INDUSTRY Insights

NOVEMBER - DECEMBER 2024

MEMBERS IN INDUSTRY & PSUs COMMITTEE

Artificial Intelligence

Driving Innovation and Transforming Business & Industries

Published on 04-01-2025

THE INSTITUTE OF COST ACCOUNTANTS OF INDIA

Statutory Body under an Act of Parliament

www.icmai.in

Behind every successful business decision, there is always a CMA

Vision Statement

"The Institute of Cost Accountants of India would be the preferred source of resources and professionals for the financial leadership of enterprises globally."

Mission Statement

"The CMA Professionals would ethically drive enterprises globally by creating value to stakeholders in the socio-economic context through competencies drawn from the integration of strategy, management and accounting."

Institute Motto

असतोमा सद्गमय तमसोमा ज्योतिर् गमय मृत्योर्मामृतं गमय ॐ शान्ति शान्ति शान्तिः	From ignorance, lead me to truth From darkness, lead me to light From death, lead me to immortality Peace, Peace, Peace

About the Institute

The Institute of Cost Accountants of India (ICMAI) is a statutory body set up under an Act of Parliament in the year 1959. The Institute as a part of its obligation, regulates the profession of Cost and Management Accountancy, enrols students for its courses, provides coaching facilities to the students, organizes professional development programmes for the members and undertakes research programmes in the field of Cost and Management Accountancy. The Institute pursues the vision of cost competitiveness, cost management, efficient use of resources and structured approach to cost accounting as the key drivers of the profession. In today's world, the profession of conventional accounting and auditing has taken a back seat and cost and management accountants increasingly contributing towards the management of scarce resources like funds, land and apply strategic decisions. This has opened up further scope and tremendous opportunities for cost accountants in India and abroad.

The Institute is headquartered in Kolkata having four Regional Councils at Kolkata, Delhi, Mumbai and Chennai, 117 Chapters in India and 11 Overseas Centres. The Institute is the largest Cost & Management Accounting body in the world with about 1,00,000 qualified CMAs and over 5,00,000 students pursuing the CMA Course. The Institute is a founder member of International Federation of Accountants (IFAC), Confederation of Asian and Pacific Accountants (CAPA) and South Asian Federation of Accountants (SAFA). The Institute is also an Associate Member of ASEAN Federation of Accountants (AFA) and member in the Council of International Integrated Reporting Council (IIRC), UK.

Behind every successful business decision, there is always a CMA

INDUSTRY Insights

NOVEMBER - DECEMBER 2024

MEMBERS IN INDUSTRY & PSUs COMMITTEE

Artificial Intelligence

Driving Innovation and Transforming Business & Industries

Published on 04-01-2025

THE INSTITUTE OF COST ACCOUNTANTS OF INDIA

Statutory Body under an Act of Parliament

www.icmai.in

Behind every successful business decision, there is always a CMA

THE COUNCIL (2024 - 2025) OF
THE INSTITUTE OF COST ACCOUNTANTS OF INDIA

Statutory Body under an Act of Parliament

www.icmai.in

CMA Bibhuti Bhusan Nayak
President

CMA TCA Srinivasa Prasad
Vice President

CMA Ashwin G. Dalwadi
Immediate Past President

CMA (Dr.) Ashish Prakash Thatte

CMA Avijit Goswami

CMA Chittaranjan Chattopadhyay

CMA Harshad Shamkant Deshpande

CMA (Dr.) K Ch A V S N Murthy

CMA Manoj Kumar Anand

CMA Navneet Kumar Jain

CMA Neeraj Dhananjay Joshi

CMA Rajendra Singh Bhati

CMA Suresh Rachappa Gunjalli

CMA (Dr.) V. Murali

CMA Vinayaranjan P

CMA Avijit Goswami
Chairman
Members in Industry & PSUs Committee
The Institute of Cost Accountants of India

MESSAGE

Dear Esteemed Members,

"Wishing you a very Happy, Healthy and Prosperous New Year 2025."

We are delighted to welcome you to the November-December 2024 edition of the **"Industry Insight" Bulletin,** focused on the emerging trends in **Artificial Intelligence**. This issue provides valuable insights into how businesses can leverage this transformative technology to optimize operations and stay ahead in the market.

As we navigate the rapidly evolving landscape of business and technology, it is crucial that we remain proactive and harness the power of innovation to drive growth and success. Artificial Intelligence (AI) stands as one of the most significant technological advancements of our time, with the potential to revolutionize the way we work, live, and interact with each other. Already, AI is transforming industries from healthcare to finance, and it is poised to make a profound impact on the field of cost accounting.

As Cost Accountants, we have a unique role to play in harnessing the power of Artificial Intelligence to enhance business decision-making and optimize costs. AI enables us to analyze vast amounts of data, identify patterns, and make informed predictions that can drive more effective cost management strategies.

However, as we embark on this journey, it is imperative that we also consider the ethical implications of Artificial Intelligence. We must ensure that this technology is utilized responsibly, transparently, and in alignment with our professional values.

As the Chairman of the Members in Industry & PSUs Committee of the Institute of Cost Accountants of India, I am committed to equipping our members with the knowledge, skills, and resources needed to thrive in this rapidly changing environment. Together, we can unlock the full potential of AI to drive business success, while maintaining the integrity and ethical standards of our profession.

We look forward to your continued support and engagement as we explore these exciting journey.

Warm regards,

CMA Avijit Goswami

Date: 04-01-2025

Inside...

CONTENTS

Role of Artificial Intelligence in Various Sectors

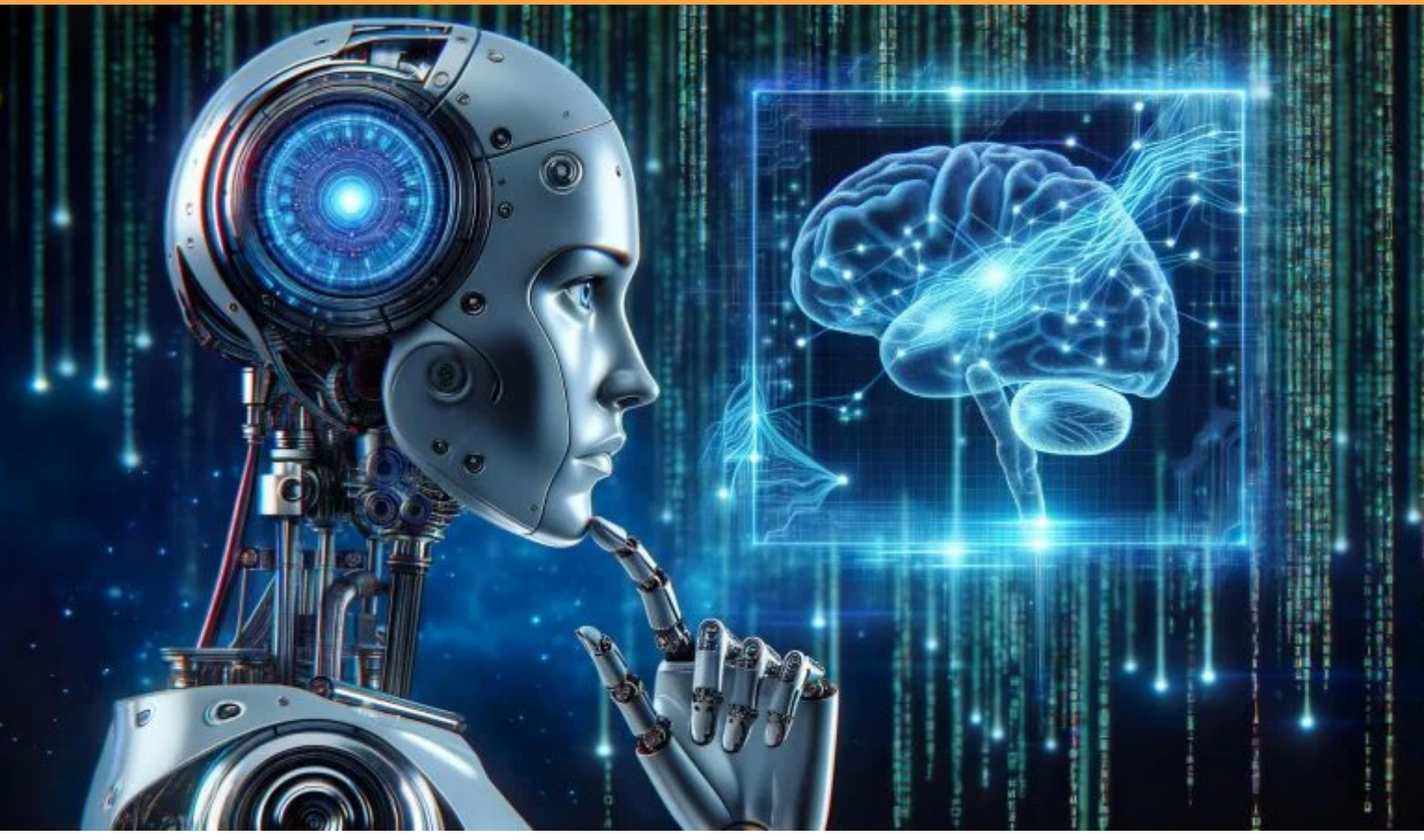


Image Source: https://scitechdaily.com/how-ai-is-learning-to-think-on-its-own-like-humans/

Artificial Intelligence

A specific branch of computer science is artificial intelligence. The overarching objective of this emerging field is to develop intelligent agents that can carry out tasks that normally require for human cognitive ability. Among these functions include decision-making, speech recognition, and problem-solving. In simple words, this artificial intelligence (AI) enables machines and computers the power to act intelligently like humans. This includes a variety of technologies which allow machines to think, act, perceive, and learn in ways that are comparable to those of humans.

How does AI work?

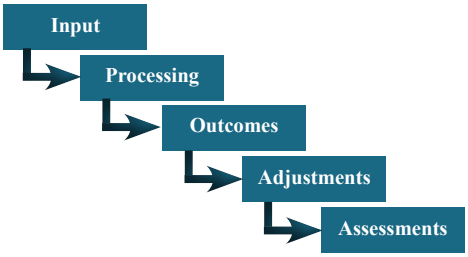


Figure 1: AI Workflow

- **Input:** AI systems begin by collecting data, including text, speech, and images. It is divided into groups, such as those that the algorithms can read and those that they can't.
- **Processing:** The next stage is to let the AI system determine what to do with the data after it has been collected and submitted. Using patterns, it has been trained to learn, the AI sorts and interprets the data until it finds recurring patterns in the data being filtered into the system.
- **Outcomes:** Following processing, the AI system generates an output that may indicate whether the input data was handled successfully or not. The AI is trained to determine if a given piece of data is a "pass" or a "fail" in this step; that is, whether it fits past trends. This establishes results from which decisions can be made. The effectiveness of the AI is then determined by closely examining this result through analysis, discovery, and feedback.
- **Adjustments:** When data sets are deemed a "fail," AI learns from the error and repeats the procedure in a different setting. It's possible that the algorithm needs to be slightly modified or that its rules need to be modified to fit the particular data set.
- **Assessments:**Assessment is the last stage before AI completes a task. In this case, the AI system combines knowledge from the data set to forecast future events based on the results and modifications. Before proceeding, the algorithm can include the feedback produced by the modifications.

Major Branches of AI

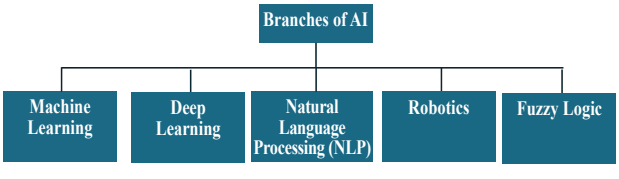


Figure 2: Major Branches of AI

- **Machine Learning:** A branch of artificial intelligence that combines coding, mathematics, and computer science is called machine learning. The goal of machine learning is to create algorithms that enable computers to learn from data and identify patterns without the need for human intervention.
- **Deep Learning:** A branch of artificial intelligence called deep learning mimics the structure and decision-making processes of the human brain. Rather than being designed to carry out a specific task, this subclass of machine learning may learn from unstructured data without supervision. Despite requiring a significant amount of data, it further reduces the need for human interaction. Common uses include advancements in natural language processing in devices such as Google Home, Amazon Alexa etc.
- **Natural Language Processing (NLP):** One essential component of artificial intelligence (AI) that allows computers to understand written and spoken language is natural language processing, or NLP. NLP is widely used in chatbots, virtual assistants, digital assistants, and spam detection. It is essential to sentiment analysis since it allows for the extraction of attitudes and feelings about a product or service from textual data.
- **Robotics:** AI is integrated into robotics to design and build devices and robots that are either fully or partially autonomous. To improve robot capabilities, this sector frequently integrates additional AI technologies like NLP and ML. With their accuracy and efficiency, AI-based robots are already having a big impact on a number of industries, including manufacturing, healthcare, and retail.
- **Fuzzy Logic:** To deal with ambiguity in AI decision-making, fuzzy logic is employed. Fuzzy logic enables AI to make conclusions based on imprecise or partial information, in contrast to classical logic that demands a binary "true" or "false." Applications such as weather forecasting, control systems, and smart home appliances can benefit from this.

Artificial Intelligence Market in India

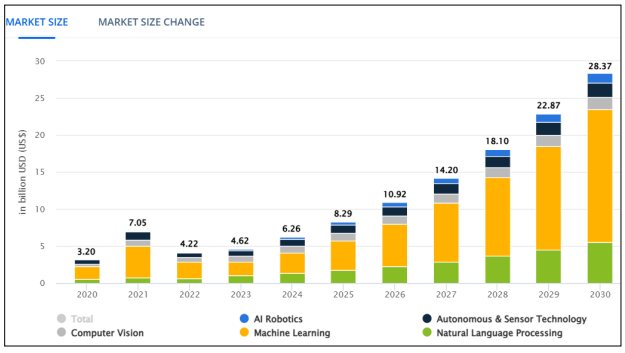


Figure 3: Artificial Intelligence Market Trend in India

Source: https://www.statista.com/outlook/tmo/artificial-intelligence/india

The market for artificial intelligence (AI) in India is expanding rapidly due to government efforts, the fast pace of digital transformation, and the growing use of AI technology in a variety of industries. By 2025, the artificial intelligence industry in India is expected to grow to a value of US$8.30 billion. By 2030, this market is projected to increase at a compound annual growth rate (CAGR 2025-2030) of 27.86%, reaching a volume of US$28.36 billion.

Information Technology Sector

Around the world, industries have undergone radical change as a result of the introduction of artificial intelligence (AI), the information technology (IT) is not exception here. This industry plays a pivotal role in leading this radical charge. IT is the unique sector that always ensures creativity and computational developments. This sector has embraced AI technology with ease to improve decision-making, redefine operational efficiency, and open up new possibilities. AI plays several kinds of roles in the IT industry, including smart data analytics, sophisticated application development, automation of routine operations, and strengthened cybersecurity. Solutions based on artificial intelligence are rapidly becoming essential at a time of growing data driven economy and complex system needs, allowing businesses to quickly adjust to changing market demands and technological advancements. In addition to simplifying operations, AI integration in IT sector stimulates the creation of cutting-edge goods and service. AI is transforming the industry environment in a number of ways, including automated workflows, customized software solutions, and automated routine maintenance in IT infrastructure. Furthermore, the introduction of artificial intelligence (AI) tools has triggered an unprecedented shift in new technologies like cloud-based computing, the Internet of Things (IoT), and big data analytics. In this context, it is important to understand how AI is driving the progress of IT, fostering sustainable growth, and shaping the future of technology-driven industries.

Role of AI in Information Technology Sector

By fostering innovation, improving operational effectiveness, and facilitating more intelligent decision-making, artificial intelligence (AI) is significantly changing the information technology (IT) industry. The IT industry, which is the foundation of contemporary economies, is using AI technology to solve difficult problems, enhance offerings, and open up new avenues for growth. Some important role AI plays in this industry are listed below:

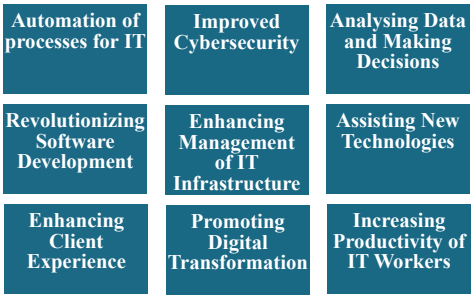


Figure 4: Role of AI in Information Technology Sector

➢ Automation of Processes for IT:

Image Source: https://rubicon8.com.au/tech-trends/the-rise-of-automation-preparing-your-business-for-success/

Automation technologies driven by AI take care of tedious and repetitive activities, allowing IT workers to concentrate on critical projects. This comprises AI-powered IT operations automation (AIOps), Chatbots and Virtual Assistants, Intelligent Workflows (IW). AIOps reduces downtime and enables predictive maintenance by monitoring, analysing, and automating IT systems. While, AI-powered chatbots improve customer service by giving prompt, precise answers to questions. IW automates processes like as patch updates, software deployment, and system monitoring.

➢ **Improved Cybersecurity**

Image Source: https://de.fi-group.com/en/sector/data-cybersecurity/

AI improves IT security through real-time threat identification and mitigation. It functions in three dimensions. The first is Threat Detection, in which machine learning algorithms look for anomalies and patterns that might point to cyberthreats. The second is Fraud Prevention, in which artificial intelligence (AI) technologies anticipate and stop fraudulent activity in sectors like e-commerce and banking. The third area is incident response, where AI technologies facilitate prompt and effective reactions to security breaches.

➢ **Analysing Data and Making Decisions**

AI analyses enormous amounts of data to produce insights for wise choices. It provides actionable intelligence by analysing both structured and unstructured data. AI predicts trends, allowing for proactive market tactics and resource management. Additionally, it provides tailored suggestions for uses such as streaming and e-commerce.

