AI: Transforming India’s Workforce and Economy

This editorial is based on “Getting to a new level in India’s online gaming sector” which was published in The Financial Express on 27/01/2025. The article brings into picture how GenAI is reshaping the global job market, challenging India’s skilled IT workforce. It emphasizes the need to reform education, focusing on practical skills to align with emerging AI-driven opportunities and harness the demographic dividend.

For Prelims: Key Recent Breakthroughs in Artificial Intelligence, Applications of AI in Different Sector, Precision farming, Digital banking, Acing Development of Innovative Technologies with iDEX (ADITI) scheme, India Skills Report, Quick commerce, Personal Data Protection Act 2023 , FutureSkills Prime initiative.

For Mains: Key Opportunities AI Revolution Brings for India's Economic Growth, Key Challenges AI Poses to India's Traditional Economy

India stands at a pivotal moment as **artificial intelligence, particularly GenAI**, reshapes the global job market. While economic growth has struggled to create **quality jobs beyond traditional sectors,** the AI revolution brings both challenges and opportunities. India’s historical emphasis on theoretical knowledge over practical skills requires urgent **rethinking**, as GenAI could replace many cognitive tasks. However, emerging fields driven by **climate change, aging populations, and advanced technology** demand **medium-skilled workers like technicians and healthcare professionals.** To fully capitalize on its demographic dividend, India must reform education and training systems to **develop skills that complement AI, ensuring future-ready employment.**

What are the Key Recent Breakthroughs in Artificial Intelligence?

- **Generative AI**: Models like **OpenAI's GPT-4** and **Google’s Bard** have revolutionized content generation, enabling human-like text, image, and code creation. Applications span across education, healthcare, and creative industries.
- **Multimodal AI**: **Meta’s LLaMA** and **OpenAI’s DALL·E 3** combines text, image, and video processing, enabling AI systems to understand and generate outputs across multiple formats.
- **AI in Drug Discovery**: AI-based platforms like **DeepMind’s AlphaFold** have predicted the structure of nearly every protein known to science (as of 2023), accelerating medical research and drug development.
- **Generative AI for Code**: Tools like **GitHub's Copilot X (2023**) and **OpenAI's Codex** automate software development, increasing developer productivity and coding efficiency.
- **Generative AI in Speech**: **ElevenLabs** and **VALL-E (Microsoft, 2023)** enable high-quality voice synthesis, revolutionizing applications in virtual assistants, audiobooks, and customer service.
- **Autonomous Agents**: AI models like **AutoGPT** and **BabyAGI** perform multi-step autonomous

tasks without human intervention, advancing the capabilities of AI beyond single-task focus.

- **AI in Creative Industries**: **Runway Gen-2** and **Adobe Firefly** empower AI-generated video and image editing, transforming digital content creation.
- **AI in Climate Modeling**: Tools like **Google's GraphCast** predict weather conditions up to 10 days in advance more accurately and much faster than the industry gold-standard weather simulation system.

