission
AI	Artificial Intelligence
AMD	Advanced Micro Devices
API	Application Programming Interface
AR	Augmented Reality
AWS	Amazon Web Services
BERT	Bidirectional encoder representations from transformers
BFSI	Banking, Financial Services, and Insurance
CAGR	Compound Annual Growth Rate
CCI	Competition Commission of India
CDCL	Committee on Digital Competition Law
CDEI	Centre for Data Ethics and Innovation
CMA	Competition and Markets Authority
CNMC	National Commission on Markets and Competition
CNN	Convolutional Neural Networks
CoE	Center of Excellence
CPU	Central Processing Unit
CRM	Customer Relationship Management
CUDA	Compute Unified Device Architecture
CV	Computer Vision
DMA	Digital Markets Act, 2022
DMU	Digital Markets Unit
DOJ	Department of Justice
DPDPA	Data Protection and Digital Privacy Act
ERP	Enterprise Resource Planning
FDI	Foreign Direct Investment
FHA	Fair Housing Act
FTC	Federal Trade Commission
GAN	Generative adversarial networks
GCP	Google Cloud Platform
Gen AI	Generative Artificial Intelligence
GDPR	General Data Protection Regulation
GPAI	Global Partnership on AI
GPS	Global Positioning System
GPT	Generative Pre-trained Transformer
GPU	Graphics Processing Unit
HPC	High-Performance Computing
HR	Human Resource

IAIC	IndiaAI Innovation Centre
ICO	Information Commissioner's Office
INR	Indian Rupee
IP	Intellectual Property
IPR	Intellectual Property Rights
IoT	Internet of Things
ISO	International Organization for Standardization
JFTC	Japan's Fair-Trade Commission
LAM	Large Action Model
LLM	Large Language Model
M&A	Mergers and Acquisitions
MeitY	Ministry of Electronics and Information Technology
ML	Machine Learning
MRFR	Market Research Future (a firm's name)
MSME	Micro, Small, and Medium Enterprises
NASSCOM	National Association of Software and Services Companies
NIST	National Institute of Standards and Technology
NLP	Natural Language Processing
OECD	Organisation for Economic Co-operation and Development
PII	Personally Identifiable Information
PIPL	Personal Information Protection Law
R&D	Research and Development
RNN	Recurrent Neural Networks
SCM	Supply Chain Management
SLM	Small Language Model
SPDI	Sensitive Personal Data or Information
SME	Small Medium Enterprise
SMS	Strategic Market Status
SSCPA	Smartphone Software Competition Promotion Act
SSDE	Systemically Significant Digital Enterprises
Tech	Technology
TPU	Tensor Processing Units
UNCTAD	United Nations Conference on Trade and Development
VC	Venture Capital

CHAPTER 1

INTRODUCTION

Artificial Intelligence (AI) is a constellation of technologies that enable machines to act with higher levels of intelligence and emulate the human capabilities of sense, comprehend and act.[9] AI is emerging as a new factor of production, augmenting the traditional factors of production, viz. labour, capital, innovation and technological changes captured in total factor productivity. AI has the potential to provide large incremental value to a wide range of sectors globally and is expected to be the key source of competitive advantage for firm.[10] AI can fundamentally reshape how firms make AI assisted or automated decisions.

The Organisation for Economic Co-operation and Development (OECD) defines an AI system as a machine-based system that, based on explicit or implicit objectives, infers from the input it receives how to generate outputs, such as predictions, content, recommendations or decisions that can influence physical or virtual environments.[11]

The Indian government emphasises that AI is a transformative force with the potential to contribute significantly to the economy and create numerous jobs. It considers AI a tool for growth, innovation and addressing social issues, focusing on sectors such as healthcare, agriculture, education, smart cities and infrastructure. The government is committed to ensuring India's readiness for AI through various initiatives that promote development of technology, infrastructure, AI literacy and skills across different population segments. Trends captured by various surveys indicate that AI market in India is projected to grow significantly in the years to come. The trends also highlight high AI penetration in sectors like Banking, Financial Services, and Insurance (BFSI), Healthcare, retail, e-commerce, logistics and marketing, etc.

Government of India key initiatives and strategies include the 'National Strategy for Artificial Intelligence'[12], which envisions India as a leader in AI and addresses challenges related to access, affordability, expertise and the launch of the National AI Portal. The Ministry of Electronics and Information Technology (MeitY) has also issued policy documents and advisories under the Information Technology Act, 2000 and the Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021. In May 2022, MeitY introduced the draft National Data Governance Framework Policy (NDGFP) to enable and catalyse a vibrant AI and data led research and startup ecosystem, by creating a

[9] NITI Aayog National Strategy for Artificial Intelligence. https://www.niti.gov.in/sites/default/files/2023-03/National-Strategy-for-Artificial-Intelligence.pdf

[10] Ibid

[11] https://indiaai.gov.in/news/oecd-adopts-a-new-definition-of-ai

[12] 'National Strategy for Artificial Intelligence' Niti Aayog (2018) https://www.niti.gov.in/sites/default/files/2023-03/National-Strategy-for-Artificial-Intelligence.pdf

large repository of India datasets.[13] MeitY has launched the IndiaAI Mission, an umbrella initiative for utilising transformative technologies to promote inclusion, innovation, and adoption for social impact. The IndiaAI Mission aims to build a comprehensive ecosystem that fosters AI innovation by democratising computing access, enhancing data quality, developing indigenous AI capability, attracting top AI talents, enabling industry collaboration, providing startup risk capital, ensuring socially impactful AI projects, and promoting ethical AI. This mission drives responsible and inclusive growth of India's AI ecosystem. The IndiaAI Mission's INR 10,300 crore financial infusion, slated over the next five years, is poised to catalyse various components of the mission, including pivotal initiatives like the IndiaAI Compute Capacity, IndiaAI Innovation Centre (IAIC), IndiaAI Datasets Platform, IndiaAI Application Development Initiative, IndiaAI FutureSkills, IndiaAI Startup Financing, and Safe & Trusted AI.[14] The IndiaAI Mission has partnered with OpenAI, developer of ChatGPT and signed an Memorandum of Understanding to launch first international educational platform OpenAI Academy in India.[15] It will also establish AI Safety Institute (AISI) under the Safe and Trusted AI pillar.[16] The government is focused on promoting responsible, trusted and safe AI through the development of indigenous tools and frameworks and a governance framework. The goal is to transform AI into a digital tool for national development, bridging the gap between the demand and supply of AI talent.

The growing use of AI across industries has however given rise to novel questions regarding its implications for competitive dynamics in markets. AI is increasingly influencing economic decisions, raising concerns about potential anti-competitive behaviour, such as algorithmic collusion. Cases across the globe highlighting anti-competitive behaviour due to the use of AI, are on the rise.

1.1 Scope of the study

This market study has been undertaken to understand the implications of Artificial Intelligence (AI) for competition dynamics across markets in India. The scope of this study is to establish an in-depth understanding *inter-alia* across the following pivotal areas:

1. AI Ecosystem Analysis: Understanding essential AI systems, markets, actors/stakeholders, key inputs/resources, value chains, market structures, and competitive parameters, focusing on Machine Learning (ML), Natural Language Processing (NLP), Computer Vision (CV) and Generative AI (Gen AI).

[13] https://www.thehinducentre.com/resources/67557000-National-Data-Governance-Framework-Policy_compressed.pdf
[14] https://www.pib.gov.in/PressReleasePage.aspx?PRID=2012375
[15] https://www.livemint.com/technology/tech-news/openai-signs-mou-with-indiaai-mission-to-launch-openai-academy-in-india-11749131568891.html
[16] https://www.thehindu.com/opinion/op-ed/designing-indias-ai-safety-institute/article69289911.ece

2. Emerging Competition Issues Identification: Examining emerging and potential competition issues within these AI markets/ecosystems, including barriers to entry, market concentration, incumbency advantages, and possible anti-competitive behaviours facilitated by AI.
3. AI Applications and Competition Implications: Capturing the scope and nature of AI applications/use cases, particularly in the retail, e-commerce, logistics & delivery, and marketing sectors, to assess opportunities, risks, and competition ramifications.
4. Regulatory and Legal Framework Analysis: Mapping existing and evolving regulatory frameworks governing AI applications in India and major international jurisdictions, thereby identifying best practices and regulatory benchmarks.

This study explores the potentially transformative capabilities of AI and competition issues on both supply-side and demand-side of the AI ecosystem. The supply-side encompasses the AI offerings by upstream AI stack players that supply data, infrastructure, models or AI deployment platforms as well as downstream AI stack players who base their offering on and around AI. The demand-side comprises current and prospective users, consumers, investors and allied government or non-government stakeholders of AI. This study also includes observations from consultations with specific user industry sector – viz. retail, e-commerce, logistics and delivery and digital marketing companies. Thus, the study elucidates the emerging competition dynamics in the development ecosystems of the AI industry and the implications of AI applications for competition, efficiency and innovation in key user industries.

The outputs envisaged through this report include detailed insights derived from both secondary data analyses and comprehensive stakeholder consultations across technology developers, input suppliers, AI platforms, end-user firms, investors, industry associations, and legal experts. The report not only identifies challenges but also provides a roadmap, to enhance compliance, stakeholder sensitisation, and policy frameworks to foster competitive AI markets.

1.2 Methodology and Data Collection Approach

To achieve the aforementioned objectives effectively, and given the complex and evolving nature of AI and Competition, the research employed a mixed-method approach, combining both qualitative and quantitative data collection techniques to provide robust and comprehensive insights. Secondary data analysis addressed objective elements such as trends and market size. Stakeholder-specific questionnaires captured perceptions directly from market participants, allowing for aggregated insights. To tackle nuanced aspects such as unobservable phenomena—including market monitoring and algorithmic collusion—as well as evolving regulatory paradigms, detailed semi-structured interviews were conducted with AI experts, startups, legal experts, and big

technology firms. Interviews were transcribed and analysed to identify key insights and findings were iteratively refined through stakeholder validation without compromising respondent confidentiality. The research methodology was structured into the following phases:

- Secondary Data Review: Initially, extensive literature review and secondary research were conducted to objectively address market trends, AI ecosystem structures, regulatory landscapes, and global best practices. Data from important databases like STATISTA, NASSCOM, MRFR and TRACXN was referred to understand the market of AI ecosystem.
- Stakeholder Identification and Sampling: A stakeholder database was constructed, including labs/technology firms, major AI customer firms, input suppliers, AI development platforms, investors, experts from AI and competition law fields, and industry associations. (See Table 1)

Table 1: Overview of stakeholders (respondents) for primary data collection

Category	Description	Number of respondents
A	Labs/ technology firms/ consortiums developing AI models/ systems/applications	50
B	Independent developers / innovators / startups/researchers	
C	Firms supplying inputs (data/hardware/compute/cloud services)	5
D	AI development platforms	5
E	Customer firms/major deployers of AI	30
F	Investors	4
G	Experts from the field of competition law and policy	11
H	Industry associations	1
		106

- Primary Data Collection: A combination of structured surveys, in-depth semi-structured interviews, and focused group discussions were conducted. These interviews, guided by scholarly literature and regulatory documentation, helped uncover nuanced insights, especially around competition issues and regulatory complexities.
- Analysis and Triangulation: The collected qualitative and quantitative data underwent rigorous analysis to ensure robust and comprehensive conclusions. The findings were iteratively validated through stakeholder feedback.

1.3 Report Structure

The report is organised in six chapters including the Introduction. Chapter 2 establishes an understanding of AI ecosystems, AI technologies such as Machine Learning (ML), Natural Language Processing (NLP), Computer Vision (CV) and Generative AI (Gen AI). Chapter 3 addresses the scope and nature of AI applications/use cases, particularly in retail, e-commerce, logistics & delivery, and marketing sectors, to assess opportunities, risks, and broader competition ramifications. Chapter 4 discusses the key competition issues in the AI industry and user sector. Chapter 5 discusses the existing and evolving regulatory frameworks relevant for AI across jurisdictions. Chapter 6 presents the action plan for a competitive, dynamic and innovative AI ecosystem.

CHAPTER 2

THE AI ECOSYSTEM

AI ecosystem is a complex and interconnected network comprising various components, stakeholders and regulatory frameworks that shape the development, deployment and governance of AI. AI relies on algorithms, large datasets and computational power, all supported by hardware, software and cloud infrastructure, and talent to ensure smooth functionality.

Usually, data collected from various sources needs to be segregated, classified and processed to gain some insights. This data processing requires computational power which is provided in the form of both algorithms (software) and hardware. The development of powerful hardware capable of handling complex computations like Graphics Processing Units (GPUs) have emerged as a game-changer for AI applications, significantly accelerating AI tasks. Software or Algorithmic processing may be simple statistical machine learning or it may be based on training through neural network processing.[17] There are different kinds of learning mechanisms through which a model learns to do tasks autonomously such as unsupervised learning (learning without labelled data), supervised learning (learning with labelled data), semi-supervised learning (a hybrid of supervised and unsupervised learning) and reinforcement learning (objective driven learning which uses reward and penalties for optimisation).

Neural network processing is a function of the nature and type of neural network being utilised. Three major different types of neural networks include Convolutional Neural Networks (CNN) which are primarily used for vision and at times, for voice, Recurrent Neural Networks (RNN) which are primarily used for sequence-based data or natural language processing. Third type of network is known as the Transformer Network. The Transformer Network is a complex architecture that includes multiple attention mechanisms together with encoder-decoder mechanism, making them more suitable for language related tasks. These transformers and their variants form the basic building block for Gen AI. A foundation model, often referred to as a "base model" or a "pre-trained model," is the core architecture that serves as the basis for more specialised models. Foundation models are trained on massive amounts of text, video, image data and learn to understand and generate human-like text, images etc. Large Language Models (LLMs) such as BERT, RoBERTa, ChatGPT etc. are foundation models (pre-trained) designed primarily for understanding and generating human-like text. In their basic form LLMs remain generic and not domain-specific. Therefore, in order to make them domain-specific, model fine-tuning is required. For the model fine tuning, the context-specific data which can either

[17] A neural network is a type of machine learning model inspired by the structure and function of the human brain. It is system of inter-connected neurons (nodes) organized in layers that process data to identify patterns, make predictions or perform other tasks.

belong to an organisation or user, is required. These transformers may be trained appropriately for multi-modal tasks.

Big Technology companies / Hyperscalers like Google, Microsoft, AWS, Meta are the front runners in making the above neural networks available to developers and users in a form that is useful for them. TensorFlow from Google and PyTorch by Meta are two interfaces and libraries which are extensively used to implement various forms of neural networks. To facilitate better computation, players like Nvidia developed CUDA, which enabled faster response to TensorFlow instructions from the GPU. Chinese companies like SenseTime developed their own interface called SenseCode parallel to TensorFlow and PyTorch to reduce their dependence on these products.

Some pre-trained neural networks such as CNNs or RNNs may need to be exposed to a specific context in order to improve the outcomes. This kind of training is known as transfer learning as it utilises pre-trained models with certain modifications for specific context. Apart from using transfer learning, users may directly utilise Gen AI (foundation models) for language related tasks like GPT or BERT. However, since these models are trained on general data, they may not perform well in specialised domains (e.g., legal, medical). To make them more useful for a specific organisation or task, these models are further fine-tuned using that organisation's own data.

To effectively implement, scale, innovate and sustain these AI models, collaboration across various sectors becomes crucial. The ecosystem supporting AI development and deployment relies heavily on the collaboration and collective contributions of key stakeholders, including technology companies, startups, academic institutions, research labs, government agencies, and business users implementing AI solutions.

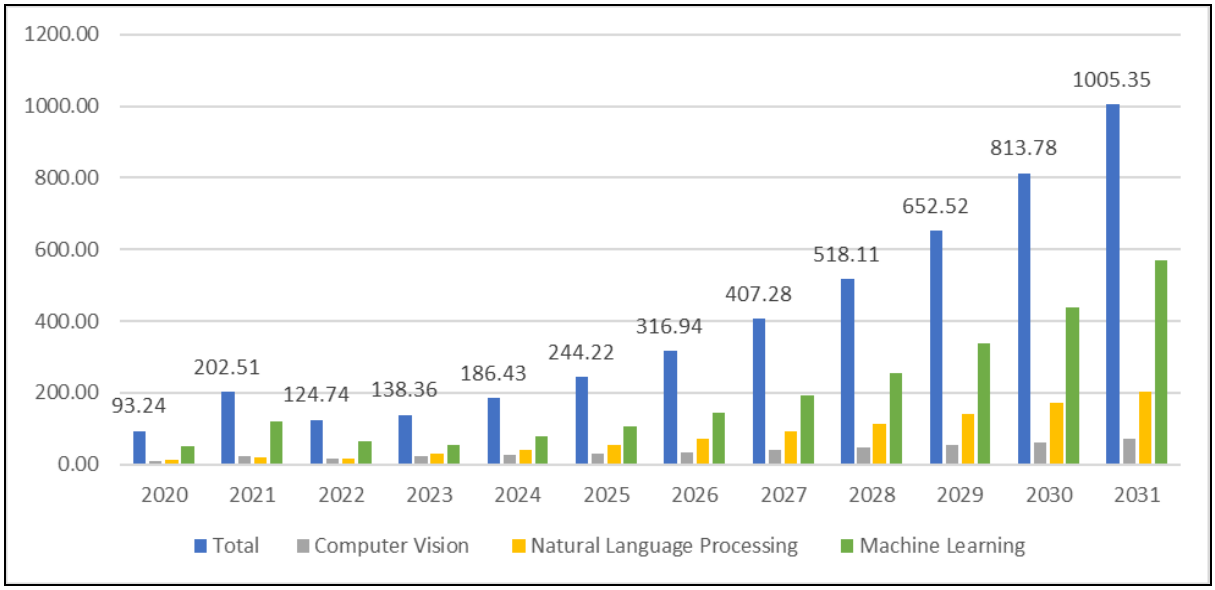
Large corporations spearhead advancements through substantial R&D investments, while startups introduce niche innovations. Academia contributes by fostering research and developing talent, while governments establish regulations to address AI ethics, privacy, and security. Regulatory bodies shape AI governance, through policies ensuring ethical, responsible, and competition compliant AI development and deployment. Data providers supply high-quality datasets essential for training AI models, while venture capitalists fund AI startups. Finally, alliances and partnerships between firms, researchers, and policymakers enhance AI development, with governments playing a crucial role in fostering global AI collaborations.

2.1 AI Market Trends

The adoption and market size of AI have experienced exponential growth in recent years, driving innovation across industries and redefining how businesses operate. The exponential growth in data, acceleration in digitisation, advancements in ML, data analytics and computational power have fuelled AI

adoption and made it accessible to organisations of all sizes. From automating routine tasks to enabling sophisticated decision-making, AI has been integrated into diverse fields such as healthcare, finance, retail, logistics and transportation, and manufacturing. As organisations increasingly recognise AI's potential to enhance efficiency and unlock new opportunities, the global AI market, including India, is witnessing remarkable growth. The AI market worldwide has increased from USD 93.24 billion in 2020 to USD 186.43 billion in 2024 and global AI market is projected to grow from USD 244.22 billion in 2025 to USD 1 trillion in 2031.[18]

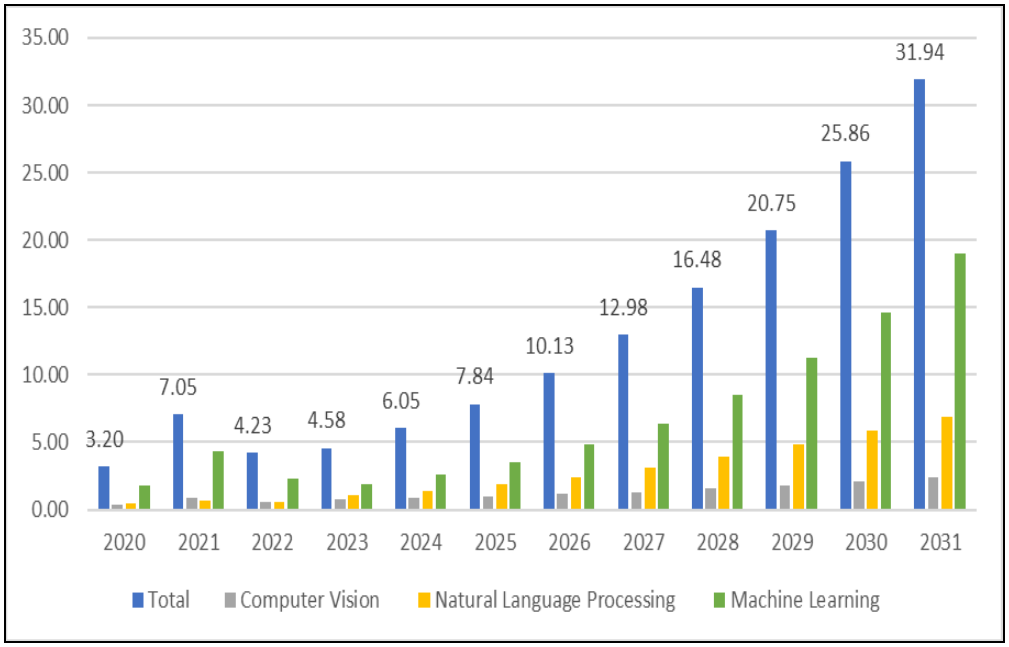
Figure 1: AI market size (in billion USD) worldwide



The market size of AI in India has increased from USD 3.20 billion in 2020 to USD 6.05 billion in 2024. AI market in India expected to grow from USD 7.84 billion in 2025 to USD 31.94 billion in 2031.[19]

[18] https://www.statista.com/outlook/tmo/artificial-intelligence/worldwide
[19] https://www.statista.com/outlook/tmo/artificial-intelligence/india

Figure 2: AI market size (in billion USD) of India



As per another report, the global market size of AI has increased from USD 103.6 billion in 2020 to USD 288.8 billion in 2024. During the same period, the AI market in India has expanded from USD 2.97 billion to USD 7.63 billion.[20] The global AI market is projected to expand from USD 406.3 billion in 2025 to USD 3.62 trillion by 2032, reflecting a CAGR of 36.7%.[21] The Indian AI market is expected to grow from USD 11.17 billion in 2025 to USD 131.31 billion by 2032 at a CAGR of 42.2%.[22]

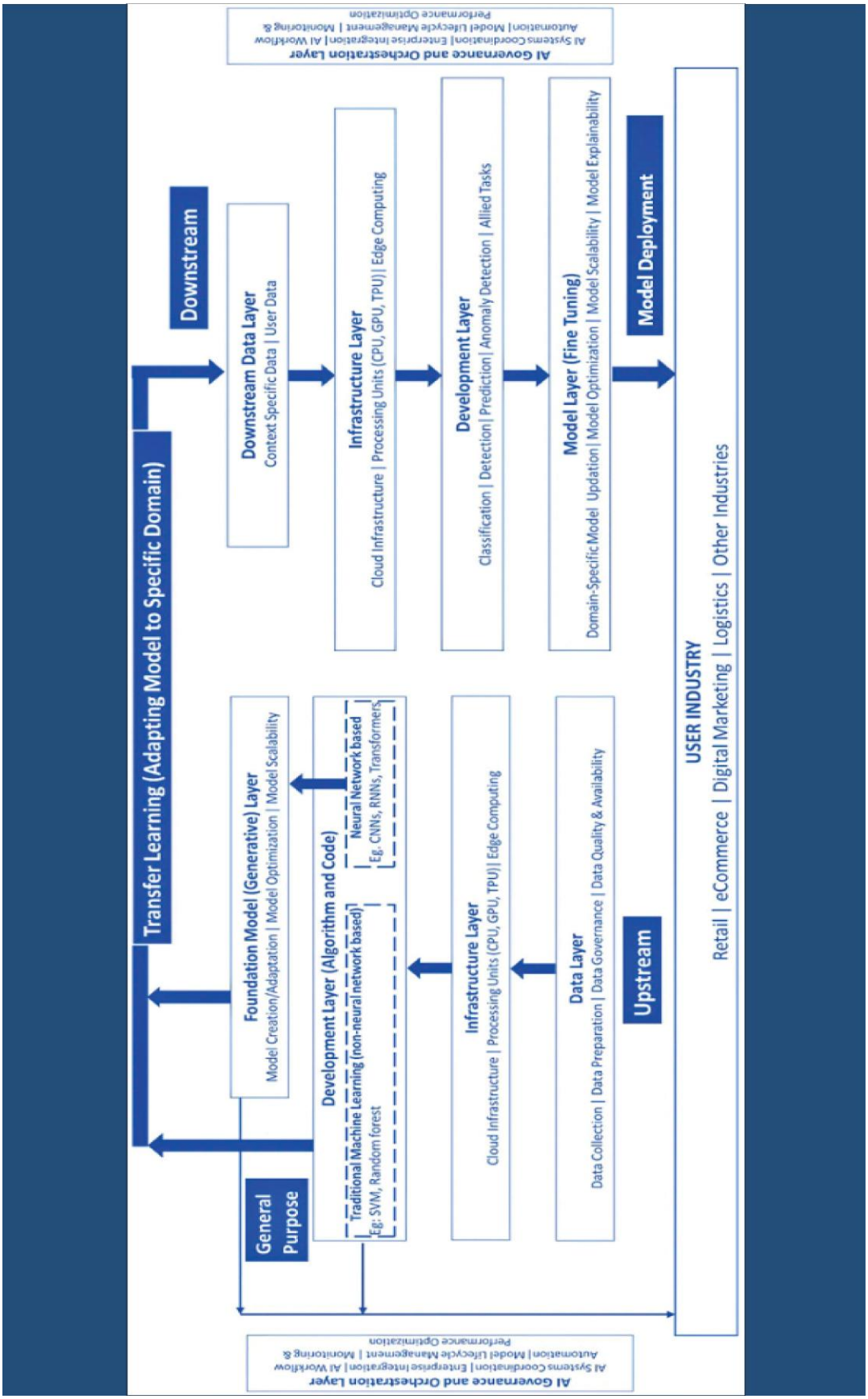
As per UNCTAD, the global AI market will soar from USD 189 billion in 2023 to USD 4.8 trillion by 2033 – a 25-fold increase in just a decade.[23] As per a joint study conducted by BCG and NASSCOM, the AI market in India is expected to grow at around 25-35% CAGR till 2027 to reach an estimated market size of USD 17-22 billion.[24]

2.2 Market Structure of AI in India: AI stack

The AI stack is organised into distinct layers that represent the entire AI workflow, spanning from gathering raw data to fine-tuning advanced AI models for specific business tasks. To capture both general and specialised needs, the AI stack is divided into "upstream" (where data and foundational technologies are prepared) and "downstream" (where AI gets adapted and deployed in real-world contexts). The main layers encompass the data layer, infrastructure layer, development layer and model layer.

[20] Market Research Future: India Artificial Intelligence Market Research Report Market Analysis (2019-2032)
[21] Ibid
[22] Ibid
[23] https://unctad.org/news/ai-market-projected-hit-48-trillion-2033-emerging-dominant-frontier-technology
[24] https://nasscom.in/knowledge-center/publications/ai-powered-tech-services-roadmap-future-ready-firms

Figure 3: Artificial Intelligence (AI) Stack for Market Study on AI and Competition



Starting at the base, is the data layer, which involves collecting, preparing, and governing the data. Above that is the infrastructure layer, providing the computing resources—such as servers, specialised chips and edge computing; necessary to power AI. Next comes the development layer, which includes the algorithms and programming frameworks (such as neural networks or more traditional machine-learning methods) that actually "build" the AI. At the next level of the general-purpose side, is the generative AI or foundation model layer, which involves creating or adapting large, versatile models (for example, large language models) that can be scaled or optimised for various tasks.

On the downstream side, where AI is shaped for specific applications there is a AI model layer for model fine-tuning, where domain-specific knowledge is infused into the model, and tasks like model optimisation, scalability and explainability are addressed. The downstream data layer brings in user data and context-specific information to tailor the AI to real-world needs (such as personalising product recommendations or detecting fraud). The same infrastructure layer concepts (cloud servers, specialised chips, or edge devices) remain relevant here, but now they are geared toward deploying and running solutions. Next, is the AI Release and Deployment Layer, which manages the critical transition of models from development to production through model release processes, deployment strategies, and the transfer learning mechanisms that adapt general models to specific domains. The AI User Interaction Layer is where the technology meets its users across various industries—retail, e-commerce, digital marketing, logistics, and others. This layer encompasses not just the industries themselves but also the actual touchpoints where users interact with AI: chatbots providing customer service, recommendation engines suggesting products, automated decision systems approving loans, or embedded AI features enhancing user experiences.

The Governance and Orchestration Layer spans the entire structure vertically, representing far more than just oversight. This comprehensive layer manages AI systems coordination, enterprise integration, workflow automation, model lifecycle management, monitoring, and performance optimisation. It ensures responsible AI development through legal guidelines, ethical reviews, and regulatory compliance, which also handling the technical orchestration needed to make all layers work together seamlessly. This includes model versioning, resource allocation, performance monitoring, and automation systems that keep AI pipelines running efficiently. The continuous flow of both governance and orchestration ensures that, as data and models travel through the AI pipeline, every stage remains transparent, accountable, and aligned with stakeholder and regulatory expectations.

Besides the boxes in the above Figure, it is important to understand the arrows as well. The first set of arrows shows a progression from "Upstream" to "Downstream," indicating that each stage in the stack builds on work done in the previous layer. In practical terms, data collected in the upstream data layer

flows upward, making use of infrastructure resources (such as servers and GPUs), and continues into the development layer, where algorithms learn from this data. Eventually, the output of these layers—general-purpose or "foundation" models—may be transferred to the downstream side, where more specialised tasks and applications reside. This movement highlights an iterative approach: data is refined, converted into knowledge, and passed forward so that each subsequent layer benefits from the layers before it.

One of the most prominent arrows is the "Transfer Learning" arrow, which shows how large foundation models can be adapted or fine-tuned to solve specialised problems. For instance, a model initially trained on a massive set of language data could then be calibrated for legal text analysis, e-commerce product recommendations, or logistics optimisation. This arrow makes clear that knowledge does not stop with general AI models—it must be "carried over" and repurposed for specific industries or use cases.

The infrastructure arrows appear on both upstream and downstream layers because computing resources do not serve just one phase; instead, they support the entire lifecycle of AI, from training large models to deploying them on cloud servers or edge devices.

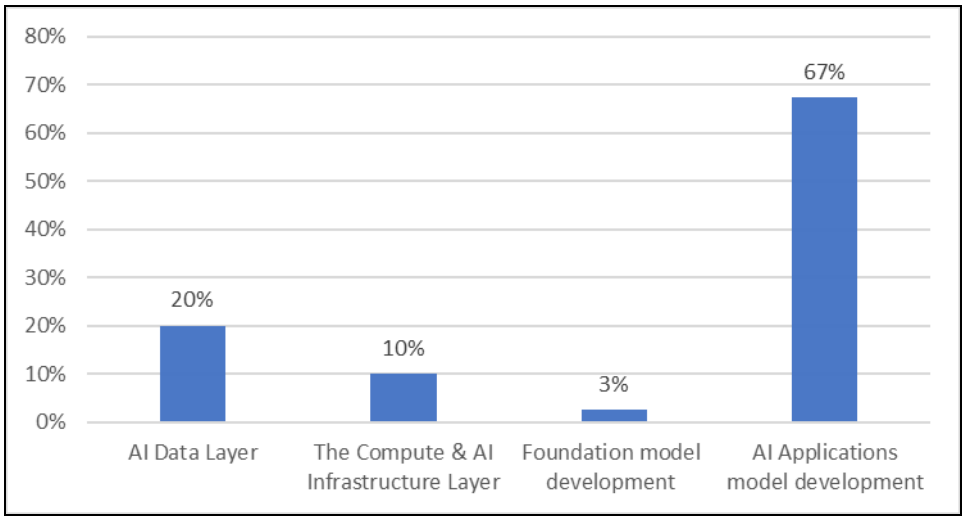
In the case of downstream data, the arrows indicate that the system is receiving domain-specific or user-focused inputs (for example, e-commerce sales logs or supply chain readings). This fresh data helps tailor the solution to real-world scenarios by refining or retraining the models in the model fine-tuning layer, ensuring the AI aligns with the precise demands of a given context. Notably, these arrows also enable feedback loops—discoveries or changes made in downstream tasks can prompt a revision of the data or techniques used upstream. This cyclical flow ensures continuous improvement and adaptability across the AI lifecycle.

The arrows representing AI governance and orchestration span the entire structure, underscoring that responsible AI is not confined to a single compartment. Instead, legal guidelines, ethical reviews, performance monitoring, and regulatory compliance run through each layer, from the moment data is gathered and processed to the point where AI solutions actively support daily business operations. This continuous flow of oversight ensures that, as data and models move through the AI pipeline, every stage remains transparent, accountable, and aligned with stakeholder and regulatory expectations. This interconnected structure enables a dynamic AI ecosystem, where models evolve and improve over time based on user feedback and operational performance.

Primary research indicates that for almost 67% of AI startups in India, the core area of work is in the AI application model layer. These companies use existing foundation models to build applications. There is negligible evidence of companies working on developing foundation models i.e., only 3%. In addition,

20% of the interviewed companies are working in AI data layer. Only a small proportion (approximately 10%) provide compute and AI infrastructure.

Figure 4: Core areas of work of startups



These services are provided by global big technology companies and Indian companies are using their services to develop AI models. These layers are discussed in detail in following paragraphs:

2.2.1 Data Layer

The data layer is the foundation of AI systems, ensuring that data is collected, prepared, governed, and managed effectively. Activities in this layer play a crucial role in maintaining data quality, reliability, and compliance with legal standards across industries such as retail, e-commerce, logistics, and marketing. Main activities conducted in this layer include data collection from various sources (e.g., IoT devices, social media), data preparation i.e. cleaning, labelling and transforming data to make it usable for AI models and data governance while ensuring data security, privacy and regulatory compliance. A well-structured data layer is essential for AI models to deliver reliable and unbiased outcomes.

Major players in the Indian market in the data layer referred to as the data set in the MRFR report are Appen, AWS, Google, Microsoft Azure and Scale AI. The percent share of Appen is 23.4%, followed by AWS which is 19.2%. Google has 15.3% share for providing data to train and build AI models, Microsoft Azure has 11.3% and Scale AI has 9.4%. Others have 21.4% market share & which includes companies like IBM, Kaggle, Meta, Wipro, Playment and Infosys.[25]

Appen specialises in customised AI training data, utilising a global workforce to provide datasets for applications like speech recognition and computer vision. AWS Data Exchange facilitates access to diverse third-party datasets, seamlessly

[25] Market Research Future: India Artificial Intelligence Market Research Report Market Analysis (2019-2032)

integrating with AWS services for enhanced analytics and machine learning. Google streamlines dataset discovery through structured metadata, improving accessibility for researchers and analysts. Meta contributes large-scale, multimodal datasets to accelerate AI research while ensuring privacy and bias mitigation. Microsoft Azure Open Datasets offers domain-specific, curated public datasets that integrate with Azure's AI tools, reducing data preparation time and improving model accuracy. Lastly, Scale AI supports businesses and government agencies with advanced data labelling, fine-tuning, and testing tools, collaborating with major AI organisations such as OpenAI and Meta.