➢ **Revolutionizing Software Development**

Image Source: https://www.webhopers.com/software-development-company-in-karnal

By speeding up code creation and error correction, automating software reliability testing, and enabling customized software designs based on user behaviour and preferences, artificial intelligence is completely changing the software development lifecycle.

➢ **Enhancing Management of IT Infrastructure**

By processing real-time IoT data, optimizing resource allocation, reducing cloud computing costs, and simplifying virtualization procedures for improved hardware resource utilization and decision-making, artificial intelligence (AI) improves IT infrastructure management.

➢ **Assisting New Technologies**

Through improving data processing, lowering latency, streamlining transaction processing, and enabling more lifelike simulations and immersive experiences, artificial intelligence (AI) is revolutionizing a number of technologies, including edge computing, blockchain, and AR/VR. This promotes integration and progress.

➢ **Enhancing Client Experience**

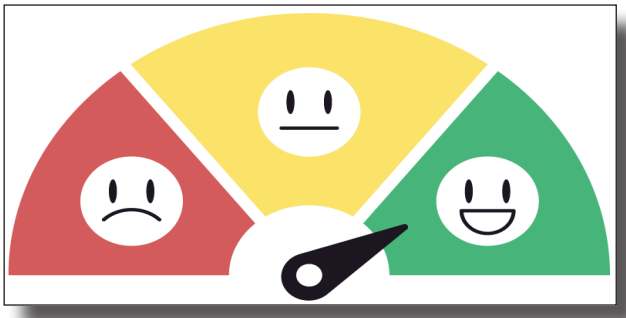


Image Source: https://medium.com/swlh/client-experience-matters-bd2dc41c904d

Through sentiment analysis, chatbots, virtual assistants, and dynamic content delivery, artificial intelligence improves user interactions. Chatbots and virtual assistants speed up response times and offer round-the-clock customer service. In contrast, Sentiment Analysis AI assesses client comments to raise the calibre of services. Delivery of Dynamic Content AI improves engagement by personalizing content distribution and user interfaces.

➢ **Promoting Digital Transformation**

For IT-driven enterprises, artificial intelligence is essential to enabling advanced level of digital transformation. This includes smart automation, which improves organizational efficiency by automating activities across departments. Market positioning and strategic choices are guided by business intelligence, which uses AI-driven insights. AI-powered e-government and smart city projects that enhance infrastructure and public services.

➢ **Increasing Productivity of IT Workers**

Image Source: https://elearningindustry.com/ways-to-improve-employee-productivity-in-the-workplace

AI-Augmented Decision Making, Upskilling, and Training Increase IT Workforce Productivity. AI is used into learning platforms to offer customized training courses that assist IT workers in improving their abilities. IT teams may make better strategic decisions by using AI tools to assess difficult circumstances.

Hence, the information technology (IT)is being drastically altered by artificial intelligence (AI), which has become a disruptive force. AI has revolutionized how businesses handle data, create software, and provide user-centric experiences in the IT industry by increasing productivity, enhancing cybersecurity, and facilitating the development of creative solutions. By enhancing safety, streamlining logistics, enabling autonomous vehicles, and optimizing traffic systems, artificial intelligence has simultaneously transformed transportation.The significant effects of AI on these two industries have been emphasized in this article, along with how it can both solve long-standing problems and open up new opportunities. AI in IT is helping companies navigate an increasingly digital environment by promoting automation, scalability, and adaptability.

References

https://www.datacamp.com/blog/ai-in-technology

Finance Sector

Artificial Intelligence in Finance

Artificial intelligence (AI) in finance helps drive insights for data analytics, performance measurement, predictions and forecasting, real-time calculations, customer servicing, intelligent data retrieval etc. By leveraging AI, financial institutions can gain deeper market understanding, personalize customer interactions, and improve operational efficiency through advanced analytics and automation. AI involves creating computer systems that can perform tasks that typically require human intelligence, such as learning, problem-solving, and decision-making. In finance, AI is transforming various aspects of the industry, from automating customer service interactions to enhancing fraud detection capabilities.

AI for financial operations solutions will undoubtedly continue to do so in the future. Here are some key areas where AI is changing financial services today.

- Predictive models help banks identify fraud before it happens by predicting which customers will be more likely to default on their loans.

- Deep learning can predict market volatility and place trades accordingly in seconds.
- Natural language processing (NLP) can answer basic queries or complete complicated transactions using voice commands or typing alone on a mobile device.
- Machine learning can predict customer preferences and suggest products accordingly without making errors like a human would make under pressure or when tired.

How does AI impact the finance industry

AI is a large driving force for how financial organizations conduct risk management, which includes security, regulatory compliance, fraud, anti-money laundering (AML), and know-your-customer (KYC) guidelines. With AI as part of their infrastructure, banks, investment firms, and insurance companies can use it to perform real-time calculations to forecast performance, detect anomalous spending behavior, or maintain compliance, among a plethora of other applications.

Benefits of AI in Finance

- **Automation:** AI empowers financial institutions to streamline operations, enhance customer experiences, and strengthen security. AI drives significant value across the financial sector by automating workflows, making autonomous and responsible decisions, and improving decision-making processes. For instance, AI can automate cybersecurity measures by continuously monitoring and analysing network traffic, while also enabling banks to offer more personalized and secure digital banking experiences that cater to individual client needs.
- **Accuracy:** Through automation and algorithms that consistently follow the same procedures, AI can assist financial services organisations in reducing human error in data processing, analytics, document processing and onboarding, client interactions, and other jobs.
- **Efficiency:** By automating repetitive tasks such as document verification, call transcription, and answering basic customer inquiries, AI frees up human employees to concentrate on more strategic and value-added activities. AI-powered bots effectively handle routine or low-touch tasks, improving efficiency and productivity within organizations.
- **Speed:** In addition to processing more data faster than a human, AI is able to identify links and patterns in data that a human would overlook. This translates into quicker insights to inform trading communications, risk modelling, compliance management, decision-making, and more.
- **Availability:** AI empowers financial institutions to provide exceptional customer service by enabling clients to complete financial tasks, achieve their financial goals, and manage their finances seamlessly anytime, anywhere. Cloud-based AI and machine learning systems operate continuously, ensuring that these services are always available and consistently improving their performance.
- **Innovation:** By rapidly analysing massive datasets, AI empowers businesses to develop innovative and differentiated products and services that surpass the competition. For example, predictive analytics powered by AI is transforming the insurance industry, enabling a more personalized customer experience while maintaining the crucial human element.

Ethics in AI in the Finance Sector

Artificial intelligence does not come without some ethical challenges, especially when it comes to protecting your personal and financial information. The Fintech Times highlights three areas of concern when it comes to AI in the finance sector:

There are certain ethical issues with artificial intelligence, particularly with regard to safeguarding personal and financial information. Regarding AI in the financial

industry, The Fintech Times identifies three areas of concern:

- **Bias:** Failures in AI are possible, and frequently the cause is an algorithmic issue. An illustration from The Fintech Times is as follows: An AI system that determines a customer's creditworthiness may soon engage in predatory behaviour and seek out borrowers with poor credit scores in order to offer subprime loans if it is charged with maximising profits. Although society may view this as unethical and undesirable, the AI is incapable of comprehending such subtleties.
- **Accountability:** Determining accountability for AI-driven errors presents a significant challenge. In the event of an AI-powered system malfunctioning, such as a self-driving car accident, it becomes crucial to establish who bears the responsibility. This complex issue requires careful consideration of various factors, including the role of developers, manufacturers, users, and the AI system itself.
- **Transparency:** Understanding the decision-making processes of AI algorithms can be challenging. It's often difficult to decipher how and why an algorithm arrives at a specific conclusion, leading to concerns about transparency and accountability.

Companies Using AI in Finance

- Kensho Technologies
- Enova
- Scienaptic AI
- Socure

Education Sector

Artificial Intelligence (AI) in the Education Sector

Artificial intelligence (AI) has the potential to revolutionize the way we learn and teach, making it more personalized, engaging, and efficient. AI in education refers to the use of AI technologies, such as machine learning and natural language processing, to enhance the learning experience. It involves the use of algorithms that analyze data, identify patterns, and make predictions, enabling educators to personalize learning for each student. The potential benefits of using AI in education are significant.

The Role of AI in Education

The basic goal of AI is to mimic human intellect and execute complex human tasks more efficiently and quickly. In the educational sector, AI can quickly expedite the entire teaching-learning process. AI plays a crucial role in education through tools like educational apps, online tutoring systems, and interactive games. By analyzing data and personalizing learning experiences, AI enhances educational efficiency, creates engaging content, and tailors instruction to individual student needs. Let's explore the role of artificial intelligence in the education sector:

- **Personalized Learning:** AI can help personalize the learning experience for each student, allowing them to learn at their own pace and according to their individual needs and abilities. This can lead to improved learning outcomes and increased student engagement. AI algorithms can provide instant and specific suggestions for improvement.
- **Enhanced Teaching and Learning:** AI can automate time-consuming tasks such as grading, administrative work, and lesson planning, allowing teachers to dedicate more time to student interaction and personalized support. AI-powered tutors can provide personalized guidance and support to students, and can supplement classroom teaching.
- **Improved Accessibility:** AI-powered tools like speech-to-text, text-to-speech, and translation applications help students with disabilities or language barriers.
- **Smart Connect:** AI enhances education by making teaching materials more interactive and personalized. Digital resources adapt to each student's pace,

ensuring content is always up-to-date and aligned with current standards. This benefits both students and teachers, creating a more dynamic and engaging learning experience.

- **Data-Driven Insights:** AI can analyse vast amounts of data on student performance, learning patterns, and engagement levels, providing valuable insights to teachers and administrators for improving instructional practices and resource allocation.
- **Universal Access:** By leveraging AI, teachers can create a more inclusive learning environment that reaches a wider audience. AI also facilitates remote learning, ensuring educational continuity even during unforeseen disruptions.
- **Improved Student Engagement:** AI can help improve student engagement by providing interactive and engaging learning experiences. For example, chatbots and virtual assistants can make learning more fun and interactive, and adaptive learning technologies can help students stay engaged by presenting material at their level of understanding.
- **Efficient Administrative Tasks:** AI automates repetitive tasks like grading, attendance tracking, and scheduling, allowing educators to focus on teaching.
- **Learning Gap Analysis:** With the help of AI tools, teachers can easily identify learning gaps among students. Teachers can get access to detailed reports and insights into each student's learning journey. By using these insights, educators can tailor their teaching strategies to meet the individual needs of their students, ensuring that no one is left behind.
- **Global Collaboration:** AI enables cross-border collaboration among students and educators through language translation and remote learning platforms.

Concern about Student use of AI

One of the primary concerns among educators is the potential for students to misuse AI technology by using it to complete assignments without genuine learning. To mitigate this risk, educators should focus on designing assignments that demand personal engagement and critical thinking, making them more challenging for AI systems to replicate. Furthermore, fostering AI literacy among students is paramount. Students should understand the capabilities and limitations of AI, including the potential for biased or inaccurate outputs. By encouraging responsible use of AI tools as learning aids rather than shortcuts, educators can maintain academic integrity. By proactively addressing these concerns and implementing thoughtful strategies, educational institutions can harness the transformative power of AI while mitigating its potential drawbacks.

Concern about Privacy, Biasness and Equity

Data privacy is a paramount concern when implementing AI in education. AI tools frequently collect and process substantial amounts of student data, raising critical questions about data usage and security. To address these concerns, educators must prioritize transparency. This includes informing students and parents about the types of data collected, how it will be used, and the safeguards in place to protect student privacy. Obtaining explicit consent before utilizing AI tools is crucial to building trust and ensuring ethical data practices.

Bias in AI is another significant issue, as AI systems can inherit biases from their training data, leading to unfair or discriminatory outcomes. Educators should be aware of these biases and seek to use AI tools that have been rigorously tested for fairness. Additionally, incorporating diverse perspectives in AI development and regularly spot-checking for bias can help mitigate problems.

Access to AI tools can exacerbate existing inequities in education. Not all students have equal access to technology, creating a digital divide that can further marginalize disadvantaged learners. Schools must proactively address this issue by ensuring equitable access to AI resources for all students. This includes providing

necessary devices, reliable internet connectivity, and affordable access to AI-powered educational platforms. Furthermore, comprehensive training programs for both students and teachers are crucial to ensure that everyone can effectively utilize these tools and benefit from their educational potential.

Example of Artificial Intelligence Tools in the Education Sector

- Duolingo
- Quizlet
- Intelligent Tutoring Systems
- ChatGPT
- Squirrel AI

Healthcare Sector

Impact of Artificial Intelligence on Healthcare sector

Artificial Intelligence in healthcare is revolutionizing the industry, providing innovative solutions that improve the quality, efficiency, and accessibility of medical care. AI in healthcare refers to the use of machine learning, natural language processing, computer vision, robotics, and other AI technologies to solve complex healthcare problems, optimize clinical processes, and improve patient outcomes. Here's an overview of the key areas where AI is making a significant impact:

1. AI in Diagnostics and Imaging

- **Medical Imaging:** AI algorithms, particularly deep learning models, are highly effective at analyzing medical images like X-rays, CT scans, MRIs, and ultrasounds. AI can detect abnormalities such as tumors, fractures, or infections at an early stage, often with greater accuracy than human radiologists.
- **Early Detection:** AI models can analyze patterns in images and other patient data to identify early signs of diseases like cancer, heart disease, and neurological conditions (e.g., Alzheimer's disease). Early detection improves treatment outcomes by enabling interventions at earlier, more treatable stages.

2. Personalized Medicine

- **Genomics:** AI helps analyze genetic data to develop personalized treatment plans based on an individual's genetic makeup. This approach, known as precision medicine, can optimize drug therapies and minimize adverse effects, offering better outcomes for patients.
- **Customized Treatments:** AI can analyze patient history, lifestyle factors, and genetic information to tailor treatments specifically for individuals, ensuring more effective therapies that account for variability in patients' responses to treatment.

3. AI in Drug Discovery and Development

- **Accelerating Drug Development:** AI can predict the properties of drug molecules, reducing the time needed to identify potential candidates. AI models can analyze vast datasets from biological, chemical, and clinical studies to predict how new drugs will behave, leading to faster and cheaper drug discovery.
- **Clinical Trials Optimization:** AI helps optimize clinical trials by identifying suitable candidates based on their medical history, genetics, and other factors. This increases the likelihood of successful trials and accelerates the introduction of new drugs to the market.

4. Clinical Decision Support Systems (CDSS)

- **Decision-Making Assistance:** AI can analyze vast amounts of patient data, including medical history, lab results, and real-time vital signs, to support healthcare providers in making informed decisions. AI-powered systems can alert doctors to potential issues such as drug interactions, allergic reactions, or deviations from treatment protocols.

- **Evidence-Based Recommendations:** AI helps clinicians by providing up-to-date, evidence-based guidelines and treatment protocols, leading to more accurate and informed clinical decisions.

5. Robotic Surgery and Assistance

- **Minimally Invasive Surgery:** AI-powered robotic systems assist surgeons in performing precise, minimally invasive procedures, which reduce patient recovery time and lower the risk of complications.
- **Surgical Robotics:** AI can assist in real-time decision-making during surgery, providing guidance based on the latest data.

6. Natural Language Processing (NLP) in Healthcare

- **Clinical Documentation:** AI-based NLP technologies can analyze and extract important information from clinical notes, medical records, and patient histories, streamlining administrative processes and improving data accuracy.
- **Voice Assistants for Healthcare:** AI-driven voice recognition tools enable healthcare providers to dictate patient notes or queries, significantly reducing the time spent on manual documentation.

7. Predictive Analytics for Patient Monitoring

- **Early Warning Systems:** AI can predict patient deterioration by analyzing continuous streams of data from wearables, vital monitors, and electronic health records (EHR). AI systems can identify warning signs of conditions such as sepsis, heart failure, or respiratory failure, allowing for early interventions.
- **Chronic Disease Management:** AI tools can monitor chronic conditions like diabetes or hypertension in real-time, providing alerts to patients and physicians if intervention is needed, thus improving long-term health outcomes.

8. Telemedicine and Remote Care

- **Virtual Consultations:** AI-powered telemedicine platforms enable virtual consultations, allowing patients to access healthcare remotely. AI chatbots and virtual assistants can help with initial patient inquiries, triage, and even offer basic diagnostic assistance.
- **Remote Monitoring:** AI-driven wearables and sensors allow healthcare providers to remotely monitor patients' health, enabling timely interventions and reducing hospital visits for routine checkups.

9. AI in Health Administration and Operations

- **Workflow Automation:** AI can automate administrative tasks such as scheduling, patient intake, and billing. This reduces the workload on healthcare staff and allows for more efficient use of resources.
- **Predictive Resource Management:** AI can help healthcare institutions optimize the allocation of resources like staff, equipment, and facilities by predicting patient flow, demand surges, and other operational variables.

10. Improving Patient Engagement and Experience

- **Personalized Health Recommendations:** AI-driven applications can provide personalized advice on diet, exercise, medication adherence, and other aspects of health management, helping patients to make informed decisions.
- **Chatbots and Virtual Assistants:** AI chatbots can answer patient queries, schedule appointments, provide medication reminders, and offer basic health advice, improving the overall patient experience.

11. AI in Mental Health

- **Early Detection of Mental Health Disorders:** AI tools are being used to monitor speech patterns, social media activity, and other behavioral indicators to detect early signs of mental health conditions such as depression, anxiety, and schizophrenia.

- **Therapeutic Chatbots:** AI-powered chatbots, such as Woebot, provide cognitive-behavioral therapy (CBT) to patients, offering support and guidance for mental health management.