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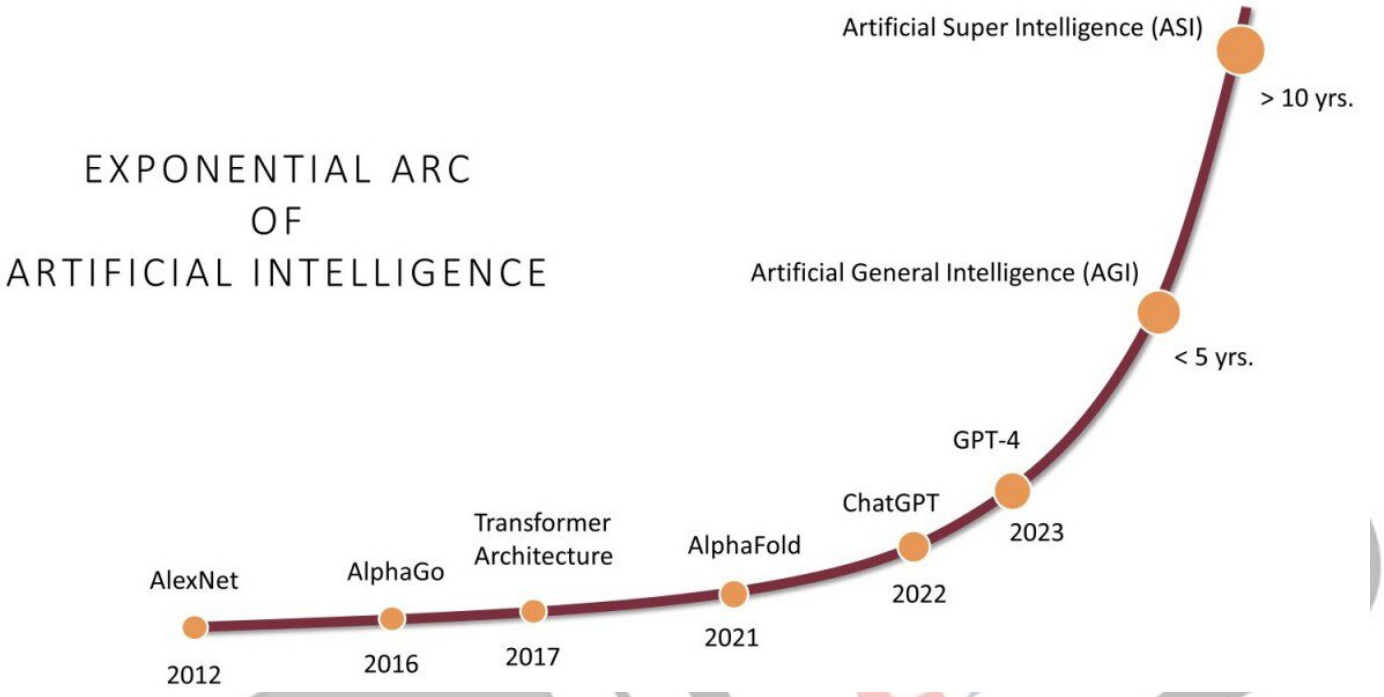

What are the Key Opportunities AI Revolution Brings for India's Economic Growth?

- **Boosting Productivity Across Sectors:** AI can revolutionize traditional industries such as **agriculture**, **manufacturing**, **and logistics** by optimizing processes, reducing waste, and improving supply chain efficiency.
    - For instance, **precision farming** **using AI-powered drones and sensors** can enhance crop yields and reduce input costs.
    - **AI-enabled automation in manufacturing** can bridge gaps in India’s lagging industrial productivity.
    - **NITI Aayog** estimates AI has the potential to add **$957 billion to India’s GDP by 2035.**
        - A December 2024 report states that as many as **78% of small and medium-sized businesses (SMBs) in India** using artificial intelligence (AI) have reported revenue growth

Business function	% Adoption (2020-21)	% Adoption (2022-23)
Human resources	43%	68%
Risk, legal, compliance	23%	62%
Finance and tax	28%	67%
Sales and marketing	61%	86%
Customer service	68%	87%
Manufacturing and operations	36%	75%
Research and development/ innovation	40%	67%
Supply chain and logistics	26%	69%
IT and cybersecurity	60%	87%

- **Expanding the IT and Knowledge Services Sector:** India, **already a global leader in IT services,** can harness AI to move up the value chain by **offering advanced AI-based services** such as **cloud computing, generative AI applications, and cybersecurity solutions.**
    - This positions **Indian IT firms** to capture a greater share of the **$297 billion global AI services market projected by 2027.**
    - Indian companies like **TCS** are investing heavily in artificial intelligence (AI) and generative AI, with a **project pipeline exceeding $1.5 billion.**
- **Enhancing Healthcare Delivery:** AI applications in diagnostics, predictive health, and personalized medicine can revolutionize healthcare in India by making it more **accessible, affordable, and efficient.**
    - AI-powered tools like telemedicine platforms and diagnostic algorithms are critical in bridging gaps in rural healthcare infrastructure.
    - For instance, **Karnataka's AI-based lung cancer screening** has detected **133 cases of high lung nodule malignancy** and identified nearly 3,000 TB-presumptive cases
- **Fostering Financial Inclusion:** AI is driving financial inclusion by enabling **digital banking, fraud detection, and micro-lending platforms** that use AI to assess creditworthiness for underserved populations.
    - It has significantly improved access to formal financial services in rural areas through mobile-based platforms and AI-driven chatbots.
    - For instance, **Aye Finance**, an Indian fintech company, **uses AI to analyze alternative data like phone usage, social media, and transactions** to assess creditworthiness, enabling financial inclusion for small businesses.
        - This approach has helped extend credit to thousands of enterprises across India.
- **Enabling Smart Governance and Public Service Delivery:** AI can make governance **more efficient by aiding decision-making,** predicting policy outcomes, and ensuring better targeting of welfare schemes.
    - AI-powered tools like **grievance redressal systems** and real-time data analytics can enhance public service delivery and transparency.
    - For instance, **Unique Identification Authority of India (UIDAI)** launched an AI-based chatbot, **"Aadhaar Mitra"**,which is trained to respond to resident's queries.
- **Accelerating Climate Resilience and Renewable Energy Growth:** AI tools for **climate**