The AI data layer[26] in India is gaining traction, with startups enabling the collection, preparation, quality assurance, and governance of data for AI applications. Startups like Tuplejump, which provided infrastructure tools for building big data-powered apps before being acquired by Apple, and Extracto, a platform that automates extraction from PDFs and financial documents, are emblematic of innovation in this space. Firms such as ML LABS focus on regenerative AI systems for high-volume, data-intensive environments, while Prakash and WitHub enhance enterprise decision-making with data observability and encrypted enterprise search platforms. These companies are primarily based in Karnataka, Maharashtra, and Telangana, and were founded post-2015 in response to increasing demand for trustworthy AI data pipelines. Institutional investors have supported these ventures through early and growth-stage rounds, signalling confidence in the layer's role as foundational to scalable AI systems. The diversity of offerings from synthetic data to enterprise-grade annotation tools indicates a growth-oriented segment focused on AI readiness and governance-by-design principles.

The need for high quality labelled data has led to the growth of data annotation services. Data annotation refers to the process of labelling data (text, images, audio, video) so that machines can understand and learn from it. Demand for data annotation is particularly high in sectors like automotive (autonomous driving), healthcare, retail, agriculture, and BFSI. iMerit, Cogito Tech, Anolytics, Teksun, and Playment are prominent players in India.

2.2.2 Computing and AI Infrastructure Layer

The computing and AI infrastructure layer provides the computational resources and technology needed to support AI workloads. It includes cloud infrastructure for scalable AI workloads, specialised hardware and AI chips (such as GPUs) for training and deploying models, edge computing to enable real-time processing closer to data sources like warehouses and delivery vehicles, high-performance

[26] Tracxn Analysis 2025

computing (HPC) for handling large-scale AI training and analytics, robotics[27] for industrial applications. This layer ensures AI models can efficiently process data and operate at scale.

The cloud computing landscape in India is characterised by the presence of major global players like Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP), each offering scalable computing, storage, and AI/ML tools. In 2024, the Indian cloud services market was led by AWS with a market share of 32.6%, followed by Microsoft Azure at 20.8% and Google Cloud Platform (GCP) at 11.5%, while other vendors accounted for the remaining 35.1%.[28] These other vendors include: Oracle, IBM Cloud, Utho, DigitalOcean, LLC, ESDS Software Solution Ltd., Tata Communications, Cyfuture India Private Limited, PixelCrayons etc.[29] This diverse ecosystem reflects the expanding market for scalable, secure and innovative cloud solutions in India. Others use data service providers for their data requirements.

The growing demand for AI technology is driving semiconductor manufacturing and innovation, while advanced chips enable more powerful AI. According to the Semiconductor Industry Association (SIA) the global semiconductor sales reached USD 627.6 billion in 2024[30], an increase of 19.1% compared to the 2023 total sales of USD 526.8 billion. The market is projected to grow from USD 755.28 billion in 2025 to USD 2,062.59 billion by 2032, with a CAGR of 15.4%.[31] Major global players include Taiwan Semiconductor Manufacturing Company (TSMC), Samsung, Intel, NVIDIA, Qualcomm, and Broadcom. These semiconductor players provide specialised chips for various segments right from consumer electronics, networking equipment to niche automotive products whereas high end AI-based chips are the stronghold of players like NVIDIA, Intel and AMD.[32]

[27] Robotics can be seen as a form of AI hardware as it utilises physical components and AI-powered software to create intelligent machines capable of performing tasks autonomously or semi-autonomously. Robotic hardware includes sensors, actuators, and control systems that allow robots to interact with their environment, while AI algorithms enable them to perceive, learn, and make decisions.

[28] Market Research Future: India Artificial Intelligence Market Research Report Market Analysis (2019-2032)

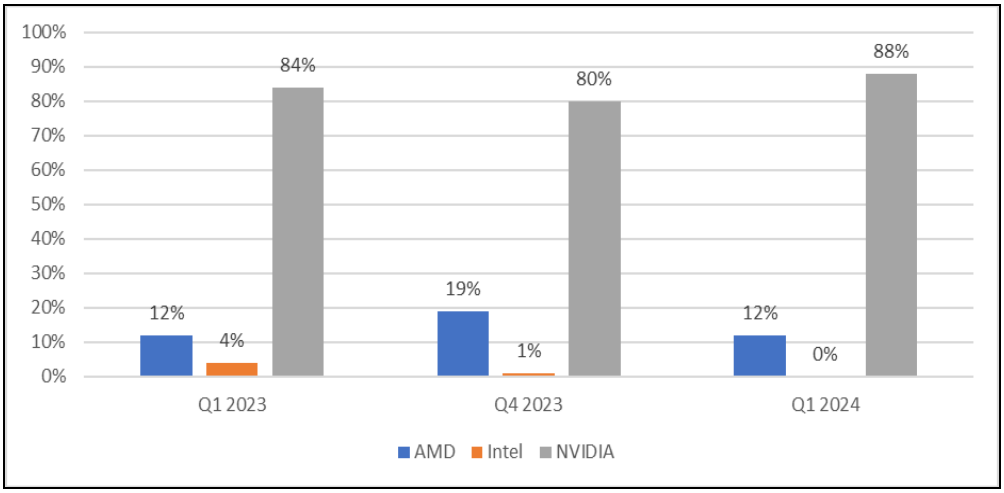
[29] Ibid

[30] https://www.semiconductors.org/global-semiconductor-sales-increase-19-1-in-2024-double-digit-growth-projected-in-2025/

[31] https://www.fortunebusinessinsights.com/semiconductor-market-102365

[32] https://research.aimultiple.com/ai-chip-makers/

Figure 5: Global GPU market share[33]



In India, the market size of the overall semiconductor industry was at USD 45 billion and AI semiconductor market size was USD 3 billion in 2023. It is estimated that by 2030 the semiconductor market for AI in India will increase sevenfold, reaching USD 21 billion.[34] India is now striving to make her place in the semiconductor manufacturing. As of May 2025, six chip fabrication units are under construction with commitments from various players to boost semiconductor manufacturing.[35] Major Indian players that have actively initiated manufacturing either individually or in partnership include Tata Group, Micron, HCL-Foxconn etc. The Indian initiative is focused on applications across the automotive, telecom, power, and railway verticals. Further, another parallel national initiative aims to train 85,000 engineers in advanced semiconductor and electronics manufacturing.[36]

A couple of advanced manufacturing and assembly facilities began construction in early 2024. A commercial semiconductor fabrication plant has been set up by Tata Electronics Private Limited, located in Dholera, Gujarat. This is a joint project with Taiwan-based Powerchip Semiconductor Manufacturing Corporation (PSMC), which is providing the technologies and engineering support. This facility is set to be India's first advanced semiconductor fabrication plant, and the chips produced there will be used to supply India's automotive, AI, and wireless communications sectors. The first batch of semiconductor chips is expected to be rolled out by the end of 2026.[37] Micron Technology, a leading memory controller manufacturer from the United States, is in the advanced stages of setting up semiconductor manufacturing facility for assembly, testing, marking, and packaging (ATMP) in Sanand, Gujarat. This initiative marks a

[33] https://www.xda-developers.com/nvidia-88-gpu-market-share/
[34] Powerhouse in the Making: AI Market in India, Statista
[35] https://www.india-briefing.com/news/setting-up-a-semiconductor-fabrication-plant-in-india-what-foreign-investors-should-know-22009.html/
[36] https://www.ibef.org/news/first-made-in-india-semiconductor-chip-expected-by-2025-union-minister-of-electronics-and-information-technology-mr-ashwini-vaishnaw
[37] https://www.tata.com/newsroom/business/first-indian-fab-semiconductor-dholera

significant milestone, as this will be the first time that a global semiconductor manufacturer establishes a production facility in India.[38]

These developments reflect India's strategic push to become a significant player in the global semiconductor industry, supported by substantial investments and government incentives. This advancement will significantly impact the AI industry upstream ecosystem.

In addition to chip manufacturing, the infrastructure layer in India is anchored by a growing set of startups focused on cloud computing and edge computing.[39] This layer comprises startups, with hubs in Karnataka, Delhi, and Maharashtra. Examples include JarvisLabsAI, which provides on-demand GPU-powered cloud platforms tailored for model training and deep learning workflows, and NeevCloud, a homegrown HPC-as-a-service provider offering AI superclusters to train and deploy generative models. On the edge computing front, MoboDexter offers Kubernetes-integrated edge servers built for ML and IoT analytics, while BrainChip develops neuromorphic processors that mimic human brain functions for sensor data analysis. Several firms, such as those building optoelectronic processors and SoCs (System-on-Chip), reflect India's ambition to localise semiconductor design for AI-specific tasks. This domain has historically attracted support from institutional investors such as Reliance Jio GenNext, Speciale Invest, and IvyCap Ventures, particularly in edge AI, compute infrastructure, and chip innovations.

2.2.3 AI Development Layer

The AI development layer is where algorithms are developed, trained and applied to the create AI models using ML. NLP, CV, and Gen AI. This includes developing new models and fine-tuning existing ones for industry-specific applications. Key components of this layer include algorithms (e.g., supervised learning, unsupervised learning, reinforcement learning, clustering, decision trees, neural networks and deep learning models), ML i.e. training algorithms to predict outcomes, classify data and optimise business operations e.g. demand forecasting and customer segmentation, NLP i.e. algorithms that process and understand human language used for chatbots and sentiment analysis and text classification, CV for visual data recognition in areas like warehouse automation and Gen AI for generating text, images etc.

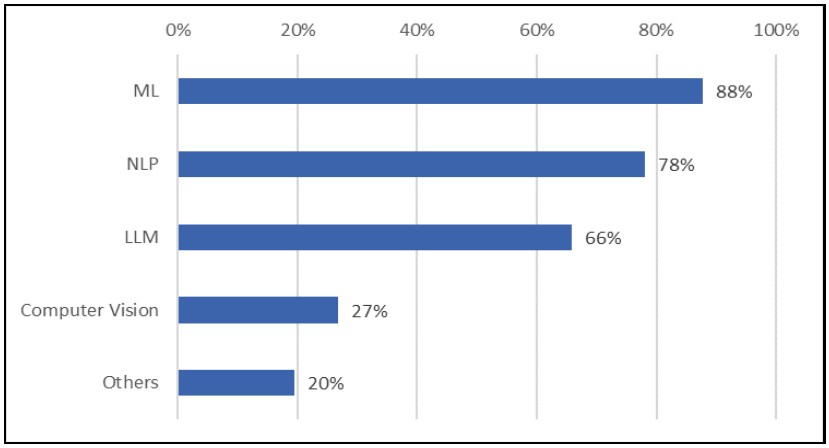
In view of the growing importance of AI for businesses, it is important to understand how key AI technologies are being adopted by companies. Research found that many of the interviewed companies were working on multi-modal AI systems which means the companies are working in more than one technology.

[38] https://investors.micron.com/news-releases/news-release-details/micron-announces-new-semiconductor-assembly-and-test-facility

[39] Edge computing is a distributed computing framework that brings enterprise applications closer to data sources such as IoT devices or local edge servers. This proximity to data at its source can deliver strong business benefits, including faster insights, improved response times and better bandwidth availability.

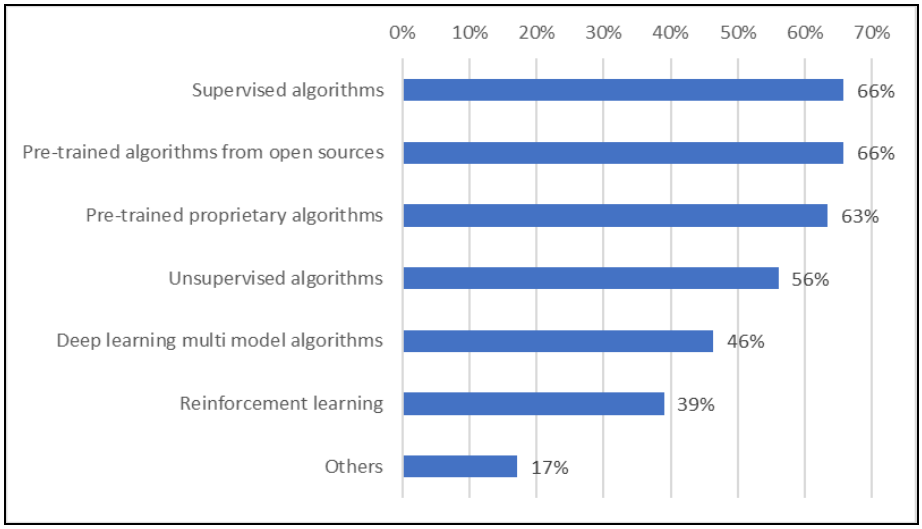
This also implies that they are building their capabilities in more than one technology. As per the survey of startups, 88% of the startup respondents said that they use ML to build their AI solutions, 66% respondents said they use (Gen AI) LLMs for application development, 78% use NLP and 27% work in the field of CV. ML emerged as the most popular and widely used technology.

Figure 6: AI Technology Used



Companies use pre-trained algorithms as well as indigenously developed supervised, unsupervised and reinforcement learning-based models. It was found that the pre-trained proprietary algorithms and pre-trained open-source algorithms are used by 63% and 66% of the respondent companies, respectively. Pre-trained open-source algorithms may result in increased competition (lower barriers to entry). Supervised, unsupervised and reinforcement learning algorithms are used by 66%, 56% and 39% of the companies, respectively. Deep learning multi-modal algorithms with multiple types of data inputs, such as text, images and audio, are used by 46% of the respondent companies.

Figure 7: AI Algorithms in Use



Different AI technologies—such as ML, NLP, and CV—offer unique benefits across industries, from automating workflows to enhancing customer experiences. By analysing adoption trends, businesses can identify and select the most suitable AI tools, address challenges like scalability and integration, and ensure responsible and ethical AI use. This knowledge also helps in making informed investment decisions, optimising resources, and staying ahead in the rapidly evolving AI landscape. The adoption of AI technologies in India is rapidly accelerating across various industries, driven by advancements in ML, NLP and automation. Therefore, it is pertinent to look at each of the technology in detail.

i. Machine learning (ML)

Machine Learning (ML) is a type of AI that processes huge datasets to identify patterns and trends, then uses them to build models that make future prediction. ML algorithms enable systems to learn patterns from data, improve performance and make decisions or predictions without being explicitly programmed. Common ML techniques include supervised learning, unsupervised learning and reinforcement learning. Machine Learning is increasingly being used to analyse massive volumes of data, providing accurate projections to drive strategic decision-making and altering typical demands from higher-ups on IT staff. Deep learning is a powerful subset of ML that mimics the human brain's neural networks, has revolutionised fields such as NLP, image recognition and autonomous systems. The popularity of deep learning is driven by the explosion of data and continuous advancements in computational technologies. ML is widely used in fraud detection, predictive analytics, recommendation systems and autonomous vehicles, and it has been adopted across sectors such as finance, manufacturing, retail and healthcare. The market size of ML in India has increased from USD 1.76 billion in 2020 to USD 2.63 billion in 2024. It is projected to grow from USD 3.55 billion in 2025 to USD 18.96 billion in 2031.[40] As per another report, the market size for ML in India is expected to increase from USD 4.23 billion in 2025 to INR USD 46.79 billion by 2032 at a CAGR of 40.9%.[41]

ii. Natural Language Processing (NLP)

Natural Language Processing (NLP) is a type of AI that uses machine learning to enable computers to understand and communicate in human language. NLP technology allows machines to interpret and respond to human language by combining deep learning, linguistics and statistical methods to process text and speech. Its applications include chatbots, language translation sentiment analysis and speech recognition. Early NLP models worked with text for predicting sentiments and related analysis. As the field continues to evolves, it is driving innovation in AI-driven content creation and real-time language translation, leading to increasing adoption

[40] https://www.statista.com/outlook/tmo/artificial-intelligence/India

[41] Market Research Future: India Artificial Intelligence Market Research Report Market Analysis (2019-2032)

and popularity. The market size of NLP in India has increased from USD 0.47 billion in 2020 to USD 1.37 billion in 2024. It is projected to grow from USD 1.84 billion in 2025 to USD 6.88 billion in 2031.[42] As per another report, the adoption of NLP in AI solutions is expected to grow from USD 3.07 billion 2025 to USD 37.33 billion by 2032[43] at a CAGR of 42.8%.

iii. Computer Vision (CV)

Computer Vision (CV) is a field of artificial intelligence that enables computers and systems to derive meaningful information from digital images, videos, and other visual inputs and take actions or make recommendations based on that information. CV technologies enable AI systems to analyse and interpret visual information. It involves techniques such as image recognition, object detection and facial recognition. CV uses pre-trained annotated data to identify images and videos, allowing computers to analyse and understand digital images and videos. It is widely used in areas such as facial recognition, object detection, medical imaging, surveillance systems and augmented reality. With advancements in deep learning and neural networks, CV continues to evolve, improving accuracy and efficiency in tasks ranging from real-time image processing to complex decision-making. Adoption of CV is expected to grow, especially in industries such as healthcare, retail and security. The market size of CV in India has increased from USD 0.34 billion in 2020 to USD 0.88 billion in 2024. It is projected to grow from USD 1 billion in 2025 to USD 2.39 billion in 2031.[44] As per another estimate, the market size is expected to increase from USD 2.05 billion in 2025 to USD 24.56 billion in 2032 at a CAGR of 42.6%.[45]

India's AI development layer[46] is witnessing rapid growth with startups building tools across machine learning algorithms, computer vision, and natural language processing (NLP). Companies like Quickwork offer no-code integration platforms for API and AI workflows, while Ai Awaaz enables regional language audio content through Indian-accent-aware text-to-speech solutions. FinLock leverages computer vision for fraud detection, and REVARN Cybernetic creates programmable AI chat agents for customer service. Automator, on the other hand, develops accessible voice automation tailored for Indian users. Startups in this layer are largely concentrated in Bengaluru and Hyderabad, having emerged after 2017 to meet surging enterprise demand for model customisation and deployment. While direct investor names are unavailable in the dataset, this segment has historically attracted capital from institutional backers such as Sequoia Capital India, Blume Ventures, Axilor Ventures, and Pi Ventures, who

[42] https://www.statista.com/outlook/tmo/artificial-intelligence/india
[43] Market Research Future: India Artificial Intelligence Market Research Report Market Analysis (2019-2032)
[44] https://www.statista.com/outlook/tmo/artificial-intelligence/india
[45] Market Research Future: India Artificial Intelligence Market Research Report Market Analysis (2019-2032)
[46] Tracxn Analysis 2025

have shown strong interest in AI tooling, edge computing, and applied generative AI.

2.2.4 Generative AI/ Foundation Model Layer

Generative AI (Gen AI) enables users to generate new content based on a variety of inputs. Inputs and outputs to these models can include text, images, sounds, animation, 3D models, or other types of data. These are the latest advancements in artificial intelligence (AI). Foundation models are huge neural network models that are pre-trained on enormous amounts of unlabelled data often using the Generative Pretrained Transformer (GPT) architecture to generate human like text. The primary purpose of foundation models is to serve as a starting point or a basic building block for a wide variety of AI applications, such as NLP, question-answering, text generation, summarisation, and even code generation. Foundation models have billions or trillions of parameters and can effectively learn patterns and relationships in the training data. Early models like GPT 3 were text-centric. They accept text input and produce text output.

Foundation models (Generative AI) are capable of creating new content, such as images, music, text and code, based on the patterns they have learned. Powered by deep learning techniques such as transformers and generative adversarial networks (GANs), GenAI is used in applications such as ChatGPT for human-like text generation, DALL-E for AI-generated art and AlphaCode for automated coding. This has given organisations the ability to create personalised content, enhance creativity and automate tasks that traditionally required human intelligence. GenAI is seeing growing adoption in creative industries such as advertising, content generation and personalised learning material, and gaming as well as in sectors like retail, finance and healthcare. The market size of Gen AI in India has increased from USD 0.10 billion in 2020 to USD 0.67 billion in 2024 and is expected to grow from USD 1.18 billion in 2025 to USD 7.81 billion in 2031.[47] As per another report, the growing popularity of GenAI and its rapid adoption by businesses is evident from a CAGR of 43.4% for the 2025–2032 period. GenAI use in business is expected to grow from USD 0.36 billion in 2025 to USD 4.53 billion by 2032.[48]

Newer models such as CLIP, Stable Diffusion, and Gato are multimodal capable of processing data types such as images, audio files, and videos.

Globally, technology giants like Microsoft, Google and Meta are major players in this layer. Google has 18 foundation models followed by Meta which has 11, Microsoft with 9 and open AI with 7 foundation models.[49] It may also be noted that foundation models increased in number from 2021 to 2023. Academia has contributed 43 foundation models during 2019 to 2023 and Industry has contributed 194 during the same period. ChatGPT software which is an interface

[47] https://www.statista.com/outlook/tmo/artificial-intelligence/india
[48] Market Research Future: India Artificial Intelligence Market Research Report Market Analysis (2019-2032)
[49] Ibid

to a large language model was launched in November 2022. GPT 4, BERT, DALL-E 3, CLIP, Sora, etc., are some of the examples of foundation models.[50] Leading Generative AI startups in India include Observe.AI, Pixis, Ola Krutrim, InVideo, Sarvam AI, Avaamo AI, Senseforth.ai etc.[51] The Government of India has signalled interest in supporting Indian companies and research institutions in developing home-grown foundation models, reducing dependence on proprietary models from global players. This is especially crucial in industries such as healthcare, agriculture and governance, where localised AI solutions are needed. Sarvam AI, a Bengaluru-based AI startup, has announced the launch of Sarvam 1, its latest open-source LLM tailored for Indian languages. The system reportedly supports 10 Indic languages, namely Bengali, Gujarati, Hindi, Marathi, Malayalam, Kannada, Odia, Tamil, Telugu, Punjabi as well as English.[52]

2.2.5 AI Model Layer

The AI model layer focuses on fine-tuning, optimisation and management of AI models for specific use cases. It ensures that AI systems are accurate, relevant, and responsive to evolving needs. This layer involves model adaptation for local markets and industries, domain-specific fine-tuning using sector-specific data (e.g., retail, logistics), real-time model optimisation through live data and feedback, and model scalability to adjust AI performance based on operational demands.

AI technologies and models can be broadly categorised into open-source and closed-source depending on their accessibility, licensing and usage rights. Open-source AI models and tools are freely available for public use, modification and distribution, whereas closed-source AI models are proprietary models and technologies with restricted access developed by companies. While open-source models are transparent and cost-effective, closed-source models provide better security, reliability and dedicated customer support. Open-source models foster innovation and collaboration, while closed-source models ensure controlled enterprise-grade AI solutions.

Worldwide, open-source frameworks and cloud giants provide algorithms for model building. Open-Source contributions include PyTorch & TensorFlow which dominate deep learning, Scikit-learn, XGBoost, LightGBM, and CatBoost widely used for traditional ML, and Hugging Face used for NLP & generative AI etc. Open source/proprietary algorithms provided by different global technology giants are given in the following table:

[50] Market Research Future: India Artificial Intelligence Market Research Report Market Analysis (2019-2032)
[51] Powerhouse in the Making: AI Market in India, Statista
[52] https://www.pib.gov.in/PressReleasePage.aspx?PRID=2108810

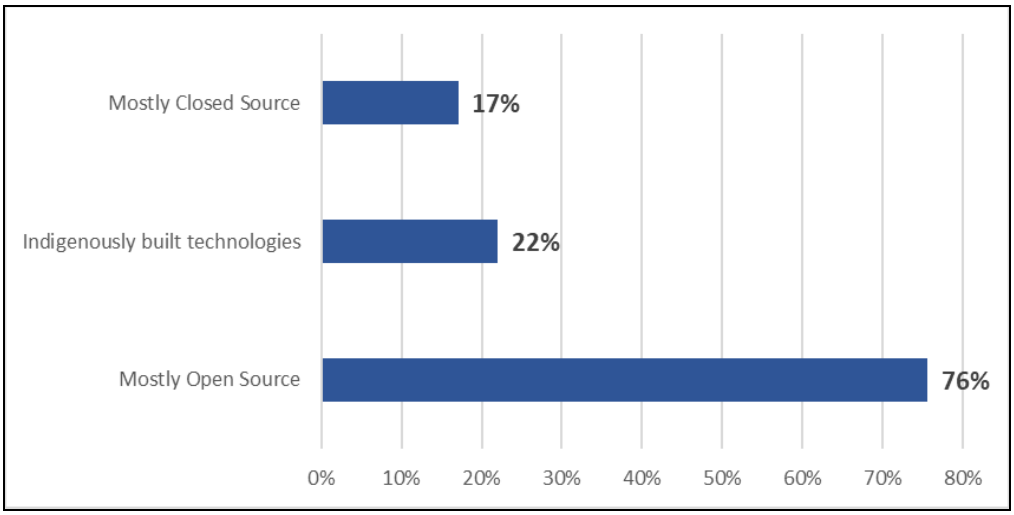
Table 2: Algorithms provided by different global technology giants[53]

Company	Algorithms
Google	TensorFlow, JAX, AutoML
Microsoft	Azure Machine Learning, LightGBM
Meta	PyTorch, Llama for LLMs
Amazon	SageMaker, AutoGluon
OpenAI	GPT models, Codex, DALL-E

In India, the majority (43%) of Gen AI Indian startups prefer a hybrid architecture consisting of a mix of open-source and closed-source models. [54]

Notably, 76% of the interviewed companies build their application solutions using open-source technologies. Using stable, tested open-source AI technologies provides developers and researchers with free and accessible tools to build, conduct experiments and deploy AI models. It is evident that open-source technologies are helping boost the startup culture in the AI space. The interviewed companies use existing open-source or closed-source LLMs to build their applications, reducing the need to train models from scratch and accelerating innovation in AI applications. 17% of the participants are using mostly closed-source technologies i.e., technologies that are proprietary and need to be very secure. 22% of respondents use other technologies, such as indigenously built technologies.

Figure 8: Sources of technologies used



Around 80% of Indian Large Language Model (LLMs) are estimated to be built atop existing foundational models.[55]

The AI Model Layer[56] in India is rapidly expanding, with startups working on model training, fine-tuning, optimisation, and Gen AI solutions. This includes

[53] Market Research Future: India Artificial Intelligence Market Research Report Market Analysis (2019-2032)
[54] https://nasscom.in/knowledge-center/publications/indias-generative-ai-startup-landscape-2024-0#dwn-report
[55] Ibid

both domain-specific adaptations and tooling for scalable deployment. Notable players like Npluslabs offer a secure, federated machine learning platform tailored for researchers and developers, while EDGE Neural enables model training and optimisation directly at the edge, promoting hardware-independent AI deployments. Grey Chain AI delivers a generative AI product suite spanning content management to conversational assistants for enterprise clients, and Aqeeq Technologies provides custom predictive analytics and ethical AI auditing services for SMEs. Karnataka, Telangana, and Delhi dominate this layer, reflecting the strong confluence of academic AI talent and enterprise AI demand. The segment has drawn funding from institutional players such as Together Fund, Lightspeed India, and Peak XV, particularly in GenAI orchestration and domain-specific foundation models.

2.2.6 AI Release and Deployment Layer

The AI release and deployment layer manages the deployment, versioning, and distribution of AI models to businesses, ensuring seamless updates and real-time performance. It includes proprietary AI models developed in-house for specific business needs (e.g., fraud detection), open-source AI models from frameworks like TensorFlow and PyTorch for flexible adaptation, AI-as-a-Service solutions from cloud providers that simplify AI adoption, and versioning & continuous deployment to keep models optimised and up to date.

The AI release and deployment layer[57] is still in its early phase in India, with startups innovating in model deployment, AIOps, validation, and real-time observability. Key players like Sygmoid offer end-to-end model lifecycle platforms with features such as auto-validation, deployment automation, and cataloguing for AI pipelines. Cumin AI enables scalable batch APIs and managed vector stores for offline AI workloads, helping teams operationalise open-source models. Meanwhile, Inferless provides a serverless GPU platform designed for latency-optimised deployment of production-grade ML models, and produktiv.ai contributes governance-linked retrieval-augmented generation tools that integrate large language models with enterprise data. The ecosystem is concentrated in Karnataka and Telangana, driven by cloud-native development teams. This space has seen interest from institutional investors such as Blume Ventures, Axilor Ventures, and Antler, particularly in tools that lower the time from model training to deployment.

2.2.7 AI User Interaction Layer

The AI user interaction layer focuses on how customers and employees engage with AI-powered systems, enhancing both user experience and operational efficiency. It includes customer-facing AI, such as chatbots and recommendation engines that improve engagement, operational AI for real-time decision-making

[56] Tracxn Analysis 2025
[57] Ibid

in logistics and warehouse management, contextual AI that adapts to changing conditions like traffic or demand fluctuations, and personalisation engines that tailor experiences based on user behaviour and preferences.

The AI User interaction layer in India is thriving, with startups spanning conversational interfaces, UI/UX design tools, and multilingual virtual assistants. Notable startups include Haptik, which powers enterprise-grade chatbots across sectors like telecom and banking; Yellow.ai, offering omnichannel virtual agents for enterprises; and Engati, enabling no-code chatbot deployment. Meanwhile, firms like Sketcha and Frontitude are pushing AI-based design automation for product teams. The majority of these startups emerged after 2016, with Mumbai, Bengaluru, and Delhi-NCR leading as innovation hubs. Several funding rounds have been recorded across this segment, backed prominently by institutional investors like Kalaari Capital, SAIF Partners, Lightspeed India, and Blume Ventures. Startups are addressing use cases from WhatsApp commerce to customer onboarding automation, reflecting strategic pivot toward AI-enhanced user engagement solutions in both B2B and consumer domains.

2.2.8 Governance and Orchestration Layer

This layer is responsible for the coordination, management and integration of AI models within the organisation's broader IT infrastructure. It ensures that AI models work together seamlessly, are integrated with enterprise systems and are continuously monitored and optimised for performance. The governance layer manages AI systems coordination to prevent conflicts between multiple AI models, ensures enterprise integration with Enterprise Resource Planning (ERP), Customer Relationship Management (CRM) and Supply Chain Management (SCM) systems for smooth data flow, and enables AI workflow automation to streamline business processes. Additionally, it oversees model lifecycle management to track updates and ensure optimal performance, along with monitoring and performance optimisation for real-time adjustments.

The AI Governance & Orchestration Layer[58] in India is evolving rapidly, with startups building capabilities across workflow automation, ethical oversight, LLMOps[59] and data integration. Solutions ranges from Impler, which offers an open-source data import infrastructure for SaaS platforms, to CleanDesk AI, enabling multilingual conversational interfaces that replace static websites with dynamic real-time AI experiences. Companies like Neurocrafts provide model optimisation and compression tooling for edge AI deployment, while AiEnsured focuses on safety and validation through a dedicated testing suite for AI products. Meanwhile, firms such as augmentIQ—acquired by L&T Infotech—have offered enterprise-wide data orchestration and analytics platforms. Most startups in this layer are clustered in Karnataka and Maharashtra, with a surge in activity

[58] Tracxn Analysis 2025

[59] LLMOps, or Large Language Model Operations, refers to the practices, techniques, and tools used to manage and deploy large language models (LLMs) in production environments. It encompasses the entire lifecycle of an LLM, from development and training to deployment, monitoring, and maintenance.

post-2018.[60] There has been participation from institutional VCs such as Kalaari Capital, Endiya Partners, JSW Ventures, and Nexus Venture Partners, in MLOps[61], agent orchestration, and responsible AI frameworks. This layer underpins the AI ecosystem's trust, scalability, and system-level integration essential for enterprise-wide AI adoption.

Summary

The AI ecosystem refers to a complex, interdependent framework comprising data, algorithms, computational infrastructure, human capital, and regulatory environments that together facilitate the development, deployment, and governance of artificial intelligence. At its core, AI depends on the availability of large datasets, robust processing capabilities, and sophisticated algorithmic models often supported by specialised hardware like GPUs and cloud-based infrastructure.

The AI ecosystem exhibits a well-defined structural hierarchy encompassing distinct layers, each serving specific functions in the AI value chain. The data layer forms the foundational bedrock. Data is collected from a variety of sources: open, closed and proprietary and must be curated, labelled, and structured before being processed using machine learning algorithms. This layer has presence of global players such as Appen, AWS, Google, Microsoft Azure, and Scale AI.

The infrastructure layer, experiencing robust growth trajectories, is characterised by the presence of major cloud service providers, while simultaneously witnessing India's strategic initiatives in semiconductor manufacturing through approved projects with significant investments. This structural composition indicates a maturing ecosystem where both global technology leaders and domestic initiatives are contributing to comprehensive AI infrastructure development.

The AI development layer comprises of traditional (statistical models) or advanced (machine learning, neural networks) algorithms. The learning paradigms vary from supervised and unsupervised to semi-supervised and reinforcement learning. Neural networks are central to modern AI. The rise of Gen AI/foundation models has expanded the boundaries of what AI can achieve. These models are capable of creating new content, such as images, music, text and code, based on the patterns it has learned. This enables users to quickly generate new content based on a variety of inputs. The AI model layer focuses on management, fine-tuning, and optimisation of AI models for specific use cases. It ensures that AI systems are accurate, relevant, and responsive to evolving needs. The AI release and deployment layer manages the critical transition of models from development to production through model release

[60] Tracxn Analysis 2025

[61] MLOps, or Machine Learning Operations, is a set of practices that streamline the entire lifecycle of machine learning models, from development to deployment, monitoring, and retraining

processes, deployment strategies, and the transfer learning mechanisms that adapt general models to specific domains. The AI User Interaction Layer is where the technology meets its users across various industries—retail, e-commerce, digital marketing, logistics, and others. The governance and orchestration layer spans the entire structure vertically, this layer handles AI systems coordination, enterprise integration, workflow automation, model lifecycle management, monitoring, and performance optimisation.

The big technology companies are playing a major role in data, infrastructure and AI development layer. In addition, the India AI stack ecosystem is witnessing growing green shoots with the startups emerging as players in the upstream layers. The presence of Indian startups in downstream layers is vibrant and growing.

There is a growing focus on democratising AI through open standards, public infrastructure, and collaborations etc.

CHAPTER 3

APPLICATION OF AI IN USER INDUSTRIES

In India, the adoption of artificial intelligence (AI) spans multiple sectors, supported by initiatives such as the 'National Strategy for AI'[62] and the National AI Portal, launched by the Government of India. With the exponential increase in data generation, there is an intensified emphasis on leveraging AI-powered data analytics to extract actionable insights, enhance operational efficiency, and foster innovation.