AI in healthcare is driving transformation across diagnostics, treatment, patient care, and administration. It holds the potential to improve outcomes, reduce costs, and make healthcare more accessible. AI technology continues to evolve; it will play an increasingly crucial role in reshaping the healthcare industry.

Manufacturing Sector

Impact of AI on Manufacturing Sector

Artificial Intelligence (AI) is reshaping traditional industries in India, transforming agriculture, manufacturing, and logistics by enhancing productivity, efficiency, and decision-making. While these sectors are undergoing substantial modernization, challenges related to infrastructure, costs, skill gaps, and data privacy continue to hinder full-scale adoption. This article examines the impact of AI on these industries and the hurdles they face on the path to digital transformation.

AI in Manufacturing: Transforming Production Processes and Quality Control

India's manufacturing sector, known for its labour-intensive nature, is undergoing a shift toward smart manufacturing due to AI. AI is streamlining operations by enabling predictive maintenance, enhancing quality control, and optimizing supply chains, all of which can increase productivity and reduce costs.

Predictive maintenance, powered by machine learning, analyses historical data to predict equipment failures before they happen, allowing for timely repairs that minimize downtime. Quality control processes have also improved with AI technologies such as computer vision, which can detect minor defects that might otherwise go unnoticed, thereby reducing waste and ensuring high-quality output. Additionally, AI-driven supply chain optimization improves demand forecasting, inventory management, and supplier coordination, allowing manufacturers to meet market demands more efficiently and avoid stock surpluses.

AI is transforming manufacturing by automating tasks, enhancing safety, and improving efficiency. Key AI technologies making an impact include:

- **Machine Learning (ML):** ML analyses data to identify patterns and optimize processes like quality control, predictive maintenance, and production forecasting. It adapts to enhance performance and reduce downtime.
- **Computer Vision:** Paired with ML, computer vision inspects production lines, detecting defects and ensuring product quality with high accuracy.
- **Robotics and Automation:** AI-powered robots handle tasks like assembly and material handling, adapting to their environment and collaborating with humans to improve productivity.
- **Natural Language Processing (NLP):** NLP enables machines to understand and process human language, streamlining communication and enhancing maintenance through voice control and data analysis.

Applications of AI in Manufacturing

- **Predictive Maintenance:** AI predicts machinery failure, enabling preemptive maintenance and reducing disruptions, improving efficiency and cost-effectiveness.
- **Quality Control and Defect Detection:** AI uses computer vision to automate and speed up quality control, minimizing human error and improving accuracy in detecting defects.

- **Automated Production:** AI optimizes workflows, automates tasks, and enhances adaptability in dynamic manufacturing environments through data-driven decision-making.
- **Supply Chain Optimization:** AI forecasts demand and improves inventory management, ensuring efficient supply chain operations and real-time decision-making.

The AI market in manufacturing is expected to grow significantly, reaching $68.3 million by 2032.

Projected AI Market Size in Transportation by Category (2020-2030)

Year	Total Market Size	AI Robotics	Autonomous & Sensor Tech	Computer Vision	Machine Learning	Natural Language Processing
2020	3.20	-	-	-	-	-
2021	7.05	-	-	-	-	-
2022	4.22	-	-	-	-	-
2023	4.62	-	-	-	-	-
2024	6.26	-	-	-	-	-
2025	8.29	-	-	-	-	-
2026	10.92	-	-	-	-	-
2027	14.20	-	-	-	-	-
2028	18.10	-	-	-	-	-
2029	22.87	-	-	-	-	-
2030	28.37	1.31	1.96	1.67	17.87	5.56

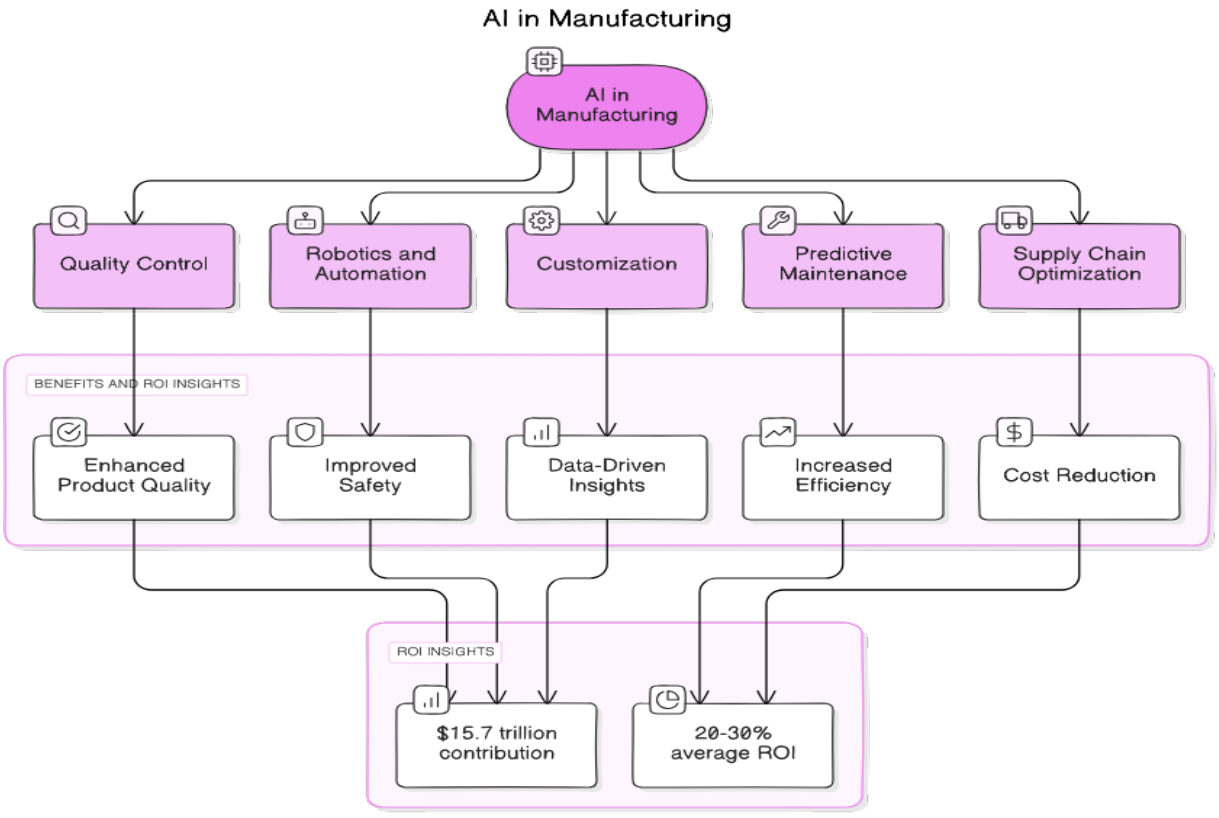
Notes: Data converted using average exchange rates of respective years.

Source: Statista Market Insights (March 2024).

India's manufacturing sector is undergoing a significant transformation with the integration of Artificial Intelligence (AI) and Machine Learning (ML), marking the rise of smart factories. A NASSCOM report highlights that digital technologies will account for 40% of manufacturing expenditure by 2025, up from 20% in 2021. This shift is expected to boost efficiency, reduce downtimes, and drive substantial growth in the industry, with the industrial automation market projected to reach $29.43 billion by 2029.

AI and ML are reshaping various industries, such as automotive, electronics, chemicals, pharmaceuticals, and textiles. In the automotive sector, AI-powered robotics enhance precision and speed on assembly lines, while the electronics industry benefits from AI-driven machine vision for quality control. Smart factories in chemicals and pharmaceuticals utilize AI for process monitoring, drug discovery, and product quality, while the textile industry uses CAD/CAM applications to optimize manufacturing processes.

India's industrial robotics market is growing rapidly, expected to reach $264.10 million by 2028, driven by AI algorithms that improve production efficiency and reduce labor costs. Companies like Hyundai Motors are adopting advanced manufacturing technologies, including AR & VR for quality assurance and training. Additionally, AI, smart sensors, RFID, and blockchain are streamlining operations from raw material management to packaging, helping minimize downtimes and enhance productivity.



The Indian government is actively supporting AI integration in manufacturing with policies like the National Program on Artificial Intelligence, aimed at fostering innovation and skills development. India's leadership in the Global Partnership on Artificial Intelligence (GPAI) underscores its commitment to responsible AI use.While AI and ML adoption may raise concerns about job displacement, they are expected to drive economies of scale, creating new opportunities and enhancing India's manufacturing capabilities. Overall, the incorporation of AI and ML in smart factories will revolutionize the sector, leading to greater efficiency, reduced manual intervention, and improved operational scales.

AI is revolutionizing the manufacturing sector by enhancing efficiency, reducing manual tasks, and improving overall product quality. Through technologies like machine learning, computer vision, robotics, and natural language processing, AI optimizes key processes such as predictive maintenance, quality control, production automation, and supply chain management. As AI adoption continues to grow, the manufacturing industry stands to benefit from smarter, more adaptive systems that drive productivity and cost savings, positioning AI as a critical driver of future manufacturing advancements.

Transportation Sector

Like the other sectors, the transportation sector has seen innovative uses of AI, from intelligent traffic control systems to driverless cars. AI is improving safety, easing traffic, and advancing sustainability by utilizing machine learning, computer vision, and predictive analytics. Additionally, AI-driven developments in public transit and logistics are enhancing service quality for end customers and optimizing resource usage. In this context, it is important to understandhow AI is driving the progress of transportation sector, fostering sustainable growth, and shaping the future of technology-driven transport industries.

Role of AI in Transportation Sector

AI is transforming the transportation industry by improving user experience, sustainability, efficiency, and safety. Its uses are found in a wide range of transportation systems, such as roads, railroads, airplanes, and ships. An extensive examination of AI's role in transportation is provided below:

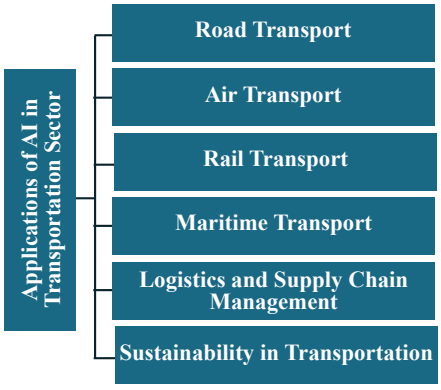


Figure 5:Role of AI in Transportation Sector

➢ **Road Transport**

Image Source: https://medium.com/@ml_artist/the-ai-powered-train-a-step-towards-futuristic-rail-transport-97ef1561307b

- **Autonomous Vehicles (i.e., Self-Driving Cars)**

Integration of the AI in car's core technologies. Perception systems (such as cameras, LIDAR, and radar) that are used for navigation, lane tracking, and obstacle identification are powered by artificial intelligence, especially machine learning.The advantages of integrating AI include minimizes human mistake, which is a primary contributor to mishaps. It also improves traffic flow by facilitating communication between vehicles and infrastructure. Autopilot and self-driving cars are common two examples. Smart driver assistants such as self-parking, lane recognition, and adaptive cruise control have become commonplace for many new cars. Some of them, such as Hyundai's advanced cruise control, have been implemented widely. However, they don't do the driver's job completely.Although autonomous vehicles are already a reality, full self-driving is hard to implement and requires a lot of work (and a ridiculous amount of data). Any confusion within real-time data transmission and processing in the vehicles can cause a fatal outcome. Hence, the projects are still not fully ready to run on every road.

- **Traffic Management and Optimization**

AI integration aids in traffic optimization and management as well. AI-powered solutions, such as smart traffic lights, lower emissions and congestion by modifying timing in response to current traffic circumstances. Predictive analytics powered by AI foresee traffic trends, improving urban design and routing. These tools include Waze, Google Maps, and AI-based traffic control systems tailored to a particular city.In order to streamline traffic, artificial intelligence should be applied to traffic management to make the roads smarter and more eco-friendly. Using computer vision machine learning, AI processes, controls, and optimizes large amounts of data from multiple sensors and cameras installed on the roads. AI and big data systems analyze those data to reveal traffic patterns. The relevant insights provide smart systems with input for traffic predictions or road blockages. Using those inputs, artificial intelligence recognizes and predicts issues that may lead to congestion.

- **Public Transportation**

AI has several beneficial effects on the administration of the public transportation system. Among these is Dynamic Scheduling, in which AI modifies train and bus timetables in response to passenger demand and current

circumstances. AI also provides customized features that (depending on commuters past travel patterns) suggest the best routes and times. Predictive maintenance powered by AI keeps an eye on a car's condition to avoid malfunctions, which lowers maintenance expenses and downtime.

➢ **Air Transport**

AI reduces fuel consumption in flight by adjusting speed and choosing the best flying routes. It incorporates autonomous systems such as drones for aerial surveys and cargo delivery, AI-assisted autopilots for improved safety and navigation, and chatbots for booking and customer support to improve the customer experience. Faster security and check-ins are also possible with AI-powered facial recognition. It also helps customers to book their flight tickets digitally.

➢ **Rail Transport**

Image Source: https://medium.com/@ml_artist/the-ai-powered-train-a-step-towards-futuristic-rail-transport-97ef1561307b

Rail transportation incorporates artificial intelligence (AI) to improve passenger experience, safety, and efficiency. By predicting wear and tear patterns from sensor data, AI algorithms lower maintenance costs and downtime. By examining past performance, weather, and passenger demand, it also optimizes scheduling. While AI-driven recommendation systems provide tailored travel recommendations, chatbots with AI capabilities offer real-time information about timetables, delays, and platform changes. Computers are used by driverless trains to maximize energy and speed, making travel more comfortable and effective.

➢ **Maritime Transport**

Image Source: https://www.linkedin.com/pulse/ai-revolution-shipping-efficiency-advantages-challenges-manik-t-ijh9c

In maritime transportation, artificial intelligence (AI) is essential, especially for route optimization and navigation. AI technology analyses historical behaviour and applies what it learns to apply actions, allowing ships with little or no crew to sail without assistance from humans. This guarantees secure cargo delivery and improved efficiency by freeing up deckhands to concentrate on other crucial duties. In order to improve resource and expense management, AI may also monitor fuel use and recommend ways to cut it. Additionally, it might shed light on ineffective procedures, leading to enhancements in ship operations. Ship efficiency and safety depend on maintenance. Whole systems can be affected by even small damage, which raises expenses and consumption. AI analyses equipment performance via sensors and notifies staff of problems. Instead of waiting until the next cycle of maintenance, repair, or inspection, this raises awareness and visibility, enabling equipment to get the attention it needs sooner. To get more precise results, AI also examines data from several sources, such as GPS scanners, radar, and sonar. AI can assist vessels in securely navigating water by reducing the number of ships they encounter by recording other vessels and retaining historical data. Ships gain from this information in a number of ways, such as making trips more quickly by determining when to port early and encouraging increased maritime safety. Hence, artificial intelligence (AI) is essential to maritime transportation since it offers important insights about port density, traffic patterns, equipment maintenance, navigation, and fuel usage.

Logistics and Supply Chain Management

Image Source: https://easyvessel.com/the-key-role-of-artificial-intelligence-in-logistics/

By increasing productivity, offering new capabilities, and boosting visibility and predictive power, artificial intelligence (AI) is radically altering the logistics and supply chain sector. By taking into account variables like traffic, weather, delivery locations, and worker strikes, artificial intelligence (AI) can optimize routes, lowering carbon emissions and fuel consumption. By combining machine learning and computer vision to detect damage, identify possible malfunctions, and analyze data from equipment sensors, it can also anticipate maintenance. By gathering goods in one place at the same time, classifying packages according to categories, defects, and damages, and guaranteeing on-time delivery, AI may also optimize picking and packing. Logistics problems like disjointed supply chains, unstable markets, safety issues, and the effect of freight and trucking on climate change can all be resolved by AI.

➢ Sustainability in Transportation

AI integration is essential to promoting sustainability in the transportation infrastructure. This includes the development of artificial intelligence (AI) to control EV charging stations in order to balance EV demand. Eco-Friendly Navigation is made possible by AI, which recommends routes that reduce emissions and fuel use. AI also aids in maximizing the lifespan and performance of batteries.

Indian Scenario

Artificial intelligence (AI) is significantly impacting India's transportation sector by improving traffic management through real-time data analysis, optimizing route planning, enhancing safety with driver assistance systems, promoting sustainable practices by reducing fuel consumption, and potentially enabling autonomous vehicles, leading to a more efficient and convenient transportation system across the country.

AI adoption in India's transportation sector has seen significant year-wise developments:

- 2018: Initiation of smart city projects integrating AI for traffic management and urban mobility.
- 2019: Deployment of AI-driven logistics solutions by companies like Delhivery and Rivigo for optimized operations.
- 2020: Use of AI in predictive maintenance and smart surveillance for public transport systems.
- 2021: Indian Railways began implementing AI for train scheduling and efficiency improvements.
- 2022: Increased investments in autonomous vehicle technology and electric mobility powered by AI.

These advancements highlight AI's role in enhancing efficiency, safety, and sustainability in India's transportation landscape.

With the government's focus on promoting green energy solutions and the aim to have 70% of commercial vehicles, including buses, to be electric by 2030, the future of public transportation looks increasingly sustainable. Technological developments, coupled with government offerings and incentives, are driving the adoption of green fuel-based buses and electric buses.

With the government's focus on promoting green energy solutions and the aim to have 70% of commercial vehicles, including buses, to be electric by 2030, the future of public transportation looks increasingly sustainable.

Technological developments, coupled with government offerings and incentives, are driving the adoption of green fuel-based buses and electric buses.