modeling, renewable energy **forecasting,** and energy grid optimization can bolster India's climate resilience efforts and aid in achieving its ambitious renewable energy targets.
    - AI is already used in solar and wind energy optimization for maximizing output.
        - For instance, **Tata Power uses AI to predict solar energy production** from its factory's solar power plant. This helps the company better manage its grid and ensure it has enough power to meet demand.
    - A recent report from McKinsey reveals that **AI-driven technologies can help businesses reduce their CO2 emissions by up to 10%** and cut energy costs by 10-20%.
- **Catalyzing the Startup Ecosystem:** India's burgeoning startup ecosystem is a key beneficiary of the AI revolution, with startups leveraging AI in **fintech, edtech, healthtech, and agritech.**
    - This has enabled the creation of **innovative, scalable solutions** that attract significant venture capital investments.
    - India is home to more than **100 GenAI startups** and these startups have raised more than **$600 million since 2019.**
    - Unicorns like **Fractal Analytics** are examples of Indian startups thriving in the global AI market.
- **Driving Innovation in Defense and National Security:** AI can transform India's defense sector by **enabling autonomous systems**, real-time threat detection, and predictive intelligence.
    - AI-based tools are also strengthening cybersecurity infrastructure to counter emerging threats in the digital domain.
    - For instance, launched in March 2024, the **Acing Development of Innovative Technologies with iDEX (ADITI) scheme** aims to foster innovations in critical defence technologies essential for national security.
    - **DRDO has developed "Divya Drishti,"** an AI tool that combines face recognition with immutable physiological parameters like gait and skeleton.

What are the Key Challenges AI Poses to India's Traditional Economy?

- **Job Displacement in Low-Skill and Routine Jobs:** AI-driven automation poses a significant threat to jobs in sectors like **manufacturing, agriculture, and low-skill services,** where routine, repetitive tasks are dominant.
    - Traditional industries relying on **manual labor may face redundancies,** exacerbating unemployment in India's informal sector, **which already employs over 90% of the workforce**.
    - **Automation threatens 69% of jobs in India over the next 20 years,** posing a significant challenge to employment. This shift could reshape the workforce landscape significantly.
- **Widening Skill Gap:** The rapid rise of AI creates a demand for high-skilled workers in **coding, machine learning, and data science,** while traditional workers lack access to the necessary skilling resources.
    - The education system's focus on theoretical learning, with **limited emphasis on vocational and AI-relevant training**, further deepens the skills mismatch.
    - This imbalance could marginalize millions of workers from India's demographic dividend.
    - The India Skills Report **2023** highlights that **only 48.7% of Indian graduates are considered employable**, with demand for AI skills outpacing supply.
- **Erosion of Traditional Business Models:** AI-driven platforms and digitalization are disrupting traditional businesses, particularly in **retail, agriculture, and small-scale manufacturing.**
    - Local traders and artisans are losing **ground to e-commerce giants (especially quick commerce)** and automated supply chains that leverage AI to optimize costs and reach larger markets.
    - This disruption risks eroding small businesses, which are the backbone of India's economy.
- **Cybersecurity Threats to Traditional Businesses:** As traditional sectors integrate AI to remain competitive, they face increased **vulnerability to cyberattacks and data breaches.**
    - Many small businesses lack the expertise to secure AI systems, putting their operations and customer data at significant risk.
        - This hampers the trust and reliability of AI integration in traditional industries.
    - For instance, in 2023, India experienced over **79 million cyberattacks,** ranking it third globally in terms of the number of such incidents and the escalation continued into 2024.