AI has witnessed rapid adoption in India across various sectors. BFSI, IT and telecom, healthcare, retail and e-commerce, automotive, manufacturing, and transportation and logistics are the major sectors integrating AI into their operations. Other sectors include education, Global Positioning System (GPS) and navigation, agriculture, lifestyle, social media, gaming and astronomy. The CAGR for AI market in India across industry verticals is projected to range between 39% to 43% between 2025 to 2032.[63]

With AI-powered technologies increasingly supporting various sectors, it is crucial to analyse their applications and modes of implementation, alongside addressing any potential competition-related concerns. In consumer-facing sectors, businesses must not only adopt innovative methods of customer interaction but also evaluate their implications for the foundational principles of building and maintaining customer relationships.[64] As noted, in such sectors, the conceptualisation and strategic framing of technologies such as AI are crucial for these enterprises as they continue to navigate ways to embed AI and support their businesses.[65]

AI is transforming the retail, e-commerce, logistics, delivery, and marketing sectors by reshaping traditional operations and enabling innovative practices. Businesses are increasingly leverage AI-driven solutions to enhance efficiency, optimise processes, and deliver personalised experiences. This integration reflects a strategic shift towards embedding advanced technologies into daily operations, fostering both adaptability and competitiveness in a rapidly evolving marketplace.

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[62] 'National Strategy for Artificial Intelligence' Niti Aayog (2018). https://www.niti.gov.in/sites/default/files/2023-03/National-Strategy-for-Artificial-Intelligence.pdf

[63] Market Research Future: India Artificial Intelligence Market Research Report Market Analysis (2019-2032)

[64] Barak Libai, Yakov Bart, Sonja Gensler, Charles F. Hofacker, Andreas Kaplan, Kim Kötterheinrich, Eike Benjamin Kroll, 'Brave New World? On AI and the Management of Customer Relationships' Journal of Interactive Marketing, Vol. 51 (2020). https://doi.org/10.1016/j.intmar.2020.04.002

[65] Grewal, Dhruv, Mirja Kroschke, Martin Mende, Anne L. Roggeveen, and Maura L. Scott. 2020. 'Frontline Cyborgs at Your Service: How Human Enhancement Technologies Affect Customer Experiences in Retail, Sales, and Service Settings' Journal of Interactive Marketing 51 (1): 9–25. https://doi.org/10.1016/j.intmar.2020.03.001

3.1 Retail

AI holds significant potential for the retail sector in India. As the industry undergoes digital transformation, the adoption of advanced data analytics and predictive technologies has substantially enhanced the speed, accuracy, and efficiency of business operations. As per Kearney Research, India's retail industry is projected to grow at a CAGR of 9% over 2019-2030.[66] India is currently the fifth-largest retail market globally and is set to become the third-largest within a decade. The retail tech sector has attracted over USD 4.5 billion in foreign direct investment (FDI) by the end of 2023.[67] India's e-commerce industry, valued at INR 10,82,875 crore (USD 125 billion) in FY24, is projected to grow to INR 29,88,735 crore (USD 345 billion) by FY30, reflecting a CAGR of 15%.[68]

By 2025, Gen AI is expected to boost retail sector profitability by 20%, with notable effects on customer experience, product innovation, cost reduction, and the overall value chain.[69]

The ongoing discourse emphasises that retail businesses should utilise AI-driven innovations to create unique experiences, improve virtual interactions, prioritise ethical data use, and build trust while focusing on enhancing the shopping experience without pressuring customers.[70] Prominent use cases in Consumer Packaged Goods (CPG) and Retail have been related to better operational efficiencies through AI, such as omnichannel inventory optimisation, demand forecasting, and the use of conversational AI.[71]

There are four key purposes for deployment of AI in the retail sector:

First, AI in retail enhances personalisation by analysing customer behaviour, preferences, and past purchases to offer tailored recommendations and targeted marketing, boosting loyalty and conversion rates. Retailers use recommendation engines and dynamic pricing to improve customer experiences and maximise revenue. As AI advances, it allows for even more precise personalisation by considering real-time actions and other factors. This means retailers can predict customer needs and send highly personalised messages across various channels. For instance, Swiggy has incorporated Gen AI to enhance user experience and optimise operations. By implementing a custom

[66] https://www.ibef.org/industry/indian-retail-industry-analysis-presentation
[67] NASSCOM, AI Adoption Index 2.0
[68] https://www.ibef.org/industry/ecommerce
[69] https://www.ey.com/en_in/newsroom/2024/01/71-percent-of-indian-retailers-plan-to-adopt-gen-ai-in-the-next-12-months-says-ey-survey
[70] V. Kumar, Abdul R. Ashraf, Waqar Nadeem, 'AI-powered marketing: What, where, and how?' International Journal of Information Management, Vol. 77 (2024). https://doi.org/10.1016/j.ijinfomgt.2024.102783
[71] AI Adoption Index 2.0, NASSCOM; Tiutiu, Miriam, and Dan-Cristian Dabija. 2023. 'Improving Customer Experience Using Artificial Intelligence in Online Retail.' Proceedings of the ... International Conference on Business Excellence 17 (1): 1139–47. https://doi.org/10.2478/picbe-2023-0102

neural search engine for common queries, they offer personalised food recommendations.[72]

Second, AI aids in demand forecasting to predict future customer demand, incorporating sales, customer, and market data for more effective planning. AI models offer greater accuracy by detecting patterns traditional methods may miss. These tools help retailers optimise inventory and logistics while adapting quickly to market changes. For instance, Reliance Retail harnesses AI for demand forecasting[73], enabling precise predictions of customer preferences and optimised inventory management. Tata Steel employs AI to track supplier performance and enhance logistics, ensuring a steady supply of raw materials while minimising downtime.[74]

Third, AI is transforming customer engagement within the retail sector. AI-powered virtual assistants and chatbots enhance customer engagement by providing instant support, helping customers navigate product offerings, and resolving issues efficiently. With advancements in NLP, these tools facilitate more human-like interactions and can automate complex customer service tasks, scaling outreach. For example, AI-powered chatbots have been used by Myntra for responding to customer queries in real-time and offering guidance that feels personalised, which has helped in gaining users for the company.[75]

Additionally, AI-assisted search and augmented reality enable customers to research and virtually try products before purchasing online, enriching the shopping experience, particularly in sectors like fashion and beauty.[76] For instance, a prominent use case is self-checkout systems. These systems enable contactless shopping, reduce staff workload, and enhance efficiency while showcasing a brand's innovation.[77] BigBasket, a leading online retail and grocery chain, launched a self-service offline store equipped[78] with an AI-powered computer technology platform capable of identifying fruits and vegetables without relying on barcodes. However, concerns about their inefficiency, particularly regarding customer exchanges, still persist.[79]

Fourth, AI optimises inventory and supply chain management in retail by

[72] 'Top Generative AI Adoptions by Consumer Companies in India' IndiaAI, https://indiaai.gov.in/article/top-generative-ai-adoptions-by-consumer-companies-in-india

[73] https://cleartax.in/s/ai-in-supply-chain

[74] Sejuti Das, 'How Tata Steel Uses AI: A Case Study' Analytics India Magazine, December 31, 2024, https://analyticsindiamag.com/it-services/how-tata-steel-uses-ai-a-case-study/

[75] Navikenz, 'Empowering Indian Retail with AI: Personalization and Innovation at Scale' Navikenz (November 18, 2024). https://navikenz.com/empowering-indian-retail-with-ai-personalization-and-innovation-at-scale/

[76] Beatrice Romano, Sean Sanda, Jason Pallant, 'Augmented Reality and the Customer Journey: An Exploratory Study' Australasian Marketing Journal, Vol. 29 (2020). https://doi.org/10.1016/j.ausmj.2020.06.010

[77] Kazi, Zainab S. 2023. 'Scanning the Self-checkout Space.' India Retailing. October 15, 2023. https://www.indiaretailing.com/2023/10/15/scanning-the-self-checkout-space/

[78] https://aws.amazon.com/blogs/machine-learning/how-bigbasket-improved-ai-enabled-checkout-at-their-physical-stores-using-amazon-sagemaker/

[79] Moore, Simon, Sandy Bulmer, and Jonathan Elms. 2021. 'The Social Significance of AI in Retail on Customer Experience and Shopping Practices.' Journal of Retailing and Consumer Services 64 (September): 102755. https://doi.org/10.1016/j.jretconser.2021.102755.

automating supplier and transportation logistics. It enhances operational efficiency by refining transportation routes, reducing delivery times and adjusting schedules, reducing manual ordering efforts, and ultimately streamlining operations. For example, Mamaearth uses AI to optimise inventory management, preventing stockouts by predicting demand and aligning replenishment. This ensures better demand planning and swift responses to demand spikes.[80]

3.2 E-commerce

The current business landscape is witnessing a rapid transformation driven by the adoption of AI in e-commerce. Areas such as monitoring, predictions, recommendations, and decision-making processes use AI-powered tools that analyse vast amounts of data in real-time, leading to more informed and efficient operations. Businesses are leveraging these tools for monitoring consumer behaviour, predicting market trends, and optimising decision-making processes.[81]

Industries utilising AI in e-commerce are also benefiting from enhanced decision-making capabilities. AI-driven insights assist companies in understanding competitive landscapes, adjusting pricing strategies dynamically, and improving marketing effectiveness.[82] Automated systems track customer sentiment, enabling brands to tailor engagement strategies for higher conversions. As AI adoption continues to evolve, it is shaping a business ecosystem where data-driven monitoring, real-time predictions, and strategic recommendations are driving sustained growth and operational efficiency across industries.[83]

AI market size in E-commerce and Retail has increased from USD 0.33 billion in 2019 to USD 0.86 billion in 2024. It is projected to grow at a CAGR of 43.2% during 2025-2032, from USD 1.27 billion in 2025 to USD 15.7 billion in 2032.[84]

There are three key purposes for deployment of AI in the e-commerce sector.

First, AI is transforming delivery mechanisms in e-commerce by enhancing logistics capabilities, improving inventory management, and optimising marketing strategies. ML algorithms and predictive analytics are increasing supply chain visibility, enabling faster last-mile deliveries, and reducing

[80] Varun Aggarwal, 'How Indian Retailers Are Getting AI Savvy' ETCIO (2021). https://cio.economictimes.indiatimes.com/news/next-gen-technologies/how-indian-retailers-are-getting-ai-savvy/87717041

[81] Abayomi Abraham Adesina, Toluwalase Vanessa Iyelolu, Patience Okpeke Paul, 'Leveraging predictive analytics for strategic decision-making: Enhancing business performance through data-driven insights' World Journal of Advanced Research and Reviews (2024). https://doi.org/10.30574/wjarr.2024.22.3.1961

[82] 'Leveraging AI for Dynamic Pricing Strategies in Online Stores: Enhancing Profitability and Customer Engagement' Bing Digital, last modified November 28, 2024, https://www.bingdigital.com/leveraging-ai-for-dynamic-pricing-strategies-in-online-stores/

[83] Adib Bin Rashid, MD Ashfakul Karim Kausik, 'AI revolutionizing industries worldwide: A comprehensive overview of its diverse applications' Hybrid Advances, Vol. 7 (2024). https://doi.org/10.1016/j.hybadv.2024.100277

[84] Market Research Future -India Artificial Intelligence report market analysis (2019-2032)

inefficiencies. AI-driven route optimisation analyses traffic, weather, and real-time delivery data to improve efficiency.[85] Reports suggest that AI-powered systems can reduce transit times by 20% and lower delivery costs by 15%, making logistics more cost-effective and sustainable.[86]

Second, AI-driven dynamic pricing uses ML to analyse demand patterns and adjust prices based on market conditions and consumer behaviour. Techniques such as clustering, regression, and reinforcement learning help optimise pricing strategies, enhancing both profitability and customer experience.[87] A key use is real-time demand forecasting and competitor analysis, enabling precise price adjustments. For example, Uber and Amazon use AI for dynamic pricing - Uber adjusts fares in real-time based on demand and traffic, while Amazon updates product prices frequently by analysing competitors, demand, and stock levels.[88]

Third, AI-enabled predictive analytics enhances the process of effective inventory management by leveraging ML algorithms such as decision trees and neural networks to analyse historical sales data, seasonal trends, and market conditions. By accurately forecasting demand, businesses can optimise stock levels, reducing overstocking and preventing stockouts.[89] This aids in improving overall operational efficiency and enhances customer satisfaction by ensuring that the products demanded are available when needed. The integration of predictive analytics in e-commerce highlights the transformative potential it holds in driving better decision-making and maximising business outcomes.[90] For example, Myntra leverages AI and ML to analyse data from fashion portals, social media, and its customer database, identifying the fastest-selling products and ensuring their availability on the platform. This enables Myntra to launch new collections more quickly than its competitors.[91]

3.3 Logistics and Delivery

Logistics optimisation helps businesses streamline supply chain operations by carefully planning, organising, and managing the movement of goods and

[85] Ashodia H, 'How Quick Commerce Is Taking over E-Commerce with AI Integration' ET Edge Insights (2025). https://etedge-insights.com/technology/artificial-intelligence/how-quick-commerce-is-taking-over-e-commerce-with-ai-integration/

[86] 'How AI Is Transforming E-Commerce with Smarter Delivery and Marketing Cost Solutions' Financial Express (December 8, 2024). https://www.financialexpress.com/business/brandwagon-how-ai-is-transforming-e-commerce-with-smarter-delivery-and-marketing-cost-solutions-3686840/

[87] S. Vimaladevi VG, 'AI And Dynamic Pricing in E-Commerce: Strategies for Maximizing Revenue and Customer Value' (2024) 14 European Economic Letters (EEL) 347

[88] Sahota N, 'Harnessing AI For Dynamic Pricing For Your Business' Forbes (June 24, 2024) https://www.forbes.com/sites/neilsahota/2024/06/24/harnessing-ai-for-dynamic-pricing-for-your-business/

[89] Jakkula AR, 'Predictive Analytics in E-Commerce: Maximizing Business Outcomes' Scientific Research and Community Ltd (June 30, 2023)

[90] Takyar A, 'AI in Inventory Management: An Overview' Leewayhertz (September 5, 2023). https://www.leewayhertz.com/ai-in-inventory-management/#How-does-AI-in-inventory-management-work

[91] 'AI-Powered eCommerce: The Top 10 Applications to Increase ROI' WebEngage, https://webengage.com/blog/harnessing-ai-in-ecommerce/

services. Logistics demand improving efficiency by identifying and removing wasteful processes, allowing for smoother operations and better overall performance.[92] Here, digital technology plays a crucial role.[93]

As noted by the NASSCOM survey report, the transport and logistics sector excels in adopting transformation-driven AI strategies (35%) and small-scale AI adoption (29%). AI is extensively used by 88% of respondent companies in this sector for demand-based inventory management and real-time tracking of fleets and products. This highlights the sector's strategic integration of AI to enhance efficiency.[94] The sector also presents a significant number of use cases, with key examples including demand forecasting for inventory management and real-time tracking.[95] The AI market size in transportation and logistics grew from USD 0.14 billion in 2019 to USD 0.40 billion in 2024. It is projected to grow at a CAGR of 41.9% during 2025-2032, from USD 0.58 billion in 2025 to USD 6.77 billion in 2032.[96]

There are three key purposes for deployment of AI in the logistics sector.

First, AI enhances inventory and route management, which is essential given the increasing complexity of operations and rising demand for faster, more efficient deliveries.[97] AI technologies, including machine learning, computer vision, and robotics, optimise warehouse networks by improving inventory tracking, streamlining order processing, and enhancing supply chain visibility. AI-powered systems help reduce fulfilment times, improve order accuracy, and minimise inventory costs by optimising warehouse layouts, pick paths, and storage locations.[98] For instance, Flipkart[99] utilises AI to streamline inventory management, ensuring products are readily available while minimising waste. Similarly, Reliance Retail uses AI for demand forecasting, accurately predicting customer needs and optimising inventory control.[100]

Second, AI is essential for optimising warehouse automation, a key aspect of logistics and inventory management. Through Automated Storage and Retrieval Systems, Robotics, and the Internet of Things (IoT), businesses can proactively refine warehousing strategies to ensure precise inventory placement and

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92 Burinskiene, A., A. Lorenc, and T. Lerher. 2018. 'A Simulation Study for the Sustainability and Reduction of Waste in Warehouse Logistics.' International Journal of Simulation Modelling 17 (3): 485–97 https://doi.org/10.2507/ijsimm17(3)446

93 Granillo-Macías, Rafael. 2020. 'Inventory Management and Logistics Optimization: A Data Mining Practical Approach.' Logforum 16 (4): 535–47. https://doi.org/10.17270/j.log.2020.512

94 NASSCOM, AI Adoption Index 2.0

95 ibid

96 Market Research Future -India Artificial Intelligence report market analysis (2019-2032)

97 Granillo-Macías, R. Inventory management and logistics optimization: A data mining practical approach. LogForum 2020, 16, 535–547

98 Ibid

99 Ghatak A, 'How Flipkart Revolutionizes Online Shopping with E-Commerce AI' DQ (May 28, 2024). https://www.dqindia.com/features/how-flipkart-revolutionizes-online-shopping-with-e-commerce-ai-4655164

100 https://cleartax.in/s/ai-in-supply-chain

operational efficiency.[101] A key example of warehouse automation is Autonomous Mobile Robots (AMRs), which enhance warehouse efficiency by automating material transport, order picking, and replenishment, reducing reliance on manual labour.[102] Amazon is a prime example of advanced warehouse automation, utilising over 200,000 robots to collaborate with workers, streamline fulfilment, and improve productivity.[103]

Third, AI enhances logistics and delivery through advanced demand forecasting and serves as a fundamental component of planning and procurement processes. Accurate predictions enable manufacturers, distributors, and retailers to anticipate demand fluctuations, optimise resource allocation, and improve supply chain resilience.[104] The nature of demand forecasting can vary and is influenced by several factors, including the time horizon, market scope, and level of detail.[105] This ensures better inventory management, minimises disruptions and enhances operational efficiency.

3.4 Marketing

The extant business landscape in the marketing sector is undergoing a transformative shift with the rapid adoption of AI, as evidenced by the growing body of literature emphasising its role in enhancing efficiency and personalisation. AI in marketing represents a significant shift, incorporating data-driven analysis, NLP, and ML to not only inform but also revolutionise marketing strategies.[106]

Gen AI has revolutionised content creation by producing high-quality marketing materials, saving time and resources while tailoring messages to target audiences. Brands have been using AI to analyse customer data and enhance engagement.[107] AI-driven audience segmentation refined marketing strategies by categorising users based on behaviours and interests, improving targeting. This ensures personalised content delivery, fostering stronger customer connections and maximising marketing efficiency.

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[101] Adesoga, None Temitayo Oluwadamilola, None Tolulope Olusola Ajibaye, None Kenneth Chukwujekwu Nwafor, None Ummulikhaeri Temitope Imam-Lawal, None Emmanuel Ayobamidele Ikekwere, and None Daniel Ikechukwu Ekwunife. 2024. 'The Rise of the 'Smart' Supply Chain: How AI and Automation Are Revolutionizing Logistics.' International Journal of Science and Research Archive 12 (2): 790–98 https://doi.org/10.30574/ijsra.2024.12.2.1304

[102] Sodiya, None Enoch Oluwademilade, None Uchenna Joseph Umoga, None Olukunle Oladipupo Amoo, and None Akoh Atadoga. 2024. 'AI-driven Warehouse Automation: A Comprehensive Review of Systems.' GSC Advanced Research and Reviews 18 (2): 272–82. https://doi.org/10.30574/gscarr.2024.18.2.0063

[103] 'Automated Warehouse: Examples, Benefits, and Trends' Inbound Logistics, November 1, 2023, https://www.inboundlogistics.com/articles/automated-warehouse/

[104] Mediavilla, Mario Angos, Fabian Dietrich, and Daniel Palm. 2022. 'Review and Analysis of Artificial Intelligence Methods for Demand Forecasting in Supply Chain Management.' Procedia CIRP 107 (January): 1126–31 https://doi.org/10.1016/j.procir.2022.05.119

[105] Infosys Limited. 2021. 'Optimize Supply Chains with AI-based Demand Forecasting' https://www.infosys.com/oracle/insights/documents/ai-based-demand-forecasting.pdf

[106] 'Why Do You Need AI in Marketing?' (IndiaAI) https://indiaai.gov.in/article/why-do-you-need-ai-in-marketing

[107] ibid

There are four key purposes for deployment of AI in the Marketing domain.

First, it streamlines content creation, allowing brands to generate blogs and social media posts efficiently using business data and past insights. AI-powered chatbots provide 24/7 customer support by understanding context through NLP.[108] For instance, Nykaa's virtual assistant enhances the shopping experience by providing personalised product recommendations based on customer preferences. It also offers the option of video consultations with experts and independently assists customers in finding the suitable products.[109]

Second, it aids in personalisation, as AI analyses user behaviour to recommend products and create tailored experiences.[110] Predictive analytics help businesses forecast trends, identify high-value customers, and mitigate supply chain risks.[111] AI also optimises social media strategies by determining the best posting times and monitoring engagement. For instance, Spotify's AI-powered 'Wrapped' campaign analyses user data to generate personalised year-in-review stories. The AI handles data processing, and it has made Spotify's campaign resonate with human emotions by fulfilling them through shared and personalised experiences.[112]

Third, AI improves Search Engine Optimisation (SEO) in digital marketing by generating keywords and optimising web pages. It enhances ad campaigns by analysing demographic data to optimise placements and bid for ad spaces in real-time.[113] Additionally, AI-driven sentiment analysis evaluates customer reviews and social media feedback, enabling brands to gauge public perception and refine strategies accordingly.[114] For instance, Coca-Cola has expanded its AI marketing efforts by launching its AI-powered creative platform, developed in partnership with OpenAI and Bain & Company. The platform, called Create Real Magic, allows fans to engage with the brand by creating their own AI-generated artwork, which could be featured in official Coca-Cola campaigns. This innovative approach blended autonomous technology with user-generated content.[115]

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[108] Cillo P and Rubera G, 'Generative AI in Innovation and Marketing Processes: A Roadmap of Research Opportunities' Journal of the Academy of Marketing Science (2024)

[109] 'A Leading Indian Beauty Brand Automated Customer Support Using AI-Based Platform' IndiaAI, https://indiaai.gov.in/case-study/a-leading-indian-beauty-brand-automated-customer-support-using-ai-based-platform

[110] Rama Krushna Panda, 'The Impact of AI on Digital Marketing' https://community.nasscom.in/communities/ai/impact-ai-digital-marketing

[111] 'How to Design an AI Marketing Strategy' Harvard Business Review (July 1, 2021) https://hbr.org/2021/07/how-to-design-an-ai-marketing-strategy

[112] Arora S, 'AI in Marketing: Where Tech Meets Human Emotion' Campaign India (August 22, 2024) https://www.campaignindia.in/article/ai-in-marketing-where-tech-meets-human-emotion/497879

[113] Popov E, 'How AI Is Transforming The Marketing Industry' Forbes (March 21, 2024) https://www.forbes.com/councils/forbestechcouncil/2024/03/21/how-ai-is-transforming-the-marketing-industry/

[114] 'What Is AI Marketing?' Salesforce. https://www.salesforce.com/in/marketing/ai/guide/

[115] "Coca-Cola's 'Create Real Magic' AI Campaign: Lessons for CIOs' https://www.cio.inc/coca-colas-create-real-magic-ai-campaign-lessons-for-cios-a-23996

Fourth, AI-driven programmatic advertising automates the buying and selling of online space, enabling real-time bidding and targeted ad placements. This improves efficiency, enhances audience targeting through data analysis, and optimises campaigns in real time for better performance.[116] Similarly, AI is revolutionising social media marketing by analysing user behaviour, tracking trends, and refining content strategies. It helps in understanding public perception, identifies suitable influencers for brand partnerships, and optimises ads to ensure more effective marketing campaigns.[117] For example, to address declining readership, the Economist leveraged AI-driven programmatic advertising to automate targeted ad buying and selling. By analysing consumer data, web, and app usage, it identified a segment of reluctant readers and gained insights into their reading habits. Further, by matching cookies, subscriber data, and other datasets, 'The Economist' created lookalike audiences, leading to improved audience engagement and a resurgence in readership.[118]

Beyond consumer-facing domains, AI's influence is accelerating in India's most data-rich and compliance-heavy industries such as BFSI and healthcare.

These sectors face a dual mandate: deliver seamless, personalised services while upholding stringent trust, security and regulatory requirements. The following two subsections examine how AI is remodelling core workflows in finance and medicine, the competitive considerations that arise, and the scale of value creation projected through 2030.

3.5 Banking, Financial Services, and Insurance (BFSI)

The BFSI industry in India is rapidly adopting AI-driven technologies to enhance customer experiences, streamline operations, and improve risk management. According to market research, the AI market in India's BFSI sector increased from USD 0.75 billion in 2019 to USD 2.01 billion in 2024. It is expected to grow from USD 2.92 billion in 2025 to USD 33.68 billion in 2032, representing a CAGR of 41.7%.[119] This significant growth trajectory underscores the sector's commitment to digital transformation and the strategic importance of AI integration in financial services. Banks and financial institutions are increasingly leveraging AI technologies to address various operational challenges and enhance service delivery. The adoption spans across multiple domains, including customer service, risk assessment, compliance, and investment advisory.

[116] Kovalenko M, 'AI's Influence On The Programmatic Advertising Industry' Forbes (December 5, 2023) https://www.forbes.com/councils/forbestechcouncil/2023/12/05/ais-influence-on-the-programmatic-advertising-industry/

[117] Yadav S, Banshiwal N and Yadav P, 'Artificial Intelligence Integration in Social Media Marketing: A Comprehensive Analysis' IJ Research Organization (2024)

[118] Hughes D, 'Best Examples of AI in Marketing' Digital Marketing Institute (2023) https://digitalmarketinginstitute.com/blog/some-inspiring-uses-of-ai-in-digital-marketing

[119] Market Research Future -India Artificial Intelligence report market analysis (2019-2032)

There are four key purposes for deployment of AI in the BFSI sector

First, AI enhances fraud detection and security in financial transactions. ML algorithms analyse patterns in transactional data to identify suspicious activities and potential security breaches in real-time. This proactive approach to fraud prevention helps financial institutions safeguard customer assets and maintain trust in digital financial services.

Second, AI improves customer experience through automated support systems. AI-powered chatbots and virtual assistants provide 24/7 customer support, addressing queries and facilitating routine transactions without human intervention. These systems use NLP to understand customer intent and deliver personalised responses, enhancing accessibility and convenience in banking services.

Third, AI optimises credit risk assessment and loan processing. Advanced algorithms analyse traditional and alternative data sources to evaluate creditworthiness more accurately and inclusively than conventional methods. This enables faster loan approvals while maintaining robust risk management, particularly beneficial for expanding financial inclusion to underserved populations.

Fourth, AI transforms wealth management through robo-advisory services. These platforms utilise algorithms to provide automated, data-driven investment recommendations tailored to individual financial goals and risk profiles. By democratising access to financial advisory services, AI-powered solutions are making professional investment guidance more affordable and accessible to a broader customer base.

3.6 Healthcare

The healthcare industry in India is witnessing rapid AI adoption to enhance diagnostics, treatment planning, and patient care. The AI market in Indian healthcare grew from USD 0.39 billion in 2019 to 1.01 billion in 2024. It is projected to grow from USD 1.49 billion in 2025 to USD 18.76 billion in 2032, with a CAGR of 43.5%[120], making it the fastest-growing sector for AI adoption in the country.

This accelerated growth reflects the transformative potential of AI in addressing critical healthcare challenges, including access to quality care, diagnostic accuracy, treatment personalisation, and operational efficiency. Hospitals, research institutions, and healthcare startups are increasingly integrating AI solutions across the care continuum, from preventive healthcare to specialised treatment protocols.

[120] Market Research Future -India Artificial Intelligence report market analysis (2019-2032)

There are four key purposes for deployment of AI in the healthcare sector.

First, AI enhances medical imaging and diagnostics. AI algorithms analyse medical images such as X-rays, MRIs, and CT scans to detect abnormalities with greater precision and speed than traditional methods. This improves diagnostic accuracy, enables early disease detection, and helps address the shortage of specialised radiologists, particularly in underserved regions.

Second, AI facilitates drug discovery and development. ML models accelerate pharmaceutical research by predicting drug-target interactions, optimising molecular structures, and identifying potential therapeutic candidates. This significantly reduces the time and cost associated with bringing new treatments to market, addressing critical healthcare needs more efficiently.

Third, AI optimises hospital operations and patient management. Predictive analytics help healthcare facilities forecast patient admissions, optimise resource allocation, and streamline administrative workflows. This improves operational efficiency, reduces waiting times, and enhances the overall quality of care delivery.

Fourth, AI enables personalised treatment planning and precision medicine. By analysing patient data, including genetic information, medical history, and treatment responses, AI systems help clinicians develop tailored treatment protocols that maximise efficacy while minimising adverse effects. This patient-centric approach represents a paradigm shift from standardised care to precision medicine, improving outcomes across diverse patient populations.

Across all sectors, organisational AI adoption follows a distinct pattern where enterprises are integrating AI capabilities into their operational frameworks at varying maturity levels. Large corporations are establishing dedicated AI Centers of Excellence (CoE) to drive enterprise-wide implementation, while mid-sized organisations often adopt targeted AI solutions for specific business functions. The internal integration of AI technologies is creating new competitive dynamics, as organisations with more sophisticated AI implementation gain significant market advantages through enhanced operational efficiencies and data-driven decision-making capabilities. This internal organisational adoption gap may create significant market imbalances as AI-mature organisations consolidate their competitive position through superior data utilisation and algorithmic capabilities, potentially raising barriers to entry for smaller market participants.

3.7 Competitive advantages for AI adopters and disadvantages for AI non-adopters

3.7.1 Advantages for AI adopters

- Increasing operational efficiency and reducing costs: AI can significantly enhance operational efficiency and productivity, allowing adopters to reduce

costs and improve service quality. This can lead to a competitive advantage by enabling firms to offer better products or services at lower prices.[121] AI can automate routine processes, thereby reducing the need for manual labour and improving operational accuracy and speed. This not only lowers costs but also allows firms to scale operations more effectively, enhancing their competitive position in the market.[122]

Furthermore, the ability to optimise customer service with AI can also lead to improvements. AI-powered chatbots, virtual assistants and recommendation systems can handle a large volume of customer inquiries and transactions, enhancing service delivery while minimising the need for customer service representatives. This enables firms to maintain high-quality customer engagement without the escalating costs associated with hiring and training large customer support teams.[123]

- Leveraging Proprietary Data and Strategic Partnerships for Enhanced AI Integration: AI-adopting businesses gain a significant competitive advantage by leveraging proprietary and industry-specific data, enabling the creation of tailored AI solutions that enhance operational efficiency. A strong digital infrastructure, such as cloud migration and centralised data systems, allows businesses to integrate and fine-tune AI models for better outcomes, outperforming those with weaker digital foundations.[124] AI adoption also allows for continuous workforce learning and upskilling, enabling employees to take on more strategic roles as automation handles routine tasks.

  Furthermore, businesses that deeply integrate AI across their workflows, transforming entire processes rather than isolated functions, can achieve profound efficiency gains.[125] Businesses that develop partnerships with other tech firms can speed up innovation and scale AI adoption faster. Prioritising responsible AI practices that address ethical concerns such as data privacy, security, and bias helps build trust with customers and regulators, giving businesses an edge in an increasingly scrutinised market.[126]

- Data-Driven Decision Making: AI enables businesses to analyse vast amounts of data in real time, transforming raw information into actionable insights. By

[121] Ezrachi, Ariel and Stucke, Maurice E., Artificial Intelligence & Collusion: When Computers Inhibit Competition (April 8, 2015). University of Illinois Law Review, Vol. 2017, 2017, Oxford Legal Studies Research Paper No. 18/2015, University of Tennessee Legal Studies Research Paper No. 267, https://ssrn.com/abstract=2591874

[122] Filippucci, Francesco, Peter Gal, Cecilia Jona-Lasinio, Alvaro Leandro, OECD, Giuseppe Nicoletti, LUISS Lab of European Economics, and LUISS Business School. 2024. 'The Impact of Artifical Intelligence on Productivity, Distribution, and Growth.' OECD Artificial Intelligence Papers https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/04/the-impact-of-artificial-intelligence-on-productivity-distribution-and-growth_d54e2842/8d900037-en.pdf

[123] Thomas Davenport & Abhijit Guha & Dhruv Grewal & Timna Bressgott, 2020. 'How artificial intelligence will change the future of marketing,' Journal of the Academy of Marketing Science, Springer, vol. 48(1), pages 24-42, January

[124] Bombalier J, 'The Competitive Advantage of Using AI in Business' FIU College of Business (2024) https://business.fiu.edu/academics/graduate/insights/posts/competitive-advantage-of-using-ai-in-business.html

[125] Azagury J and Moore M, 'Competitive Advantage in the Age of AI' (2024) 67 California Management Review Insights

[126] Gow G, 'AI's Competitive Advantage' Forbes (May 12, 2024) https://www.forbes.com/sites/glenngow/2024/05/12/ais-competitive-advantage-for-small-and-medium-enterprises/

utilising AI-driven analytics, companies can make more informed, timely, and accurate decisions that align with market trends, customer preferences, and operational needs.[127] This ability to make precise, data-backed decisions enhances business strategies, minimises risks, and allows firms to pivot quickly when necessary, giving them an edge over non-adopters who rely on intuition or slower, manual data analysis methods.

AI adoption in business also leads to process automation, streamlining workflows, and improving productivity. For instance, AI can automate routine tasks such as data entry, inventory management, and customer service, enabling firms to focus human resources on more strategic and value-driven initiatives. This automation, paired with AI's predictive capabilities, provides companies with a substantial advantage over non-adopters, who may struggle with fragmented or outdated systems that hinder efficient data management and AI integration.[128]

3.7.2 Disadvantages for AI non-adopters

Businesses not adopting AI may face several challenges that can hinder their ability to remain competitive in an AI-driven world. Without access to proprietary or industry-specific data, these companies are limited to generic, publicly available data, reducing their capacity to create specialised AI-driven solutions. A lack of strong digital infrastructure, including cloud adoption and data centralisation, prevents them from fully leveraging AI's potential, making them less efficient and innovative. Non-adopting businesses may find it challenging to provide the level of personalisation and responsiveness that AI-driven competitors offer, leading to lower customer satisfaction and loyalty.[129]

Additionally, non-adopting businesses miss out on the opportunity to upskill their workforce for higher-value roles, which limits their ability to adapt to automation and AI advancements. By failing to integrate AI into their entire workflow, such businesses risk missing out on transformative operational changes, leading to stagnant growth.[130]

Firms that do not integrate with AI may lose out on opportunities to enhance efficiency and innovate, potentially leading to a decline in competitiveness.[131] AI can automate tasks, reduce costs and facilitate the development of new

[127] 'The Advantages of Data-Driven Decision-Making: HBS Online.' 2019. Business Insights Blog. August 26, 2019. https://online.hbs.edu/blog/post/data-driven-decision-making

[128] Bombalier, Janelle. 2024. 'The Competitive Advantage of Using AI in Business.' College of Business. October 15, 2024. https://business.fiu.edu/academics/graduate/insights/posts/competitive-advantage-of-using-ai-in-business.html.