Key Impacts of AI on Indian transportation

Traffic Management

- Dynamic Signal Adjustment: AI algorithms analyze live traffic data to adjust traffic signal timings, minimizing congestion and optimizing traffic flow.
- Route Optimization: AI can suggest the most efficient routes based on real-time traffic conditions, reducing travel time and fuel usage.
- Incident Detection: AI-powered systems can identify accidents or road hazards quickly, enabling faster emergency response.
- Autonomous Vehicles: Driver Assistance Systems: AI-powered features like lane departure warning, adaptive cruise control, and autonomous emergency braking are enhancing road safety.
- Self-Driving Vehicles: Development of fully autonomous vehicles could revolutionize public transportation, particularly in congested urban areas.

Logistics and Delivery Optimization

- Route Planning: AI algorithms can analyze factors like weather, traffic patterns, and delivery windows to determine the most efficient delivery routes, minimizing costs and delivery times.
- Fleet Management: AI can optimize fleet operations by monitoring vehicle performance, fuel consumption, and driver behaviour.

Sustainability

- Reduced Emissions: By optimizing routes and traffic management, AI can contribute to lower carbon footprint from transportation.
- Smart Parking Systems: AI-powered parking systems can improve parking space utilization, reducing traffic congestion.

Passenger Experience

- Personalized Travel Information: AI-powered apps can provide real-time updates on travel schedules, disruptions, and alternative routes to passengers.
- Smart Ticketing Systems: AI can streamline ticket purchasing and fare collection processes.

AI is revolutionizing India's transportation sector by optimizing traffic management, reducing congestion, and improving road safety. Advanced technologies such as predictive analytics and machine learning enable smarter urban mobility solutions, including AI-driven public transport systems that enhance efficiency and user experiences. The logistics sector benefits from streamlined supply chains and cost reductions, while AI-powered predictive maintenance minimizes accidents and downtime. Additionally, the rise of autonomous and electric vehicles integrates sustainable and innovative approaches, fostering economic growth and transforming India's transportation landscape.

References

https://www.mitags.org/ai-impact-maritime-industry/

Retail and E-Commerce Sector

Role of AI in Retail and E-Commerce

Artificial Intelligence (AI) is revolutionizing the retail and e-commerce industries by enhancing customer experiences, streamlining operations, and optimizing business strategies. AI technologies, such as machine learning (ML), natural language processing (NLP), and computer vision, are reshaping how companies interact with consumers, manage inventory, and personalize shopping experiences.

- **Personalized Shopping Experience:**AI-driven recommendation systems are among the most notable impacts on retail and e-commerce. By analysing vast amounts of consumer data—such as browsing history, past purchases, and social media

activity—AI can provide highly personalized product recommendations. For example, online retailers like Amazon and Netflix use AI to suggest products or media based on individual preferences, increasing the likelihood of a sale. Personalized experiences not only enhance customer satisfaction but also boost sales and customer loyalty.

- **Chatbots and Virtual Assistants:**AI-powered chatbots and virtual assistants are transforming customer service in retail. These systems provide instant, 24/7 support, answering queries, assisting with order tracking, and even helping with product selection. By automating customer interaction, businesses reduce the need for human agents, saving on labour costs, while simultaneously improving response times and enhancing the customer experience.
- **Inventory Management and Demand Forecasting:**AI algorithms help retailers optimize their inventory by analysing historical sales data, market trends, and other variables. This allows for more accurate demand forecasting, reducing both overstocking and stockouts. Efficient inventory management ensures that retailers maintain the right level of stock, improving cash flow and minimizing waste.
- **Price Optimization and Dynamic Pricing:** AI can also help retailers optimize pricing strategies. By continuously analysing market conditions, competitor prices, and demand fluctuations, AI algorithms enable dynamic pricing, where the cost of a product adjusts in real-time based on various factors. This allows retailers to maximize revenue while staying competitive.
- **Supply Chain and Logistics Optimization:** AI technologies are improving the efficiency of supply chains by predicting the most efficient delivery routes, automating warehouses with robotics, and analysing logistical data to minimize shipping delays. These innovations reduce operational costs and improve delivery speed, which is critical for e-commerce companies competing in an increasingly fast-paced market.

Impact of AI on Retail and E-Commerce

The adoption of AI in retail and e-commerce has brought substantial improvements in operational efficiency and customer experience. By automating processes like customer service, inventory management, and price optimization, businesses can focus on strategic growth. Moreover, the ability to offer highly personalized experiences has resulted in higher customer engagement and conversion rates. On the consumer side, AI makes shopping more convenient, accurate, and enjoyable, from personalized product recommendations to smoother transactions and faster deliveries.

Main Issues and Challenges

Despite its advantages, the integration of AI into retail and e-commerce also presents several challenges:

- **Data Privacy and Security:** AI systems rely on massive amounts of consumer data, which raises concerns about privacy and data security. Retailers must ensure that they comply with regulations such as GDPR and implement robust security measures to protect sensitive customer information.
- **High Implementation Costs:** Implementing AI technologies requires significant investment in both infrastructure and talent. Smaller retailers may struggle to afford these technologies, leading to a disparity in their ability to compete with larger companies that have more resources.
- **Bias and Ethical Concerns:** AI systems can unintentionally perpetuate biases if not properly trained, leading to unfair or discriminatory outcomes. For instance, biased product recommendations or pricing algorithms could alienate certain customer groups.

- **Job Displacement:**Automation driven by AI could lead to job losses, particularly in roles such as customer service, inventory management, and logistics. This could create tension between technological advancement and workforce concerns.

Hence, AI is reshaping retail and e-commerce by driving efficiency, improving customer experience, and increasing profitability. However, the industry must address ethical, security, and financial challenges to fully harness the potential of AI while maintaining customer trust and fairness.

Agriculture Sector

Role of AI in Agriculture: Impact, Opportunities, and Challenges

Artificial Intelligence (AI) is transforming agriculture by enabling smarter farming techniques, enhancing productivity, and addressing global food security challenges. AI-powered tools and technologies are optimizing crop management, precision farming, pest control, and more. The integration of AI in agriculture promises significant advancements in efficiency and sustainability, but it also presents challenges related to data privacy, accessibility, and ethics.

- **Precision Agriculture and Crop Monitoring:** AI technologies, particularly machine learning (ML) and computer vision, are crucial in monitoring crop health and improving farming practices. Drones, sensors, and satellite imaging collect real-time data on soil moisture, crop health, temperature, and other variables. AI algorithms process this data to detect early signs of diseases, pests, or nutrient deficiencies. This allows farmers to take proactive measures, reducing the need for pesticides and fertilizers, and optimizing water usage. For example, AI-powered systems can identify areas in a field that require attention, enabling farmers to apply fertilizers or water only where necessary, a practice known as precision agriculture. This reduces resource waste and minimizes environmental impact.

- **Predictive Analytics for Yield Forecasting:** AI is revolutionizing yield prediction, which has traditionally been a challenging aspect of farming. By analyzing historical data, weather patterns, and soil conditions, AI algorithms can predict crop yields with high accuracy. This helps farmers make informed decisions about planting, harvesting, and resource allocation. Tools like Climate Field View from The Climate Corporation and John Deere's Operations Center use AI to provide farmers with data-driven insights for better crop management. AI can also forecast market demand and pricing, enabling farmers to plan their production cycles more effectively and reduce the risk of market volatility.

- **Automation in Farming:** AI-driven automation is playing a key role in reducing labor costs and improving efficiency. Autonomous tractors, harvesters, and planting machines equipped with AI are transforming how tasks like planting, weeding, and harvesting are carried out. These machines can operate 24/7 with minimal human intervention, improving productivity and reducing physical strain on farmworkers.For example, Octinion's Rubion is a robotic strawberry harvester that uses AI to identify ripe strawberries, picking them with precision. This type of automation not only speeds up harvests but also reduces food waste, as ripe produce is harvested at the optimal time.

- **AI in Pest and Disease Control:** AI is being used to detect and manage pest infestations and plant diseases before they spread. By processing data from drones and sensors, AI can identify patterns indicative of pest damage or disease symptoms, allowing for early intervention. For example, AI applications like Xarvio and Taranis analyze aerial imagery to detect pest infestations, enabling farmers to apply treatments only where needed, reducing chemical usage and minimizing environmental harm.

- **Supply Chain Optimization and Food Security:** AI also helps in optimizing agricultural supply chains, ensuring that products are transported efficiently from farm to market. Machine learning models predict demand and supply fluctuations, helping farmers and suppliers manage inventory, logistics, and distribution more effectively. AI tools are particularly useful for perishable goods, reducing waste and ensuring food security.

Impact of AI on Agriculture

The impact of AI in agriculture is profound:

- Increased Efficiency and Productivity: AI reduces inefficiencies in farming practices, increasing crop yields and resource use efficiency.
- Sustainability: Precision farming reduces the overuse of water, pesticides, and fertilizers, leading to more sustainable agricultural practices.
- Cost Reduction: Automation and predictive analytics reduce operational costs, making farming more profitable for small and large-scale operations alike.
- Improved Food Security: AI helps farmers make better decisions that increase food production and reduce waste, addressing the growing global demand for food.

Main Issues and Challenges

Despite its advantages, AI in agriculture faces several challenges:

- **Data Privacy and Security:** Agricultural AI systems rely heavily on data from farmers, which raises concerns about privacy and security. Unauthorized access to sensitive farming data can lead to misuse or exploitation.
- **High Initial Investment:** Implementing AI technologies can be expensive, making it difficult for small-scale farmers to adopt these innovations. The high upfront costs for AI-powered tools, machines, and software can be a barrier for widespread adoption, especially in developing countries.
- **Access to Technology and Skills:** AI adoption requires specialized knowledge and technical skills. Farmers may struggle to access training, limiting the effective use of AI tools, particularly in rural or underdeveloped areas.
- **Ethical Concerns and Job Displacement:** As AI technologies automate agricultural processes, there may be concerns about job displacement for laborers in farming communities. Additionally, AI systems may exacerbate inequalities if access to technology is concentrated in wealthier regions.
- **Environmental Impact:** While AI can reduce environmental impacts, the large-scale implementation of AI tools requires substantial energy consumption, particularly in data centers and with the deployment of sensors and drones. Ensuring these technologies are used sustainably is key to minimizing their environmental footprint.

Power Sector

AI is reshaping the agriculture sector by improving efficiency, productivity, and sustainability. From precision farming to pest management and supply chain optimization, AI offers significant benefits. However, challenges such as high costs, data privacy, and access to technology must be addressed to ensure that AI's advantages can be fully realized and equitably distributed across farming communities. As AI continues to evolve, its role in agriculture will be critical to addressing global challenges such as food security and climate change.

Conceptual Framework

The Power Sector is really important for a country's development and well-being. In India, having a good power infrastructure is crucial for the economy to grow. The goal is to make sure everyone can sustainably afford electricity. The Ministry of Power has been working hard

to make sure there is enough electricity for everyone by connecting the whole country with a national grid, improving the distribution network, and making sure every household has access to electricity. India has a diverse mix of power sources, including coal, natural gas, oil, hydro, nuclear power, wind, solar, and even agricultural and domestic waste. The demand for electricity in the country is increasing rapidly, and more power plants need to be built to meet this demand.

Important Facts about India's Power Sector

- India is the third-largest producer and consumer of electricity worldwide.
- Power consumption in FY23 grew by 9.5%, reaching 1,503.65 billion units (BU).
- India has pledged to increase non-fossil fuel-based electricity generation capacity to over 500 GW by 2031-32, aligning with its sustainability goals.
- 100% FDI is allowed in the power sector, attracting significant foreign investments.
- Total FDI inflows in the power sector between April 2000 and March 2024 amounted to US$ 18.28 billion.
- The sector is expected to attract investments worth Rs. 17 lakh crore (US$ 205.31 billion) over the next 5–7 years.
- According to the National Infrastructure Pipeline (2019–25), energy sector projects account for the largest share (24%) of the total projected capital expenditure of Rs. 111 lakh crore (US$ 1.4 trillion).

Role of Artificial Intelligence in Power Sector

The integration of Artificial Intelligence (AI) in the power sector is transforming its operations, enhancing efficiency, and contributing to sustainability. Here's a detailed discussion of AI's role in the power sector:

1. Demand Forecasting and Load Management

AI-based predictive models analyze historical and real-time data to forecast electricity demand with high accuracy.

Benefits

- It helps utilities optimize generation and distribution.
- It also helps in reducing energy waste and prevents grid overloads.

Example: National Grid in the UK uses AI to predict electricity demand based on historical data, weather conditions, and consumer behaviour. This helps optimize energy production and distribution, reducing waste and improving reliability.

2. Smart Grid Optimization

AI enables the development of smart grids, which are essential for modern power systems.

Applications:

- Identifying faults in the grid and isolating affected areas.
- Managing bidirectional power flows from renewable sources like solar panels and wind turbines.
- Enhancing reliability and reducing downtime.

Example: Siemens uses AI in smart grids to manage power distribution in real-time. AI algorithms balance supply and demand, detect outages, and reroute power automatically to minimize disruptions.

3. Renewable Energy Integration

AI improves the integration of intermittent renewable energy sources (e.g., solar and wind) by:

- Predicting weather patterns for accurate renewable energy generation forecasts.
- Balancing supply and demand dynamically in real time.

Example: Google's DeepMind uses AI to optimize wind farm operations. By predicting wind power output 36 hours in advance, AI helps make renewable energy more predictable and integrate better into the grid.

4. Energy Efficiency and Cost Optimization

AI-powered systems monitor energy consumption patterns and suggest ways to reduce energy use. Smart meters and IoT devices, combined with AI, provide personalized insights to consumers to lower their electricity bills.

5. Predictive Maintenance

AI algorithms analyze data from sensors installed in power generation and transmission equipment to predict potential failures.

Benefits

- Reduces downtime by scheduling maintenance proactively.
- Lowers maintenance costs and extends equipment lifespan.

Example: General Electric (GE) uses AI to monitor power plant equipment like turbines and generators. Sensors collect data, and AI analyzes it to predict equipment failures before they occur, reducing downtime and maintenance costs.

6. Enhanced Customer Experience

AI-driven chatbots and virtual assistants improve customer service by:

- Addressing queries related to billing, outages, and energy-saving tips.
- Offering personalized energy solutions based on usage patterns.

Example: Utilities like Southern California Edison use AI-driven chatbots and recommendation systems to guide customers toward energy-saving programs and adjust consumption during peak hours through demand response programs.

7. Fraud Detection and Cybersecurity

AI helps detect anomalies in energy usage that might indicate theft or fraud. It also strengthens cybersecurity by identifying and mitigating potential threats to critical infrastructure.

Example: AI systems like those developed by Schneider Electric detect and respond to grid anomalies and potential cyber threats in real time, ensuring the grid remains stable and secure.

8. Energy Trading and Market Optimization

AI enables automated trading in energy markets by analyzing real-time data to optimize buying and selling decisions. Algorithms also assist in setting dynamic tariffs based on demand-supply fluctuations.

9. AI in Power Plant Management

AI optimizes power plant operations by:

- Improving fuel efficiency in thermal power plants.
- Enhancing operational efficiency in hydro and nuclear power plants.

Example: AI systems by companies like ABB optimize the operation of thermal and hydroelectric power plants, adjusting parameters like fuel usage and water flow for maximum efficiency.

10. Climate Impact and Sustainability

AI contributes to achieving sustainability goals by:

- Reducing carbon emissions through optimized energy use.
- Accelerating the transition to a cleaner energy mix by improving renewable energy adoption.

Challenges of Implementing AI in the Power Sector

- **Data Availability and Quality:** AI relies on large datasets, and ensuring data quality can be a challenge.
- **High Initial Costs:** Implementing AI-based solutions requires significant investment.
- **Skill Gaps:** The sector needs skilled professionals to develop and manage AI systems.
- **Cybersecurity Concerns:** Increased digitalization raises the risk of cyberattacks.

Hence, AI is revolutionizing the power sector by making it smarter, more efficient, and sustainable. From optimizing grid operations to integrating renewable energy, AI plays a pivotal role in addressing the challenges of a modern, dynamic energy ecosystem. However, addressing implementation challenges through investment, collaboration, and regulatory frameworks will be key to maximizing AI's potential.

Reference

- https://powermin.gov.in/en/content/power-sector-glance-all-india
- https://www.nextias.com/blog/power-sector/?utm_source
- https://www.iea.org/countries/india
- https://www.trade.gov/country-commercial-guides/india-renewable-energy

Entertainment and Media Sector

The Role of Artificial Intelligence in Entertainment and Media Sector

Artificial Intelligence (AI) is reshaping the entertainment and media landscape, revolutionizing how content is created, consumed, and distributed. From streamlining production processes to enabling immersive experiences, AI is becoming a cornerstone of innovation in the industry. This article delves into the detailed role of AI across various facets of entertainment and media, exploring its transformative impact and the challenges it presents.

- **AI in Creative Content Development:** AI has transformed the creative process in entertainment, enabling artists, writers, musicians, and filmmakers to innovate and streamline their workflows.
- **Automating Scriptwriting and Story Development:**AI-powered tools like ChatGPT and DeepStory have become invaluable for content creators. These tools analyze vast datasets of existing literature, films, and scripts to generate original plots, characters, and dialogues. While human creativity remains at the forefront, AI assists by suggesting unique perspectives, identifying storytelling gaps, and even predicting audience preferences.For example, AI algorithms are now used to simulate alternate endings or plot twists, offering creators a sandbox for experimentation. Studios can test audience reactions to these variations, ensuring optimal engagement before finalizing content.
- **Enhancing Visual Effects and Animation:** AI has revolutionized the field of visual effects (VFX) and animation. Traditional VFX processes, which required extensive manual labour, are now expedited with AI-powered tools like NVIDIA's AI-based rendering. These tools can generate realistic environments, textures, and simulations, drastically reducing production time and costs.In animation, AI enables real-time motion capture and automated character rigging, which were once labour-intensive processes. It also allows creators to upscale older content to modern standards, preserving cultural heritage while meeting contemporary quality expectations.
- **AI in Music Composition and Sound Design:** AI-driven platforms like AIVA (Artificial Intelligence Virtual Artist) and Amper Music are now composing original scores, catering to specific moods and genres. Musicians and producers use these tools for background scores, advertisements, and video games, leveraging AI to generate high-quality music rapidly.AI is also enhancing sound design by creating realistic soundscapes for films and games, simulating environmental acoustics, and synchronizing audio elements with visual content.
- **AI-Driven Personalization and Audience Engagement:** AI has made entertainment experiences more tailored, creating a deeper connection between audiences and content.