- **Digital Exclusion of Rural Areas:** India's rural economy, which relies on agriculture and local enterprises, risks being sidelined as AI adoption remains concentrated in urban areas.
    - **Poor digital infrastructure and low digital literacy** prevent rural entrepreneurs and workers from leveraging AI, widening the urban-rural divide.
    - For instance, **only 45% of the Indian population,** or about 665 million citizens, do not access the internet as of 2023, according to a joint study by the Internet and Mobile Association of India (IAMAI) and Kantar released on Tuesday.
- **Dependence on Foreign AI Technologies:** India's reliance on imported AI technologies from global tech giants like **Google, Microsoft, and OpenAI** poses risks to **technological sovereignty and economic security.**
    - This dependency also drains foreign exchange and limits the development of indigenous AI capabilities needed to support traditional industries.
    - India's **Personal Data Protection Act 2023 emphasizes data localization,** requiring data to be stored within the country.
        - However, **AI-driven global data flows challenge this approach,** as data increasingly transcends borders. The tension between local data control and global data movement presents a complex issue.
- **Environmental Costs of AI Adoption:** AI technologies are **energy-intensive, requiring significant computing power** that contributes to carbon emissions.
    - Large-scale AI deployment in traditional industries could exacerbate India's environmental challenges, especially as many industries still rely on non-renewable energy sources.
    - A study by **MIT** found that **training a single AI model can emit as much carbon as five cars in their lifetime.**
        - A more recent study reported that training **GPT-3 with 175 billion parameters consumed 1287 MWh of electricity**, and resulted in carbon emissions of 502 metric tons of carbon
- **Ethical and Regulatory Concerns:** AI adoption in traditional sectors raises ethical challenges, including **algorithmic bias, data privacy issues, and lack of transparency.**
    - Unregulated use of AI in agriculture pricing, healthcare diagnostics, or credit assessments could harm vulnerable groups, undermining trust in these systems.
    - For instance, the **RBI has warned that the increasing reliance on AI in India's banking sector** could lead to concentration risks, systemic vulnerabilities.
        - While AI is being used for customer service and loan screening, these tools may also introduce **unpredictable consequences due to their opacity.**

What Steps Can India Take to Harness the AI Revolution for Economic Growth?

- **Build a National AI Skilling Ecosystem:** India must establish a national AI skilling framework to address the massive skill gap in AI-related fields.
    - By integrating the **Skill India Mission** with the **FutureSkills Prime initiative**, the government can deliver **scalable AI training programs targeting medium-skilled workers.**
    - Focus should also be given to practical training in areas like **data analytics, machine learning, and robotics** to prepare workers for mid-level AI-enabled jobs.
- **Incentivize AI Adoption by SMEs and Startups:** The government can offer tax incentives, subsidies, and access to AI platforms for small and medium enterprises (SMEs) to encourage AI integration.
    - Combining the **Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE)** with subsidized AI toolkits can lower the entry barrier for SMEs.
        - This will allow traditional businesses to automate routine tasks, optimize supply chains, and improve productivity.
- **Promote Indigenous AI Research and Innovation:** India must invest heavily in indigenous AI research to reduce dependency on foreign AI technologies.
    - This can be achieved by strengthening the **National AI Portal** to support AI startups in sectors like healthcare, education, and defense. Additionally, government-backed AI innovation hubs should be set up in **tier-2 and tier-3 cities** to nurture local talent and foster innovation.
- **Integrate AI into Agriculture for Rural Economic Growth:** AI-driven solutions can help optimize farming by **enabling precision agriculture, crop disease detection, and efficient**