[129] Gonçalves RAHG and others, 'Gaining Competitive Advantage through Artificial Intelligence Adoption' Inderscience Publishers (2022)

[130] Mthokozisi Hlatshwayo, 'The Integration of Artificial Intelligence (AI) Into Business Processes' Research Gate (2023) https://www.researchgate.net/publication/375489528_The_Integration_of_Artificial_Intelligence_AI_Into_Business_Processes

[131] Daniel F Spulber, Antitrust and Innovation Competition, Journal of Antitrust Enforcement, Volume 11, Issue 1, March 2023, Pages 5–50. https://academic.oup.com/antitrust/article/11/1/5/6593929

products and services.[132] While non-adoption of AI can lead to immediate competitive disadvantages for individual firms, it may also have broader implications for market competition and regulatory oversight

3.8 User Sector Survey Findings and Stakeholder Perspectives

This section consolidates the empirical findings from the market study, including survey results and insights gathered through stakeholder interviews and focus groups. The research methodology encompassed a comprehensive examination of AI adoption patterns, implementation strategies, decision-making applications, and efficiency outcomes across various user sectors. The market study surveyed participants from diverse industries including BFSI, healthcare, IT, manufacturing, retail, e-commerce, and logistics. Respondents included professionals in leadership positions spanning digital marketing, legal and policy, product management, and technical project management. The survey specifically explored three key dimensions of AI implementation: (1) adoption patterns across industry sectors, (2) applications in monitoring and decision-making processes, and (3) competitive advantages gained through AI-driven innovations.

3.8.1 AI Adoption Across User Industry Sectors

The primary survey of user industries reveals a diverse landscape in which AI is being adopted across multiple industries. The results show that while sectors such as BFSI, healthcare, IT, and manufacturing lead with a 52% adoption rate, more consumer-facing industries such as retail and e-commerce, marketing, and logistics/delivery follow at 24%, 14%, and 10% respectively.

Within these varied sectors, the primary focus of AI applications is on enhancing customer interactions, with 62% of organisations implementing AI to engage with customers. For instance, companies are leveraging chatbots, virtual assistants, and personalised recommendation engines to create seamless user experiences. In marketing and advertising, these tools are used to automate campaign management, optimise ad targeting, and generate dynamic content based on real-time consumer behaviour.

The survey also highlights that more technical applications—such as those used for supply chain management and pricing strategies—are gaining traction, with 21% and 14% of organisations respectively deploying AI solutions in these areas. In the context of supply chain management, AI is used to track inventory, forecast demand, and optimise logistics networks, whereas in pricing, dynamic

[132] Mayer Brown. 2024. Expert Q&A on the Competition Law Issues Raised by Generative AI. Mayer Brown Publications. https://www.mayerbrown.com/-/media/files/perspectives-events/publications/2024/07/expert-qanda-on-the-competition-law-issues-raised-by-generative-ai.pdf

pricing models help companies adjust in real time to changes in demand and competition.

Technologically, ML is the backbone of most AI implementations, as reported by 76% of respondents, which underscores the industry's reliance on advanced data analysis and pattern recognition. In addition, a substantial 48% of organisations are utilising NLP to enhance customer service and data interpretation, while 45% are working with LLMs that support more complex, context-aware applications.

Overall, this distribution not only illustrates a significant momentum toward data-driven decision making but also emphasises a customer-centric approach across industries. The varied percentages across different sectors indicate that while traditional industries such as BFSI and healthcare are rapidly innovating with AI, consumer-facing sectors are strategically leveraging these technologies to improve both operational efficiency and customer engagement in a highly competitive market.

3.8.2 Industry and Investor Perspectives on AI Implementation

AI adoption now permeates critical operational functions across B2B and B2C sectors, creating notable market dynamics relevant to competition oversight. In e-commerce, comprehensive AI integration spans supply chain management and customer service, with chatbots resolving a major portion of customer inquiries, alongside sophisticated marketing personalisation through dynamic content generation.

Across multiple sectors, businesses have deployed ML algorithms and NLP powered chatbots for continuous customer support. The primary technologies implemented include predictive analytics for inventory optimisation, LLMs for marketing content generation, and dynamic pricing engines capable of adjusting thousands of Stock Keeping Units (SKUs) hourly.

Established market incumbents have articulated several consumer and social benefits derived from AI implementation such as:

- Increased accuracy through AI/ML techniques originally developed for specific consumer applications (e.g., predictive analysis) now extends to broader societal applications, notably improving cancer screening accuracy, as demonstrated by AI systems that surpasses human experts in breast cancer detection.
- Automated systems potentially enhance decision-making fairness through consistent criteria application that eliminates human subconscious biases.
- AI optimisation contributes to improved safety and sustainability outcomes. Implementation of AI for data center cooling management has reduced energy consumption significantly, creating both environmental benefits and potential cost advantages.

- Improved productivity and efficiency of human workers by saving time on mundane processing tasks and boosting the quality of human decision making. For example, CV algorithms have enabled the City of Memphis to detect potholes that need repair, resulting in the more efficient deployment of work crews.

Finally, some stakeholders assert that AI technologies may "level the playing field" by enabling smaller firms to perform tasks that previously required extensive human resources.

3.8.3 AI's Role in Monitoring and Decision-Making Processes

AI's role in monitoring, predictions and decision making is substantial and multifaceted. Drawing on responses from a diverse group of industry professionals including leaders in digital marketing, legal and policy, product management, and technical project management from sectors such as BFSI, IT, manufacturing, consumer goods, healthcare, and e-commerce the user sector survey provided a rich contextual backdrop for these findings. For example, participants from organisations such as a major IT services firm, a global tool manufacturer, a digital payment innovator, a leading automotive company, a prominent banking institution, and a well-known graphic software company contributed insights, reinforcing the varied applications of AI across multiple fields.

According to the survey data, approximately 90% of respondent organisations leverage AI to monitor customer behaviour whereas around 27% utilise AI for supply chain efficiency monitoring. This underscores a strong industry focus on customer-centric applications. In terms of predictive capabilities, about 69% of respondents rely on AI for demand forecasting, 21% use it to predict inventory needs, and 24% for forecasting pricing trends.

3.8.4 Efficiency Gains and Competitive Advantages from AI Implementation

The survey of user industry reveals that AI-driven innovations have significantly enhanced market efficiency. According to the survey, 48% of respondents reported substantial efficiency improvements, while 24% experienced moderate gains. A major contributing factor to these enhancements was the deployment of predictive analytics cited by 69% of organisations as having the greatest impact on their operations. Companies leverage real-time data and ML models to anticipate consumer needs more accurately, enabling them to adjust inventory and pricing strategies almost instantaneously. This agility means that firms can maintain leaner inventories while reducing waste and ensuring that supply more closely aligns with consumer demand, ultimately fostering a more competitive marketplace.

Furthermore, advanced pricing strategies and automated logistics management were highlighted by 38% and 24% of respondents, respectively, as crucial for

bolstering operational efficiency. The widespread implementation of dynamic pricing algorithms enabled by AI has further optimised resource allocation, reduced waste, and improved responsiveness to demand fluctuations. Collectively, the survey results illustrate that AI-driven innovations are not only enhancing operational efficiency but also catalysing fundamental shifts in market structure. These changes are characterised by more responsive pricing strategies, streamlined operations, and a paradigm shift towards data-centric decision-making. Such transformative effects are paving the way for more agile market dynamics, enabling businesses to rapidly adapt to evolving consumer preferences and competitive pressures in an increasingly digital economy.

In content creation and marketing, Gen AI tools are streamlining workflows through automated copy production and dynamic creative optimisation. These capabilities provide particular advantages to digital-native businesses, enabling faster market responses at lower costs. The combined effect of these innovations enhances resource allocation efficiency while enabling greater competitive agility in rapidly evolving markets. These productivity gains may create significant advantages for early adopters, potentially reshaping competition dynamics across sectors.

3.9 Pro-competitive aspects for MSMEs

AI is driving improvements in efficiency, reducing errors, and streamlining operations across various sectors in India, especially for enterprises that do not have the same capabilities as larger organisations.[133] According to NASSCOM,[134] despite challenges in fully realising AI's competitive advantages, there is a strong belief that AI can provide Micro, Small, and Medium Enterprises (MSMEs) with a competitive edge, enabling them to compete in the market effectively.

Market competition has a positive correlation with smaller and medium enterprises' performance in emerging economies, whereby they can enhance performance through cost leadership and innovation-oriented differentiation strategies.[135] MSMEs in India, which contribute significantly to the country's economy, have the potential to serve niche markets,[136] particularly those that larger organisations may overlook due to their smaller scale. By leveraging AI into their extant business processes, MSMEs gain a deeper understanding of their target audiences, enabling them to offer highly personalised products and services tailored to specific needs.

Further, AI enables faster decision-making and adaptability to market changes.

[133] Adib Bin Rashid, MD Ashfakul Karim Kausik, 'AI revolutionizing industries worldwide: A comprehensive overview of its diverse applications' Hybrid Advances, Vol. 7 (2024). https://doi.org/10.1016/j.hybadv.2024.100277

[134] 'Empowering India's Growth: Unlock AI's Potential for Tech-Enabled MSMEs' Nasscom, https://nasscom.in/ai/ai-enablement/pdf/enablement-of-ai-for-msme-whitepaper.pdf

[135] Yariv Taran, Harry Boer, Peter Lindgren, 'A business model innovation typology' Aalborg Universitet, Vol. 46 (2015). https://doi.org/10.1111/deci.12128

[136] 'MSME Industry in India' India Brand Equity Foundation, https://www.ibef.org/industry/msme

Through AI-powered analytics, MSMEs can make more informed decisions in real-time, in contrast to larger, more bureaucratic organisations that often struggle to respond swiftly to shifts in market conditions or customer preferences.[137,138] This agility gives MSMEs a competitive edge over slower-moving, larger organisations. Additionally, AI helps MSMEs optimise resource allocation, ensuring that investments are made in areas that yield the most significant impact while avoiding wasteful expenditure, mitigating supply chain risk and gaining sustainable competitive advantage.[139]

Larger organisations have already integrated AI into their operations; however,[140] the adoption of AI by MSMEs has the potential to level the playing field. A notable case study is that of ElasticRun, a data-centric commerce and logistics company in India that uses AI to streamline product supply for grocery stores, helping small independent owners access stock availability more efficiently. By leveraging technologies such as Microsoft Azure and Kubernetes, the company automates logistics from ordering to delivery, managing orders from over 200,000 stores in 19,000 villages.[141]

Lastly, AI has the potential to streamline business operations, particularly in documentation and compliance processes.[142] For MSMEs, which may have smaller teams than larger organisations, AI can alleviate employees' workload, [143] by automating routine tasks and allowing them to focus on more complex issues. AI integration enhances operational efficiency and ensures smoother compliance procedures, allowing businesses to innovate and compete in the market.

Summary

The examination of AI applications across user industries in India reveals a landscape undergoing fundamental transformation, with technology adoption reshaping traditional business paradigms and operational frameworks. AI has

[137] Tor Sporsem, Anastasiia Tkalich, Nils Brede Moe, Marius Mikalsen, 'Understanding Barriers to Internal Startups in Large Organizations: Evidence from a Globally Distributed Company' SINTEF. https://arxiv.org/pdf/2103.09707

[138] Decision making in the age of urgency, McKinsey & Company https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Organization/Our%20Insights/Decision%20making%20in%20 the%20age%20of%20urgency/Decision-making-in-the-age-of-urgency.pdf

[139] Abhishek Behl, Jighyasu Gaur, Vijay Pereira, Rambalak Yadav, Benjamin Laker, 'Role of big data analytics capabilities to improve sustainable competitive advantage of MSME service firms during COVID-19 – A multi-theoretical approach' Journal of Business Research, Vol. 148 (2022). https://doi.org/10.1016/j.jbusres.2022.05.009

[140] For instance, DHL, which uses AI to enhance logistics operations, with a platform optimizing routes and schedules. AI-powered sorting robots, DHLBots, boost sorting capacity by 40%, sorting over 1,000 parcels per hour with 99% accuracy. These robots reduce missorting and eliminate secondary sorting. With growing shipment volumes, robots are essential for handling tasks more efficiently than humans, as seen in DHL's 17.3% volume increase in 2020. https://www.dhl.com/global-en/delivered/innovation/ai-in-logistics.html

[141] https://news.microsoft.com/source/asia/features/how-elasticrun-is-transforming-the-lives-of-grocers-in-indias-villages-with-cloud-and-ai/

[142] 'Research: Case Studies of Successful AI Implementations in Document Processing' KY & Company https://kyand.co/successful-ai-implementations-in-document-processing/

[143] CS Tanmay Mukund Pethkar, 'Artificial Intelligence (AI) in Corporate Governance: Transformative Trends and Legal Pathways in India' ICSI (2024). https://www.icsi.edu/media/webmodules/CSJ/August-2024/16.pdf

evolved from an experimental technology to an integral component of business strategy across diverse sectors including retail, e-commerce, logistics and delivery, marketing, BFSI, and healthcare.

The study reveals distinct patterns of AI integration across user industries, with each sector developing specialised applications tailored to their unique operational requirements. Retail and e-commerce enterprises have embraced AI for demand forecasting, inventory optimisation, and personalised customer experiences. The logistics sector has leveraged AI for route optimisation, warehouse automation, and predictive maintenance, while marketing organisations utilise AI for content creation, customer segmentation, and targeted advertising campaigns. This sectoral specialisation indicates the maturation of AI from generic tools to industry-specific solutions addressing particular business challenges.

User industries are realising substantial operational improvements through AI implementation. Organisations report enhanced efficiency in core business processes, improved decision-making capabilities, and the ability to deliver more personalised services to customers. The technology enables real-time data processing, predictive analytics, and automated workflows that contribute to cost reduction, improved service quality, and enhanced customer satisfaction. These operational enhancements demonstrate AI's capacity to drive measurable business value across different industry contexts. Also, AI capabilities are becoming essential for maintaining market relevance and competitive positioning.

The study findings indicate that ML, NLP, and LLMs represent the predominant technological approaches adopted by user industries. Organisations demonstrate varied implementation strategies, with many enterprises opting for third-party solutions while simultaneously building internal capabilities. This hybrid approach reflects the strategic importance organisations place on AI adoption while acknowledging the complexity and resource requirements associated with in-house development.

While substantial benefits are evident, user industries continue to navigate challenges including skill development, data quality management, and technology integration complexities. As organisations continue to mature their AI capabilities, the potential for further transformation and value creation across user industries remains substantial, indicating continued evolution in how businesses leverage AI to achieve strategic objectives and operational excellence.

CHAPTER 4

AI AND COMPETITION

While AI-driven advancements foster innovation and growth, they may also risk distorting competition and increasing market concentration. As AI is proliferating, competition issues are emerging within the AI industry as well as the user sectors. In the AI industry, major firms may leverage their control over data, infrastructure, and proprietary models to entrench their market position which may end up raising barriers to entry. In user sectors, the widespread deployment of opaque AI systems may raise the risk like algorithmic collusion, where pricing or strategic decisions may converge without explicit coordination, undermining fair competition. The lack of transparency in how AI systems make decisions also makes it difficult to detect or address such practices in real time. Ensuring a level playing field is essential to sustaining innovation and promoting competition. This chapter discusses the potential competition issues both within the AI industry and user industry based on the survey conducted as part of this study. Published literature and cases across the world are also referred to illustrate emerging competition issues.

4.1 Competition Issues in AI Industry and User Industries

The structure of the AI industry has evolved in a way that positions big technology firms with a significant advantage in data access. Through years of operating large-scale platforms and services, they have accumulated vast datasets. As new AI firms and startups increasingly rely on the infrastructure and cloud offerings of these hyperscalers, data often flows back to the incumbents, (depending on the nature of the agreements) further reinforcing their data advantage. This creates an uneven access to data which is skewed in the favour of big technology firms.

Big technology firms/hyperscalers are the primary providers of infrastructure, so the majority of AI developers and startups including new and upcoming players may have to enter into contractual arrangements in order to get access to infrastructure including high end computing capabilities. This leaves the startups with limited choice of suppliers creating bargaining power imbalance. This could lead to overdependence on these big technology firms/hyperscalers in future. This also has an implication for user firms regarding both price and access related uncertainty. In addition, there could be a situation where few major eco-systems may emerge, with users finding it difficult to switch from one ecosystem to another owing to compatibility issues and transaction costs leading to long-term dependency.

Competition issues in the development layer mainly arise due to usage of ready-to-use algorithms, APIs etc. by users to develop products or services. Any

changes or updates to the fundamental algorithm may lead to need for complete rewrite or redevelopment for the user, effectively tying them to a single stack or a specific OEM. For instance, such a situation may arise in developing models/applications using foundation models. Creation of a foundation model from scratch may not be feasible, may take a long time and is likely to be resource intensive. Further, creation of such models may not lead to sufficient adoption by user industry because such models may be late to market as compared to the existing models, which already have the first mover advantage.

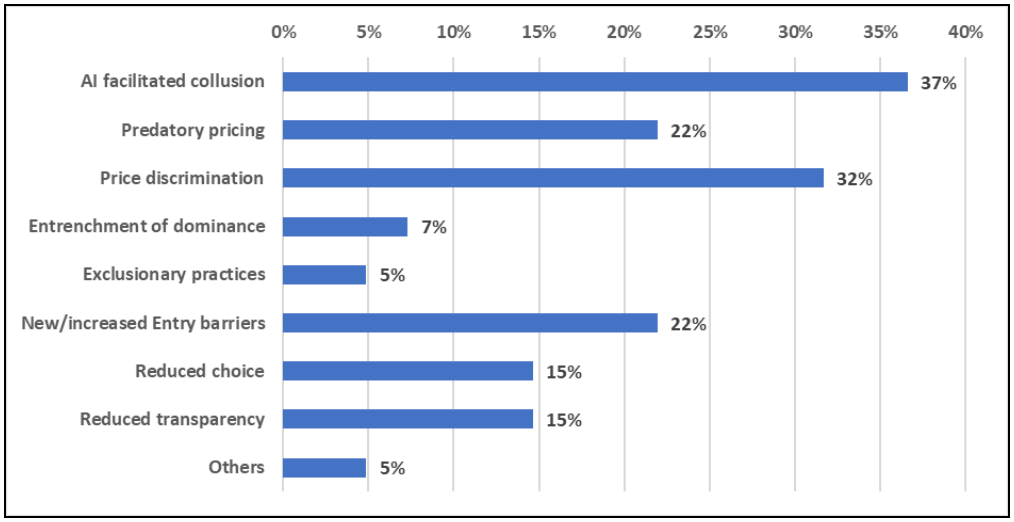
The growing adoption of AI across user industries is giving rise to novel potential competition concerns. One of the foremost issues in application of AI is the risk of algorithmic collusion, where enterprises, use AI-driven pricing algorithms that may learn to align prices over time. This can lead to outcomes similar to price-fixing, even in the absence of direct human coordination, making detection and enforcement by regulators far more complex.

Another significant concern is that enterprises that control vast datasets may be able to train more effective AI models, giving them a substantial competitive edge. This may entrench market power and create high barriers to entry for smaller or newer players, stifling innovation and reducing consumer choice.

The use of AI also enables highly targeted price discrimination, where enterprises use consumer data to set personalised prices in real time. While this can increase efficiency, it may also raise competition concerns, particularly when consumers are unaware that they are being charged different prices or when vulnerable groups are systematically disadvantaged.

Primary survey was conducted as a part of the study to understand the competition issues arising out of adoption of AI, as perceived by stakeholders. Survey of startups shows that perceived competition concerns associated with adoption of AI are mainly collusion, price discrimination, predatory pricing, limited choice, low transparency etc. Specifically, the significant issues highlighted by stakeholders are AI-facilitated collusion (37%), followed by price discrimination (32%) and new/increased entry barriers (22%). Other notable concerns include predatory pricing (22%), reduced choice (15%), and reduced transparency (15%). Further, entrenchment of dominance (7%) exclusionary practices (5%) were also indicated as potential challenges. The issues highlighted in the figure below are discussed in detail in the following sections.

Figure 9: Competition issues in AI industry



4.1.1 Algorithmic Coordinated Conduct (AI Facilitated Collusion)

AI Algorithms blur the line between explicit and tacit collusion. It is understood that use of pricing algorithms can facilitate tacit collusion between entities i.e. concertation without any agreement or communication to collude. Extensive use of pricing algorithms can lead to increased market transparency, speed of price changes and calculation of optimal prices, which together create favourable market conditions for collusion.[144] Algorithms can independently learn to coordinate prices and monitor competitors' actions without human involvement. Essentially, algorithms can replace explicit collusion with tacit coordination, creating new challenges for competition law enforcement.

As per literature, various pricing algorithms raising collusion concerns could be classified as monitoring algorithms, parallel algorithms, signalling algorithms, and self-learning algorithms.[145,146] The monitoring algorithms seek to capture the data about demand and prices through scraping or any other methods and act as messengers or data collection tools in pricing decisions. These algorithms require explicit collusion between humans for them to lead to any distortion in the market. Parallel algorithms or hub and spoke algorithms represent scenarios where multiple retailers may use a common third party or service provider to devise their pricing algorithms. While on their own such algorithms do not represent any collusive behaviour but since each hub is collecting data regarding all their spokes and in cases where market presence is substantial these algorithms could impact the overall prices in the market. Such a situation is also

[144] Antitrust Implications of Using Pricing Algorithms https://chambers.com/articles/antitrust-implications-of-using-pricing-algorithms

[145] Ezrachi, A., & Stucke, M. E. (2023). The role of secondary algorithmic tacit collusion in achieving market alignment. Working paper CCLP(L)54, University of Tennessee Legal Studies Research Paper https://ssrn.com/abstract=4546889 or http://dx.doi.org/10.2139/ssrn.4546889

[146] OECD (2023), "Algorithmic Competition", OECD Roundtables on Competition Policy Papers, No. 296, OECD Publishing, Paris. https://doi.org/10.1787/cb3b2075-en

referred to as "secondary algorithmic tacit collusion" in academic literature. Third kind of algorithm or signalling algorithms have the ability to respond to market conditions in limited ways based on sophisticated statistical models. These algorithms may not require an explicit collusion among the players in the market and may still clear the market at an above equilibrium price. If these algorithms act independently and respond to the market in a non-collusive manner that may not be a competition concern. Finally, self-learning algorithms are autonomously operating algorithms capable of using deep reinforcement learning to maximise profit responding dynamically to any changes in the market rapidly. The self-learning algorithms as well as the signalling algorithms do not require human intervention for explicit collusion. Although they may not have been designed to achieve any collusion, they may still reach collusive outcomes on their own depending upon the market conditions, by improving their outcome of profit maximisation with each cycle of learning. It may also be noted that above mentioned algorithms often operate as black-boxes making it very difficult for even authors of the algorithm or other third-party observers to understand the output at times.

Beyond pricing, algorithms could collude on other competitive parameters – allocating markets, limiting output, or even coordinating on bidding strategies in online markets. Collusion can also occur without explicit communication, via an algorithmic "middleman".

Therefore, unlike traditional collusion, AI can facilitate collusion without direct human coordination, as self-learning algorithms may independently adopt cooperative pricing strategies that maximise profits. It may also be noted that given the ready access to AI algorithms in today's world, most firms may want to use such algorithms or may want to create such algorithms using the available AI infrastructure. This makes the AI driven algorithmic paradigms different from the earlier simple deterministic rule-based settings for pricing dynamically based on the consumer ability to pay. AI-powered algorithms therefore, increase the risk of market collusion by enabling real-time data analysis including personalised data of the users, rapid price adjustments, and multi-market coordination, making collusive outcomes more stable and rewarding even if they may also end up benefiting customers in some cases by improving transparency and reducing information asymmetry from a pricing perspective.

A particular class of self-learning algorithms, based on deep reinforcement learning are the Q-learning programmes (Waltman & Kaymak, 2008), adapt their behaviour based on previous experience by engaging in actions that have more frequently resulted in success. By implementing Q-learning in an oligopoly-like economic setting, Calvano et al. (2020) found that simple pricing algorithms not only learnt to collaborate but also reached equilibrium above the conventional Nash-Bertrand price.

Assad et al. (2024), provided an empirical example in which the adoption of algorithmic approaches to pricing by German gasoline retailers caused an increase in margins. Furthermore, Ezrachi and Stucke (2023) pointed out that the alignment among spokes brought about by accessing the additional data harvesting capabilities of the hub may further contribute to aligning prices, even across heterogeneous and moderately concentrated markets. They also conclude that under conditions of high transparency of prices and high-speed responses to discounts by rivals, the algorithms of hubs may learn to collude and set higher prices for clients. Some well-known cases related to alleged algorithmic collusion or price-fixing, have been mentioned below:

a. Online poster retailers Topkins, US case[147]: A landmark case on pricing algorithms facilitating collusion was the Poster Cartel case decided by the US district court of Northern California in 2015. In this case David Topkins, director of a company selling posters online, was held liable for horizontal price fixing with other merchants on the Amazon platform. Having agreed with other merchants on the levels of prices and specific algorithms to be used, Mr. Topkins wrote a code for his company's algorithm to set prices on the posters as they were agreed with other merchants.

b. Trod/GB Eye case[148]: CMA's investigation into Trod Ltd was launched in December 2015, following receipt of a leniency application from Trod Ltd's competitor, GB eye Limited. To secure immunity from fines, GB eye confessed to the CMA that it had entered into an agreement with Trod whereby each agreed not to undercut the other's prices for wall posters and frames sold on Amazon's UK (United Kingdom) website and supplied evidence of the illegal agreement. In April 2015, the US Department of Justice (DOJ) announced the prosecution of David Topkins, the founder of Poster Revolution, an online poster retailer in the US. He was found guilty of conspiring with other online sellers to fix the prices of certain posters sold through Amazon Marketplace in the United States over the period from September 2013 to January 2014. The Federal grand jury in San Francisco indicted Trod Ltd in San Francisco in August 2015, and Daniel Aston, the boss of Trod Ltd, in December 2015, for separate but similar conduct. It seems that it was the existence of the DOJ's investigation that compelled GB eye Limited to confess its wrongdoing to the CMA in the UK. Trod pleaded guilty for fixing prices of posters in August 2016.

c. Online travel platform E-TURAS case[149]: In the EU the issue of pricing algorithms was considered by the Court of Justice of the EU in the E-TURAS case.[150] E-TURAS, an online travel booking system, sent messages to its

[147] US v Topkins [2015] https://www.justice.gov/atr/case-document/file/628891/dl?inline=

[148] https://www.nortonrosefulbright.com/en/knowledge/publications/7e7bdcca/online-retailers-should-tread-carefully-after-trod

[149] https://curia.europa.eu/juris/liste.jsf?&num=C-74/14

[150] C-74/14 "Eturas" UAB and Others v Lietuvos Respublikos konkurencijos taryba [2016] ECLI:EU:C:2016:42 http://curia.europa.eu/juris/liste.jsf?&num=C-74/14.

travel agents through the online system announcing technical restrictions to its pricing algorithm capping discounts at 3%. The Court of Justice confirmed that even though travel agencies did not formally respond to the message the fact that they were aware of such message, did not distance themselves from it and have subsequently continued to use the system, such agencies may be liable for the price-fixing cartel.

d. Realestate firm Proptech case[151]: The case started *ex-officio* when the Directorate of Competition of the CNMC (National Commission on Markets and Competition), the Spanish competition regulator became aware (through press releases and information available on websites) of the possible existence of a conduct consisting of fee fixing and sensitive information exchange by real estate intermediaries, relying on specialised platforms and specific software tools. The anticompetitive agreement was reached within a multiple listing service (MLS). MLSs consist of a database where members (real estate brokers and agencies) can share property listings and sales in that pool. When an MLS member finds a property (sale/rental) to list, it can upload the property in the system, so that other members have the chance to convert the sale/rental. The agreed fee (for the overall brokerage service offered) is finally distributed between the member which found the property and the one which finally made the sale/rental. While MLSs were not in themselves an issue, the MLS and the CRM (customer relationship management) software were designed in a such a way that a property could only be shared in the MLS if the member shared the information on the fee (when uploading the property) and the actual fee was above the established minimum of 4%. If the fee was below the agreed minimum, the property would not be uploaded in the MLS pool and the system would send a pop-up warning specifying the reason (the fact that the broker was not respecting the minimum fee). Deviations from the rules were monitored and could be punished with monetary fines and the ultimate exclusion from the MLS. Therefore, the membership in the MLS limited the incentives and the ability of real estate agencies to compete and set commissions independently. In December 2021, the CNMC's Board declared the existence of a cartel and sanctioned several companies with €1.25 million for entering into brokerage price-fixing and information-sharing agreements in online real estate intermediation. The companies fined were the two real estate franchisers, which had launched the system and drafted and enforced the rules, and several IT companies, which were running the MLS and which had adapted the CRM software in order to make sure that properties were uploaded only when complying with the rules.

e. Consumer electronic firms Asus, Denon & Marantz, Philips and Pioneer case[152]: In 2018 the EU Commission also emphasised that pricing algorithms can also facilitate vertical price fixing, in particular, in maintaining resale

[151] https://www.cnmc.es/expedientes/s000320
[152] https://ec.europa.eu/commission/presscorner/detail/en/ip_18_4601

prices. Thus, Asus, Denon & Marantz, Philips and Pioneer[153] were fined for resale price maintenance which was facilitated by use of price comparison web-sites (which in turn are based on pricing algorithms) and special pricing programme which helped producers to trace prices of online retailers, detect deviation and maintain a certain level of retail prices. All four companies cooperated with the Commission by providing evidence with significant added value and by expressly acknowledging the facts and the infringements of EU antitrust rules. The Commission therefore granted reductions to the fines depending on the extent of this cooperation ranging from 40% (for Asus, Denon & Marantz and Philips) to 50% (for Pioneer).

Scholarly work, work done by other competition authorities across the world and available empirical evidence, indicate that:

- Even simple algorithms can raise prices above competitive levels without entering into explicit collusion.
- Certain self-learning algorithms can independently learn to execute collusive strategies thereby driving prices above the equilibrium prices.
- Wide-scale adoption of algorithmic pricing software could lead to collusion in markets previously not susceptible to it.

4.1.2 Algorithmic Unilateral Conduct

Dominant enterprises can use algorithms to engage in abuse of market dominance. Such abuse of dominant position may manifest itself as algorithmic exclusionary conduct and/or algorithmic exploitative conduct. Algorithmic exclusionary conduct indirectly harms consumers through the exclusion of competitors in the market. A dominant firm can engage in algorithmic exclusionary conduct, when its algorithm prevents the competitors from challenging the dominant firm's market position. Algorithmic exclusionary conduct includes self-preferencing; predatory pricing; and tying and bundling. Algorithmic exploitative conduct on the other hand comprises imposition of unfair pricing; unfair conditions and price discrimination etc.

- Self-Preferencing

Self-preferencing is understood as an enterprise with market power favouring its own products and services over those of its rival competitors. AI algorithms may facilitate self-preferencing which can harm competition and consumers in multiple ways. For example, if a leading platform's search ranking algorithm favours its related entities at the expense of third-party players, through increased visibility, advertising exposure etc., it distorts competition and restricts consumer choice. Such practices enable leveraging in other markets, create barriers to entry, and drive competitors out of these markets. Self-

[153]Asus (Case No 40465) [2018] http://ec.europa.eu/competition/antitrust/cases/dec_docs/40465/40465_337_3.pdf

preferencing may also be done through techniques such as biased choice architecture, default settings, exclusive integration, limited interoperability etc.

Further, dominant enterprises may leverage their market power to promote their own AI solutions, potentially limiting competition and consumer choice. Self-preferencing of own products across the vertical AI tech stack can further reinforce presence across markets restricting access for smaller players, as leading enterprises control multiple stages of the AI value chain. For example, a startup or an AI developer and AI user can be an existing consumer of a Big Tech cloud computing service provider. While looking for any other associated services (such as data and foundational models), they may be nudged through self-preferencing to procure them from the same Big Tech company.

- Predatory Pricing

This involves the use of algorithms to set prices below cost or at unsustainable levels in the predation phase, with the strategic intent to undercut competitors, eliminate market rivals, and ultimately consolidate market power.

What differentiates AI-driven predatory pricing from traditional forms is the speed, scale, and precision with which algorithms can respond to competitor behaviour, market conditions, and consumer demand. AI systems can monitor competitors in real time, adjust prices dynamically, and identify the most vulnerable market players to target. Thus, AI could help implement predatory strategies successfully, by targeting below-cost pricing only for price-sensitive customers or customers at risk of switching, while leaving the pricing unchanged for other customers. Once competition is weakened or driven out, prices may be raised to recoup losses.

While such strategies may benefit consumers in the short term through lower prices, they pose significant long-term competition risks, including reduced innovation, market concentration, and higher consumer prices post-elimination of rivals. Regulatory bodies are also increasingly concerned about the opacity of algorithmic decision-making and the difficulty in proving intent or identifying harm in real time.

- Tying and Bundling

Tying of products involves selling the tying product and tied product together. Similarly, bundling of products may be pure or mixed with lower price being offered for the bundle. Algorithmic targeting enables enterprises with market power to make higher profits by identifying and offering the less price sensitive (inelastic) customers tied bundles at high price, while simultaneously offering discounted bundles to more price sensitive customers.
Further, Big Tech companies may weave in-house AI tools or applications into their core products like search engines, browsers, and operating systems etc. While this speeds up adoption of AI, it also makes it tough for smaller competitors to enter the market/s. Cloud giants may bundle their AI models with cloud services, making it harder for independent AI providers to compete.

Moreover, such products and services may lock in customers, reinforcing the dominance of major players.