- **Customized Viewing and Listening Experiences:** Platforms like Netflix, YouTube, and Spotify use AI-powered recommendation algorithms to analyze user behaviour. By examining factors such as viewing history, genre preferences, and time spent on content, AI curates personalized playlists, video suggestions, and movie recommendations.This hyper-personalization not only improves user satisfaction but also increases viewer retention and platform engagement. For instance, Netflix's recommendation engine is estimated to drive 80% of its watch time, showcasing the power of AI in connecting audiences with content.
- **Interactive Storytelling and Gaming:** AI is redefining how audiences interact with stories and games. In interactive films and video games, AI-driven non-player characters (NPCs) adapt to player actions, creating dynamic and personalized narratives. Games like The Elder Scrolls V: Skyrim and Red Dead Redemption 2 utilize AI to make NPC behaviour more realistic, enhancing immersion.In the realm of virtual reality (VR) and augmented reality (AR), AI enables responsive environments that adjust to user input, offering highly engaging and adaptive storytelling experiences.
- **Virtual Influencers and AI-Powered Chatbots:** AI has given rise to virtual influencers like Lil Miquela, who interact with audiences on social media. These AI-generated personas blur the lines between reality and fiction, attracting millions of followers and opening new marketing opportunities for brands.Similarly, chatbots powered by natural language processing (NLP) are being used in live events, fan interactions, and customer support, enriching the overall audience experience.

AI in Media Production and Operations

AI is streamlining production processes, reducing costs, and enabling creators to focus on innovation.

- **Smart Editing and Post-Production:** AI-powered tools like Adobe Sensei and Runway AI are transforming post-production. These tools can analyze raw footage, identify the best takes, and automate editing tasks, such as colour correction and scene transitions.AI is also being used to create trailers by identifying key emotional or action-packed moments in a film, ensuring maximum impact in marketing.
- **Localization and Translation:** AI is breaking language barriers through automated dubbing, subtitling, and translation. Platforms like Papercup use AI to produce high-quality translations in multiple languages, making content accessible to global audiences.This capability extends to real-time translation, allowing live broadcasts and events to reach diverse viewers, fostering inclusivity and expanding market reach.
- **Predictive Analytics for Distribution:** AI plays a critical role in optimizing content distribution. By analysing audience demographics, viewing habits, and market trends, AI helps studios decide when and where to release content.For instance, AI can predict the best release windows for films or recommend specific platforms for streaming, ensuring maximum visibility and revenue.

AI in Advertising and Marketing Strategies

AI has revolutionized how entertainment and media companies approach advertising, offering unparalleled precision and effectiveness.

- **Programmatic Advertising:** AI-driven programmatic advertising automates the buying and placement of ads. Platforms like Google Ads and Meta Ads Manager analyze user behaviour to deliver targeted advertisements, ensuring higher engagement and ROI.AI also personalizes ad content, tailoring visuals and messaging to individual preferences. This level of customization enhances the viewer experience while maximizing the impact of campaigns.

- **Audience Analytics and Insights:** AI tools provide deep insights into audience behaviour, helping marketers understand what drives engagement. For instance, tools like Nielsen's AI-driven analytics offer data on audience demographics, viewing patterns, and content preferences, allowing for more informed decision-making.These insights are also used to refine marketing campaigns, ensuring that they resonate with target audiences and align with broader consumer trends.

Challenges and Ethical Considerations

The widespread adoption of AI in entertainment and media comes with significant ethical and practical challenges.

- **Bias in AI Systems:** AI algorithms are only as unbiased as the data they are trained on. If the training data reflects societal biases, the AI may perpetuate stereotypes or exclude certain demographics. Addressing these biases is crucial to ensure fair and inclusive content.
- **Impact on Employment:** As AI automates creative and technical tasks, concerns about job displacement are growing. While AI creates new roles in data science and machine learning, it also reduces demand for traditional roles in editing, VFX, and localization. Balancing automation with human creativity is essential to sustain industry employment.
- **Data Privacy Concerns:** Personalized recommendations and targeted advertising rely on extensive data collection. This raises privacy concerns, as users may not fully understand how their data is being used. Companies must prioritize transparency and compliance with regulations like GDPR to build trust with audiences.
- **Authenticity and Accountability:** AI-generated content raises questions about authenticity and authorship. Should AI-created works be credited to their creators, or the algorithms themselves? Clear guidelines and ethical standards are necessary to address these issues.

Future of AI in Entertainment and Media

AI's potential in entertainment is vast, with emerging trends promising even greater innovation.

- **Real-Time Content Creation:** Advancements in AI will enable real-time generation of visuals, music, and dialogues, transforming live performances, interactive storytelling, and gaming.
- **Emotionally Responsive Media:** Emotional AI, capable of interpreting human emotions through facial expressions, voice, and text, will allow content to adapt dynamically to audience reactions. This technology could revolutionize genres like drama and horror, creating deeply personalized experiences.
- **AI in the Metaverse:** AI will be a driving force behind the creation of the metaverse—an interconnected virtual world. From generating realistic avatars to designing interactive environments, AI will play a pivotal role in shaping this next frontier of entertainment.

Artificial Intelligence is transforming the entertainment and media industry, serving as a creative partner and operational optimizer. From streamlining production to delivering personalized experiences, AI is enhancing every aspect of the industry.While challenges such as bias, privacy concerns, and job displacement remain, the opportunities AI offers far outweigh the risks. As AI continues to evolve, its integration into entertainment will unlock new dimensions of creativity and connection, redefining how stories are told and experienced in the digital age.

Defence and Security Sector

The Role of Artificial Intelligence in Defence and Security

Artificial Intelligence (AI) is revolutionizing the fields of

defence and security, introducing capabilities that enhance surveillance, automate operations, and improve decision-making processes. By integrating AI into military strategies, governments and organizations are developing smarter, more efficient systems to protect their assets and ensure national security. This article explores the various dimensions of AI in defence and security, providing in-depth insights and examples for each application.

- **AI in Threat Detection and Surveillance:** AI-powered systems have significantly improved the ability to identify and respond to potential threats in real-time. These systems analyze vast amounts of data from multiple sources, making surveillance and detection faster and more accurate.
- **Automated Threat Identification:** AI systems excel at identifying potential threats using machine learning models trained on diverse datasets, such as facial recognition data, behavioural patterns, and geospatial intelligence. These systems can detect anomalies in crowded places, such as airports or public gatherings, where traditional methods may fall short.For instance, an AI system deployed in a railway station might flag a person carrying a suspicious object based on heat signatures or object recognition algorithms. Security personnel can then intervene promptly, preventing possible incidents.
- **Predictive Analytics for Threat Forecasting:** AI's predictive analytics capabilities enable organizations to anticipate and mitigate risks. By analysing historical patterns of terrorist activities, cyberattacks, or natural disasters, AI systems provide insights that allow authorities to take preemptive measures.For example, predictive models can identify high-risk periods for cyberattacks during geopolitical tensions, helping governments bolster their cybersecurity defenses.
- **Integrated Border Surveillance:** AI-powered drones and sensors enhance border security by monitoring vast, remote areas that are difficult to patrol manually. These systems can autonomously identify unauthorized crossings, illegal trafficking activities, and potential breaches.An example is the use of AI-enabled drones along the U.S.-Mexico border, which monitor real-time movements and relay critical data to border control agents, ensuring quicker responses to threats.

AI in Cybersecurity

The digitalization of defence and security systems has increased vulnerabilities to cyberattacks. AI has become a cornerstone of cybersecurity, offering advanced tools to protect sensitive information and infrastructure.

- **Real-Time Threat Detection:** AI systems monitor network activity in real-time, detecting and neutralizing potential threats before they cause harm. These systems use anomaly detection algorithms to identify unusual behaviours, such as unauthorized logins or irregular data transfers.For instance, an AI-powered cybersecurity system in a government agency might detect an unusual data access attempt during non-business hours, automatically blocking the attempt and alerting administrators.
- **Adaptive Defense Mechanisms:** Traditional cybersecurity measures rely on predefined rules, making them less effective against evolving threats. AI systems, however, adapt to new attack patterns, such as polymorphic malware, ensuring continuous protection.Darktrace, a cybersecurity firm, uses AI to build "immune systems" for organizations. These systems learn the normal behavior of a network and respond to anomalies autonomously, minimizing the impact of attacks.
- **Fraud Detection and Prevention:** AI algorithms analyze user behaviour and transaction patterns to identify fraudulent activities, such as phishing or identity theft. Financial institutions and government agencies use these systems to protect sensitive operations.For example, AI in payment systems

can detect a sudden, high-value transaction from an unusual location, flagging it for verification before processing.

AI in Autonomous Systems and Combat Technologies

Autonomous systems powered by AI are reshaping modern combat, reducing human involvement in dangerous scenarios and improving mission efficiency.

- **Unmanned Aerial and Ground Vehicles:** AI-enabled drones and vehicles are increasingly used for reconnaissance, surveillance, and combat missions. These systems can independently navigate hostile environments, gather intelligence, and execute tasks with minimal human oversight.For instance, Israel's Harpy drone uses AI to detect and neutralize enemy radar systems autonomously, providing a significant tactical advantage.
- **Precision-Driven Weaponry:** AI allows the development of weapons systems with exceptional accuracy, minimizing collateral damage. These systems use real-time data to adjust trajectories and target positions during operations.The U.S. military's Joint Direct Attack Munition (JDAM) systems, enhanced with AI algorithms, improve the precision of airstrikes, ensuring greater operational success and reduced civilian casualties.
- **Swarm Robotics:** Swarm robotics involves multiple autonomous devices working collaboratively to achieve a shared objective. AI enables these devices to communicate and adapt to changes in real-time, making them invaluable for search-and-rescue missions or offensive operations.For example, during disaster relief, AI-powered robotic swarms can search through debris for survivors, relaying their locations to human responders.

AI in Decision Support Systems

AI enhances decision-making processes by analysing data and providing actionable insights, allowing defence personnel to make informed and timely decisions.

- **Battlefield Intelligence:** AI systems synthesize information from multiple sources, such as satellite imagery, drone footage, and radar data, to provide a comprehensive battlefield overview. This allows commanders to assess threats, deploy resources, and plan strategies effectively.For example, AI tools like Palantir analyze battlefield data to predict enemy movements, helping military leaders prepare for potential scenarios.
- **Simulation and Training:** AI-powered simulations provide military personnel with realistic training environments, improving their readiness for combat scenarios. These systems replicate battlefield conditions, allowing soldiers to practice tactics and decision-making under pressure.VR platforms integrated with AI can simulate hostage situations or urban warfare, giving soldiers hands-on experience without the risks associated with live training exercises.
- **Crisis Management:**AI aids in crisis management by forecasting potential disaster scenarios and recommending response strategies. During natural disasters or terrorist attacks, AI systems can prioritize resource allocation and coordinate relief efforts efficiently.For instance, during the COVID-19 pandemic, AI tools helped governments predict hotspots and allocate medical supplies effectively.

AI in National Security and Counterterrorism

AI enhances national security efforts by enabling faster, more accurate intelligence analysis and counterterrorism measures.

- **Intelligence Gathering and Analysis:** AI processes vast amounts of data from intercepted communications, surveillance footage, and public records to identify threats. This accelerates the detection of terrorist networks and the planning of countermeasures.For example, the UK's GCHQ uses AI tools to sift through intercepted communications, identifying keywords and patterns associated with extremist activities.

- **Social Media Monitoring:** AI analyses social media platforms to detect signs of radicalization, propaganda dissemination, or coordinated attacks. By monitoring trends and sentiment, security agencies can identify potential threats and intervene early.For instance, AI algorithms flagged suspicious activity on social media platforms during the 2020 U.S. elections, helping authorities prevent misinformation campaigns.
- **Infrastructure Protection:** AI systems safeguard critical infrastructure, such as power grids, transportation networks, and financial institutions, from cyber and physical threats. These systems detect vulnerabilities and ensure continuity during attacks. AI-powered cybersecurity tools, such as those used in nuclear facilities, monitor and prevent breaches, ensuring the safety of sensitive operations.
- **Ethical Challenges and Concerns:** The use of AI in defence and security comes with ethical considerations that must be addressed to ensure responsible implementation.
- **Autonomy in Lethal Systems:** Delegating life-and-death decisions to AI raises ethical concerns. Autonomous weapons could act unpredictably or be misused, necessitating international regulations to govern their deployment.

Bias in AI Models

AI systems trained on biased data can produce unfair or discriminatory outcomes. In defence, this could lead to wrongful targeting or profiling, undermining trust in AI technologies.

- **Privacy and Surveillance Concerns:** The use of AI in surveillance raises privacy concerns, especially when deployed in civilian areas. Governments must strike a balance between security and individual rights to prevent misuse.
- **Adversarial AI:** Adversarial AI involves malicious actors exploiting AI systems to create harm, such as misleading algorithms with manipulated data. Ensuring robust AI security is critical to counter these threats.

Future Trends in AI-Driven Defence and Security

The role of AI in defence and security is expected to grow, with emerging technologies offering unprecedented capabilities.

- **AI-Enhanced Space Defence:**AI will play a key role in managing satellite constellations, monitoring space debris, and detecting adversarial activities in space, ensuring a strategic advantage.
- **Quantum Computing and AI Integration:**The integration of AI with quantum computing will enhance cryptographic systems, enabling secure communication and faster data processing for defence operations.
- **Human-AI Collaboration:** Future systems will prioritize collaboration between human operators and AI, ensuring that machines serve as effective tools rather than independent decision-makers. This will optimize operations while maintaining accountability.

AI is transforming defence and security, offering advanced capabilities that enhance efficiency, accuracy, and safety. While challenges remain, the potential of AI to revolutionize these fields is undeniable. By addressing ethical concerns and fostering innovation, nations can harness AI as a strategic advantage in protecting their citizens and assets.

Environment and Climate Change

Conceptual Framework

The environment and climate change have become critical factors influencing businesses worldwide. Here's a brief overview of their impact:

- **Regulatory Compliance**

- Governments are introducing stricter environmental regulations, such as carbon taxes, emissions trading

schemes, and energy efficiency standards.

- Businesses must adapt their operations to comply, which can increase costs but also foster innovation.

➢ **Shift to Sustainable Practices**

- Consumers and investors increasingly favour companies with sustainable and environmentally responsible practices.
- Businesses are adopting green initiatives like renewable energy, waste reduction, and sustainable sourcing to meet market demands.

➢ **Risks to Operations**

- Climate change leads to extreme weather events (floods, droughts, hurricanes) that disrupt supply chains, damage infrastructure, and increase insurance costs.
- Businesses need to build resilience by diversifying suppliers, improving infrastructure, and investing in disaster recovery plans.

➢ **Opportunities in Green Economy**

- Climate change has created opportunities in renewable energy, electric vehicles, carbon capture technologies, and sustainable products.
- Businesses investing in green technologies and innovations can gain a competitive edge and tap into new markets.

➢ **Investor and Stakeholder Pressure**

- Investors are prioritizing Environmental, Social, and Governance (ESG) criteria.
- Companies must align with sustainability goals to attract funding and maintain a positive public image.

➢ **Legal and Reputational Risks**

- Failure to address environmental concerns can lead to legal actions, fines, and reputational damage. Transparency in environmental practices is crucial to maintain trust.

➢ **Financial Impacts**

- Rising energy costs and resource scarcity due to climate change can affect profitability.
- Transitioning to energy-efficient processes and renewable energy sources can mitigate these risks.

Role of AI for Carbon Emissions Tracking and Reduction

Artificial Intelligence (AI) is a transformative tool in the fight against climate change, particularly in tracking and reducing carbon emissions. Here's an in-depth look at its applications:

➢ **Carbon Emissions Monitoring**

- Satellite-Based Monitoring: AI analyzes satellite imagery to detect and quantify greenhouse gas emissions (e.g., CO_2, methane) from industrial facilities, forests, and urban areas. Example: AI-powered platforms like Google's Earth Engine and Climate TRACE monitor emissions globally in near-real time.
- IoT Sensors and Data Analysis: AI processes data from IoT sensors installed in factories, vehicles, and power plants to provide accurate emissions measurements. Example: AI systems track emissions in supply chains to identify inefficiencies and hotspots.
- Land Use and Deforestation Analysis: AI models assess land-use changes, deforestation, and degradation, which are significant sources of carbon emissions.

➢ **Optimizing Industrial Processes**

- Predictive Maintenance: AI predicts equipment failures, ensuring industrial machinery runs efficiently and reduces unnecessary energy consumption.
- Process Optimization: AI algorithms identify inefficiencies in manufacturing and optimize

operations to minimize energy use and emissions. Example: AI helps cement and steel industries reduce emissions by optimizing kiln temperatures and raw material usage.

➢ **Energy Efficiency in Buildings**

- Smart Energy Management Systems: AI monitors energy consumption in buildings and suggests real-time adjustments to reduce carbon footprints.

Examples

➢ Google DeepMind reduced cooling energy usage in data centers by 40% using AI.

➢ AI-based HVAC systems optimize heating and cooling, reducing unnecessary emissions.

➢ **Supporting Renewable Energy Integration**

- Renewable Energy Forecasting: AI predicts renewable energy generation (e.g., solar and wind) and adjusts grid operations to reduce reliance on fossil fuels. Example: AI helps utilities predict energy demand and match it with renewable supply, reducing emissions from backup fossil fuel power plants.
- Energy Storage Optimization: AI optimizes battery usage and storage systems to ensure efficient energy supply during periods of low renewable generation.