water usage.
    - The government should integrate the **Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)** with AI-powered tools like satellite-based soil monitoring and weather forecasting.
    - Additionally, **deploying AI-based agri-marketplace platforms** can help farmers get better prices by connecting them directly with buyers.
- **Strengthen AI in Healthcare and Public Welfare:** AI can revolutionize healthcare delivery by improving diagnostics, personalized medicine, and early disease prediction.
    - India should expand initiatives like **Ayushman Bharat Digital Mission** to incorporate AI tools for **real-time patient monitoring and telemedicine in underserved rural areas.**
    - AI can also be integrated into vaccination campaigns and maternal health programs to ensure targeted outreach.
- **Create AI-Powered Climate Resilience Programs:** India can leverage AI to mitigate the effects of climate change by enabling real-time monitoring of air quality, managing water resources, and optimizing renewable energy production.
    - Integrating AI into the **National Action Plan on Climate Change (NAPCC)** will improve India's ability to forecast and adapt to extreme weather events.
    - AI can also enhance energy efficiency in urban areas through smart grids and resource management.
- **Establish Ethical and Regulatory Frameworks:** India must develop robust ethical and regulatory frameworks to govern AI use, ensuring transparency, accountability, and data privacy.
    - Building on the **Digital Personal Data Protection Act (2023)**, India should establish sector-specific AI regulations for **healthcare, finance, and defense** to address ethical challenges like bias and misuse.
        - This will ensure trust in AI systems and prevent monopolistic practices.
    - The **EU AI Act,** establishes guidelines to ensure AI systems are safe, transparent, and uphold fundamental rights. **India can draw valuable lessons from this framework.**
- **Integrate AI into Smart Governance:** AI can transform governance by enabling predictive analytics, improving public service delivery, and optimizing welfare schemes.
    - The government should integrate AI into existing programs like the **Aspirational Districts Programme** to identify gaps in education, health, and infrastructure and address them efficiently.
    - AI-powered grievance redressal systems can improve accountability and citizen satisfaction
- **Facilitate AI-Driven Export Growth:** India can position itself as a global hub for **AI-enabled services by promoting AI innovation** in export-oriented sectors like IT, pharmaceuticals, and textiles.
    - The government can integrate **Make in India** with AI-based design and production tools to enhance quality and cost-effectiveness in exports.
    - AI-backed platforms for supply chain management can further improve India’s competitiveness in global markets
- **AI-Powered Regional Language Ecosystem:** Develop AI tools to support regional language processing and translation, making AI solutions accessible to non-English speakers in India.
    - This can **boost digital inclusion and allow small businesses, artisans, and rural entrepreneurs** to use AI-driven tools for marketing, production, and customer engagement in their native languages.
    - AI-powered multilingual platforms can also help bridge the digital literacy gap in rural India.
- **AI-Driven Village-Level Microfactories:** Establish AI-integrated microfactories at the village level to enhance productivity in small-scale industries like **textiles, pottery, or agro-processing.**
    - These microfactories can use AI for design, production optimization, and quality control, reducing inefficiencies in rural manufacturing.
    - The government can provide subsidies under **MSME Cluster Development Programs** to promote AI-based microfactories in rural hubs.
- **AI-Integrated Tourism Infrastructure:** Leverage AI to develop smart tourism platforms that personalize travel experiences, manage tourist flows, and promote cultural heritage.
    - AI can be used to create **immersive experiences using AR/VR,** such as virtual tours of

historic sites, while also optimizing tourist services like transport and hospitality.
    - The **Dekho Apna Desh initiative** could integrate AI tools to boost domestic tourism.

Conclusion:

The AI revolution presents a transformative opportunity for India to **accelerate economic growth, enhance productivity, and foster innovation across sectors.** However, to harness its potential, India must address challenges like **job displacement, skill gaps, and digital exclusion.** By investing in **AI-driven skilling, indigenous research, and ethical frameworks,** the country can align AI adoption with inclusive development. Strategic integration of AI in agriculture, healthcare, and governance will ensure equitable growth.

Drishti Mins Question:

Discuss how artificial intelligence (AI) could disrupt India's traditional economy, particularly in agriculture, small-scale industries, and services. Suggest measures to mitigate its impact on livelihoods

UPSC Civil Services Examination, Previous Year Question:

Q. With reference to foreign-owned e-commerce firms operating in India, which of the following statements is/are correct? (2022)

1. They can sell their own goods in addition to offering their platforms as market-places.
2. The degree to which they can own big sellers on their platforms is limited.

Select the correct answer using the code given below:

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

Ans: (b)