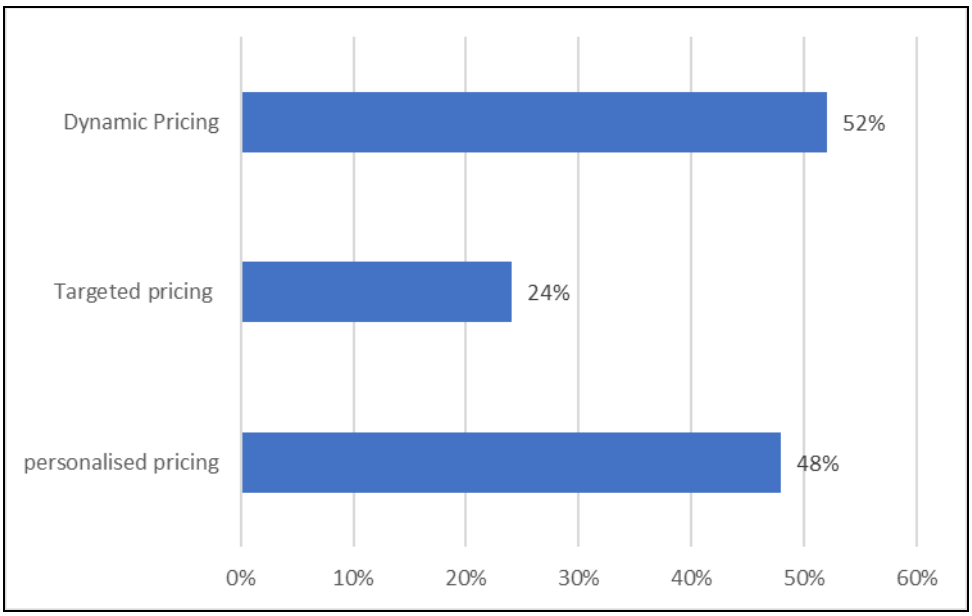
- Price Discrimination

AI-driven price discrimination is emerging as a strategic pricing tool, enabled by advanced analytics and ML. By leveraging real-time consumer data such as browsing behaviour, location, device type etc., firms can segment customers with high precision and tailor prices according to customers' willingness to pay. While this approach can drive revenue optimisation and improve conversion rates, it introduces potential regulatory risks. Key concerns include lack of transparency, reduced consumer trust, particularly for vulnerable segments. It is desirable that enterprises carefully balance commercial objectives with fairness and compliance considerations while adopting such strategies.

4.1.3 Pricing Practices: Dynamic, Targeted and Personalised

Major pricing related practices arising in the AI market are personalised pricing, targeted pricing and dynamic pricing. The survey of AI users also highlights growing usage of AI-driven pricing practices. Dynamic pricing emerged as the most common practice cited by 52% of respondents. Personalised pricing was identified as practice in vogue by 48% of respondents. Finally, targeted pricing was identified as a common practice by 24% respondents.

Figure 10: Algorithmic pricing practices



Adoption of AI enables firms to process an increasing volume of data on consumers and their characteristics. This allows firms to set prices not just based on broad categories of consumers, but in some cases individually tailored prices based on estimates of the consumer's willingness to pay, consumer profiling as ascertained using multiple data points, also called personalised

pricing.[154] In particular, AI applications may be able to generate inferred data (such as consumption preferences, brand loyalty, and purchasing behaviours) based on data provided by and observed about consumers in a way that was not possible beforehand.[155] While data can make some degree of personalisation possible in many digital markets, AI decision-making can enable more extensive, accurate and granular personalisation. AI can be used to personalise the functionality and information provided to consumers. In fact, personalisation may become significantly amplified because of AI applications. For example, it can play a role in the ranking of products in a search query, or in the timing and content of notifications directed to consumers.[156] Further, this personalisation may occur without a consumer's knowledge. In many cases, personalised pricing can be beneficial, increasing total output and consumer welfare. It may also allow firms to set a lower price and profitably sell to consumers that would not be willing to pay the uniform price that firms would otherwise set. Similarly, the ability to offer targeted discounts might help new entrants to compete, particularly in markets with high switching costs.[157]

However, there are other situations where personalised pricing could lead to consumer harm. The conditions under which competition authorities might be concerned about personalised pricing include where there is insufficient competition. In addition, personalised pricing could cause consumers to lose trust in online markets. It could also be harmful for economic efficiency when personalised pricing increases search and transaction costs.

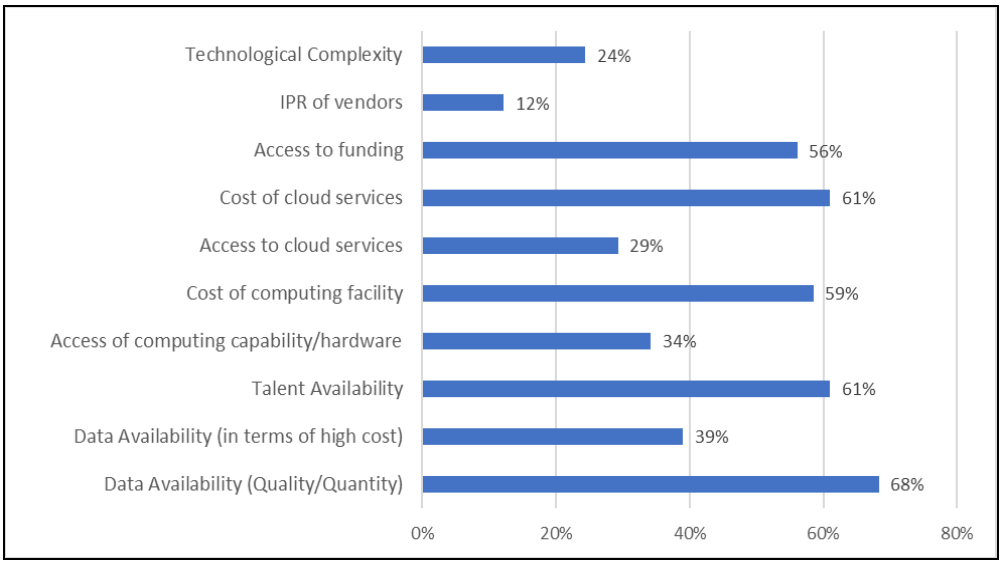
Enterprises may use algorithms to identify users of rival products and implement "selective pricing" or use behavioural nudges in order to lure them away.[158] Such strategies could constitute an exclusionary abuse of dominance, depending on the circumstances. Other concerns are associated with dominant firms exploiting its market power by using an algorithm to impose excessive prices on some consumers.

4.1.4 Entry Barriers

Barriers to entry can prevent or impede entry of new players in the market and entrench power of the existing players. Barriers to entry can include access to essential inputs, high startup costs, regulatory hurdles, or other obstacles that prevent new competitors from entering the market. They benefit existing firms by foreclosing competition and entrenching the position of the incumbent. In the primary research, startups were asked about entry barriers in the AI industry. Survey results show that the major barriers to entry in the AI industry that startups and smaller companies face when trying to compete with established firms are data availability, cost of cloud services, talent availability etc.

[154] OECD (2018), Personalised Pricing in the Digital Era: Background note by the Secretariat
[155] Ibid
[156] Competition and Markets Authority (2021), Algorithms: How they can reduce competition and harm consumers
[157] Ibid
[158] OECD (2018), Personalised Pricing in the Digital Era: Background note by the Secretariat

Figure 11: Barrier(s) to Entry



As can be seen from the chart above, as per 68% respondents, data availability (quality/quantity) is the most significant barrier, as AI models require vast amounts of high-quality data, which is often controlled by large corporations. The cost of cloud services (61%) and talent availability (61%) also pose significant challenges, as AI development demands substantial computational power and highly skilled professionals, both of which are expensive and difficult to access.

Other obstacles include the high cost of computing facilities (59%) and limited access to funding (56%), making it difficult for new entrants to invest in the necessary infrastructure. Additionally, data availability in terms of high cost (39%) and access to computing capability/hardware (34%) further restrict innovation, as AI requires specialised and costly hardware such as GPUs and TPUs. Access to cloud services (29%) also remains a challenge, as cloud computing is essential for scaling AI solutions but can be expensive or restricted by major providers.

While technological complexity (24%) is recognised as a barrier, it is not as pressing as financial and resource-related challenges. Lastly, intellectual property rights (IPR) of vendors (12%) is the least concerning factor, suggesting that proprietary AI technologies and patents are not the primary roadblocks to entry.

The ability to participate in AI development depends, among other factors, on access to data, computational resources, talent and funding. The stakeholder feedback indicates that large technology firms may have ready access to compute, vast volumes and variety of data, financial capital etc., which may provide them with a competitive advantage over new or potential entrants. This may create barriers to entry for startups and smaller companies, limiting competition and potentially slowing innovation.

The survey suggests that while AI creates new forms of competitive advantage that could influence market power distribution in the long term it may simultaneously also lower certain entry barriers.

The findings of the study with regard to various potential entry barriers are discussed below:

- Availability of Data

All AI companies survive and thrive on data. Data can be classified in two categories i.e. open- source data and closed-source data. Open-source data is publicly available for anyone to use, modify, and distribute, while closed-source data is restricted and only accessible to specific individuals or organisations. Governments, research institutions, and organisations provide open data to encourage transparency and innovation.[159] Closed source data is restricted and proprietary, meaning access is limited to authorised users. This data is often used for commercial, security, or privacy reasons. Examples include transaction & financial records, and medical patient data. Such data is protected by intellectual property laws, non-disclosure agreements (NDAs), and organisational policies.[160]

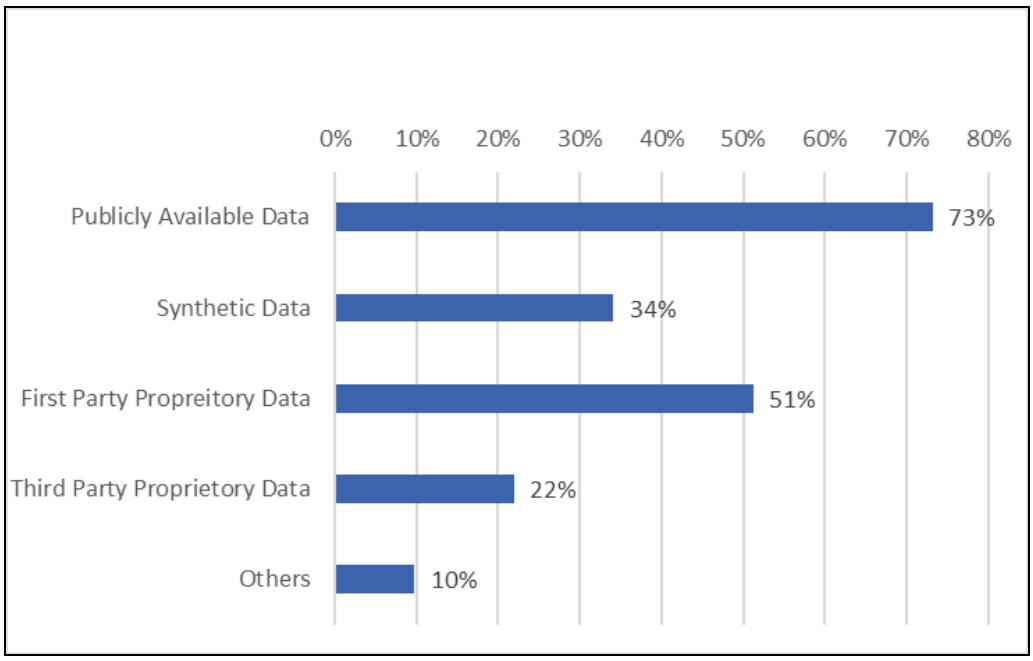
AI foundation model developers and use-case application developers identified non-availability of good quality data as major entry barriers by the startups. Large technology companies have an advantage in data availability, although some AI's developers and users are now using synthetic and open-source data, which is available easily. However, the majority of the startups in the application development segments mentioned that closed-source data are not easily available to train their models. There is room for improvement in accessing closed source data, after appropriate aggregation and anonymisation of these datasets.

Although startups have access to open data sources, with 73% of them using open-source data to train their models, they are also using synthetic data. Publicly available data remains an essential resource for Indian companies doing AI research and development. Depending on the business requirements, there are instances in which third-party proprietary data such as social media data, are used to train the models. Lack of AI-relevant data for startups might be a challenge.

[159] https://opendatahandbook.org/

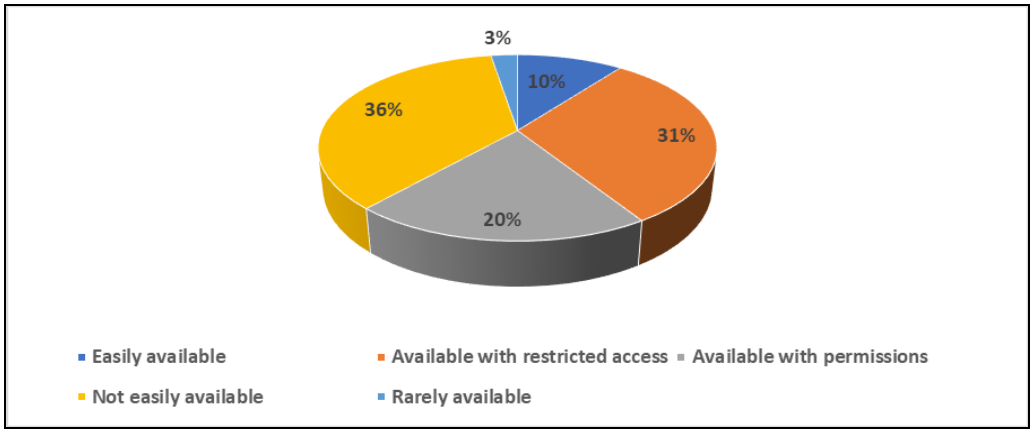
[160] Kitchin, R. (2014). The Data Revolution: Big Data, Open Data, Data Infrastructures and Their Consequences. Sage Publications

Figure 12: Sources of data



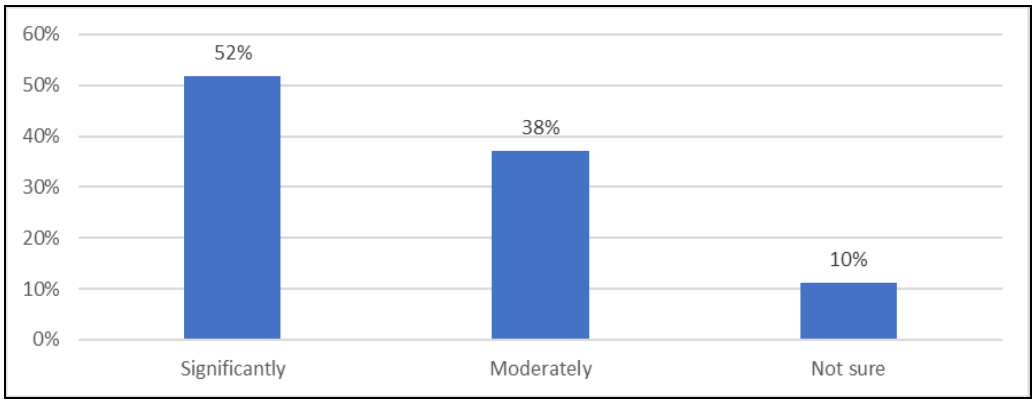
The figure below shows that data availability varies significantly. Only 10% of respondents have said data is easily available, while the majority falls under restricted access (31%) or requires permissions (20%). According to 36% of respondents, data is not easily available. This suggests that data is not freely accessible, often requiring permissions or facing restrictions, which may impact efficiency and decision-making process.

Figure 13: Ease of Data Access



52% of the AI user industry believe that large companies with more access to data have a significant advantage in using AI, while 38% acknowledge some advantages due to availability of data with some incumbents.

Figure 14: Data advantage to large firms

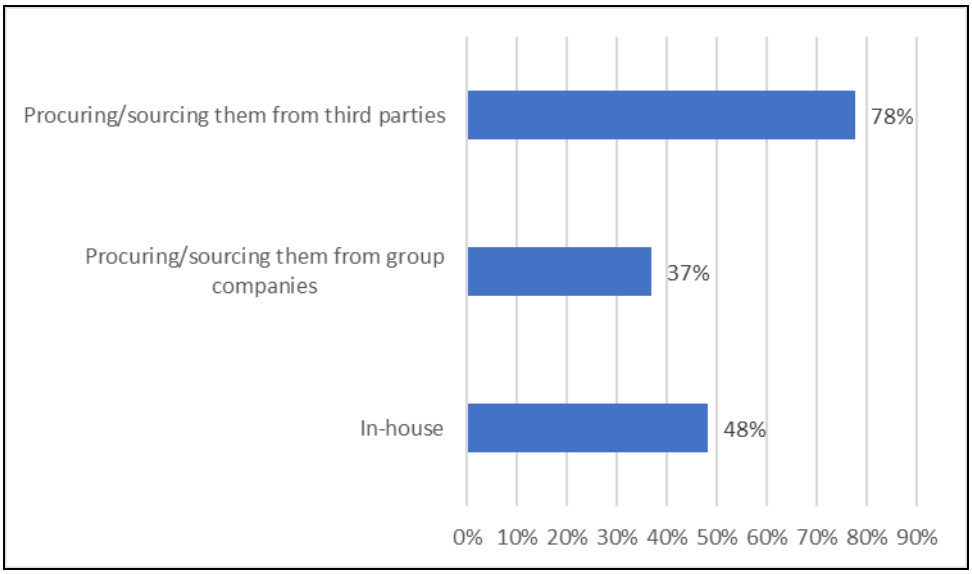


Surveyed startups indicated that organisations that possess or have access to a larger volume of data have an advantage over their competitors and that the same may act as an entry barrier for those not having similar access.

- Source of AI application development

The sourcing strategy for AI applications in the user industry also plays a role in competitive positioning, with 78% of AI user firm respondents relying on third-party AI solutions as given in the chart below. While this approach reduces development costs, it may create dependency risks and limit the unique competitive advantages derived from proprietary AI systems.

Figure 15: Source of AI application development



- High Cost of Infrastructure

AI infrastructure providers play a crucial role in enabling the development, deployment and scaling of AI applications. They offer the foundational technologies required for AI-driven innovation across industries. By providing the necessary hardware, software and services, these infrastructure providers

empower startups, enterprises and researchers to build innovative AI applications efficiently and at scale.

Indian enterprises and research institutions have begun investing in advanced hardware to support AI workloads. International technology companies are collaborating with Indian firms to provide AI-optimised hardware, such as GPUs and TPUs, to accelerate AI model training and deployment. However, dependency on imported components and limited indigenous manufacturing remain a challenge.

Training large AI models requires immense computational power, and startups are dependent on cloud services from global IT companies. These services are expensive, constraining AI innovation by startups. Without competitive alternatives, the cost of innovation rises, and the ability to build independent AI solutions remains constrained. There is apprehension, as echoed by the startups, that access to cloud services is one of the biggest entry barriers. Startups are finding scaling up of their operations and availability of markets for their products as significant challenges.

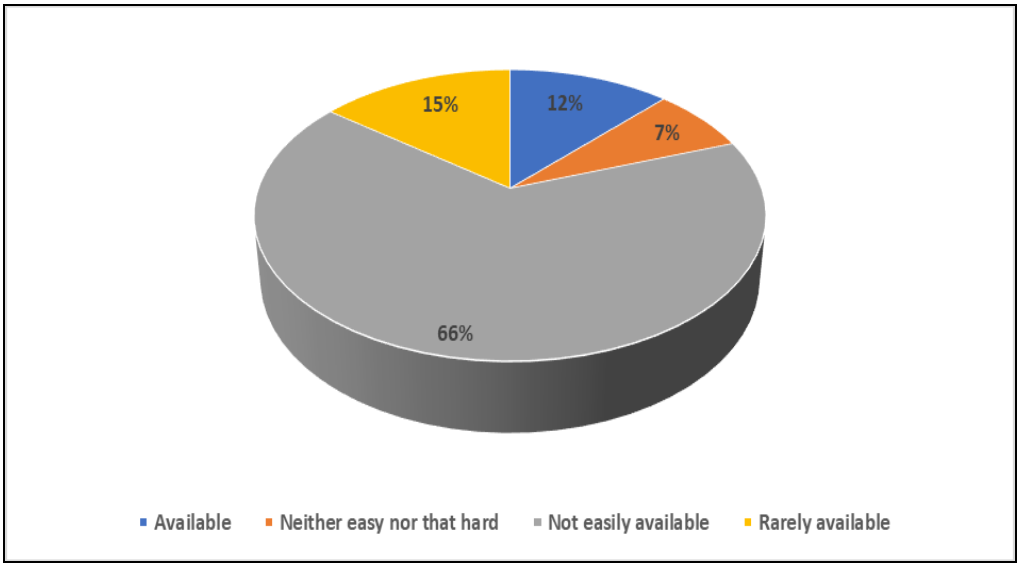
The AI ecosystem remains concentrated in the hands of a few firms, which control essential resources like computing power and large-scale datasets. This creates challenges for Indian startups looking to develop AI-driven solutions, as they must navigate market barriers and access constraints in a highly centralised industry.

The foundation models are provided by handful of firms. Even access to high-quality, large-scale datasets remains largely controlled by few companies. Due to this, startups in India that aspire to build AI-driven solutions often find themselves apprehensive about the overwhelming market concentration in the AI ecosystem. Some of the AI startups find complex technology and IPR of vendors as entry barriers.

- Availability of Skilled Resources

The Indian AI market has seen rapid growth over the past few years, driven by increased adoption across industries and within organisational functions. A skilled workforce proficient in ML, data science and AI development is essential for driving innovation and maximising AI’s potential. This section assesses skill availability and gaps. There appears to be a dearth of AI experts, especially among startups. Many companies resorted to training their employees in the skills they needed.

Figure 16: Availability of skilled resource



The chart indicates significant challenges in finding skilled professionals. 12% respondents have stated that talent is somewhat accessible. The majority (66%) report that talent is not easily available, with an additional 15% stating it is rarely available. The growing AI market has created a surge in demand for skilled professionals across industries. A study conducted by BCG-NASSCOM[161] highlights that demand for AI talent in India is expected to grow at 15% CAGR till 2027 to serve the AI market.

Since India has the second largest annual supply of STEM graduates in the world[162], base-level hiring is not difficult, but the higher order skills and capability is said to be a challenge. There is an increased focus on re-skilling the employees for simpler AI roles and up-skilling existing tech employees on advanced AI skills. To address the skill gap in AI technologies, companies are investing heavily in employee training. Companies are designing in-house training programmes, partnering with ed-tech platforms, collaborating with universities and technical institutes to upskill their employees. In 2024, 52% of companies resorted to in-house talent development and for consuming AI-as-a-Service. Enterprises are also increasingly relying on external service providers to kick-start their AI journeys due to the limited availability of domain and technology skills in AI.

- Availability of Funds

Survey findings indicate that 83% of startup respondents invest in-house funds in their business. Access to venture capital (VCs) and government funding was difficult for the majority of the ventures. Startups face challenges not only in obtaining initial funding but also obtaining continuous funding. In the absence of

[161] BCG-NASSCOM Report on AI powered Tech Services: a Roadmap for Future-ready Firms
[162] "State of Data Science & AI Skills in India – Data and the Art of Smart Intelligence" https://nasscom.in/knowledge-center/publications/state-data-science-ai-skills-india-data-and-art-smart-intelligence

appropriate valuation models, startups do not get valued and find it difficult to obtain the next level of funding.

Angel investors support 44% of startups, playing a significant role in external funding. Other funding sources, such as government schemes (15%) and miscellaneous sources (20%), contribute relatively less. While external funding options exist, startups depend on self-financing to sustain and grow their businesses.

Figure 17: Source of funding of AI startups

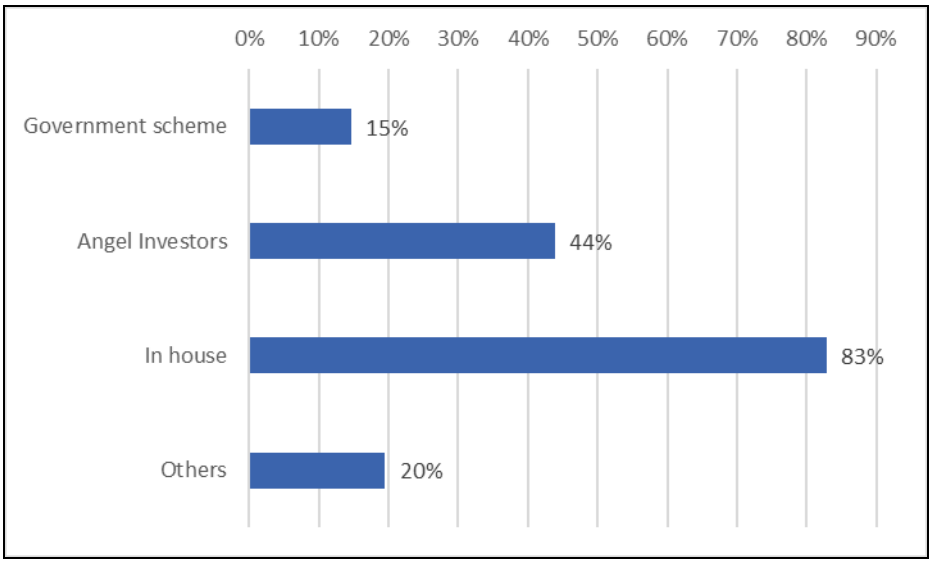
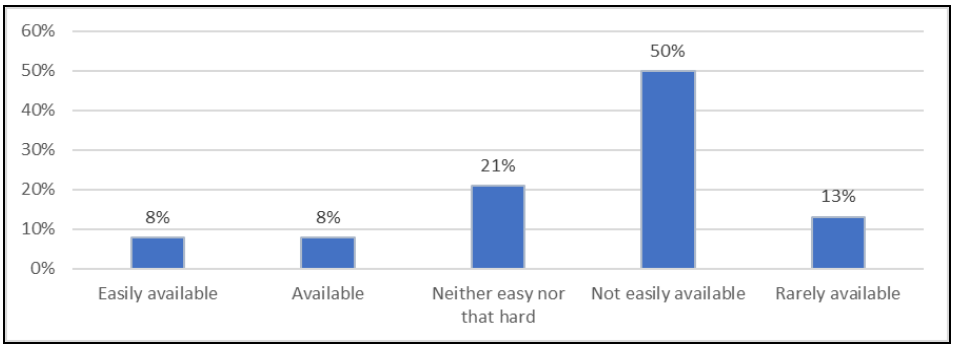


Chart below shows that 16% startups are able to avail next level funding. As per the survey, 21% startups are indifferent about the ease of next level funding, but the majority 50% of the startups report that funding is not easily available. Additionally, 13% say funding is rarely available, which suggests that while some funding options exist, most startups encounter significant difficulties in accessing the capital needed for growth and scaling up.

Figure 18: Availability of next level funding of AI startups



4.1.5 Reduced Transparency and Reduced Choice

As the startups rely on foundational models, infrastructure, and platforms provided by a few large players, the lack of visibility into how these systems operate, including opaque APIs, black-box algorithms, and unclear pricing

structures, creates uncertainty and dependency. This lack of transparency may hinder innovation and may complicate compliance. Simultaneously, reduced choice in infrastructure and model access limits the ability of smaller players to compete effectively, forcing them into ecosystem lock-in and reducing overall market dynamism.

4.1.6 Network Effects

Digital markets often exhibit network effects. AI markets may also provide settings where indirect or data network effects could arise. Markets for foundation models or generative AI, where downstream applications are broad, may generate indirect network effects where the value of these technologies increases with the number of downstream applications that are used for or integrated into. Recent research has pointed to the relationship between AI and data network effects, in which as more user data is collected by an AI system the success of these technologies improves, in turn attracting more data generating users.[163]

Platforms such as social media or e-commerce benefit from network effects because as more users participate, AI algorithms improve, making the platform more attractive and reinforcing its market power. Network effects are often bolstered further with the usage of AI algorithms. As large firms consolidate their positions, smaller firms may find it increasingly difficult to compete on innovation alone, leading to less overall market dynamism.

4.1.7 Mergers & Acquisitions and Partnerships

The AI industry is a rapidly evolving, innovative and dynamic industry with high growth potential. The growth in the industry is taking place organically as well as through mergers, acquisitions, partnerships etc. These strategies enable players to expand their presence across the layers of the AI stack, have access to inputs such as data, technology, compute etc. Big tech firms are also adopting these approaches to consolidate and enhance their position.

To further bolster their presence in the Indian market, major players operating in the Indian AI market are also employing various strategies, including mergers and acquisitions, partnerships, joint ventures, licence agreements and new product launches.

The Indian AI landscape has witnessed acquisition activity in recent years, with AI startups emerging as a focal point for strategic investments. For instance, Gupshup has undertaken a series of strategic acquisitions including AskSid (April 2022)[164], an AI-based conversational platform; Active.Ai (April 2022)[165], a cloud-

[163] Artificial Intelligence and Competition, Discussion Paper -March 2024, Competition Bureau Canada

[164] https://www.gupshup.io/resources/press-releases/gupshup-acquires-asksid-the-leading-conversational-ai-platform-for-ecommerce-and-retail-companies

[165] https://www.gupshup.io/resources/press-releases/gupshup-acquires-active-ai-the-leading-conversational-ai-platform-for-banks-and-fintech-companies

based AI conversational banking platform; and Knowlarity (January 2022)[166], a cloud telephony solution, for a substantial USD 100 million. Freshworks has also pursued an aggressive acquisition strategy, targeting companies like Device (May 2024)[167] for USD 230 million, Flint (July 2020)[168], Answeriq (February 2020)[169], Joe Hukum (July 2017), Chatimity (October 2016), and Airwoot (April 2016)[170]. Other players such as Haptik, acquired conversational startups like Convrg (July 2019) and Buzzo.ai (September 2019)[171], while 24/7 AI acquired Engageclick (April 2016), Campanja (August 2015), and Voxify (February 2012)[172] for USD 39 million. More recently, iMerit acquired Ango.ai (October 2023)[173]. The acquisition landscape includes backed startups like Natero (backed by Y Combinator) and Konotor (backed by Qualcomm Ventures and Accel). These strategic moves reflect the growing importance of AI-powered customer engagement solutions in the Indian technology ecosystem, with transactions concentrated in conversational AI, chatbots, customer support automation, and data analytics platforms.

In the user industry recently, India's AI landscape has witnessed several acquisitions across the retail, e-commerce, logistics and delivery, and marketing sectors. For example, in 2018, Flipkart acquired the Bangalore-based Liv.ai to integrate advanced speech recognition capabilities into their platform, enabling voice-based shopping in multiple Indian languages.[174] In the same year, Flipkart also acquired Upstream Commerce, an Israeli firm specialising in automated competitive pricing and product assortment optimisation, strengthening their e-commerce capabilities.[175] In 2021, Amazon India expanded their digital retail reach by acquiring Perpule, a Bangalore startup offering a cloud-based point-of-sale and store management solution designed to digitise traditional kirana stores.[176] Meanwhile, in the marketing domain, Reliance Jio's 2019 acquisition of Haptik[177] provided a robust conversational AI platform for customer engagement, and Reliance Industries' 2019 acquisition of Reverie Language Tech brought advanced multilingual NLP to their digital ecosystem.[178] In the logistics space, Swiggy's 2019 acquisition of Kint.io – focused on deep learning and computer vision (CV) for object recognition – enhanced their visual discovery

[166] https://www.bloomberg.com/news/articles/2022-02-02/chatbot-startup-gupshup-buys-knowlarity-in-100-million-deal
[167] https://www.freshworks.com/press-releases/freshworks-completes-acquisition-of-device42/
[168] https://techcrunch.com/2020/07/09/freshworks-acquires-it-orchestration-service-flint/
[169] https://economictimes.indiatimes.com/small-biz/startups/newsbuzz/freshworks-buys-ml-ai-provider-answeriq/articleshow/74327984.cms?from=mdr
[170] https://www.vccircle.com/freshworks-buys-chatbot-startup-joe-hukum-in-eighth-acquisition
[171] https://www.haptik.ai/blog/haptik-acquires-buzzo-ai/
[172] https://tracxn.com/d/acquisitions/acquisitions-by-247.ai/__iPrM6--6gmxBCN2WP6xtjJzeEn4jBXF_HgbAEfbIuVQ#list-of-acquisitions
[173] https://www.crunchbase.com/acquisition/imerit-acquires-ango-ai--dafcb757
[174] https://www.livemint.com/Companies/G3xizf7B81qqaU3INYC49L/Flipkart-buys-AI-startup-Livai.html
[175] https://www.livemint.com/Companies/4G9JiFNxPxRukRX0Sqej4N/Flipkart-acquires-Israelbased-startup-Upstream-Commerce.html
[176] https://www.livemint.com/companies/news/amazon-acquires-perpule-to-bolster-kirana-tech-play-11617116966624.html
[177] https://www.vccircle.com/reliance-to-acquire-87-stake-in-chatbot-maker-haptik
[178] https://www.business-standard.com/article/news-cm/reliance-industries-to-acquire-reverie-language-technologies-for-rs-190-cr-119022300472_1.html

and delivery tracking capabilities,[179] while Zomato's 2018 acquisition of TechEagle Innovations aimed to develop drone-based autonomous deliveries.[180] More recently, Shiprocket announced a deal in 2022 with Wigzo Tech, a Delhi-based company specialising in an AI-driven customer data platform for personalised marketing automation,[181] and in 2019, Netcore Solutions acquired Boxx.ai to bolster their AI personalisation engine for e-commerce marketing.[182]

The big technology/hyperscalers having their presence across multiple layers in the AI stack are engaging with startups in various ways. Some mergers and acquisitions entered into by the players may lead to unilateral or co-ordinated competition concerns. In the case of a conglomerate merger, where post-merger the combined firm competes in multiple related markets, it may create the ability or the incentive for the firm to engage in anti-competitive tying strategies. Mergers, of any form, involving a firm who supplies compute inputs, such as AI chips and cloud services, could warrant competition assessment due to the existing high levels of concentration in these markets. Further, mergers in AI markets may require scrutiny as large established firms may seek to acquire emerging competitors as a means of preventing or lessening competition.[183]

The AI ecosystem is also witnessing partnerships amongst players across layers in the AI stack. These partnerships can spur growth and innovation by facilitating access to critical inputs, technologies etc. However, such partnerships in the AI space may also raise competition concerns under certain conditions. For instance, exclusive partnerships may distort the competitive landscape by foreclosing access to essential resources. Even non-exclusive agreements, may create dependencies and lock-in due to high switching costs thereby having exclusionary outcomes. For instance, an AI application developer or an AI user may stick to only one platform service provider due to high switching costs. Further, partnership arrangements entered into by large firms may lead to further strengthening of their market position. In July 2024, the UK's Competition and Markets Authority (CMA) initiated an investigation into the partnership of Alphabet (Google's parent company) with AI startup Anthropic.[184]

Acquisitions and partnerships in the AI space may thus be scrutinised for their likely effect on competition, based on the competition law frameworks in different jurisdictions.