➢ **Transportation Emissions Reduction**

- Smart Traffic Management: AI-powered systems reduce emissions by minimizing traffic congestion and optimizing traffic flow. Example: AI-based platforms like Waze and Google Maps suggest fuel-efficient routes.
- Fleet Optimization: AI tracks and optimizes logistics and delivery operations, reducing emissions by minimizing unnecessary travel.
- Electric Vehicle (EV) Management: AI enhances EV performance by optimizing charging patterns and battery usage, reducing reliance on fossil fuels.

➢ **Carbon Capture and Storage (CCS)**

- Improving Efficiency of Carbon Capture: AI models simulate chemical processes to improve the efficiency of carbon capture technologies in industrial facilities. Example: AI enhances material selection for CCS systems to reduce costs and improve performance.
- Carbon Sequestration Monitoring: AI analyzes geological data to identify suitable sites for long-term carbon storage and monitors stored carbon to prevent leaks.

➢ **Supply Chain Emissions Reduction**

- Sustainable Procurement: AI tracks the carbon footprint of raw materials and selects suppliers with lower emissions.
- Lifecycle Analysis: AI evaluates the carbon footprint of products across their lifecycle, from production to disposal, enabling eco-friendly design and sourcing decisions.

➢ **Empowering Climate Policies and Carbon Markets**

- Carbon Pricing Models: AI predicts the economic impact of carbon pricing policies and helps governments set effective carbon tax rates.
- Carbon Credits Trading: AI-powered platforms analyze market trends to facilitate carbon credit trading, enabling organizations to offset emissions.

Real-World Examples

- **Climate TRACE:** It uses AI and satellite data to track emissions across sectors globally, helping governments and industries identify reduction opportunities.
- **Microsoft's Sustainability Calculator:** It helps businesses calculate and reduce carbon footprints using AI-driven insights.

- **DeepMind's Energy-Saving AI:** Reduced emissions in Google's data centres by optimizing cooling and power usage.
- **Greyparrot:** A software startup based in London, United Kingdom, has developed an AI system that analyzes waste processing and recycling facilities to help them recover and recycle more waste material.
- **Sipremo:**In São Paulo, Brazil, a company called Sipremo is using AI to predict where and when climate disasters will occur, and what type of climate disasters they will be.

Challenges in AI Adoption

- Data Gaps: Lack of quality data in remote areas or developing regions.
- High Costs: Advanced AI systems require significant investment.
- Ethical Concerns: Misuse of AI data can lead to unintended environmental harm.

AI is a powerful tool in the fight against climate change and environmental degradation. Its applications in monitoring, mitigation, adaptation, and research provide innovative solutions to complex challenges. By scaling up AI technologies responsibly, governments, businesses, and organizations can accelerate progress toward a sustainable future.

Reference:

- https://time.com/7171445/ai-natural-disaster-cities/
- https://www.thetimes.com/static/generative-ai-productivity-time-saving-business-benefits/
- https://www.weforum.org/stories/2024/02/ai-combat-climate-change/#:~:text=The%20use%20of%20artificial%20intelligence,the%20World%20Economic%20Forum%20says.

Law and Legal Service

Role of Artificial Intelligence on Law and Legal Service

- In recent times, Artificial Intelligence (AI) is rapidly transforming the legal and legal service sector, impacting various aspects from research and document review to client interaction and case management, and also playing a significant role by automating repetitive tasks, enhancing legal research, providing predictive analytics, and generally improving efficiency by allowing lawyers to focus on more complex legal strategy and client interaction, rather than mundane data analysis and document review; however, concerns around bias and data privacy remain crucial considerations.
- According to recent LexisNexis research, 82% of lawyers are now either using or planning to use AI into their practices, up from 39% last year. This increase underscores AI's surging popularity in a profession known for its heavy workloads, even if traditionally risk averse. AI powers through data heavy tasks, its limitations have become more apparent as its use has increased. It has become obvious that AI cannot be swapped in for human expertise and instead can be used to amplify what lawyers do best, enhancing efficiency while leaving critical judgement, strategy, and client relationships firmly in human hands.
- Artificial Intelligence (AI) has transformed every professional sector including legal profession. Software solution replacing paperwork and data management. Globally, Legal business having rapid growth and technology advancement. Everything is open to be replaced by technology except some services which depends on the experience and judgement. According to the company named 'Deloitte' "Over 100,000 jobs in the legal sector have a big chance of being automated in the next twenty years".

- AI helps in document review tools of legal aspects such that it's algorithms can quickly sift through massive volumes of documents (emails, contracts, etc.) during discovery, identifying key evidence and relevant information, which saves significant time and reduces costs associated with manual document review. Kira Systems and Seal Software are used for AI powered automated document review. AI can also analyze contracts for clauses, discrepancies, and potential risks, helping lawyers and businesses manage contracts more efficiently.
- AI enhances legal research with its powerful search engines. It enables semantic searches that understand the context and meaning behind legal terms, going beyond simple keyword matching. This helps lawyers find more relevant information quickly. AI algorithms can analyze vast amounts of legal data (cases, statutes, regulations) much faster and more efficiently than humans. They can identify relevant precedents, statutes, and legal arguments with greater precision. AI can analyze past case data to predict the likelihood of success in specific legal cases, helping lawyers make informed decisions about litigation strategy. LexisNexis and Westlaw have integrated AI-powered research tools.
- Al helps in improvement of access to justice with the help of chatbots that can provide preliminary legal advice and guidance to individuals, particularly those who cannot afford traditional legal services. AI can facilitate online dispute resolution platforms, helping individuals and businesses resolve conflicts without resorting to expensive litigation. This can democratize access to legal information and empower citizens. DoNotPay software provides automated legal services through chatbots.
- AI helps in Augmenting Legal Professionals as it has the capability to augment the legal professionals, but not to replace them. AI reduces the likelihood of human error and speeds up processes, increasing efficiency and improving overall accuracy, and also provides lawyers with data-driven insights that can help them make more informed decisions and provide better legal services to their clients. AI also automates routine tasks, allowing lawyers to focus on more strategic and complex aspects of law practice.
- AI helps in Streamlining Case Management as it can automate case scheduling, deadlines, and court date reminders, reducing administrative burden and preventing missed deadlines. It can help law firms improve client communication, personalize interactions, and manage client data effectively. It can also manage tasks and track progress on cases, enhancing collaboration and organization within law firms. Clio and MyCase are examples of legal practice management software with AI features.
- The legal profession is on the point of a transformative era, with AI poised to reshape how legal services are delivered. This year's report reveals an even stronger consensus among professionals regarding the profound impact of AI. A remarkable 79% of law firm respondents anticipate that AI will have a high or transformational impact on their work within the next five years, a significant 10 percentage point increase from 2023. Moreover, the belief in AI's transformational potential has surged, with 42% now holding this view, up from 34% in the previous year. These findings underscore the growing recognition of AI as a game changer in the field of legal aspect.
- AI's role in the law and legal sector is transformative, although its potential should be seen as augmenting human capabilities rather than replacing them. Generative AI tools like chatbots serve as a valuable asset within a lawyer's toolkit, allowing for faster responses and streamlined processes. But the foundational aspects of law such as interpretation, strategy and empathy are areas where human expertise remain essential.

- The impact of AI on the Indian judicial system is significant, with the potential to reduce judicial delays and improve the efficiency of the court system. AI can assist courts by employing predictive technology to provide critical information about ongoing cases based on prior cases of a similar nature. It can also help judges make quick decisions and predict potential delays, allowing them to handle the workload of each case appropriately.
- There are several AI related startups that are making a significant impact in the legal sector like Spot Draft, CaseMine, CaseIQ, NearLaw, Practice League that uses AI to examine legal documents, decrease paperwork, and provide AI-based legal solutions to lawyers and law firms.

There are some of the Artificial Intelligence (AI) systems which are already available for the betterment of law and legal service in recent times:

- **ROSS Intelligence:** It is an Al powered legal research tool that uses the most advanced technology of Natural Language Understanding (NLU) which is developed in 2014 at the University of Toronto. It is built to answer all your queries and the NLU allows you to ask your legal issues or describe the facts and procedures to the system in natural language instead of using Boolean terms or keywords. ROSS's Al searches for the most relevant cases that are related to a question and will provide an accurately ranked list of leading cases within a few seconds, with the most useful cases on the top. ROSS marks the relevant portions of a case so that one can go through them without reading the entire judgment.
- **eBrevia:** Developed in 2012 by two Harvard Law School Graduates, eBrevia is like an e- discovery tool, used to find out relevant texts from various long and complicated legal documents and contracts within a very short period. It uses Al and advanced machine learning to identify and extract content from a contract and makes a summary report of that extracted part. Saving around 50-60% of the time, eBrevia can extract important information from a contract, customize that extracted data and present it in Word, Excel, or other databases. eBrevia's software is designed in such a way that it can directly transfer the extracted data to the company's Enterprise Resource Planning (ERP), Contract Management System (CMS), or Contract Lifecycle Management (CLM) system. Another important feature is eBrevia maintains the security of the data by using the best security service providers and top- class encrypted Secure Socket Layers (SSL).
- **KIRA Systems:** KIRA is an efficient, award winning Artificial Intelligence system founded in the year 2011 that is designed for recognizing, extracting, and examining clauses from contracts and various other legal documents. Using the process of due diligence and machine learning, KIRA can review thousands of unorganized third party contracts of any file format in a very short span of time. Moreover, its machine learning tool, Quick Study, enables it to learn to identify and extract new clauses. It saves 20% to 60% time for first time users and saves around 90% time for the experienced ones and it reviews the contracts with 100% accuracy, automatically highlighting and extracting the related texts within seconds. It is designed to review contracts in different languages such as Spanish, French, German, etc., and can learn new languages. It can combine a contract with other contracts to find out the risks and analyse them.
- **LawGeex:** It was developed by Noory Bechor and Ilan Admon in 2014, LawGeex is a contract review automation solution that has been designed to manage, review, and approve daily contracts and business agreements through Al. It has reduced human errors as the Al backed system automatically detects and highlights the questionable clauses within seconds. It allows the users to store their contract review guidelines in digital playbooks and can store multiple

playbooks at a time. Then the contracts are reviewed as per the guidelines given and it also takes the help of a secure algorithm to check the contracts against the guidelines given by a company and to find out whether there is anything wrong with it. It highlights the texts that require corrections and if it finds nothing wrong with the contract then it is approved. It takes less than an hour to review the contracts and can save more than 80% of the time.

- **FaXiaotao:** Developed by a Chinese company named Wu Song Network Technology Co in the year 2016, FaXiaotao is China's first Al powered robotic research tool, FaXiaotao is designed mainly to analyze a case and then to recognize the type of the case and provides the best possible ways to solve the dispute. Finally, it helps people in choosing the best attorneys that are ideal for representing them in court. It has more than 3,00,000 attorneys registered in its database from across the country and suggests the best three options to the people.
- **Xiao Fa:** It is an Artificial Intelligence robot that has been introduced in the courts of Beijing to provide legal services to judges, litigants, and court officials. It is 1.46 meters in height and explains the legal matters in a child's voice. It has been manufactured to explain complicated legal matters and legal definitions to people in a very simple language. It can answer more than 40,000 litigation questions along with more than 30,000 legal issues and contains information regarding 7,000 laws and over 5 million cases. Thus, it helps in reducing the cost of litigation, improves the efficiency of the justice system, and saves trial resources.

Construction Sector

Impact of AI on Construction Sector

AI is increasingly shaping the global construction industry, which sees over $10 trillion in annual spending, growing at a rate of 4.2%. McKinsey's 2020 report highlights AI's significant impact across the entire construction value chain, from design and bidding to operations and asset management. AI offers solutions to the sector's major challenges, including improving safety, addressing labor shortages, and mitigating cost and schedule overruns. By leveraging AI, the industry can enhance project efficiency, streamline procurement, and ultimately drive transformative change in business models and operations.

AI is transforming the construction industry in various ways, offering solutions to improve efficiency, safety, and cost-effectiveness. Here are 10 key applications of AI in construction:

- **Prevent Cost Overruns**: AI predicts cost overruns by analyzing factors like project size, team competence, and historical data, enabling better budget management and faster project delivery.
- **Generative Design**: AI-powered generative design creates optimized building models by learning from each iteration, ensuring no clashes between architectural and engineering plans.
- **Risk Mitigation**: AI monitors and prioritizes risks on construction sites, helping teams focus on high-risk factors and improving safety, quality, and overall project success.
- **Project Planning**: AI uses data from 3D scans and deep neural networks to track project progress, predict potential delays, and optimize future planning through reinforcement learning.
- **Increased Productivity**: Autonomous machinery for tasks like concrete pouring, bricklaying, and demolition increases efficiency and frees up human workers for more complex tasks.
- **Construction Safety**: AI analyzes job site photos to identify safety hazards, ensuring workers are following protocols and preventing accidents by computing risk ratings for the site.
- **Addressing Labor Shortages**: AI helps plan labor and machinery distribution across job sites, using

robots to monitor progress and optimize resource allocation in real-time.

- **Off-Site Construction**: AI-driven robots assemble building components in factories, improving efficiency, while human workers focus on detail work like plumbing and electrical systems.
- **Big Data in Construction**: AI leverages massive amounts of data from job sites, including mobile devices, drones, and BIM, to derive insights that improve decision-making and project outcomes.
- **Post-Construction**: AI continues to offer value after construction by monitoring building performance, predicting maintenance needs, and enhancing security.

AI is reshaping the construction industry by reducing costs, improving safety, and enhancing productivity. While concerns about job losses exist, AI is expected to complement the workforce, driving efficiency and innovation. Early adoption of AI technologies will position companies for long-term success in an evolving industry.

Here is a table summarizing the benefits and challenges of AI in construction:

Benefits

- AI-Driven Insights for Informed Decision-Making: Processes data to provide actionable insights for better decision-making.
- Optimized Project Scheduling: AI predicts delays and optimizes timelines.
- Improved Risk Management: Identifies and mitigates risks, ensuring smooth project execution.
- Cost Savings: Reduces inefficiencies, optimizes resources, and prevents costly errors.
- Efficient Supply Chain Management: Enhances demand forecasting and logistics optimization.
- Enhanced Safety Measures: AI detects safety hazards on job sites, preventing accidents.
- Increased Productivity: Automation and AI-driven machinery improve task efficiency.
- Quality Control and Assurance: AI ensures continuous quality monitoring, reducing defects.
- Real-Time Monitoring and Reporting: Tracks project progress and generates up-to-date reports.
- Competitive Advantage: Early adopters gain a competitive edge with faster project completion and lower costs.

Challenges

- Data Security and Privacy Concerns: Handling vast amounts of data raises security and privacy issues.
- Integration with Existing Systems: Complex integration with current workflows and systems.
- High Initial Cost: Significant cost to implement AI technology, including hardware and training.
- Ethics and Governance: Potential concerns about transparency, accountability, and fairness in AI decisions.
- Digital Debt: Lack of groundwork for smooth AI adoption, causing inefficiencies.

This table provides a concise view of the key benefits and challenges of using AI in the construction industry.

Future of AI in Construction Industry of India

The future of AI in India's construction industry is expected to be transformative, with AI playing a significant role in improving efficiency, reducing costs, enhancing safety, and optimizing project planning through features like automated design, predictive maintenance, robotic operations, and real-time data analysis, ultimately leading to faster project completion and better quality construction across various sectors like infrastructure and residential development; early adopters of AI solutions are likely to gain a significant competitive edge in the market.

India's construction industry faces significant challenges,

including project delays, cost overruns, labour shortages, and safety concerns. AI, which involves simulating human intelligence in machines, can offer solutions to these issues by improving project planning, design, scheduling, risk management, and resource allocation.

AI Applications in Construction Management

- **Project Planning and Design:**
  - **AI Tools:** Building Information Modelling (BIM) integrated with AI for creating intelligent 3D models.
  - **Benefits:** Improved design accuracy, reduced rework, and optimized project planning.
- **Resource Allocation and Scheduling**
  - **AI Tools:** Machine learning algorithms analyzing historical data for optimal resource utilization and scheduling.
  - **Benefits:** Efficient resource usage, reduced delays, and cost savings.
- **Construction Safety**
  - **AI Tools:** AI-powered drones and computer vision for safety monitoring and compliance.
  - **Benefits:** Enhanced safety, reduced accidents, and better safety regulation compliance.
- **Quality Control**
  - **AI Tools:** AI systems using data from sensors and cameras to detect defects and maintain quality standards.
  - **Benefits:** Improved construction quality, reduced rework, and adherence to quality standards.
- **Predictive Maintenance**
  - **AI Tools:** Predictive maintenance systems analysing data from equipment to forecast failures.
  - **Benefits:** Reduced downtime, extended equipment lifespan, and cost savings.

To reach its $1 trillion construction industry goal, India needs to improve productivity. AI can play a crucial role in this transformation by addressing labour shortages and enhancing overall productivity. AI can enhance training by providing on-the-job learning through more accurate data, ensuring better project planning. AI-powered drones and monitoring systems can improve safety protocols, ensuring that construction sites adhere to safety standards and reducing accidents. Predictive analytics can help optimize resource allocation by foreseeing potential delays and optimizing designs. Additionally, smart sensors embedded in materials can detect structural weaknesses early, preventing costly repairs and enhancing the overall durability and safety of structures. Through these interventions, AI has the potential to drive significant improvements in India's construction sector.

India's construction sector is at the beginning stages of AI adoption compared to the Gulf countries, where advanced infrastructure projects like the Dubai Metro and Burj Khalifa have showcased the benefits of AI. However, with the right investments in technology, research, and skill development, AI can revolutionize India's construction industry by improving efficiency, reducing costs, and promoting sustainability.By learning from global AI applications and embracing AI innovations, India can address its construction challenges and foster intelligent urban development, ultimately leading to shorter project timelines, improved quality, and a safer workforce.