4.2 Competitive advantages from use of AI

Though there are emerging competition issues in the AI ecosystem, however, AI is also becoming instrumental in fostering innovation and competition. As

[179] https://www.livemint.com/companies/startups/swiggy-acqui-hires-ai-startups-kint-io-1549274944344.html
[180] https://yourstory.com/2018/12/zomato-makes-bet-drone-delivery-acquires-techeage-drone-delivery-startup
[181] https://www.vccircle.com/zomato-backed-shiprocket-to-pick-75-stake-in-data-platform-wigzo-tech
[182] https://www.vccircle.com/marketing-platform-netcore-buys-ai-startup-boxx-ai-unicorn-india-ventures-exits
[183] Artificial intelligence and competition Discussion paper- March 2024, Competition Bureau Cananda
[184] http://www.gov.uk/cma-cases/alphabet-inc-google-llc-slash-anthropic-merger-inquiry

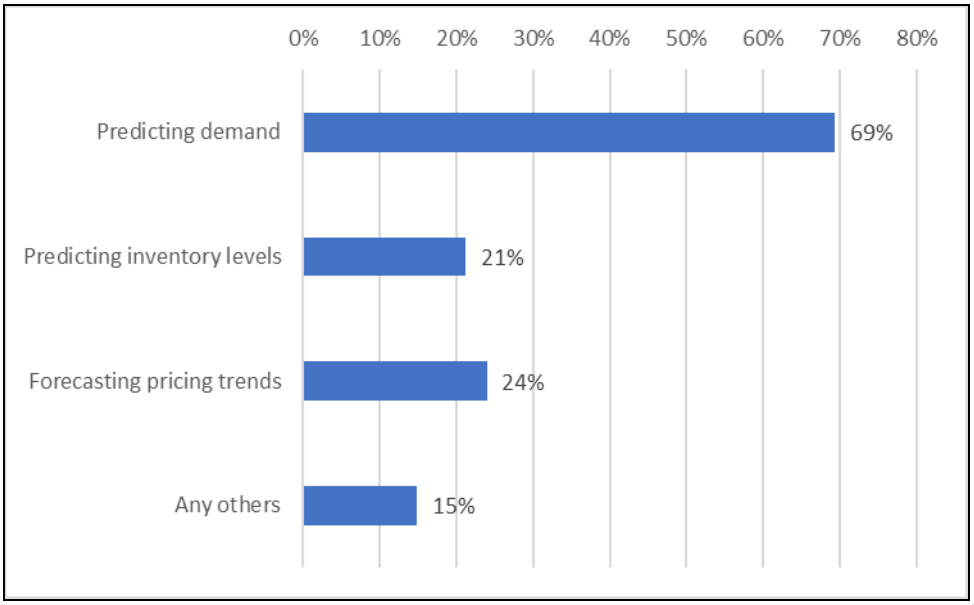
discussed earlier in the report, AI accelerates product development cycles, enables real-time market responsiveness, and fosters more dynamic pricing and service models, all of which heighten competitive pressure. As firms race to harness AI capabilities, the pace of innovation increases, compelling continuous improvement and value creation across the ecosystem. This creates a more competitive and adaptive marketplace, benefiting end consumers through better products, services, and experiences.

AI enhances supply chain management through improved demand forecasting, inventory optimisation and logistics planning. In marketing, AI enables personalised customer experiences and more targeted campaigns. AI adoption also leads to better sensing, seizing and reconfiguring of market opportunities and creates new sources of a competitive advantage through human–machine capabilities. AI applications in retail create value through automation, hyper-personalisation, complementarity and innovation.

For the AI user industry, the primary advantages lie in operational efficiency and cost reduction. AI technologies enable firms to streamline operations through automation, predictive analytics and real-time data integration. In logistics and delivery, AI optimises routing and fleet management, reducing fuel costs and delivery times. Predictive maintenance ensures minimal downtime, thereby improving asset utilisation (Sharma et al., 2022). Similarly, in retail and e-commerce, AI helps optimise inventory management by predicting demand fluctuations and automating supply chains. This allows companies to reduce overhead costs, avoid stockouts and maintain leaner inventories (Kumar & Gupta, 2022). These efficiencies give AI adopters a cost advantage over competitors who rely on traditional methods, allowing them to offer lower prices and improve profit margins.

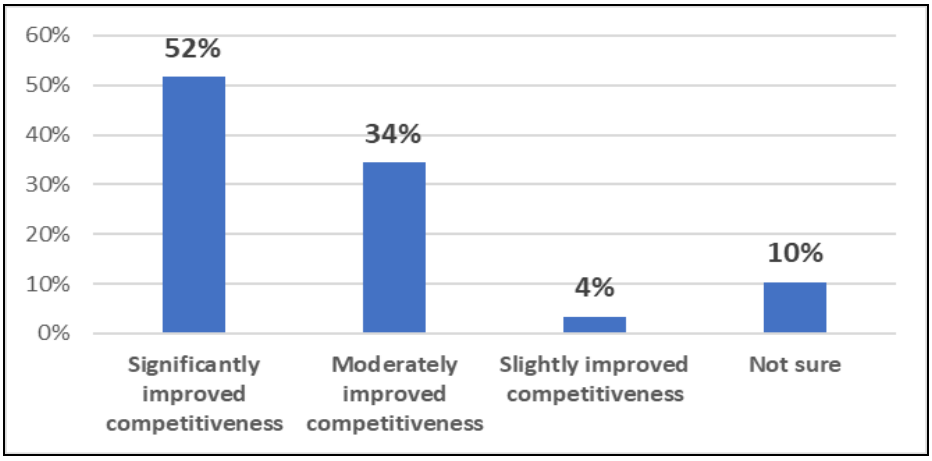
The user industry survey response indicates that 69% of the companies are using AI for predicting demand. Only 24% are using it for forecasting pricing trends, 21% are using it for predicting inventory levels leading to optimisation of inventory costs.

Figure 19: Use of AI in prediction



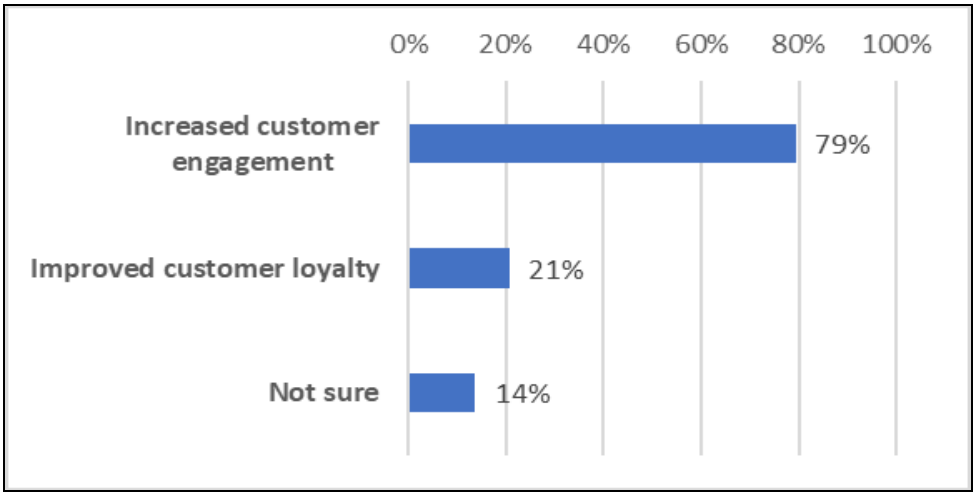
The integration of AI technologies in user industries has profoundly affected market structure, conduct and performance. A significant majority (52%) of the AI user industry reported that use of AI has substantially improved competitiveness in their user industry by providing innovative competitive edge over their competitors who do not use AI. Another 34% of AI user respondents have noted moderate improvements.

Figure 20: Influence of AI on Competitiveness



This enhanced competitiveness is reflected particularly in consumer engagement, where 79% of users observe increased customer interactions facilitated by AI. However, the impact on customer loyalty appears more limited, with only 21% reporting improvements in this area.

Figure 21: Effect of adoption of AI on consumer behaviour

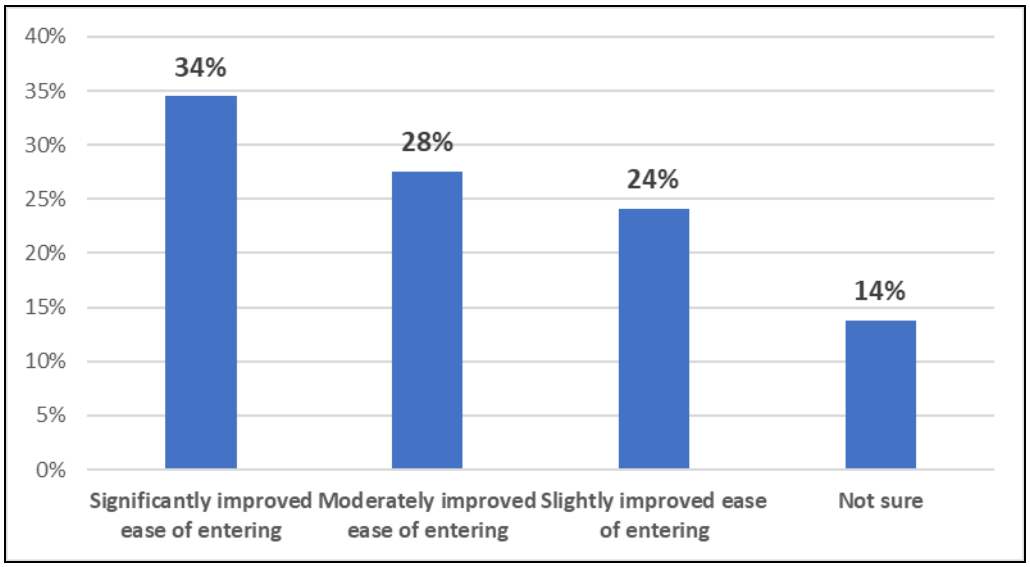


On the consumer engagement front, the AI user industry benefits from personalisation and enhanced customer experiences. In retail and e-commerce, AI-driven personalisation engines analyse customer data to tailor product recommendations, marketing content and pricing strategies to individual preferences, thereby increasing customer satisfaction and loyalty. This ability to offer personalised experiences gives AI adopters a competitive edge, as consumers increasingly expect tailored interactions. Moreover, in marketing, AI enables targeted advertising, where firms can use ML algorithms to analyse customers' behaviour and preferences to deliver more relevant ads.

AI non-adopters may face significant disadvantages in terms of customer engagement. Without AI-driven personalisation, non-adopters rely on generic advertising and broad customer engagement strategies, which are less effective at retaining customers and driving sales. As consumers become more accustomed to personalised experiences, firms that cannot deliver these experiences risk losing their market shares to competitors that can. Additionally, non-adopters in marketing struggle to match the efficiency of AI-enabled firms in managing large-scale advertising campaigns. Programmatic advertising, which automates the buying and selling of ad space using AI, enables firms to optimise their ad spend and improve their return on investment. Non-adopters, in contrast, rely on manual processes that are slower and less efficient, reducing the overall effectiveness of their marketing efforts (Verma & Rao, 2021).

From the AI user industry perspective, 62% respondents have stated that AI has significantly or moderately improved the ease of entering their industry. Details of survey data are given in chart below.

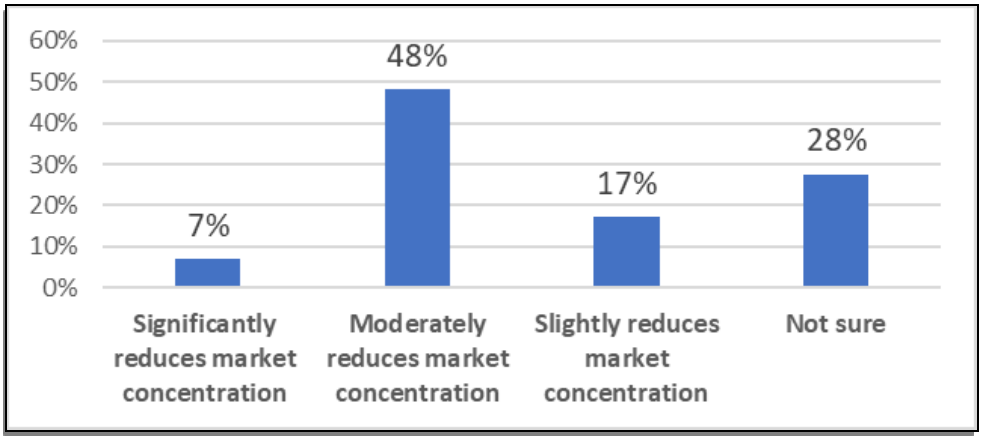
Figure 22: Impact of AI on ease of entering business



Thus, the survey suggests that while AI creates new forms of competitive advantage that could influence market power distribution in the long term it may simultaneously also lower certain entry barriers.

In terms of market concentration 48% of respondents believed that AI moderately reduces market concentration and 7% believe that it significantly reduces market concentration. However, 28% of respondents are unsure about the same.

Figure 23: AI impact on market concentration



Thus, AI adoption in user industries has significantly enhanced competitiveness by accelerating product development, enabling real-time responsiveness, and fostering innovation. Applications like predictive analytics, inventory optimisation, and personalised marketing allow AI adopters to outperform non-adopters in customer engagement and service delivery. Firms leveraging AI benefit from operational efficiencies, cost reductions, and better market agility, which may translate into growth and improved market position.

Summary

AI is reshaping the competitive dynamics in both the AI industry and its user industries. It underscores that while AI brings about innovation, efficiency, and new market opportunities, it may introduce challenges related to market concentration, entry barriers, and anti-competitive practices.

In the AI industry, hyper-scalers—Big Tech firms—have established a stronghold through their control over essential infrastructure, proprietary foundation models, and vast proprietary data. This may create high entry barriers for startups and smaller players, who face challenges in accessing quality data, cloud services, skilled talent, and funding. Moreover, the dependency on proprietary platforms may increase switching costs and reduce long-term flexibility for new entrants.

Self-learning algorithms, especially those using deep reinforcement learning, have the potential to autonomously learn collusive pricing strategies, undermining traditional antitrust enforcement. Cases such as Topkins in the U.S. and GB Eye in the U.K. illustrate how algorithmic tools can be used to fix prices and manipulate markets. Even in the absence of human coordination, algorithmic behaviour may lead to supra-competitive pricing.

AI may also enable anti-competitive conduct such as predatory pricing, self-preferencing, and price discrimination. Dominant firms can dynamically adjust prices to eliminate competitors and then recoup losses, a strategy that harms long-term market health. Bundling AI solutions with existing products may further consolidate market power, making it harder for independent providers to survive. Personalised pricing may raise competition concerns, especially when transparency is lacking.

The chapter highlights the evolving landscape of AI-related mergers and partnerships and attendant competition issues. While such alliances may foster innovation, they also carry the risk of potential competition concerns.

Though there are emerging competition issues in the AI ecosystem, AI also has pro-competitive effects and brings competitive advantage to user industries. AI adoption enhances productivity, improves customer engagement, reduces costs. In sectors like retail, logistics, and marketing, firms that embrace AI may outperform non-adopters in efficiency, innovation, and responsiveness. Firms leveraging AI may thus benefit from cost reductions, and better market agility, leading to growth and improved market position.

CHAPTER 5

LEGAL AND REGULATORY FRAMEWORKS

Regulators in various jurisdictions, such as the European Union (EU), the United Kingdom (UK), the United States (US), Japan, China and India, are actively assessing how AI influences market dynamics. This chapter captures the approaches and framework(s) adopted by the governments and the regulatory agencies, to address the novel issues and challenges posed by the AI ecosystem.

The primary research included a survey and structured interviews to ascertain the stakeholder(s) perspectives on the AI ecosystem: big tech companies, startups, user industries and legal & policy experts. The interviews and focused group discussions were organised to collect first-hand data, which brought out key aspects of legal and regulatory frameworks as well as suggestions for future regulations. The interactions facilitated discussions on key themes, including understanding of competition issues in the AI sphere, key applicable regulations for AI development and deployment in India, challenges in complying with existing regulations, the effectiveness of the current regulatory regime in safeguarding competition, and the role of competition regulators in the AI ecosystem.

5.1 Evolution of Legal and Regulatory Frameworks

Given the potential role of AI in competition, regulators are proactively and closely examining emerging and novel challenges, including competition issues. The legal and regulatory frameworks governing AI have been evolving rapidly across jurisdictions, each adopting unique approaches influenced by their legal traditions, economic interests and societal values. This section provides a comprehensive analysis of the development of AI regulations in major jurisdictions including, US, EU, UK, China, Australia, France, Canada and Japan.

5.1.1 United States of America

In the US, pre-existing laws may be relevant for the AI ecosystem. These include privacy laws such as; the Electronic Communications Privacy Act (ECPA) of 1986[185,186], protecting electronic communications from unauthorised government surveillance and the Children's Online Privacy Protection Act (COPPA) of 1998, regulating online data collection from children under the age of 13. Consumer protection laws, such as; the Federal Trade Commission Act (1914, amended multiple times), granting the FTC authority to combat deceptive and unfair trade practices. Anti-discrimination laws, including the Civil Rights Act of 1964, prohibiting discrimination in hiring and employment, and, the Fair

[185] https://bja.ojp.gov/program/it/privacy-civil-liberties/authorities/statutes/1285
[186] https://trumpwhitehouse.archives.gov/ai/ai-american-values/

Credit Reporting Act (FCRA) of 1970, regulating credit assessments and automated decision-making in lending.

From 2016, the U.S. government began acknowledging AI's societal and economic impacts, particularly; job displacement due to automation, economic inequality caused by AI-driven changes in employment, and the need for ethical AI systems and responsible development. The 2016 Report titled Artificial Intelligence, Automation, and the Economy[187] called for a balanced AI development and prioritising benefits for all citizens in the context of that AI advancements.

The American AI initiative (2019) [188] was launched to maintain the US's global AI leadership by promoting AI R&D, increasing access to federal data and resources and ensuring the safety and ethics of AI systems. The National Institute of Standards and Technology (NIST) began working on developing frameworks and standards for trustworthy AI, ensuring AI systems are secure, reliable and adhere to ethical standards. To attain these objectives, in 2019-2020, NIST developed AI-related standards, guidelines, and best practices and also released 'Four Principles for Explainable AI' (2020)[189], emphasising explanation, meaningfulness, explanation accuracy, and knowledge limits, in AI models.

Since 2021, the focus has gradually shifted more towards AI ethics, accountability and equity. NIST's ongoing development of the AI Risk Management Framework is central to this effort, aiming to provide voluntary guidelines for AI governance. Taking a step in this direction, in 2023, NIST released 'The AI Risk Management Framework' (AI RMF)[190] providing voluntary best practices for AI risk management.

In the US, key applicable laws pertaining to antitrust enforcement are the Sherman Act, the Clayton Act, and the Federal Trade Commission Act (FTCA). The Sherman Act prohibits every contract, conspiracy, or combination that restrains trade or commerce, and prohibits monopolisation and any attempt to monopolise. The Clayton Act, on the other hand, prohibits and addresses any harm that could potentially arise from certain practices that are not specifically prohibited under the Sherman Act, such as mergers and acquisitions, that may significantly lessen competition or create monopolies. The FTCA establishes the Federal Trade Commission (FTC). The FTC and Antitrust Division of the US Department of Justice (DOJ) are jointly responsible for the enforcement of the above laws.[191] The FTC and DOJ conducted a series of investigations into alleged anti-competitive practices by online digital platforms. The House Judiciary Committee and both Houses of Congress have approved twelve Bills to enhance

[187] Artificial Intelligence, Automation, And The Economy https://obamawhitehouse.archives.gov/sites/whitehouse.gov/files/documents/Artificial-Intelligence-Automation-Economy.PDF

[188] https://trumpwhitehouse.archives.gov/ai/ai-american-innovation/

[189] Four Principles of Explainable Artificial Intelligence https://nvlpubs.nist.gov/nistpubs/ir/2021/NIST.IR.8312.pdf

[190] AI Risk Management Framework - https://www.nist.gov/itl/ai-risk-management-framework

[191] Ibid

the regulation of large digital platforms in digital markets in the US.[192] AI driven competition issues may also get addressed under the aforesaid existing/proposed legislations.

In July 2021, an Executive Order on Promoting Competition in the American Economy ("Executive Order") was issued by the White House. The Executive Order encouraged the DOJ and the FTC to enforce antitrust laws to address challenges posed by the rise of dominant digital platforms owing to the acquisition of nascent competitors. The Executive Order also established the White House Competition Council within the President's Executive Office.[193]

Further, as per information available, the US Federal Trade Commission[194,195,196,197,198] provided guidance for the use of AI and ML, highlighting fairness and competition. It was emphasised that companies use AI in ways that are fair, transparent and competitive. Companies are encouraged to proactively address the risks associated with AI, and to verify that their AI systems are accountable and transparent. It urged that companies using AI must vouchsafe that their systems are fair and do not result in discriminatory outcomes.

On April 25, 2023, the Federal Trade Commission (FTC), the Civil Rights Division of the U.S. Department of Justice (DOJ), the Consumer Financial Protection Bureau (CFPB), and the U.S. Equal Employment Opportunity Commission (EEOC) released a joint statement[199] highlighting their commitment to "vigorously use [their] collective authorities to protect individuals" with respect to AI and automated systems, which have the potential to negatively impact civil rights, fair competition, consumer protection, and equal opportunity. These regulators intend to use their existing authority to enforce consumer protection and employment laws, which apply regardless of the technology used for making decisions or delivering products and services.

[192] https://prsindia.org/files/parliamentry-announcement/2024-04-15/CDCL-Report-20240312.pdf
[193] AI Risk Management Framework - https://www.nist.gov/itl/ai-risk-management-framework
[194] Federal Trade Commission, USA. Aiming for Truth, Fairness and Equity in Your Company's Use of AI https://privacysecurityacademy.com/wp-content/uploads/2021/04/Aiming-for-truth-fairness-and-equity-in-your-companys-use-of-AI.pdf
[195] The FTC Is Regulating AI: A Comprehensive Analysis https://www.hklaw.com/en/insights/publications/2023/07/the-ftc-is-regulating-ai-a-comprehensive-analysis
[196] Spiro, M. (2020). The FTC and AI governance: A regulatory proposal, Seattle Journal of Technology, Environmental & Innovation Law, 10(1), Article 2, https://digitalcommons.law.seattleu.edu/cgi/viewcontent.cgi?article=1001&context=sjteil
[197] Joint Statement On Enforcement Efforts Against Discrimination And Bias In Automated Systems, https://www.ftc.gov/system/files/ftc_gov/pdf/EEOC-CRT-FTC-CFPB-AI-Joint-Statement%28final%29.pdf?utm
[198] https://www.ftc.gov/system/files/ftc_gov/pdf/ai-accomplishments-1.17.25.pdf
[199] https://www.dwt.com/-/media/files/blogs/artificial-intelligence-law-advisor/2023/eeoccrtftccfpbaijointstatementfinal.pdf?rev=48dcf764e19242cab6379768cbd6c2bc&hash=6800938D001AE187DD72927944107B41

The FTC relied on its broad mandate under the FTC Act to pursue deceptive AI-driven practices, such as opaque algorithms in targeted advertising or undisclosed automated decision-making in e-commerce.[200,201]

At the state level, California's AI Transparency Bill (2022) mandates businesses to disclose when AI interacts with consumers, and Illinois' AI Video Interview Act (2020) regulates AI-based hiring tools to prevent discrimination.[202,203]

The courts and the regulators have also taken cognisance in various cases where AI systems were improperly used. For instance; in March 2019, Facebook was charged with improper use of AI. The complaint alleged that Facebook's advertising platform enabled and perpetuated housing discrimination. The core of the complaint was that Facebook's ad targeting tools allowed advertisers to exclude specific demographics from viewing housing ads, effectively enabling discrimination based on race, colour, national origin, religion, familial status, sex, and disability categories, and thus violating anti-discrimination laws. Beyond explicit targeting, the complainant alleged that Facebook's ML algorithms inherently favoured certain demographics over others. Even when advertisers did not specify exclusions, the platform's AI-driven ad delivery system disproportionately presented ads to specific groups, leading to unintentional yet systemic discrimination.[204] Facebook vehemently denied the allegations and argued that advertisers set their parameters, meaning AI was not solely responsible for bias. Moreover, AI was merely an optimisation tool, not an independent decision-maker. Rejecting Facebook's claims, a civil penalty of USD 115,000 was imposed, the maximum penalty ever imposed under the Fair Housing Act (FHA). Meta (the owner of Facebook) agreed to overhaul its ad targeting technology to ensure compliance with anti-discrimination laws and to develop and implement a new system, "variance reduction system" to ensure equitable distribution of housing ads across different demographic groups, preventing disproportionate targeting or exclusion. Additionally, Facebook had to remove "special audience" tools that could potentially enable advertisers to exclude protected classes.[205] Further, the company agreed to subject itself to regular third-party audits to ensure adherence to the settlement terms and the effectiveness of the new system in preventing discrimination.[206]

In another lawsuit, Clearview AI was sued by the American Civil Liberties Union (ACLU) for its facial recognition technology, which allegedly scraped personal data from the web without consent, raising significant concerns about privacy

[200] "FTC Announces Crackdown on Deceptive AI Claims and Schemes", available at, https://www.ftc.gov/news-events/news/press-releases/2024/09/ftc-announces-crackdown-deceptive-ai-claims-schemes

[201] "Federal Agencies Will Jointly Look for Bias and Discrimination in AI", available at https://www.dwt.com/blogs/artificial-intelligence-law-advisor/2023/05/ai-bias-civil-rights-ftc-cfpb-eeoc

[202] https://sd18.senate.ca.gov/news/california-state-senate-approves-california-artificial-intelligence-bill-rights

[203] https://www.ilga.gov/Legislation/ILCS/Articles?ActID=4015&ChapterID=68

[204] Benner, Katie; Thrush, Glenn; Isaac, Mike (28 March 2019). "Facebook Engages in Housing Discrimination with Its Ad Practices, U.S. Says". The New York Times

[205] https://aibusiness.com/companies/meta-unveils-new-ad-algorithms-to-settle-doj-lawsuit#close-modal

[206] Meta settles lawsuit with Justice Department over ad-serving algorithms". TechCrunch

and the ethical use of AI. In 2020, a lawsuit was filed against Clearview AI in an Illinois state court in Chicago, after the New York Times revealed that Clearview was building a secretive tracking and surveillance tool using biometric identifiers.[207] Face recognition technology helped Clearview capture more than three billion faceprints, and counting, from images available on social media platform such as; Facebook. It was alleged that Clearview violated privacy laws that required companies collecting, capturing, or obtaining an Illinois resident's biometric identifier, such as a fingerprint, faceprint, or iris scan, must first notify that individual and obtain their written consent. The company argued that publicly shared photos on websites and social media could be collected and used for its facial recognition database without violating privacy laws. However, Authorities ruled that Clearview AI's actions violated privacy laws. In May 2022, Clearview agreed to settle the 2020 lawsuit. The settlement prohibited the sale of its facial recognition database to private individuals and businesses.[208,209,210] These cases illustrate regulators' and courts' approaches for handling improper use of AI and data privacy violations.

5.1.2 European Union

In the early stages of AI regulation in the European Union, AI-related concerns could get captured under broader legal frameworks, particularly the General Data Protection Regulation (GDPR), which came into effect in May 2018.[211] While not explicitly designed for AI, the GDPR had relevance for AI governance by establishing strict data privacy and protection rules. It covered how digital systems could collect, process, and store personal data, ensuring that technology driven markets adhered to privacy rights and transparency requirements.

The regulatory discussions during initial period focused primarily on the ethical implications of AI, particularly in areas such as data protection, privacy, and human dignity. While, the EU recognised the potential risks of AI technologies it relied on existing legal instruments to address emerging concerns.

The AI Strategy for Europe known as "Artificial Intelligence for Europe", launched in 2018, marked the EU's coordinated effort to regulate AI.[212] The European Commission emphasised the need for AI to be trustworthy, ensuring that AI systems were developed in alignment with fundamental ethical principles, including fairness, accountability, and transparency. This period also saw a shift from general discussions on AI ethics to structured policymaking and research investments aimed at shaping the future of AI governance.

[207] https://www.nytimes.com/2024/06/13/business/clearview-ai-facial-recognition-settlement.html
[208] https://lawreview.law.miami.edu/take-it-at-face-value-court-approves-equity-based-settlement-in clearview-ai-facial-recognition-class-action/
[209] https://www.aclu.org/cases/aclu-v-clearview-ai
[210] https://www.theguardian.com/us-news/2022/may/09/clearview-chicago-settlement-aclu
[211] General Data Protection Regulation https://gdpr-info.eu/
[212] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2018:237:FIN

A major development was the establishment of the High-Level Expert Group on AI (HLEG) in 2018, tasked with creating ethical guidelines for AI governance. The Ethics Guidelines for Trustworthy AI, published in April 2019[213], set out seven key requirements for AI systems:

i. Human agency and oversight: AI should support human decision-making rather than replace it entirely.

ii. Technical robustness and safety: AI must be secure, reliable, and resilient to adversarial attacks.

iii. Privacy and data governance: AI must comply with GDPR principles, ensuring user privacy.

iv. Transparency: AI systems should be explainable and their decision-making processes clear.

v. Diversity, non-discrimination, and fairness: AI must be free from unjust biases.

vi. Societal and environmental well-being: AI should contribute positively to society.

vii. Accountability: AI developers and deployers must be responsible for their systems.

Simultaneously, the EU increased investment in AI research and innovation, laying the groundwork for future AI regulations. Funding programmes, such as Horizon 2020[214] (has been succeeded by Horizon Europe), allocated billions of euros to support responsible AI development, ensuring that European AI technologies remained competitive while adhering to ethical standards.[215]

The guidelines issued by EC[216] under the Digital Services Act (DSA) *inter alia* required large Online Platforms and Search Engines whose services could be used to create and/or disseminate Gen AI content to assess and mitigate specific risks linked to AI.

The EU AI Act was published in the Official Journal (OJ) of the European Union on 12 July 2024[217], which aims to establish a comprehensive legal framework for AI across the EU. The AI Act categorises AI systems into four risk levels[218], determining the level of regulatory scrutiny required:

[213] Ethics guidelines for trustworthy AI- https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai

[214] https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en

[215] https://carnegieendowment.org/research/2024/03/charting-the-geopolitics-and-european-governance-of-artificial-intelligence?lang=en

[216] https://ec.europa.eu/commission/presscorner/detail/en/ip_24_1707

[217] https://artificialintelligenceact.eu/the-act/

[218] https://artificialintelligenceact.eu/high-level-summary/

i. *Unacceptable Risk:* AI systems that pose a severe threat to fundamental rights and safety, such as social scoring by governments or manipulative AI used in child exploitation, are outright prohibited.

ii. *High Risk: AI* used in critical sectors such as healthcare, law enforcement, and employment must comply with strict requirements, including transparency, risk assessments, documentation, human oversight, and cybersecurity safeguards. These systems must be registered in an EU-wide database to ensure accountability.

iii. *Limited Risk:* AI applications with moderate risks, such as chatbots or deepfake detection tools, must meet transparency obligations by informing users that they are interacting with AI.

iv. *Minimal Risk:* AI technologies with negligible risks, such as spam filters or AI-powered recommendations, are largely unregulated to avoid unnecessary compliance burdens.

Currently, EU regulators are focusing on compliance and accountability, with strict penalties for violations. Companies that fail to comply with the AI Act could face fines of up to €35 million or 7% of global annual revenue whichever is higher, reflecting the EU's strong commitment to ensuring a safe and trustworthy AI ecosystem.[219] The AI Act, once fully enforced, may serve as a global benchmark for AI regulation, reinforcing the EU's leadership in ethical AI governance.

The EU's Digital Markets Act, 2022 (DMA) [220,221,222], is a pioneering regulatory framework that addresses the growing power of digital gatekeepers.

Gatekeepers often control crucial digital ecosystems, such as app stores, search engines, social networks and cloud services, which allow them to dictate the terms of access to their services for businesses and consumers. The DMA aims to regulate digital gatekeepers to prevent unfair practices that could stifle competition. The DMA defines an undertaking as a gatekeeper if it meets the stipulated criteria and outlines specific obligations relating to data access, interoperability etc. and prohibitions for such digital gatekeepers, addressing practices such as self-preferencing, tying and bundling etc. By imposing obligations on these platforms to ensure fair competition, particularly in terms of data access, interoperability and prohibiting anti-competitive practices, the DMA seeks to foster a more competitive and innovative digital economy.

[219] https://artificialintelligenceact.eu/article/99/
[220] European Union's The Digital Markets Act. https://digital-markets-act.ec.europa.eu/index_en
[221] European Commission. The Digital Markets Act: Ensuring Fair and Open Digital Markets. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/digital-markets-act-ensuring-fair-and-open-digital-markets_en
[222] The Digital Markets Act (DMA) – Regulation (EU) 2022/1925. https://www.eu-digital-markets-act.com/

AI being central to the functioning of many digital gatekeepers, some of the provisions may also address AI-driven competition issues related to their core digital services.

5.1.3 The United Kingdom

The UK initially adopted a regulatory approach that focused on promoting AI innovation. During this period, the UK's regulatory framework was closely aligned with the EU, with the General Data Protection Regulation (GDPR) being a major influence on AI governance.[223]

The government supported AI development through various funding initiatives and research programmes, positioning AI as a key driver of economic growth. Institutions such as UK Research and Innovation (UKRI)[224] played a role in funding AI research, and the government encouraged public-private partnerships to enhance AI capabilities without overregulating the sector.

With the release of the AI Sector Deal (2019)[225] as part of the UK's Industrial Strategy, the government signalled a more structured approach to AI governance. This plan focused on investment in AI research and development, improving AI-related skills, and building infrastructure to support AI-driven industries. The government recognised the need for ethical AI development while ensuring that regulation did not stifle innovation.

A significant step was the establishment of the Centre for Data Ethics and Innovation (CDEI) in 2018 (now known as Responsible Technology Adoption Unit (RTA))[226,227] which became a key advisory body for AI and data ethics. The CDEI's mandate included providing guidance on AI governance, promoting responsible AI adoption, and ensuring that AI systems adhered to ethical principles such as fairness, transparency, and accountability. The UK also started developing ethical AI frameworks, exploring sector-specific guidance rather than imposing broad, uniform regulations. This approach ensured that AI applications in healthcare, finance, and law enforcement had tailored governance structures suited to their unique challenges.

Following the Brexit, the UK began crafting an independent AI strategy, separate from the EU's regulatory framework. The 'National AI Strategy', launched in September 2021[228], outlined a long-term vision for AI development, focusing on sustained growth, international collaboration, and a pro-innovation regulatory approach.

[223] https://www.gov.uk/government/publications/ai-regulation-a-pro-innovation-approach/white-paper
[224] https://www.ukri.org/
[225] https://www.gov.uk/government/publications/artificial-intelligence-sector-deal/ai-sector-deal
[226] https://www.gov.uk/government/organisations/centre-for-data-ethics-and-innovation/about
[227] https://rtau.blog.gov.uk/2025/01/22/continuing-to-drive-responsible-adoption-of-technology/
[228] National AI strategy- HM government https://assets.publishing.service.gov.uk/media/614db4d1e90e077a2cbdf3c4/National_AI_Strategy_-_PDF_version.pdf

The CDEI provides guidance on AI governance, the Information Commissioner's Office (ICO) oversees AI-related data protection and privacy issues, ensuring compliance with post-Brexit data laws.

To enable the Competition and Market Authority (CMA) to promote competition in fast-moving digital markets, while protecting UK consumers and businesses from unfair or harmful practices by large technology firms, the UK has enacted the Digital Markets, Competition and Consumers Act 2024 (DMCC Act). The law will apply only to the large technology firms, with substantial and entrenched market power in a particular digital activity. If certain conditions are met, these firms can be designated with Strategic Market Status (SMS) in relation to a particular digital activity.[229] If the CMA designates a firm with SMS, it will have two key tools: Conduct Requirements and Pro-Competition Interventions.

- Through Conduct Requirements, the CMA may put in place one or more tailored rules for SMS firms - steps that require them to take certain action or to stop a specific activity.
- Through Pro-Competition Interventions, the CMA will be able to address specific competition problems arising from a firm's market power in a particular digital activity. The CMA can design and test interventions to address the competition problems and any harmful effects on users.

In view of the increasing application of AI in digital markets, the DMCC Act may provide a mechanism to deal with competition issues relating to AI for designated SMS firms.

The CMA published the report 'AI Foundation Models: Initial review'[230] in September 2023 which focused on the three themes; competition and barriers to entry in the development of foundation models, the impact foundation models may have on competition in other markets and consumer protection. In April 2024, a 'Technical Update Report'[231] has also been published wherein the three key interlinked risks to fair, open and effective competition are:

1. Firms that control critical inputs for developing foundation models (FMs) may restrict access to them to shield themselves from competition.
2. Powerful incumbents could exploit their positions in consumer or business facing markets to distort choice in FM services and restrict competition in FM deployment.
3. Partnerships involving key players could reinforce or extend existing positions of market power through the value chain.

[229] https://www.gov.uk/guidance/how-the-uks-digital-markets-competition-regime-works

[230] https://assets.publishing.service.gov.uk/media/64528e622f62220013a6a491/AI_Foundation_Models_-_Initial_review_.pdf

[231] https://assets.publishing.service.gov.uk/media/661e5a4c7469198185bd3d62/AI_Foundation_Models_technical_update_report.pdf

5.1.4 China

China invested in AI research and infrastructure, aiming to position itself as a global leader in AI development. Public and private sectors, including tech giants like Baidu, Alibaba, and Tencent, played an active role in AI advancements, particularly in fields like facial recognition, autonomous systems, and natural language processing.[232,233] The release of the Next Generation Artificial Intelligence Development Plan (2017)[234] marked a significant point in China's AI strategy. The key priorities of this plan included: strengthening AI research and infrastructure to enhance China's AI capabilities, fostering AI talent and workforce development through education and training programmes. The introduction of the Personal Information Protection Law (PIPL) in 2021[235] provided a comprehensive data privacy law.

5.1.5 Australia

Australia's regulatory approach was initially guided by existing legal frameworks related to data protection, privacy, and cybersecurity. The Privacy Act 1988[236] played a key role in regulating how AI-driven systems handled personal data, ensuring compliance with principles of transparency and consent. The Australian Consumer Law (ACL) of 2010[237] provided oversight in cases where AI-powered products and services impacted consumer rights, the Cybercrime Act 2001[238] could address situations where AI is used for malicious purposes, such as creating AI-powered malware or using AI to launch large-scale cyberattacks.

The Australian government focused on fostering AI innovation, supporting AI research through agencies like Data61 (a division of Commonwealth Scientific and Industrial Research Organisation- CSIRO) and promoting public-private collaborations to drive technological advancements.[239] As AI adoption expanded, Australia introduced policy frameworks to guide its responsible development.[240] Australia's AI Roadmap (2020)[241], developed by CSIRO's Data61, outlined strategic investments in AI-driven industries such as healthcare, agriculture, and cybersecurity, emphasising AI's role in economic growth. Simultaneously, the government introduced the Ethical AI Framework (2019),[242] which established core principles for AI governance, including transparency, accountability, and the

[232] https://www.cbinsights.com/research/china-baidu-alibaba-tencent-artificial-intelligence-dominance/
[233] https://www.linkedin.com/pulse/artificial-intelligence-status-china-kjeld-friis-munkholm-%E5%AD%9F%E5%8F%AF%E5%92%8C-gcyzf/
[234] http://fi.china-embassy.gov.cn/eng/kxjs/201710/P020210628714286134479.pdf
[235] https://personalinformationprotectionlaw.com/
[236] https://www.legislation.gov.au/C2004A03712/latest/versions
[237] https://consumer.gov.au/australian-consumer-law/legislation
[238] https://www.austlii.edu.au/cgi-bin/viewdb/au/legis/cth/num_act/ca2001112/
[239] https://www.csiro.au/~/media/News-releases/2019/Data61-OECD/Data61-OECD-Case-Study.pdf?la=en&hash=57DF06A9ED12274D74BE065106378E86716FB16D
[240] https://architecture.digital.gov.au/responsible-use-of-AI-in-government
[241] https://s899a9742c3d83292.jimcontent.com/download/version/1610650061/module/8284003163/name/AISCI-2020-Australia.pdf
[242] https://www.digitalpolicy.gov.hk/en/our_work/data_governance/policies_standards/ethical_ai_framework/doc/Ethical_AI_Framework.pdf

prevention of harm. Further, Australia's AI Action Plan (2021)[243], outlined measures to promote AI while ensuring risks were effectively managed.

The Digital Platforms Branch of the Australian Competition and Consumers Commission (ACCC) conducted a five-year inquiry into markets for the supply of digital platform services in Australia and their impacts on competition and consumers. The tenth and final report of the ACCC's Digital Platform Services Inquiry published in March, 2025 has *inter alia* outlined how rapidly evolving digital markets and emerging technologies, like cloud computing and Gen AI, may exacerbate existing risks to competition and consumers in Australia or give rise to new ones.[244] The report reinforces the need for regulatory reform to address digital platform-related competition and consumer harms.

5.1.6 Japan

Japan's initial AI strategy was embedded within broader technology policies, with a strong focus on robotics and automation. The government viewed AI as a key component of its Society 5.0 vision, which aimed to create a super-smart society where AI, the Internet of Things (IoT), and big data seamlessly integrated into daily life.[245] AI development was particularly emphasised in sectors like healthcare, manufacturing, and transportation, where automation was seen as a solution to Japan's aging workforce and declining labour pool. During this period, Japan followed a light-touch regulatory approach, encouraging AI innovation while applying existing laws to address concerns related to privacy and data security. The Act on the Protection of Personal Information (APPI)[246], also has a role in regulating AI-driven data processing, ensuring that AI technologies comply with privacy safeguards. The "Artificial Intelligence Technology Strategy" in March 2017[247], the "Social Principles of Human-Centric AI" in March 2019[248], and the "AI Strategy 2022" in April 2022[249], promoted R&D and initiatives for the social implementation of AI technology. Another major development was the 2022 amendment to the Act on the Protection of Personal Information (APPI), which introduced stricter privacy protections for AI-driven data processing. Additionally, the AI Governance Guidelines (2022) provided best practices for AI developers, focusing on explainability, accountability, and fairness in AI decision-making.[250]

The Bill for the Act on Promotion of Competition for Specified Smartphone Software was approved and passed at the plenary session of the House of Councillors on April 26, 2024. The bill aims to develop a competitive

[243] https://wp.oecd.ai/app/uploads/2021/12/Australia_AI_Action_Plan_2021.pdf
[244] https://www.accc.gov.au/about-us/publications/serial-publications/digital-platform-services-inquiry-2020-25-reports/digital-platform-services-inquiry-final-report-march-2025
[245] https://www8.cao.go.jp/cstp/english/society5_0/index.html
[246] https://www.japaneselawtranslation.go.jp/en/laws/view/4241/en
[247] https://indiaai.gov.in/countriesregions/japan
[248] https://www.cas.go.jp/jp/seisaku/jinkouchinou/pdf/humancentricai.pdf
[249] https://www8.cao.go.jp/cstp/ai/aistratagy2022en.pdf
[250] https://www.meti.go.jp/shingikai/mono_info_service/ai_shakai_jisso/pdf/20220128_2.pdf

environment in which innovation by various entities is activated through competition. It also enables consumers to select and enjoy various services created by innovation, while ensuring security, etc. with respect to software particularly necessary for the use of smartphones (mobile operating systems (OS), application stores, browsers, and search engines, collectively referred to as "Specified Software"). The Smartphone Act[251] *inter alia* prohibits designated providers from using data acquired from business users to unfairly develop competing services, thereby ensuring algorithmic neutrality. Further, the Platform Transparency Act (2020)[252] mandates clear disclosures of search ranking algorithms and terms of service updates, preventing platforms from manipulating visibility in ways that harm competition.

5.1.7 France

The French Competition Authority (*Autorité de la concurrence)* started an ex officio inquiry in February 2024 into the competitive functioning of the generative AI sector and launched a public consultation. As part of this consultation, it gathered inputs from around 40 parties and 10 stakeholder associations were collected. The objective was to examine (i) the strategies implemented by major digital players aimed at consolidating or leveraging their current market power upstream in the generative artificial intelligence value chain, in order to expand in this booming sector, (ii) practices implemented by players that are already present in the cloud infrastructure sector, (iii) issues relating to access to cloud infrastructure, data and skilled workforces, and (iv) investments by major digital players in innovative companies specialised in generative artificial intelligence.[253]

On 28 June 2024[254], the French Competition Authority issued its opinion, inter alia recommending to

- Make the regulatory framework applicable to the sector more effective
- Use the full extent of competition law tools
- Increase access to computing power
- Take account of the economic value of data and
- Ensure greater transparency on investments by digital giants

[251] Ribera Martínez, A., & Lee, S. (2024, July 2). The Japanese Smartphone Act: Teaching Competition Law New Tricks. Kluwer Competition Law Blog. https://competitionlawblog.kluwercompetitionlaw.com/2024/07/02/the-japanese-smartphone-act-teaching-competition-law-new-tricks/

[252] https://www.japaneselawtranslation.go.jp/ja/laws/view/4532/en

[253] https://www.autoritedelaconcurrence.fr/en/press-release/generative-artificial-intelligence-autorite-starts-inquiries-ex-officio-and-launches

[254] https://www.autoritedelaconcurrence.fr/en/press-release/generative-artificial-intelligence-autorite-issues-its-opinion-competitive

5.1.8 Canada

Artificial Intelligence and Data Act (AIDA)[255] of Canada is proposed to be introduced as part of the Digital Charter Implementation Act, 2022, to set the foundation for the responsible design, development and deployment of AI systems. The Act would ensure that AI systems deployed are safe and non-discriminatory and would hold businesses accountable for how they develop and use these technologies. Under the AIDA, businesses will be held responsible for the AI activities under their control. They will be required to implement new governance mechanisms and policies that will consider and address the risks of their AI system and give users enough information to make informed decisions. The AIDA requires businesses to ensure the safety and fairness of high-impact AI systems at stages such as:

- Design: Businesses will be required to identify and address the risks of their AI system with regard to harm and bias and to keep relevant records.
- Development: Businesses will be required to assess the intended uses and limitations of their AI system and make sure users understand them.
- Deployment: Businesses will be required to put in place appropriate risk mitigation strategies and ensure systems are continually monitored.

5.2 OECD Publication

The OECD paper titled "Artificial Intelligence, Data and Competition" (May 2024)[256] inter alia discusses the effects of AI on Competition and the tools available for competition authorities to address competition issues in AI.

❖ Effects of AI on Competition

The paper mentions that the Gen AI life cycle encompasses delivery in three complex stages: Building foundation model, fine-tuning, and deployment; these stages strongly depend on access to huge datasets and resources for computing. These inputs are generally controlled by a few firms, and so entry barriers exist.

The competition risks identified are:

- Vertical integration of AI value chain by firms.
- Proprietary access to highest quality data and computing power.
- Barriers to switching across ecosystems and bundling practices in deployment phase.

These, in turn, can further entrench incumbents and limit the possibilities presented to new entrants, especially in sectors in which AI applications are

[255] https://ised-isde.canada.ca/site/innovation-better-canada/en/artificial-intelligence-and-data-act

[256] OECD (2024), "Artificial intelligence, data and competition", OECD Artificial Intelligence Papers, No. 18, OECD Publishing, Paris. https://doi.org/10.1787/e7e88884-en

expected. It is also a concern that proprietary control over foundation models and over platform access might enhance these dynamics further.

❖ Tools Available to Competition Authorities

As AI develops and transforms markets, competition authorities are evolving their toolkit to keep up with the pace. The OECD identifies a spectrum of means regulators can employ to maintain fair competition in markets driven by AI:

- Monitoring and Advocacy

Regulators are urged to closely monitor AI market developments continuously. This involves issuing public recommendations, consultation with stakeholders, and fostering competition-friendly policies. Global knowledge exchange also helps develop collective know-how and remain ahead of the curve as far as emerging concerns are concerned.

- Market Studies and Investigations

To better understand AI market structures and their functioning, regulators can decide to undertake detailed sectoral inquiries. Such studies would help detect potential imbalances in vital aspects such as access to data, computation power, or foundational models, which are inputs determining who will succeed or fail in the AI economy.

- Merger Control

Mergers involving AI companies have increasingly attracted scrutiny, more so in cases where big tech platforms buy innovative startups. Regulators are not only concerned with immediate concentration of markets but also with how such deals may hamper future innovation or bar opportunities of growth for the new entrants.

- On Enforcement and Remedies

When an anti-competition situation arises, such as bundling AI tools to the detriment of competitors or refusal of access to essential AI services, depending on the circumstances, authorities may institute remedies requiring the sharing of certain data by the offending firm, changes in its practices, or even structural remedies.

- Co-operation and Regulation

Due to the international nature of AI development, cross-border coordination by regulators is more than ever critical. Both international and national cooperation can assist in allowing comparable enforcement and preventing regulatory loopholes, particularly as future regulations for AI keep unfolding.

5.3 India: Regulatory Measures to Address Competition Issues in Technology-Driven Marketplaces

5.3.1 The Competition Act, 2002

In India, the Competition Act, 2002 (the Competition Act) serves as a modern legal framework that supports fair competition in the marketplace. The Competition Commission of India (CCI) is a statutory body established under the Act with the primary objective of preventing practices having adverse effects on competition, promoting and sustaining competition in markets, protecting the interests of consumers, and ensuring freedom of trade carried on by other participants in India. The Competition Act prohibits anti-competitive agreements (section-3), abuse of dominant position (section 4), and provides for regulation of combinations (mergers and acquisitions) (sections 5&6).

The CCI inquires into anti-competitive agreements that cause or are likely to cause appreciable adverse effect on competition (AAEC) within India. It also inquires into the abusive conduct of dominant enterprises in the market. For established contraventions, the Commission can impose monetary penalties and pass orders to address anti-competitive practices, including cease and desist orders, directions such as modification of agreements, if necessary. In addition, CCI is responsible for regulating combinations. While combinations can lead to economies of scale and improved efficiency, they may also give rise to competition concerns. CCI regulates mergers and acquisitions above thresholds specified in the Act, to assess appreciable adverse effect on competition in India, if any. CCI may approve a combination (with or without modifications), and in appropriate cases may also block the transaction. The Commission also gives its opinion to the government on competition issues and undertakes advocacy for creating awareness about competition law. It engages deeply with diverse range of stakeholders across the government, industry and academia. Its robust advocacy efforts are not only designed to educate but also to integrate competition principles more thoroughly into the economic fabric of our nation. As part of its efforts to better understand the evolving competitive dynamics and their implications for markets and competition, the Commission also regularly conducts market studies.

The Competition Act is inherently sector-agnostic, designed to preserve and promote competition across the entire economy, including traditional and emerging digital markets. It applies uniformly to all enterprises, irrespective of the industry or technology used. Its provisions under Section 3 (anti-competitive agreements), Section 4 (abuse of dominant position), and Section 5/6 (regulation of combinations) empower CCI to investigate and curb anti-competitive practices in digital platforms, e-commerce, app stores, online advertising, etc. For instance, in the recent past, the Commission ordered a number of investigations against big tech firms operating in digital markets for alleged abuse of dominance, unfair restrictions, exclusive tie-ups, deep

discounting and suspected anti-competitive arrangements with preferred sellers on their marketplaces.[257,258,259] These actions underscore how the Competition Act has been robustly applied in digital markets, ensuring that even cutting-edge technology platforms are subject to checks, thus affirming the statute's broad jurisdictional scope beyond any single sector.

Further, technology and data governance laws, such as the Information Technology (IT) Act, 2000,[260] provide a broad legal foundation for handling cybersecurity, data protection, and digital transactions.

5.3.2 Regulatory Response to Emerging Competition Challenges in the Digital and AI Era

The rapid expansion of digital markets, proliferation of platform-based business models, and increasing deployment of technologies such as AI, big data analytics, and algorithmic decision-making have posed new challenges for competition regulators globally. In response, India has taken significant forward-looking steps to strengthen its competition regime by modernising both its legislative architecture and institutional capacity, while simultaneously initiating structured policy dialogues on digital competition. These include the setting up of expert committees such as the Competition Law Review Committee (CLRC) and the Committee on Digital Competition Law (CDCL), legislative reforms through the Competition (Amendment) Act, 2023, and the establishment of Digital Markets Division (DMD) in CCI. Together, these initiatives mark a progressive and proactive approach to align India's competition law with the evolving digital economy.

- The Competition Law Review Committee (CLRC) and The Competition (Amendment) Act, 2023[261]

Recognising the need to review the Competition Act, 2002 in the context of the digital economy and international best practices, the Government of India constituted the Competition Law Review Committee (CLRC) in October 2018. Primary objectives of the CLRC included; to suggest measures to strengthen enforcement and foster a robust competition regime in the digital era, and to recommend mechanisms for speedier adjudication, institutional strengthening, and market studies. To foster technological innovation in India, the CLRC in its report released in 2019 recommended "Green Channel" mechanism for faster M&A approvals and a settlement and commitment framework.

[257] Case No. 07 of 2020
https://www.cci.gov.in/images/antitrustorder/en/order1666696935.pdf
[258] Case No. 40 of 2019
https://www.cci.gov.in/antitrust/orders/details/110/0
[259] Case No. 40 of 2021
https://www.cci.gov.in/images/antitrustorder/en/4120211665141327.pdf
[260] What is the Information Technology Act, 2000 (IT Act)?
https://www.geeksforgeeks.org/information-technology-act-2000-india/
[261] Report of Competition Law Review Committee (CLRC)
https://www.ies.gov.in/pdfs/Report-Competition-CLRC.pdf

Building on the CLRC's work, the Competition (Amendment) Act, 2023 (the Amendment Act) introduced several provisions to strengthen the CCI's ability to address emerging challenges in technology-driven markets. The Amendment Act represents a major legislative reform aimed at enhancing the enforcement toolkit of the CCI and aligning it with modern market realities. Key provisions of the Amendment Act are given below;

- *Section 3(3) - Inclusion of 'Hub and Spoke' Cartels:* The Amendment Act under section 3(3) recognises "hub and spoke" cartels, where a central entity (hub) facilitates coordination among competitors (spokes). It clarifies that even parties not directly engaged in the same business (the hub) can be considered part of the anti-competitive agreement if they "participate or intend to participate in the furtherance of such agreement". This means the hub is liable alongside the spokes for coordinating the cartel. This is particularly relevant in digital markets where AI platforms can act as hubs, enabling collusion among competitors through algorithmic means.

- *Section 3(4) - Expansion of Anti-Competitive Agreements:* The amendment broadens the scope of anti-competitive agreements under Section 3(4) to include ("*Any other agreements amongst enterprises or persons including but not restricted to agreement amongst enterprises or persons*") that may not fall strictly under horizontal or vertical categories. This expansion can encompass novel arrangements amongst market participants in the AI ecosystem which do not fit into the traditional classification of horizontal and vertical agreements.

- *Section 5(3) - Deal Value Threshold (DVT):* A new DVT provided under section 5(3) of the Amendment Act, mandates that mergers and acquisitions exceeding INR 2,000 crore (approximately USD 238 million) must be notified to the Competition Commission of India (CCI), provided the target has substantial business operations in India. This provision allows the scrutiny of combinations in the digital and AI sectors that may not meet traditional asset or turnover thresholds but have a significant market impact.

- *Sections 48A and 48B - Settlement and Commitment Framework:* The introduction of a settlement and commitment framework allows enterprises to offer commitments or settlements in cases of certain anti-competitive conduct, facilitating quicker resolution. This mechanism can be useful in cases involving rapidly evolving AI markets where prolonged litigation may hinder innovation.

With the notification of implementing regulations, the aforesaid provisions are now fully operational.

❖ Committee on Digital Competition Law (CDCL) and Digital Competition Bill, 2024[262]

In February 2023, the Ministry of Corporate Affairs (MCA) constituted the CDCL, tasked with evaluating the need for a separate ex-ante regulatory framework for digital markets in India. The CDCL Report, released in March 2024, recommended an ex-ante regulatory framework. A draft Digital Competition Bill, 2024 (DCB) was also enclosed with the report. Major recommendations included the following;

- Introduction of an ex-ante legislation applicable to large digital enterprises, to supplement the Competition Act and to ensure that the behaviour of large digital enterprises is proactively monitored, and that CCI intervenes before instances of anti-competitive conduct transpire.
- Such enterprises are to be designated as Systemically Significant Digital Enterprises (SSDEs) based on the threshold and criteria prescribed in the draft DCB.
- Stipulation of obligations as applicable to each Core Digital Service to be specified through regulations on SSDEs.
- Strengthening of the capacity of CCI's Digital Market and Data Unit to keep pace with the rapid evolution of digital markets.

While discussing the scope of the draft DCB contained in the report, the Committee opined that it should apply only to clearly identified digital services that are susceptible to concentration to avoid unintended chilling effects. However, considering the pace at which digital markets are progressing and noting the developments in AI, the Committee felt the need to keep the scope of the draft DCB inclusive and forward-looking.

❖ The Digital Personal Data Protection Act (DPDPA), 2023

The Digital Personal Data Protection Act, 2023, (DPDPA) aims to safeguard the privacy and security of digital personal data in India, empowering individuals with control over their data. It establishes a framework for processing personal data in a lawful manner, promoting innovation while ensuring data protection. The DPDPA proposes rules for data collection, storage, and processing, establishing a legal framework that may also be relevant for AI systems reliant on large-scale data analytics and machine learning.

[262] Report of CDCL https://prsindia.org/files/parliamentry-announcement/2024-04-15/CDCL-Report-20240312.pdf

❖ Ministry of Electronics and Information Technology (MeitY) Report on AI Governance Guidelines Development for Public Consultation[263]

The Ministry of Electronics and Information Technology (MeitY) has also issued various policy documents and advisories from time to time to enable and catalyse development of vibrant and secure Al ecosystem in India.

In January 2025, the Ministry of Electronics and Information Technology (MeitY) released a report on AI governance guidelines development for public consultation. The report is developed by a subcommittee under the guidance of the Principal Scientific Advisor's Advisory Group. This report outlines a principle-based framework to ensure the ethical, safe, and inclusive deployment of AI technologies in India, drawing from global standards like the OECD AI Principles and India's own NITI Aayog Responsible AI guidelines. The report emphasises eight core principles: transparency, accountability, safety, reliability and robustness, privacy and security, fairness and non-discrimination, digital by design governance, human-centered values and 'Do No Harm', and inclusive and sustainable innovation.

The report acknowledges the technology's rapid evolution and advocates for a harm-based regulatory approach that focuses on specific risks rather than broad categorisations. To foster a participatory regulatory environment, MeitY opened the report for public consultation, which concluded on February 27, 2025, receiving over 100 suggestions from various stakeholders.[264] This initiative reflects India's commitment to developing a nuanced and adaptive AI governance framework that balances innovation with public interest.

Overall, India's regulatory approach towards emerging digital and AI-driven markets reflects a balanced, forward-looking vision that is steadily evolving to address novel challenges. Multiple legislative initiatives, including the Digital Personal Data Protection Act (DPDPA), and MeitY's forthcoming AI governance guidelines, promise to further strengthen the institutional and legal framework to address AI-driven issues. With the existing and emerging instruments, India seeks to effectively regulate AI-driven harms while encouraging accountability and fairness in digital marketplaces. At the same time, there is a recognised need for proportionate safeguards, transparency standards, and industry-led self-regulation to ensure the safe, ethical, and inclusive use of AI technologies. India's approach aims to strike a delicate yet critical balance, by curbing market distortions and ensuring a level playing field for all technology players, while fostering innovation, digital entrepreneurship, and widespread technology diffusion. This co-regulatory, innovation-friendly model aligns with India's ambition to become a global AI powerhouse that champions both competitive integrity and technological progress.

[263] MeitY has issued a Report on AI Governance Guidelines Development for Public Consultation- https://indiaai.gov.in/article/report-on-ai-governance-guidelines-development

[264] https://www.storyboard18.com/how-it-works/public-consultation-on-ai-governance-guidelines-development-completed-over-100-suggestions-received-meity-59637.htm

5.4 Stakeholders' Perspectives

This section delves into insights gathered from consulting stakeholders, including legal practitioners and AI experts, on legal and regulatory frameworks. Stakeholders highlighted that India stands at a pivotal juncture, akin to the internet expansion of 2015, where careful regulatory decisions will shape the future of AI-driven markets. Striking the right balance between competition, innovation and consumer protection will be key to ensuring sustainable market growth in the digital era.

Stakeholders observed that collusion may not be inferred from the appearance of collusive outcomes, such as; similarity of prices, as these situations may not constitute collusion requiring any regulatory interventions. Algorithms working independently may arrive at similar price points, but this may not necessarily imply collusion.

However, it was pointed out that concerns may arise when third-party tools track online listed prices, potentially leading to price harmonisation across platforms. While mere price transparency is not anti-competitive, the introduction of algorithmic tools that suggest prices to clients can create scenarios mimicking collusion. The challenge is more pronounced in cases of self-learning algorithms that rely on publicly available data where the determination of liability becomes complex. International precedents, such as Spain's Partneo case,[265] indicate that price parallelism facilitated by common algorithm may be anti-competitive under certain conditions.

5.4.1 User Industries

User industries, including sectors such as digital marketing, e-commerce, logistics, and retail, leverage AI-based technologies to enhance operations, drive innovation and improve efficiency. These industry players shared key perspectives on AI adoption, regulatory challenges and competition-related concerns.

Regarding agreements with vendors, it was highlighted that these agreements can be horizontal, vertical or complementary. During discussions, it was stated that most of the agreements are negotiated. Credit agreements with upstream vendors follow standard terms, while agreements with customers tend to be customised. It was suggested that collaborations between large organisations be monitored to prevent anti-competitive practices. To facilitate access to data suggestions for the role of government in creating sector-representative data pools to support startups were made. Additionally, sustainability in AI adoption was a recurring theme, with calls for better product quality, consumer benefits and reduced carbon footprints. Regarding the amendments needed to maximise

[265] Mandrescu, D. (2018, June 7). When algorithmic pricing meets concerted practices: The case of Partneo. Lexxion. https://www.lexxion.eu/en/coreblogpost/when-algorithmic-pricing-meets-concerted-practices-the-case-of-partneo/

AI's potential, the focus on responsible AI, with an emphasis on sustainability and carbon neutrality over the next two decades was stressed. It was emphasised that regulatory frameworks may create a level playing field for everyone. The challenge lies in addressing resources imbalance between an INR 10,000-crore company and an INR 20-crore company and thus aiming to ensure fairness. User industries voiced support for subsidies to startups in Tier 2 and Tier 3 cities to ensure AI benefits reach all levels of society.

Experts from the user industry reported limited challenges with current partnerships. However, it was pointed out that as partnerships mature, differences in regulatory regimes may emerge as challenges. Respondents advocated grassroots innovation and equity-focused policies.

5.4.2 Startups

AI startups in the Indian AI ecosystem highlighted several regulatory and competition-related challenges, emphasising the need for a balanced regulatory approach. The startups expressed concerns about data control by big tech firms, discriminatory practices and algorithmic bias. Some respondents cautioned against excessive regulation and emphasised the need for policies that foster innovation. Data accessibility emerged as a critical issue. To make things fair for everyone, respondents suggested that the government may make anonymised data publicly available and introduce an AI governance policy in India, learning from the global best practices.

AI startups also highlighted the nature of agreements in which they engage for compute infrastructure, foundation models and AI application development.

It was pointed out that collaboration with upstream vendors such as AWS, Microsoft Azure etc. categorise their partners as Gold Vendors, Platinum Vendors etc., based on credit and business volume provided to the upstream vendors. It was clarified that a credit agreement with upstream vendors is usually standard, but agreements with customers are negotiated. According to respondents, customised arrangements may raise important considerations for competition policy, particularly regarding barriers to entry, long-term exclusivity, and the concentration of innovation capabilities among a few dominant players.

It was suggested that compliance requirements in the Indian context must ensure reasonable security practices to safeguard SPDI (Sensitive Personal Data or Information). For AI systems processing sensitive data, such as biometric or health information, respondents mentioned the necessity of adhering to the regulations. While providing services to international clients, compliance often involves adopting the governance and legal considerations of the client's country. It was pointed out that some companies opt to establish subsidiaries to meet regional compliance needs which adds to the operational complexities and high cost. In terms of best practices, ISO 42001 certification for AI management

systems is an emerging standard. It was further observed that AI startups are streamlining their processes and getting ISO 42001 certified.

To navigate the challenges, it was stated that there is a need to strengthen the AI regulatory framework in our country, align data protection laws with global standards and promote privacy-preserving AI techniques. It was suggested that India may establish an AI regulatory body (such as the UK's AI Safety Institute) to set performance benchmarks, third-party validation protocols and regulatory approvals for AI-based products. This would ensure legal credibility and protect against liability risks from AI mis-performance.

5.4.3 AI Platforms

AI platform companies operating in India advocated for a risk-based and proportionate regulatory framework focusing on specific AI applications rather than broad sector-wide regulations. The need for strong competition policies that prevent market concentration without stifling startups and smaller players was highlighted. Recommendations, related to refining India's copyright framework to facilitate AI model training while protecting intellectual property rights, were made. It was suggested that mechanisms to enable cross-border data flows be provided for India's AI ecosystem to remain globally competitive. Additionally, a cohesive government AI policy with inter-agency coordination and regulatory gap analysis was proposed to ensure effective governance. Promoting international regulatory alignment through India's leadership in the Global Partnership on AI (GPAI) was identified as a key strategy for enhancing global AI standards. Expanding access to open datasets was also suggested to support AI research and entrepreneurship. Overall, companies stressed that any AI regulatory framework may encourage responsible development while maintaining a dynamic and competitive market, ensuring that India remains at the forefront of AI innovation.

Insights were provided into the types of arrangements companies have with big-tech firms, highlighting the diversity of such agreements. The platform companies elaborated the vertical agreements in the cloud services market, noting that 'high-performance cloud infrastructure' is offered to companies to develop and deploy resource hungry AI models at scale, with non-exclusive arrangements allowing customers to choose their preferred providers. As an instance, it was cited that a company initially sourcing cloud services from one provider transitioned to another as its primary cloud provider, demonstrating the flexibility offered in such agreements.

AI platforms emphasised the availability of FMs on non-exclusive platforms, explaining that customers could access a variety of foundation models, ensuring competitive options. In this regard, examples of customers accessing models directly via APIs or through competing platforms were cited.

The responses also highlighted the role of investments and partnerships in fostering innovation. Non-exclusive collaborations between industry players, as well as between the public and private sectors, bring complementary resources together, accelerating the development of AI models and associated technologies. Further it was asserted that such arrangements contribute to a thriving economy by enabling innovation, enhancing competition for talent and accelerating the launch of new tools, products and features that ultimately benefit customers across industries. Generally, the importance of public and private investments and the need for regulatory certainty to unlock AI's full potential were emphasised.

The synergies and risks associated with M&As involving firms with AI capabilities were highlighted. The nature of the investment or acquisition plays a pivotal role in determining its competitive impact. It was mentioned that the minority investments with investor protection rights are generally pro-competitive, fostering a dynamic and healthy funding culture in the Gen AI sector. Such investments, when structured to preserve the independence of AI firms in areas such as input procurement, technology development and commercialisation, can facilitate innovation and positive industry growth. However, it was pointed out that significant equity or financial interests coupled with restrictive arrangements could stifle innovation and entrench dominant positions, resulting in anti-competitive outcomes. Investments that appear to be minority stakes but confer substantial influence over the target's operations or decision making may also be subject to conventional merger control reviews.

Additional factors for analysing AI-related collaborations were outlined. Exclusivity arrangements, such as cloud supply commitments, distribution agreements and exclusive rights to intellectual property (IP) were highlighted as potential indicators of acquisitions leading to harmful concentration. For instance, 'exclusive cloud supply or distribution agreements that create dependence on a particular platform' and 'exclusive rights to an AI developer's IP' were flagged as risks that could lead to concentration of market power.

It was asserted that the existing competition framework with careful case-by-case analysis, is well equipped to balance the need for competition with the need to encourage innovation. The existing competition law framework, which provides for assessment of market dynamics, entry barriers, data and innovation has successfully addressed the concerns in dynamic markets.

5.4.4 Legal Experts

The respondents called for a balanced regulatory approach that fosters innovation while addressing these issues, including the need for incentives for AI startups and more stringent oversight. A comprehensive and enforceable legal framework is increasingly perceived as essential to ensure responsible AI development which safeguards both competition and consumer interests.

The introduction of regulatory sandboxes by the EU and the UK was seen as a step forward. For example, initiatives such as the Lawtech UK sandbox allow startups to interact with regulators, lower compliance costs and foster innovation was appreciated by legal experts. The French and German governments were also cited for having provided regulatory exemptions to homegrown AI developers, such as Mistral AI, to level the playing field.