Real Estate Sector

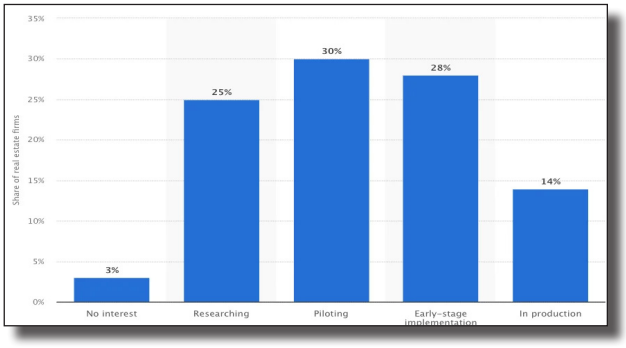
Impact of AI on Real Estate Sector

- Artificial Intelligence (AI) is significantly impacting the real estate sector by enabling data-driven decision making, streamlining transactions, improving market analysis through predictive analytics, enhancing customer service with chatbots, and optimizing property valuations, ultimately leading to increased efficiency and better investment opportunities for both buyers and sellers.

- AI is making a significant impact on the real estate industry, transforming how businesses operate and how customers interact with properties. From enhancing safety on construction sites to streamlining the design process, AI is reshaping various aspects of the real estate sector. AI-powered tools are improving the property buying and selling process, offering immersive experiences through virtual property tours and virtual agents, which simplify communication between clients and professionals. These tools allow for personalized property recommendations, virtual staging, and even predictive pricing models.
- Additionally, AI is enhancing safety in construction by using machine learning algorithms to monitor job sites, identifying potential hazards before they lead to accidents. This helps reduce worker injuries and improves compliance with safety regulations. With the AI in real estate market expected to reach $1,803.45 billion by 2030, at a compound annual growth rate (CAGR) of 35%, the technology is driving major shifts in the industry. As AI continues to evolve, it is expected to bring even more innovative solutions, making real estate transactions more efficient, safe, and personalized for both buyers and sellers.

Current Market Statistics & Scenario About the Adoption of AI in Real Estate

AI is rapidly transforming the real estate industry, offering innovative solutions that streamline processes, enhance decision-making, and improve customer experiences. Here are some of the key market dynamics:



- AI adoption in the real estate industry is rapidly advancing, with a substantial number of major companies worldwide embracing this transformative technology. According to recent research, 25% of CFOs are in the research stage, 30% are piloting AI initiatives, 28% have implemented AI in early stages, and 14% are already in the production phase. Additionally, PwC's research reveals that 64% of commercial real estate investors plan to increase their investments in AI-powered PropTech (Property Technology), which is expected to grow to $89.93 billion by 2032 at a CAGR of 11.9%.
- Companies leveraging AI have experienced significant benefits, including a 50% increase in lead generation and a 45% improvement in conversion rates. The use of generative AI in real estate is expected to generate a value between $110 and $180 billion. Furthermore, AI-based property evaluation models, such as Automated Valuation Models (AVM), have improved property valuation accuracy by 5%, leading to a 10% correction in valuations and an increase in profitability of approximately $57 million.
- Additionally, AI adoption has proven to be cost-effective, with 49% of real estate businesses reporting a reduction in operating costs and 63% experiencing an increase in revenue. The promising potential of AI is further demonstrated by advancements in areas like voice-activated search, neighbourhood quality analysis, proactive building health monitoring, and AI-driven risk assessment for natural disasters. These developments highlight the vast potential of AI to revolutionize the real estate sector, making operations more efficient, cost-effective, and ultimately more profitable. The future of AI in real estate looks extremely promising, with new applications continually emerging to enhance property management, investment, and customer experience.

AI in Indian Real Estate Sector

The Indian real estate sector is undergoing a significant transformation with the integration of Artificial Intelligence (AI) in construction management. AI technologies are revolutionizing processes, optimizing resource allocation, and improving decision-making, leading to faster project completion, reduced costs, and enhanced project efficiency.One of the most prominent areas where AI is making an impact is project planning and scheduling. AI-powered tools leverage historical data, weather patterns, and resource availability to generate precise timelines, minimizing delays and improving overall efficiency. Predictive analytics, driven by AI, also help developers identify potential risks such as cost overruns or project delays, allowing for proactive mitigation measures.AI is playing a crucial role in improving resource management as well. Machine learning algorithms are used to forecast material demand and optimize procurement, ensuring timely deliveries and minimizing waste and inventory costs. Additionally, AI-enabled construction site monitoring tools, such as drones, track project progress in real-time, ensuring adherence to plans and budgets.In terms of safety, AI solutions such as computer vision and IoT sensors are deployed to monitor construction sites for hazards and enforce safety regulations. Predictive maintenance systems powered by AI help reduce equipment downtime, ensuring smooth operations and enhanced productivity. AI-driven Building Information Modeling (BIM) allows for the integration of data from the design to construction stages, providing stakeholders with a comprehensive view of the project. This improves collaboration, minimizes errors, and ensures that everyone involved in the project is aligned with the overall goals. AI-based cost estimation tools also assist developers and buyers by providing accurate financial projections, facilitating better financial planning and decision-making.Furthermore, AI is fostering sustainability in the Indian real estate sector by optimizing energy use and waste management. With the growing demand for real estate and the challenges posed by urbanization, AI adoption is crucial for improving productivity, safety, and sustainability. As the sector continues to embrace AI, it is well-positioned to meet the demands of a rapidly expanding population, addressing the challenges of the competitive market and ensuring long-term growth and development.AI is driving significant change in the smart home sector, especially in India, where the smart home market is expected to expand from Rs 8,000 crore in 2023 to Rs 36,000 crore by 2028, according to a Redseer report. This growth is fueled by increasing consumer demand for advanced, tech-driven housing solutions.Smart homes incorporate AI-powered appliances to enhance luxury, convenience, and energy efficiency. Virtual assistants such as Alexa enable residents to control home functions like lighting, security, and appliances through voice commands. AI-powered security systems, including smart cameras and sensors, improve home safety by detecting intruders and alerting homeowners about suspicious activities in real-time. Machine learning-enabled thermostats provide personalized temperature control by learning user preferences and adjusting accordingly, resulting in greater comfort and energy savings.Moreover, AI is advancing energy efficiency in homes and buildings. AI-driven PropTech systems optimize resource usage, such as lighting and HVAC, leading to reduced energy consumption. According to the International Energy Agency, the digitalization of buildings, which includes AI-based technologies, could lower energy consumption in both residential and commercial spaces by about 10% between 2017 and 2040. This highlights AI's critical role in enhancing the sustainability and cost-efficiency of smart homes. As AI continues to evolve, its impact on the smart home industry is poised to grow, making homes more intuitive, secure, and energy-efficient, while also contributing to the broader goals of sustainability and smarter living spaces.

Here's a concise table summarizing the impact of AI on the real estate industry in India:

AI Application	Description	Impact
Predictive Analytics	AI models forecast market trends and property values.	Helps investors make data-driven decisions, such as identifying emerging neighborhoods.
Enhanced Property Valuation	AI integrates various factors to provide more accurate property valuations.	Improves valuation accuracy by up to 20% compared to traditional methods.
Market Segmentation & Targeting	AI categorizes buyers based on demographics and behaviors.	Tailors marketing strategies and offerings for different buyer segments (e.g., first-time buyers, HNWIs).
Risk Management	AI analyzes economic indicators and historical trends to assess risks.	Helps mitigate investment risks, including market volatility and regulatory changes.
Automated Insights & Reporting	AI automates data analysis and report generation.	Reduces time spent on data processing by 40%, allowing professionals to focus on strategic decision-making.

AI in real estate in India faces challenges related to data quality, integration, privacy, and transparency. As the industry continues to evolve, emerging technologies like natural language processing (NLP) and advanced machine learning are expected to further enhance AI's capabilities, enabling more nuanced insights, such as consumer sentiment analysis, to drive informed decision-making in the future.

AI is rapidly transforming the Indian real estate sector, contributing to its projected growth to $1 trillion by 2030. AI-driven technologies like predictive analytics, property valuation tools, and Automated Valuation Models (AVM) are enhancing accuracy, improving lead generation by 50% and conversion rates by 45%. AI adoption has helped 49% of businesses reduce operating costs and 63% report increased revenue. The smart home market is set to grow from ₹8,000 crore in 2023 to ₹36,000 crore by 2028, with digitalization potentially cutting energy consumption by 10%. AI-powered automation has reduced data analysis time by 40%, improving decision-making efficiency across the sector.

The integration of AI in India's real estate sector is revolutionizing how professionals approach data analysis, property valuation, market segmentation, and risk management. With AI-driven tools providing predictive insights and automating time-consuming tasks, stakeholders can make more informed, data-driven decisions, leading to increased efficiency, accuracy, and profitability. As the market grows, AI offers a way to navigate the complexities of big data and enhance decision-making. However, challenges related to data quality, integration, and privacy must be addressed to maximize AI's potential. Looking ahead, the advancement of technologies like natural language processing and machine learning will further refine AI capabilities, unlocking new opportunities for more sophisticated analysis and strategic decision-making. By embracing these innovations, India's real estate sector is well-positioned to meet future demands, fostering sustainable growth and enabling smarter, more efficient practices in the years to come.

Applications of Artificial Intelligence and AI Ethics – A Reflective Overview of Multifaceted Dimensions

CMA (Dr.) Paritosh Basu
Senior Director (Services)
Stragility Consulting Pvt. Ltd.

Artificial Intelligence and Contemporary Business Environment

Lately, commercial corporations are struggling to continue performing at the same pace as in earlier quarters, if not with acceleration in the face of sluggish consumer demand, uncertain geopolitical issues, and disruptive innovations through digital transformation by competitors. Even eCommerce entities of just yesteryears are challenged hard by quick commerce (qCommerce) players. On the other hand, the clarion call from the Indian federal government is to contribute to achieving the USD 5 trillion economy by, inter alia, more capital expenditure and employment generation. In such an environment, two of any CEO's top five agenda points are cost reduction, new digital technology-driven business models, coupled with newer revenue models.

Results of Deloitte's[1] quarterly global survey among 2,770 entities conducted in May 2024 indicated that applying advanced AI tools, particularly Generative AI, has helped 42% of respondents achieve significantly higher operating efficiency, productivity, and cost reduction. 58% of those achieved superior product innovations and effective customer engagements contributing to financial performance. 67% of them are investing more in Generative AI because of higher potentials for more value addition *"Organizations feel far less ready for the challenges Generative AI brings to risk management and governance, ... three of the top four things holding organizations back from developing and deploying Generative AI tools and applications are risk, regulation and governance issues."*

Digitalisation of operating systems and processes first helps reduce costs substantially and enhance efficiency. New business models with newer revenue models can also be created for top-line growth with higher margins. Large corporations derive enormous tangible benefits through digitalisation using AI-powered GenAI tools, industrial robotics, Internet of Things (AIIoTs), Robotic Process Automation (RPA), Blockchain added with AI layers, FinTech, etc.

However, adopting digital technology and its applications

has associated risks, challenges, and ethical dimensions besides deployment of financial and expensive human resources. Readers may refer to the author's Book[2] for more application-oriented knowledge about all these digital technologies and their applications. The limited objective of this paper is to deal with various ethical dimensions to be kept in view while adopting and applying multiple advanced tools that are emerging in the field of artificial intelligence.

AI and Contemporary Way of Living Life

Scholars worldwide have researched the implications of advanced AI tools, including Generative AI and other advanced LLM applications. They have concluded that the adoption of advanced applications has linked artificial intelligence inextricably with human beings, contemporary industries across sectors, and society. Therefore, it would not be wise to ignore the benefits of AI and its application necessities in building a better and more developed world for humanity.

Researchers might have observed that bridging the massive gap between AI and the associated legal and ethical issues is complex and enormous. This is because, as Sharma and Chaturvedi[3] in their research paper concluded that, *"…… moulding machines like humans with the same amount of creativeness and reasoning skills looks non-viable. However, biding one's time for such development to take effect while suffering various challenges by machines that affect society mentally, physically, and economically is also not the recourse."*

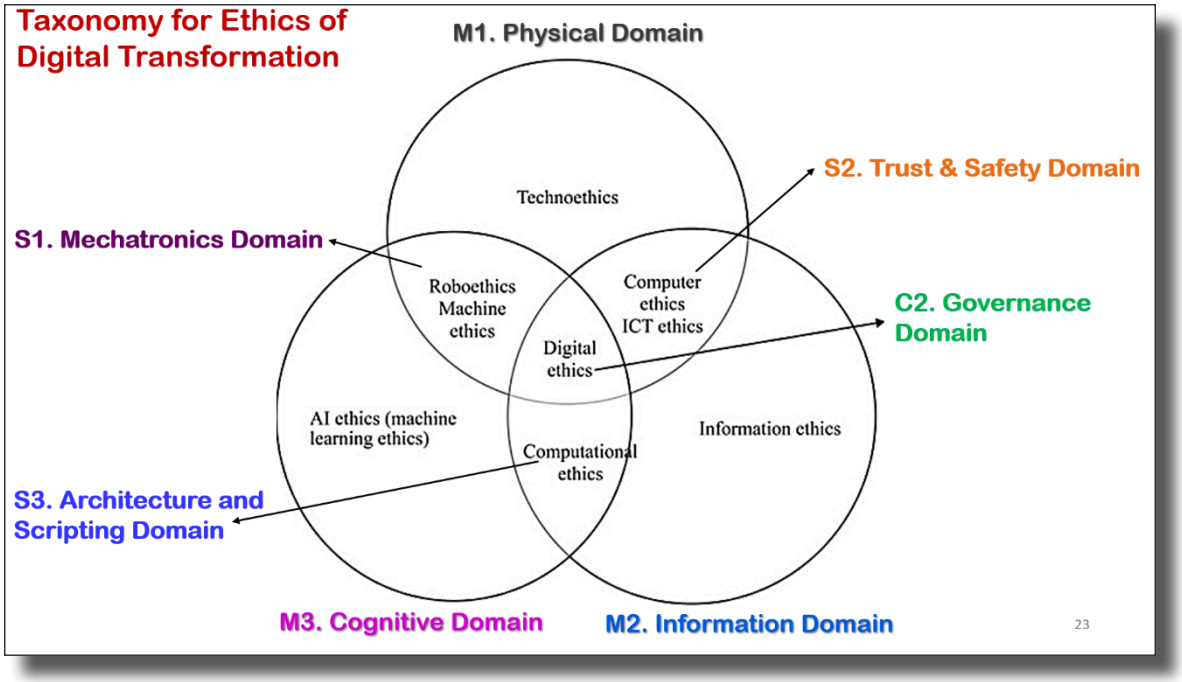
This is why multilateral agencies, such as the IMF, OECD, World Bank, etc., are pressing for overarching global codes of standards to develop and apply AI-based solutions and tools. Governments and regulatory agencies across nations are also creating multiple legislations/regulations to navigate and oversee the developments in cognitive intelligence, i.e., AI. Multivarious dimensions of ethics, the mainstay of human civilisation, is the foundation and essential driver of such laws and regulations. The four primary broad objectives of all these initiatives are to establish:

- 'Ethics of Purpose' for applying AI Tools, the
- 'Ethical Quality of the Predictions' by AI tools,
- 'Ethical Quality of the End Outcomes' inferred from those, and
- 'Ethical Quality of the Impacts' of all these on human beings.

AI Ethics and CXO's Imperatives

At this stage, knowing the definitions of "Artificial Intelligence' and ethics will be helpful. Artificial Intelligence is the theory and development of computer systems to perform tasks that can usually be done by a human being's intelligence and cognitive abilities. Such abilities include visual perception, speech recognition, decision-making, language translation, etc. On the other hand, the Oxford Dictionary has defined ethics *as "Moral principles that govern a person's behaviour or the conducting of an activity*." Thus, the word ethics relates to a person's morality for behaving in their way of life and/or doing something.

The infusion of artificial intelligence into the digital transformation process is multiplying a far-reaching socio-technical transformation that casts profound impacts across the societal strata anywhere under the sun, both positively and negatively. Therefore, before getting into the aspects of AI ethics, one must be aware of the following taxonomy for ethics of digital transformation because any organisation, irrespective of being a commercial corporation, government organisation, or NGO, uses such technologies for the digital transformation of their operations and business to achieve more cost reduction, adding new avenues to conduct business for more revenue and profit, and/or serving citizens and the humanity as a whole.



Source: https://www.sciencedirect.com/science/article/abs/pii/S0268401221001262

The above infographic can briefly be narrated in words in the following manner:

- Digital Transformation has three domains of ethics, viz., M1-Physical Domain, M2-Information Domain, and M3. Cognitive Domain,
- The intersections of the above three domains create the following three sub-domains:
  - M1 and M3 create the S1 Sub-domain of 'Robo-ethics and Machine-ethics'. This is called the 'Mechatronics Domain', which combines the ethics of four engineering disciplines in physical terms. viz., mechanical, electrical, electronic, and computer,
  - M1 and M2 create the S2 Sub-domain of 'Ethics for Physical Computers and Information and Communication Technology (ICT).' This is called the 'Trust and Safety Domain.'
  - M2 and M3 crate the S3 Sub-domain of 'Computational Ethics'
- The second level of intersections of the S1, S2, and S3 sub-domains the central domain of '**Digital Ethics**', which is also known as '**Governance Ethics**'

That is why management and technology gurus have repeatedly advised corporations to perfectly align their organisation's vision, mission, culture, and strategies with their digital vision, mission, culture, and strategy. Digital Ethics or Governance Ethics can be articulated and followed by any organisation only after articulating and abiding by the ethics for M1, M2, and M3 main domains and the ethics of S1, S2, and S3 subdomains.