As the AI industry continues to evolve, respondents highlighted critical challenges and opportunities related to the legal and regulatory frameworks that govern it, particularly for startups competing with large players. Concerns were raised about AI's potential to distort fair trade practices. It was pointed out that AI can enable companies to access personal information and engage in discriminatory practices, limiting consumer choices, A recurring concern was the concentration of data within a few large firms, which limits the access of smaller developers to valuable resources. Suggestions for regulatory mechanisms, such as mandating the disclosure of public and anonymous data were made to democratise access to data and level the playing field. On synthetic data, legal experts opined that the government should regulate synthetic data generation to avoid fake data and content. At the same time, presently the data generated in India being mostly captured by big tech companies, it was suggested that the government should encourage these companies to generate more synthetic data in the public domain so that startups have a fair chance to compete with existing players. The necessity of balancing data protection laws with mechanisms, to ensure accessible and legally compliant data sharing while maintaining confidentiality and accountability, was highlighted. Need for an AI startup policy that includes financial incentives and support for innovation was expressed to create a more equitable ecosystem, enabling startups to thrive. The need for balanced regulations that foster growth and innovation in the AI ecosystem while addressing ethical, competitive and consumer protection concerns, was emphasised.

Summary

This chapter provides an overview of the evolution of legal and regulatory developments across jurisdictions, including the US, EU, UK, China, Australia, and others, offering insights into how various legal systems globally are adapting to AI-driven competition concerns.

Further, this chapter discusses India's existing and proposed regulatory measures to address competition challenges in technology-driven markets. The perspectives of key stakeholders, including several user industries, startups, Platforms, and Legal and Policy Experts, are summarised to get insights into the multifaceted competition challenges and possible regulatory responses.

In India, the Competition Act, 2002 remains the primary tool to address anti-competitive behaviour in digital and AI markets. Recent amendments have expanded the law's scope to cover hub-and-spoke cartels and deal value

thresholds for M&As etc. Additional initiatives include the Digital Personal Data Protection Act (DPDPA), 2023 which introduces framework for secure data processing that is critical for AI and MeitY's report on AI Governance Guidelines Development, 2025 recommending AI governance principles. India's approach, blending legal reforms, policy initiatives, and stakeholder dialogue, positions it optimally to build globally competitive and vibrant digital markets, including those powered by AI.

CHAPTER 6

ACTION PLAN FOR A COMPETITIVE, DYNAMIC AND INNOVATIVE AI ECOSYSTEM

6.1 Opportunities and Challenges

AI is becoming a transformative force across industries, reshaping competition dynamics, business operations and regulatory response. In India, the adoption of AI spans multiple sectors, supported by initiatives such as the National AI Strategy and the National AI Portal, launched by the Government of India.

Opportunities

The study reveals that AI has evolved from an experimental technology to an integral component of business strategy across diverse sectors including retail, e-commerce, logistics and delivery, marketing, BFSI, and healthcare.

Increased operational efficiency: AI is driving improvements in efficiency, enhancing accuracy, and streamlining operations across various sectors in India, especially for enterprises that do not have the same capabilities as larger organisations. Further, AI enables faster decision-making, informed decisions in real-time, imparts agility and adaptability to market changes.

Improved consumer insights: By leveraging AI into their extant processes, businesses gain a deeper understanding of their target audiences, enabling them to offer personalised products and services tailored to specific needs.

Innovation - enabler: AI is increasingly seen as a critical tool in research and development (R&D) processes. AI has moved from being a novel technology to becoming a key driver of innovation strategies.

Empowering MSMEs and Startups: Larger organisations have already integrated AI into their operations; however, the adoption of AI by MSMEs has the potential to level the playing field in certain areas, enabling them to compete in the market effectively.

As organisations continue to mature their AI capabilities, the potential for further transformation and value creation across user industries remains substantial, indicating continued evolution in how businesses integrate artificial intelligence to achieve strategic objectives and operational excellence.

Challenges

While AI brings significant benefits in terms of efficiency, innovation, and consumer experience, it may introduce new challenges for competition in markets, such as:

Concentration in the AI value chain: The study has revealed potential competition concerns emanating from different stages of the AI value chain, as well as issues on account of presence of big players across multiple layers of the AI stack. The AI industry tends towards concentration due to high upfront costs, access to data, compute and talent. This may give the incumbents substantial and often insurmountable competitive edge, thereby leading to entrenched market power and high barriers to entry for smaller or newer players, who may find it difficult to overcome structural hurdles such as enormous computational requirements, lack of data, or the need for significant user bases to achieve network effects.

Ecosystem lock-in and switching costs: In addition, there could be a situation where few major ecosystems emerge with each having distinct locked-in user base. In such a scenario, users may find it difficult to switch across ecosystems, leading to long-term dependency.

Collaborations and partnerships: Further, the agreements and collaborations entered into by large players, can have significant implications for competition, depending on the terms of such arrangements. For instance, exclusive deals for cutting-edge AI chips, data etc. can raise rivals' costs or deny them essential capabilities. These factors contribute to a risk of reduced market dynamism with fewer startups scaling up and less pressure on incumbents to innovate or price competitively.

Self-preferencing: As the study brings out, self-preferencing through own products across the vertical AI tech stack can further reinforce dominance, as leading firms control multiple stages of the AI value chain, restricting market access for smaller players.

Requiring customers/developers to purchase unrelated products or services to access essential AI infrastructure or capabilities can give rise to concerns arising from anti-competitive tying, besides giving opportunities to leverage and extend market power across various markets.

Novel risk of algorithmic collusion: The potential competition concerns associated with use and adoption of AI that have emerged from the study include AI-driven collusion.

Traditional competition law has long dealt with collusion between human decision-makers. AI and algorithms, however, introduce new modes of collusion risk. The novel risk of algorithmic collusion arises, where firms, intentionally or not, use AI-driven pricing algorithms that learn to align prices over time. This can lead to outcomes similar to price-fixing, even in the absence of direct human coordination, making detection and enforcement by regulators far more complex. Beyond pricing, algorithms could collude on other competitive parameters – allocating markets, limiting output, or even coordinating on bidding strategies in online markets. Collusion can also occur without explicit communication, via an algorithmic "middleman."

Price discrimination: The use of AI may enable price discrimination, where firms use consumer data to set personalised prices in real time. While this can increase efficiency, it may raise exploitative or exclusionary concerns.

Opaque algorithms: AI can automate key business decisions (prices, search rankings etc.). Without guardrails, opaque "black-box" algorithms may facilitate self-preferencing, systematically discriminate or exclude rivals. Over time, such practices can entrench dominance by raising barriers to entry and exploiting information asymmetries and lack of transparency.

6.2 Way Forward

In this backdrop, in order to promote development of a competitive AI ecosystem in India, to prevent AI-driven anti-competitive practices and to protect consumer welfare, CCI's enforcement and advocacy efforts will be directed towards –

- Developing a culture of competition compliance
- Ensuring fair competition across the AI development value chain and applications and
- Preserving and promoting incentives for innovation

Certain measures proposed to fulfil the aforesaid objectives are enumerated below:

6.2.1 Self-audit of AI Systems for Competition Compliance

Self-audits and competition compliance programmes are proactive measures that allow businesses to identify and address potential competition concerns. In light of the rapid integration of AI across industries and the growing reliance on algorithmic decision-making, it is imperative to ensure that these systems do not inadvertently violate competition law principles. Further, AI systems, due to their autonomous and dynamic nature, can quickly scale anti-competitive effects. A self-audit mechanism facilitates early identification and mitigation of such risks before they cause market harm. These efforts enhance the auditability and explainability of AI models. The introduction of a self-audit framework for enterprises deploying AI systems, particularly those with market power or wide consumer reach, will help assess and align their algorithms with competition norms.

Principles for Self-audit

The broad principles delineated below provide an indicative framework for enterprises to conduct self-audits of their AI systems to ensure compliance with competition law:

- Documentation of AI-based decision-making process including algorithmic objectives, data sources, and access protocols

- Design and testing of algorithms with built-in safeguards to prevent/ detect unintended anti-competitive outcomes/practices and reduce unfair competition risk
- Regular internal algorithmic audits/periodic review of algorithmic outputs/market outcomes to proactively identify and eliminate inadvertent algorithm-driven collusion
- Review of AI driven pricing strategies to detect unintended price alignments or discriminatory practices
- Implementation of safeguards while using third-party tools and
- Incorporation of safeguards that prevent sharing of commercially sensitive data amongst competitors

A competition compliance-oriented self-audit for AI would ensure responsible autonomy, while protecting markets from distortions, and foster a competitive innovation ecosystem.

Guidance Note for Self-audit (Annexure I)

A self-audit guidance note (Annexure I) has been prepared, encompassing a proactive mechanism that may enable businesses to systematically identify and address competition concerns arising from their adoption of AI while maintaining operational efficiency and innovation.

The guidance note is structured around four fundamental objectives that collectively aim to foster a competitive and transparent AI ecosystem:

- The first objective focuses on helping businesses develop a comprehensive understanding of the competition implications inherent in their AI systems, enabling them to recognise potential risks before they translate into actual market harm.
- The second objective involves providing a structured and systematic approach to assessing AI systems for competition compliance, moving beyond ad-hoc evaluations to establish consistent methodologies that can be applied across different types of AI usage.
- The third objective centers on promoting a culture of responsible AI development and deployment throughout the organisation, extending beyond mere compliance to embed competition considerations into the core of AI development processes. This cultural transformation is essential because competition compliance in AI may not be treated as an afterthought but may be integrated into the design, development, testing, and deployment phases of AI systems.
- The fourth objective aims to enable enterprises to demonstrate their commitment to fair competition through documented processes, transparent

methodologies, and verifiable compliance measures. The ability to demonstrate compliance may help enterprises build trust with regulators and also provide competitive advantages by assuring business partners, customers, and stakeholders of their commitment to sound AI practices.

Needless to state that any issue relating to alleged anti-competitive conduct would be examined by the Commission on a case-by-case basis within the provisions of the Act.

6.2.2 Framework to improve transparency and reduce information asymmetry

Lack of transparency with respect to deployment of AI in decision-making can harm competition and consumers. For competitors and new entrants, opaque algorithms used by firms with market power can obscure whether a market outcome is due to genuine competition or anti-competitive practices. This can erode trust and inhibit consumer choice, especially if personalisation algorithms are at work. Furthermore, AI decisions can inadvertently become discriminatory or exclusionary. In short, opacity allows potential anti-competitive conduct and consumer harms to go undetected.

Key areas of communication

In view of the foregoing, enterprises are urged to adopt transparency measures so as to reduce information asymmetry. Such measures may include communicating the following to relevant stakeholders:

- Usage and purpose of deployment of AI in decision-making
- A general description of the main parameters for AI-based decisions
- Other information that may foster better understanding and trust in AI-powered systems

The information may be made available in plain and intelligible language and be updated periodically.

Introduction of the above-mentioned measures, however, do not seek disclosure of algorithms or any proprietary, commercially-sensitive information or details that may facilitate anti-competitive outcomes.

6.2.3 Focused Advocacy

Conference on AI and regulatory issues

CCI will organise a conference on "AI and Regulatory Issues", in association with relevant stakeholders, in the near future to provide a platform for exchange of views and promoting regulatory harmony.

Workshops on AI and Competition Compliance

The Conference will be followed by focused advocacy workshops on "AI and Competition Compliance", under CCI's advocacy mandate. These workshops will sensitise participants on how competition law applies to AI ecosystem, highlighting safeguards to mitigate risks of non-compliance and ways to foster pro-competitive innovation.

6.2.4 Removing entry barriers

The study reveals that India's AI ecosystem, while demonstrating rapid growth, faces structural challenges that could significantly impact long-term competitiveness and market fairness. Barriers to entry can prevent or impede entry of new players in the market and entrench power of the existing players. Stakeholders have highlighted that AI development requires significant computational resources, infrastructure, financial capital, access to diverse large-scale datasets and specialised AI talent, which may act as entry barriers.

Access to infrastructure

Training large AI models requires immense computational power and access to cloud services has been highlighted as a significant entry barrier. It has been suggested by stakeholders that the Government departments overseeing digital infrastructure may continue to focus on expanding national AI computing infrastructure with enhanced access mechanisms specifically designed for startups, small and medium enterprises, and research institutions.

Promotion of open-source frameworks

Promotion of open-source AI frameworks that facilitate access, model portability and platform-neutral deployment, has been suggested as another measure that would further reduce barriers to entry and facilitate smaller players to scale up.

Access to data

To address the concerns regarding data constraints, data repositories may be developed and made available to provide seamless access to high-quality, non-personal datasets to enable startups to effectively compete and contribute to AI-driven innovation.

Development of skilled workforce

A skilled workforce proficient in data science and AI development is equally essential for driving innovation and maximising AI's potential. Equipping India's workforce with cutting-edge industry-relevant AI expertise is the need of the hour.

Enhancing technological capabilities

International technology partnerships could be structured to include meaningful technology transfer provisions and create frameworks for cross-border data

governance that protect Indian interests while facilitating international collaboration. Joint research and development programs could be designed to enhance India's technological capabilities while maintaining competitive market structures.

The aforesaid measures will go a long way in empowering startups and innovators, removing entry barriers and will foster a level-playing field. The Government of India has adopted a multi-pronged approach and has initiated several measures to strengthen AI capabilities and to create an inclusive and innovation-driven ecosystem. Continued emphasis on open data, affordable access to high performance computing, and AI talent, workforce development etc. will pave the way for vibrant and competitive markets for AI development and applications.

6.2.5 Regulatory capacity building

Given the scale, complexity and diversity of AI and its applications, handling competition issues relating to this area demands specialised skills that go beyond traditional economic and legal analysis. For instance, understanding algorithmic design and its implications for market behaviour is critical to address issues like algorithmic collusion or discriminatory conduct. Expertise in AI and data analytics is essential to assess how these technologies impact competition, innovation, and consumer welfare.

Strengthening technical capabilities and infrastructure

To maintain effective regulatory oversight in the area of AI, CCI will continue to focus on strengthening its own technical capabilities and infrastructure. To this end, CCI will develop specialised expertise in AI technologies, data science, and computational methods, and track global regulatory developments. This would allow CCI to monitor developments in AI markets, identify and address potential AI-driven anti-competitive behaviour.

Setting up of a Think Tank

Markets and the policy landscape in the digital economy in India are co-evolving rapidly. The Commission requires expert views/inputs in understanding markets, technologies and the policy-antitrust interface on a continuing basis. In view of this, a Think Tank, consisting of academics (in the areas of law, economics and computer sciences), technologists and public policy experts will be set up. The idea is to interact and draw upon their expertise from time to time on matters related to digital markets with special focus on AI.

6.2.6 Inter-regulatory co-ordination

AI markets may involve overlapping concerns such as competition, data protection, IPR, cybersecurity etc. This requires a multidisciplinary approach and

inter-regulatory co-ordination amongst various government departments and regulatory authorities to address these interconnected issues comprehensively.

This coordination framework would include maintaining open channels of communication to address competition concerns effectively while respecting other regulatory mandates and statutory architecture(s). The Competition Act, 2002 also provides for such coordination mechanisms to facilitate regulatory harmony.

Memorandum of Understanding (MoU)

The Competition (Amendment) Act, 2023, provides for the CCI to enter into MoUs or arrangements with any statutory authority or department of the government for the purpose of discharging its duties or performing its functions under the Act. For structured consultation and coordination, CCI will explore entering into MoUs with relevant authorities.

6.2.7 International Cooperation

AI markets often transcend national borders, with major players operating globally.

International Co-operation Agreements

Addressing cross-jurisdictional issues would require the CCI to collaborate with international competition authorities. Such cooperation allows for information sharing, alignment of enforcement strategies and capacity building while working within the overall domestic statutory architecture.

CCI will continue to use the route of international cooperation agreements for knowledge sharing and collaborative policy development with peer authorities.

Multilateral Competition Platforms

CCI will actively participate in the multilateral competition fora such as OECD, ICN, UNCTAD etc. to keep abreast of global best practices to effectively deal with complex and novel issues arising due to dynamic and fast-evolving nature of AI industry.

Annexure -I

GUIDANCE NOTE ON SELF-AUDIT OF AI SYSTEMS FOR COMPETITION COMPLIANCE

1. Introduction and Purpose

Artificial Intelligence (AI) systems are increasingly being adopted across various sectors, from retail and e-commerce to financial services and logistics. While AI brings significant benefits in terms of efficiency, innovation, and consumer experience, it may introduce new challenges for competition in markets.

This guidance note provides a framework for businesses to conduct self-audits of their AI systems to ensure compliance with competition law. Self-audits are a proactive measure that allow businesses to identify and address potential competition concerns.

The purpose of this guidance is to:

- Help businesses understand the competition implications of their AI systems
- Provide a structured approach to assessing AI systems for competition compliance
- Promote a culture of responsible AI development and deployment
- Enable organisations to demonstrate their commitment to fair competition

This guidance note presents a six-pillar self-audit framework—governance, algorithm design, testing, monitoring, transparency and compliance integration.

This note is relevant for businesses that develop, deploy, or use AI systems that may directly/indirectly affect competition in markets. The complexity and depth of a self-audit may be proportionate to the potential competition impact of the AI system.

2. Self-Audit Framework

The self-audit framework consists of six core components:

2.1 Governance and Oversight

- Setup a system to evaluate each AI system against competition risk factors
- Establish clear responsibilities for competition compliance in AI systems
- Ensure senior management involvement in high-risk AI deployments
- Implement approval processes for AI systems with potential competition impacts

- Periodic review and reporting
- Maintain documentation of decision-making processes

2.2 Algorithm Design and Development

- Review objectives and inputs programmed into AI systems
- Assess training data for representativeness and potential bias
- Evaluate how the algorithm processes competitor information
- Document design choices and their potential market effects

2.3 Testing and Validation

- Test AI systems for unintended anti-competitive effects
- Conduct controlled experiments to assess market outcomes
- Validate performance across different scenarios

2.4 Monitoring and Control

- Implement ongoing monitoring of AI system behaviour
- Establish triggers for human review of algorithm decisions
- Maintain audit logs

2.5 Transparency

- Maintain explainability of key algorithm functions
- Ability to disclose key parameters of AI systems to relevant stakeholders.
- Create mechanisms for stakeholders to report concerns

2.6 Compliance Integration

- Align AI development with existing competition compliance programs
- Train technical teams on competition law principles
- Establish review procedures involving legal and compliance functions
- Integrate competition considerations into AI risk assessments

3 Implementation Process

Implementing the self-audit framework involves the following steps:

3.1 Preparation

- Form a cross-functional team including technical, legal, and business personnel
- Identify AI systems/components that may affect competition

- Establish audit timelines and resource requirements

3.2 System Mapping

- Document how each AI system works and its role in business operations
- Identify data inputs, decision logic, and outputs
- Map relationships between different AI systems
- Determine how the system interacts with market participants

3.3 Risk Assessment

- Evaluate each system against competition risk factors
- Identify high-risk areas requiring detailed examination
- Assess the potential impact of system misuse from competition standpoint
- Consider market-specific factors that might exacerbate risks

3.4 Detailed Audit

- Apply the self-audit checklist to each prioritised system
- Review documentation, code, and system behaviour
- Test system performance in various scenarios
- Interview system developers and users

3.5 Findings and Recommendations

- Document compliance strengths and weaknesses
- Develop specific recommendations for addressing issues
- Prioritise remediation actions based on risk level
- Create implementation plans

3.6 Implementation and Follow-up

- Execute remediation actions
- Verify the effectiveness of changes
- Document improvements and residual risks
- Plan for periodic re-assessment

Suggested Documentation

Maintaining comprehensive documentation can facilitate competition compliance. Key documentation may include:

System Documentation

- System architecture and design documents
- Data sources and processing methodologies
- Algorithm objectives and constraints
- Testing protocols and results
- Change management records

Competition Assessment Documentation

- Competition risk assessments
- Self-audit processes and findings
- Remediation plans and implementation records
- Ongoing monitoring procedures
- Incident reports and resolution actions

Governance Documentation

- Roles and responsibilities
- Decision-making processes
- Senior management oversight
- Training records
- Policy documents related to AI and competition

Documentation to be:

- Clear and understandable to both technical and non-technical audiences
- Maintained and updated throughout the AI system lifecycle
- Readily accessible for review, if required
- Able to demonstrate compliance efforts

4 Suggested Self-Audit Checklist

Governance and Oversight Checklist

- [ ] Is there a documented AI governance framework in place?
- [ ] Are roles and responsibilities for AI competition compliance clearly assigned?
- [ ] Is the senior management involved in overseeing high-risk AI systems?
- [ ] Is there a clear escalation process for potential competition concerns?
- [ ] Is competition compliance integrated into the AI development lifecycle?
- [ ] Are regular reports on AI competition compliance provided to senior management?
- [ ] Are there documented policies on AI development and deployment?
- [ ] Are there sufficient resources allocated to AI compliance activities?

Algorithm Design and Development Checklist

- [ ] Are algorithm objectives documented and reviewed for competition implications?
- [ ] Are training data sources documented and assessed for potential bias?
- [ ] Are safeguards against collusion built into the algorithm design?
- [ ] Is the algorithm's decision-making process explainable?
- [ ] Are there appropriate guardrails on algorithm behaviour to prevent anti-competitive outcomes?

Testing and Validation Checklist

- [ ] Has the algorithm been tested across various market scenarios?
- [ ] Have stress tests been conducted to assess behaviour in extreme conditions?
- [ ] Has the algorithm been evaluated for potential collusive outcomes?
- [ ] Are there documented validation procedures for algorithm updates?
- [ ] Has the algorithm been tested for bias?
- [ ] Are testing results documented and accessible for review?
- [ ] Is there a process for addressing issues identified during testing?

Competition-Specific Risk Assessment Checklist

- [ ] Does the algorithm use competitor pricing data?
- [ ] Does the algorithm use any other competitor data that is commercially sensitive?
- [ ] Could the algorithm coordinate/learn to align pricing or output with rival algorithms?
- [ ] Does the algorithm adjust prices immediately after detecting a competitor’s price change?

- [ ] Does the algorithm set different prices for different customers?
- [ ] Does the algorithm limit access to services or facilities without clear criteria?
- [ ] Does the algorithm use proprietary data that competitors cannot access?
- [ ] Does the algorithm favour affiliated products or services in rankings or recommendations?
- [ ] Is there a log of algorithmic decisions available for review?
- [ ] Is there human oversight for significant price or access changes?
- [ ] Does the algorithm lack explicit constraints to prevent below-cost or predatory pricing?
- [ ] Does AI/algorithmic pricing strategies of the firm align with competitive fairness?
- [ ] Does AI/algorithmic pricing strategies of the firm align with regulatory compliance?

Implementation and Monitoring Checklist

- [ ] Is there a monitoring system to detect unexpected algorithm behaviour?
- [ ] Are there thresholds or triggers for human review of algorithm decisions?
- [ ] Is there an audit trail of algorithm behaviour and changes?
- [ ] Are regular competition compliance checks conducted on deployed systems?
- [ ] Is there a process for addressing competition concerns raised by stakeholders?
- [ ] Are there mechanisms to quickly modify or suspend algorithm operation if issues arise?

Documentation and Transparency Checklist

- [ ] Is there documentation of the algorithm's objectives and constraints?
- [ ] Are data sources and processing methodologies documented?
- [ ] Is there documentation of competition risk assessments and mitigation measures?
- [ ] Is the algorithm's decision-making process explainable?
- [ ] Is documentation regularly updated to reflect system changes?
- [ ] Is there a process for maintaining historical records of algorithm behaviour?

Disclaimer: This note is for guidance purposes only and does not constitute legal advice.

References

Australian Government. (2024). National framework for the assurance of artificial intelligence in government. https://www.finance.gov.au/sites/default/files/2024-06/National-framework-for-the-assurance-of-AI-in-government.pdf

Australian Government. Australia's artificial intelligence ethics framework. Retrieved from https://www.industry.gov.au/publications/australias-artificial-intelligence-ethics-framework

Australian Government. Privacy Act 1988. https://statisticaldataintegration.abs.gov.au/topics/legal-and-policy-considerations/privacy-act-1988

Australian Law Reform Commission. Australian privacy law and practice (ALRC Report 108). https://www.alrc.gov.au/publication/for-your-information-australian-privacy-law-and-practice-alrc-report-108/6-the-privacy-act-some-important-definitions/sensitive-information/

Authority for Consumers and Markets (2020). Position paper: Oversight of algorithms

Autorité de la concurrence & Bundeskartellamt (2019), Algorithms and Competition

Bloomberg Law. China's personal information protection law (PIPL): FAQs. https://pro.bloomberglaw.com/insights/privacy/china-personal-information-protection-law-pipl-faqs/

California Office of the Attorney General. CCPA regulations. https://oag.ca.gov/regulations

California Privacy Protection Agency. (2023, November 27). A new landmark for consumer control over their personal information: CPPA proposes regulatory framework for automated decision-making technology. https://cppa.ca.gov/announcements/2023/20231127.html

Calvano, E., Calzolari, G., Denicolo, V., & Pastorello, S. (2020). Artificial intelligence, algorithmic pricing, and collusion. American Economic Review, 110(10), 3267–3297.

Center for Strategic and International Studies (CSIS). (n.d.). Japan's approach to AI regulation and its impact on the 2023 G7 presidency. https://www.csis.org/analysis/japans-approach-ai-regulation-and-its-impact-2023-g7-presidency

China Briefing. (2022). China's sweeping recommendation algorithm regulations in effect from March 1 https://www.china-briefing.com/news/china-passes-sweeping-recommendation-algorithm-regulations-effect-march-1-2022/

Chinese Government. (2017). Cybersecurity Law of the People's Republic of China. https://www.lawinfochina.com/Display.aspx?Id=22826&Lib=law&LookType=3

Chinese Government. (2017). Full translation: China's new generation artificial intelligence development plan. https://digichina.stanford.edu/work/full-translation-chinas-new-generation-artificial-intelligence-development-plan-2017/

Clifford Chance. (2024). Understanding the new AI operator guidelines in Japan. https://www.cliffordchance.com/insights/resources/blogs/talking-tech/en/articles/2024/06/understanding-the-new-ai-operator-guidelines-in-japan.html

Clym. Privacy Act 1988 (Australia).
https://clym.io/regulations/privacy-act-1988-australia

Commonwealth Consolidated Acts. Privacy Act 1988.
http://www6.austlii.edu.au/cgi-bin/viewdb/au/legis/cth/consol_act/pa1988108/

Competition & Markets Authority (2018). Pricing Algorithms: Economic working paper on the use of algorithms to facilitate collusion and personalised pricing, https://assets.publishing.service.gov.uk/media/5bbb2384ed915d238f9cc2e7/Algorithms_econ_report.pdf

Competition & Markets Authority (2021). Algorithms: How they can reduce competition and harm consumers
https://www.gov.uk/government/publications/algorithms-how-they-can-reducecompetition-and-harm-consumers/algorithms-how-they-can-reduce-competition-and-harmconsumers .

Competition Commission of India (CCI). (2020). Market study on e-commerce in India.

Competition Commission of India (CCI). (2021). Market study of diagnostic medical imaging equipment industry in India.

DataGovHub. (n.d.). China AI strategy.
https://datagovhub.elliott.gwu.edu/china-ai-strategy/

DataGuidance. China – Data protection overview.
https://www.dataguidance.com/notes/china-data-protection-overview

DataGuidance. UK – Data protection overview.
https://www.dataguidance.com/notes/uk-data-protection-overview

Deloitte The China personal information protection law (PIPL).
https://www2.deloitte.com/cn/en/pages/risk/articles/personal-information-protection-law.html

Digital Regulation Cooperation Forum (2022). Auditing algorithms: the existing landscape, role of regulators and future outlook
https://www.gov.uk/government/publications/findings-from-thedrcf-algorithmic-processing-workstream-spring-2022/auditing-algorithms-the-existinglandscape-role-of-regulators-and-future-outlook

European Commission. Data protection in the EU. Retrieved from https://commission.europa.eu/law/law-topic/data-protection/data-protection-eu_en

European Union. (2018). Article 9 GDPR.
https://gdpr-info.eu/art-9-gdpr/

European Commission. (2021). Proposal for a regulation laying down harmonised rules on Artificial Intelligence (Artificial Intelligence Act) and amending certain Union legislative *acts.* EUR-Lex.
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021PC0206

European Union. (2018). General Data Protection Regulation (GDPR).
https://gdpr-info.eu/

European Union. (2024). EU Artificial Intelligence Act.
https://artificialintelligenceact.eu/the-act /

Ezrachi, A., & Stucke, M. E. (2023). The role of secondary algorithmic tacit collusion in achieving market alignment. Working paper CCLP(L)54, University of Tennessee Legal Studies Research Paper.
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4546889

Garg P, Gupta B, Dzever S, Sivarajah U, Kumar V. (2020). "Examining the Relationship between Social Media Analytics Practices and Business Performance in the Indian Retail and IT Industries": The Mediation Role of Customer Engagement. International Journal of Information Management, Volume 52, 102069.

GDPR (EU). What is GDPR, the EU's new data protection law?
https://gdpr.eu/what-is-gdpr/

IBM. What you need to know about the CCPA draft rules on AI and automated decision-making technology.
https://www.ibm.com/think/news/ccpa-ai-automation-regulations

Japan Fair Trade Commission (2021). Algorithms/AI and Competition Policy

Japan. (2003). Act on the Protection of Personal Information.
https://www.japaneselawtranslation.go.jp/en/laws/view/4241/en

Japanese Government. (2003). Act on the Protection of Personal Information Act No. 57 of 2003.
https://www.cas.go.jp/jp/seisaku/hourei/data/APPI.pdf

Japanese Government. (2022). Governance guidelines for the implementation of AI principles.
https://www.meti.go.jp/shingikai/mono_info_service/ai_shakai_jisso/pdf/20220128_2.pdf

KPMG. (2017). Overview of China's Cybersecurity Law.
https://assets.kpmg.com/content/dam/kpmg/cn/pdf/en/2017/02/overview-of-cybersecurity-law.pdf

Kumar, S., & Gupta, P. (2022). Leveraging machine learning for dynamic pricing and customer engagement in Indian e-commerce. Journal of Retailing and Consumer Services, 62, 102-120.

Ministry of Electronics and Information Technology (MeitY). (2023). The Digital Personal Data Protection Act (No. 22 of 2023).
https://www.meity.gov.in/writereaddata/files/Digital%20Personal%20Data%20Protection%20Act%202023.pdf

Ministry of Foreign Affairs and Trade (MFAT). (n.d.). Understanding China's Cybersecurity Law.
https://www.mfat.govt.nz/assets/Countries-and-Regions/North-Asia/China/Understanding-Chinas-cybersecurity-law.pdf

Ministry of Science and ICT, Republic of Korea. (2023). *Artificial Intelligence Basic Act.* National Law Information Center
https://www.law.go.kr/LSW/eng/engLsSc.do?menuId=2&query=ARTIFICIAL%20INTELLIGENCE%20BASIC%20ACT#liBgcolor0

National Institute of Standards and Technology. Artificial intelligence risk management framework: Generative artificial intelligence profile.
https://nvlpubs.nist.gov/nistpubs/ai/NIST.AI.600-1.pdf

National Institute of Standards and Technology. (2023). *AI risk management framework.* U.S. Department of Commerce.
https://www.nist.gov/itl/ai-risk-management-framework.

NITI Aayog. (2018). #AIForAll: National strategy for artificial intelligence. https://www.niti.gov.in/sites/default/files/2023-03/National-Strategy-for-Artificial-Intelligence.pdf

NITI Aayog. (2022). Responsible AI #AIForAll: Adopting the framework: A use case approach on facial recognition technology. https://www.niti.gov.in/sites/default/files/2023-03/Responsible-AI-AIForAll-Approach-Document-for-India-Part-Principles-for-Responsible-AI.pdf

NITI Aayog. (2022). Responsible AI #AIForAll: Approach document for India: Part 2 – Operationalising principles for responsible AI. https://www.niti.gov.in/sites/default/files/2021-08/Part2-Responsible-AI-12082021.pdf

PRS India. (2023). The Digital Personal Data Protection Bill. https://prsindia.org/billtrack/digital-personal-data-protection-bill-2023

Sharma, P., Sinha, S., & Biswas, P. (2022). AI in retail and logistics: Enhancing efficiency through technological innovations. Journal of Business Logistics, 44(1), 35-47.

Stephanie Assad, Robert Clark, Daniel Ershov, and Lei Xu (2024); Algorithmic Pricing and Competition: Empirical Evidence from the German Retail Gasoline Market; Journal of Political Economy, Volume 132, Number 3, pp. 723-771

The White House. (2023, November). Advancing governance, innovation, and risk management for agency use of artificial intelligence. https://www.whitehouse.gov/wp-content/uploads/2023/11/AI-in-Government-Memo-draft-for-public-review.pdf

U.K. Government. Data protection in the UK. https://www.gov.uk/data-protection

U.K. Parliament. (2018). Data Protection Act 2018. https://www.legislation.gov.uk/ukpga/2018/12/contents

U.S. Congress. (2020). H.R. 2575: AI in Government Act of 2020. https://www.congress.gov/bill/116th-congress/house-bill/2575

U.S. Congress. (2022). H.R. 6580: Algorithmic Accountability Act of 2022. https://www.congress.gov/bill/117th-congress/house-bill/6580/text

U.S. Congress. (2023). H.R. 5628: Algorithmic Accountability Act of 2023. https://www.congress.gov/bill/118th-congress/house-bill/5628/text

U.S. Department of State. Artificial intelligence (AI). https://www.state.gov/artificial-intelligence/

U.S. Department of State. Risk management profile for artificial intelligence and human rights. https://www.state.gov/risk-management-profile-for-ai-and-human-rights/

UK Government. Data Protection Act: Information Commissioner and enforcement. https://www.gov.uk/government/publications/data-protection-act-information-commissioner-and-enforcement

UK Government. Processing of special categories of personal data and criminal offence data: National Security and Investment Act (Appropriate Policy Document). https://www.gov.uk/government/publications/national-security-and-investment-act-2021-privacy-

notice/processing-of-special-categories-of-personal-data-and-criminal-offence-data-national-security-and-investment-act-appropriate-policy-document

University of Cambridge. Information compliance. https://www.information-compliance.admin.cam.ac.uk/data-protection

University of Melbourne. (2019). Artificial intelligence: Australia's ethics framework. https://about.unimelb.edu.au/__data/assets/pdf_file/0031/99184/UoM_response_Data61_AI_Ethics_Framework.pdf

Verma, N., & Rao, S. (2021). Artificial intelligence in marketing: Applications and future trends. Journal of Marketing Analytics, 9(1), 12-25.

Waltman, L., & Kaymak, U. (2008). Q-learning agents in a Cournot oligopoly model. Journal of Economic Dynamics and Control, 32(10), 3275–3293.

White House. (2023). Proposed memorandum for the heads of executive departments and agencies: Advancing governance, innovation, and risk management for agency use of artificial intelligence (Draft for public review). https://www.whitehouse.gov/wp-content/uploads/2023/11/AI-in-Government-Memo-draft-for-public-review.pdf

White House Office of Science and Technology Policy. (2022). *Blueprint for an AI Bill of Rights.* The White House. https://www.whitehouse.gov/ostp/ai-bill-of-rights/

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