If the aforementioned orthodox definitions of ethics and taxonomy of ethics for digital transformation are integrated and applied to the process for adoption and application of AI technologies, one can list the following tasks of all concerned while working on the adoption and applications of AI:

- Stop mishandling data responsibility and breaching personally identifiable information (PII),

- Minimise lack of transparency of AI algorithms and tools applied for use by a computing system,
- Remove the lack of openness, fairness, and sturdiness of the entire process,
- Establish explainability of all data when scrutinised by an independent agency,
- Stop non-consideration of the needs and interests of all stakeholders to be directly and indirectly impacted by the outcomes of AI applications,
- Inculcate in all concerned team members the sense of importance and pride in achieving rightful purpose in the process of AI applications,
- Ensure financial value orientation and equitable distribution of the tangible benefits generated by AI applications,
- Introduce a structured document for delegation of authority and the process for exacting accountability as well as compliance with laws, rules, regulations, and codes of standards at all stages by all concerned,
- Safeguard that trusteeship of all stakeholders during the process of AI applications is always maintained,
- Ensure maintenance of transparency and interoperability of algorithms for AI modules,
- Sensitize all team members with the mantra of focusing on **6P Bottom Line**, viz., planet, profit, people, product, prosperity, and peace, to serve all stakeholders with the warranted objectivity, and
- Ensure that the technologies are not used for wrong purposes and with ulterior motives for harming humanity.

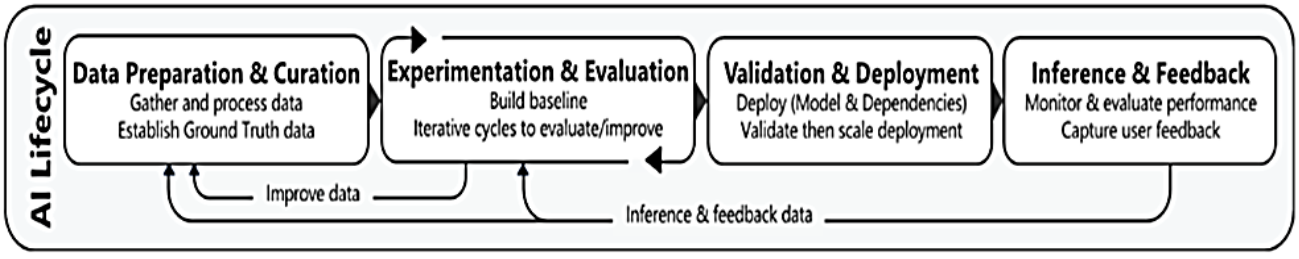
Therefore, the context of AI-related ethics is linked to users and team members working on computing systems. AI algorithms and tools, data scientists, the data itself, computing and cyber security systems, and last but not least, the organisation adopting and applying AI and so on. If any entity has to ensure that ethics of the highest order is maintained at all times while working with AI, the CEO and the leadership team of CXOs have to work on the following overarching imperatives. She/he has to:

- Formally lay down a document containing the Digital Vision, Mission, Policy, SOPs, and a white paper on ethics before adopting AI technologies and assigning responsibilities of AI project implementation with a CXO for digital leadership and AI champions for each functional area,
- Align the organisation's long-term vision, mission, purposes, and goals with those of digital transformation using AI applications and the targeted goals from AI-based projects as forecasted,
- Develop a cross-functional strategic mindset for leveraging AI and GenAI to face business challenges and create digitally transformed business models coupled with revenue models,
- Chart the strategic roadmap for AI implementation to attain sustainable competitive advantages,
- Formulate effective change management plans to build a transformative digital ecosystem and with ethical AI practices,
- Adopt a three-pronged ethics-driven cultural approach with culture as the pole star, operational framework, and employee experience,
- Collaborate to evaluate new and advanced options for AI like GenAI, Agentic AI, Retrieval Augmented Generation (RAG), etc., and attain AI-driven multi-faceted digital capabilities to meet specific business needs, consciously staying away from the absurd synthetic data and hallucinating effects of AI applications, and
- Dynamically work on project-wise 'AI Life Cycle' and monitor optimum economic value addition (EVA) for the organization for sustainable prosperity.

Pillars of AI Strategy Framework and Lifecycle

Attainment of data and AI-driven multifaceted and transformative digital capabilities in compliance with the above imperatives, an organisation must formulate their AI-based digital strategies on the foundation of the following four pillars and the data life cycle:

Source: https://www.linkedin.com/pulse/gatners-ai-trism-framework-risk-mitigation-alignment-narayanaswamy-pwowc/



Source: https://learn.microsoft.com/en-us/ai/playbook/technology-guidance/generative-ai

The above infographics are simple and self-explanatory; hence, no further narratives are being added, given this article's limited space. CXOs must operate with the mindset that the most invaluable asset of any corporation in this Industry 4.0 era of digital technologies is self-generated transactional data and data collected from the external ecosystem through ethical means. However, the relevance and currency of such data must be ensured to make the right decision at the right time for the right purpose.

While formulating digital strategies, every organisation must be conscious of the risks it is exposed to while dealing with digital technologies. Those significant risks can be summarised in the following bulleted lines:

- Potential for job displacement and employees being rendered surplus due to automation,
- Bias and unfairness in algorithms used by AI tools generating unfair outcomes,
- Concern for data privacy, security, and protection and lack of efficacy in the surveillance system, including the ethical hacking system that is used,
- Security vulnerabilities and risks emanating from probable AI-powered cyberattacks,
- Concern for maintaining multifaceted ethics in the entire process of adopting, applying, and generating outcomes without harm to humanity,
- Over-dependence on AI tools and algorithms causing depletion in the critical thinking skills of employees,
- Chance of generating deepfakes and too good to believe synthetic data by hallucinating AI,
- The non-availability of needful codes of standards and regulations may lead to directionless developments that may cause harm to stakeholders.

Data Principal, Fiduciary, and Processor

When ethical dimensions of any facet of life are adopted in framing a law, ethics are converted to legally enforceable provisions for everybody. One recent instance is the insertion of the three phrases in India's Digital Personal Data Protection Act of 2023 (DPDP Act), which is yet to be declared effective for enforcement. These three phrases are 'Data Principal,' 'Data Fiduciary', and 'Data Processor.' These legal phrases can be explained in the context of payroll processing.

The employer collects all personal data of every employee, including details of bank accounts and PANs, which are Personally Identifiable Information (PII) as per the DPDP Act and to be protected from all sorts of leakage and abuse. Thus, the employer becomes the digital 'Data Principal' and is responsible to each employee. The payroll processor becomes the 'Data Processor' accountable to the employer for data protection under the contractual obligation with the employer.

However, the main ethical issue comes for the digital 'Data Fiduciary,' the case in point for which are the Auditors and Consultants. Auditors obtain such data from the client company for audit purposes and retain it for at least ten years as audit evidence to be produced in case of any litigation in the future. So is the case of management consultants for many such other digital data. These two groups of professionals are the digital 'Data Fiduciaries' equally responsible for protecting the PII.

Impacts of AI Ethics on ROI

Any digital transformation (DT) project is not only for the benefit of stakeholders that will lead to charity; charity does not get funded for long. DT projects with ethical AI applications first create 'Economic Impact' by directly contributing towards improvements in tangible profits and ROI of any company in many ways, viz., cost reduction, improvement of productivity and efficiency, and facilitating the creation of new business models coupled with newer revenue models.

Source: Created by the Author

The above infographics also depict that observing ethics in adopting and applying AI tools and algorithms contributes to profitability indirectly through a positive 'Reputational Impact' by improving the company's brand image, which helps achieve higher market share and other competitive advantages. As explained in one of the earlier paragraphs, AI ethics also enhances employees' capabilities, which helps create organisation-wide capability with a focus on success with tangible benefits. Such a positive impact on the capabilities of employees helps achieve sustainable prosperity in the long term.

Conclusion

The author is unsure whether insights on the multifaceted dimensions of AI Ethics could be presented in the limited space of this article. Many questions may remain unanswered. Readers are urged to refer to the author's Book[2] for more knowledge and information, including digital transformation with AI tools and algorithms. There are also potential areas for conducting empirical research with collaboration, for which the author would also be keen to receive proposals from readers. Readers can contact the author without hesitation through LinkedIn at https://www.linkedin.com/in/dr-paritosh-basu-87a67a15/ or through direct mail to paritosh13286@outlook.com.

Webliography

1. https://www.deloitte.com/content/dam/assets-zone1/nz/en/docs/services/consulting/2024/nz-stateofgenai-q3-report.pdf
2. Basu, Paritosh. '*Digital Transformation – A Prismatic View'*, 2nd enlarged edition, The Institute of Cost Accountants of India, 451 pages.

   The book is available from https://eicmai.in/booksale_boasr/Home.aspx
3. Sharma S. and Chaturvedi V., *Ethical and Legal Issues of AI Technology and Its Applications*, International Journal of Law and Legal Jurisprudence Studies, ISSN:2348-8212, Volume 6 Issue 1.

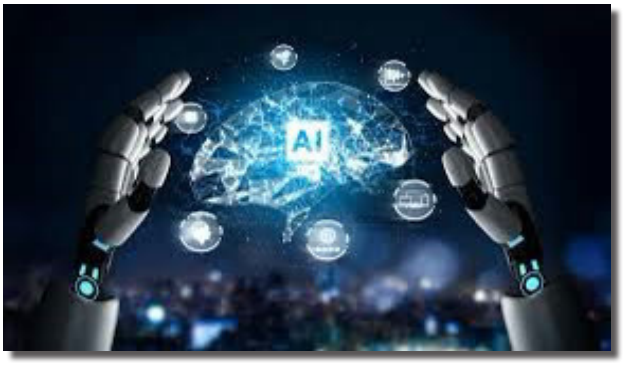
https://docs.google.com/viewerng/viewer?url=https://ijlljs.in/public/upload/user/article/ethical-and-legal-issues-of-ai-technology-and-its-applications/Artificial-intelligence-ethical-and-legal-issues-and-its-application-converted.pdf&hl=en_US

Artificial Intelligence and Its Relevance to Cost Management Accountants

Dr. Ashish Kumar Sana
Professor
Department of Commerce
University of Calcutta

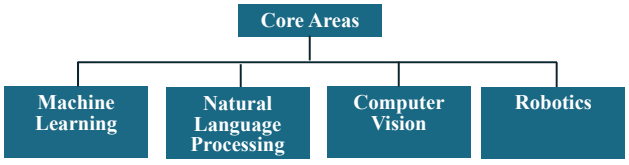
Dr. Biswajit Paul
Assistant Professor
Department of Commerce
University of Gour Banga

Artificial Intelligence (AI) has emerged as a transformative force across various industries, fundamentally altering the way businesses operate. With its ability to mimic human intelligence and perform tasks such as learning, reasoning, and self-correction, AI has found applications in diverse domains, ranging from healthcare and manufacturing to finance and supply chain management. For cost management accountants (CMAs), who play a pivotal role in ensuring the financial efficiency of organizations, AI offers unprecedented opportunities to enhance decision-making, optimize processes, and add strategic value.



❖ Introduction to Artificial Intelligence (AI)

AI refers to the simulation of human intelligence by machines, particularly computer systems. These systems are designed to perform tasks that typically require human intelligence, such as:

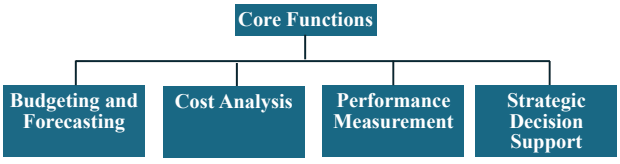


- **Machine Learning (ML):** Algorithms that enable systems to learn and improve from experience without explicit programming. For instance, ML can analyze historical financial data to identify patterns and predict future trends.
- **Natural Language Processing (NLP):** The ability of machines to understand and respond to human language. NLP is used in chatbots and virtual assistants to provide instant support and interpret complex financial documents.
- **Computer Vision:** The capability to interpret and process visual data from the world. Applications include automating document verification processes and inventory tracking through image recognition.
- **Robotics:** Machines designed to perform specific tasks, often replicating human actions. In finance, robots can automate repetitive tasks, reducing errors and increasing efficiency.

The convergence of AI technologies allows businesses to process large datasets, identify patterns, and generate insights that were previously inaccessible or time-consuming to uncover. This foundational understanding of AI helps CMAs appreciate its potential in transforming traditional accounting and financial management practices.

❖ The Role of CMAs in Modern Organizations

Cost management accountants are indispensable in modern organizations. Their primary role involves analyzing financial data to ensure optimal resource utilization and guiding strategic decisions. Their core functions include:



- **Budgeting and Forecasting:** Planning financial expenditures and predicting future financial conditions. CMAs rely on historical data and predictive models to create realistic and achievable budgets.
- **Cost Analysis:** Identifying areas of inefficiency and suggesting cost-saving measures. This involves analyzing operational processes to find opportunities for reducing waste and maximizing value.
- **Performance Measurement:** Monitoring and assessing financial and operational performance through key performance indicators (KPIs). CMAs provide actionable insights into how different departments are contributing to organizational goals.
- **Strategic Decision Support:** Assisting management in decision-making processes by presenting financial insights and projections that align with business objectives.

As businesses adopt data-driven strategies, the integration of AI tools becomes essential for CMAs to execute these functions effectively and efficiently.

❖ Applications of AI in Cost Management Accounting

Enhanced Data Analysis and Forecasting

Automated Financial Reporting

Fraud Detection and Risk Management

Cost Optimization through Process Automation

Scenario Planning and Decision Support

1. Enhanced Data Analysis and Forecasting

AI-powered tools can process vast amounts of financial data in real-time, enabling CMAs to:

- Identify cost trends and anomalies that might go unnoticed with manual analysis.
- Improve the accuracy of financial forecasts through predictive analytics that consider multiple variables and scenarios.
- Automate routine data analysis tasks, freeing time for strategic activities such as advising on investment opportunities or growth strategies.

For example, AI systems can analyze spending patterns across departments and recommend budget reallocations to optimize resource utilization.

2. Automated Financial Reporting

AI-driven systems can generate financial reports with minimal human intervention. Using NLP, these tools can draft reports that summarize key financial metrics in a clear and concise manner. CMAs benefit from:

- Faster reporting cycles, allowing timely insights for decision-making.
- Reduced human error, ensuring accurate and reliable data.
- Customized reports tailored to the needs of different stakeholders, such as executives, board members, and investors.

This automation enables CMAs to focus on interpreting the reports and advising on strategic actions rather than spending hours compiling data.

3. Fraud Detection and Risk Management

AI algorithms can analyze transactional data to detect irregular patterns indicative of fraud. For CMAs, this capability ensures the integrity of financial data and reduces risks associated with compliance violations. Key benefits include:

- Identifying unusual spending behaviors or unauthorized transactions in real-time.
- Reducing the financial and reputational impact of fraud by enabling early intervention.
- Supporting compliance with regulatory requirements through continuous monitoring of financial activities.

For instance, AI tools can flag duplicate invoices or inconsistent payment records, allowing CMAs to address potential issues promptly.

4. Cost Optimization through Process Automation

Robotic Process Automation (RPA), an AI subset, can handle repetitive tasks such as invoice processing, payroll management, and data entry. By reducing manual intervention, organizations can minimize errors and operational costs. Specific applications for CMAs include:

- Automating the reconciliation of accounts, ensuring accuracy and saving time.
- Streamlining procurement processes by integrating AI with enterprise resource planning (ERP) systems.
- Generating cost-saving insights by analyzing vendor performance and identifying areas for negotiation.

The ability to automate these processes allows CMAs to redirect their focus to more value-adding activities like strategic planning and stakeholder engagement.

5. Scenario Planning and Decision Support

AI tools enable CMAs to run multiple financial scenarios, helping them evaluate the potential impact of strategic decisions. This aids in:

- Assessing risks and rewards associated with new investments or expansion plans.
- Prioritizing resource allocation based on data-driven insights.
- Enhancing the decision-making process by providing simulations of various business outcomes.

For example, AI-driven scenario planning can help a company understand the financial implications of entering a new market or launching a new product.

❖ Challenges in Integrating AI

Despite its advantages, integrating AI into cost management accounting comes with challenges:

- Data Privacy and Security: Handling sensitive financial data requires robust security measures to prevent breaches. CMAs must ensure that AI systems comply with data protection regulations like GDPR and other local laws.
- Skill Gaps: CMAs must acquire new skills to work effectively with AI tools. Training programs and certifications in AI and data analytics are essential to bridge this gap.
- Implementation Costs: Deploying AI systems involves significant initial investments in infrastructure, software, and training. Organizations must weigh these costs against potential long-term benefits.
- Ethical Concerns: Ensuring unbiased algorithms and ethical decision-making remains critical. CMAs need to understand the limitations of AI and maintain accountability for decisions made using AI-driven insights.

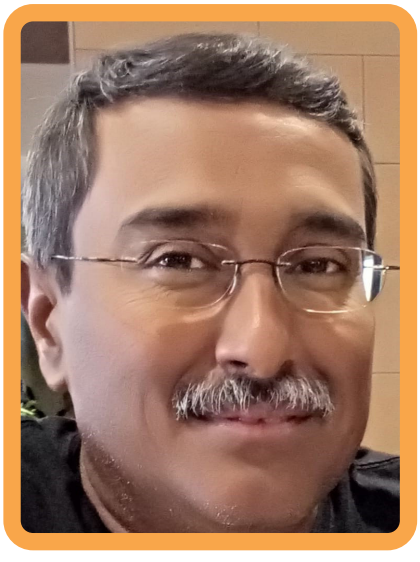
❖ The Way Forward: Embracing AI in Cost Management

To fully leverage AI, CMAs must adopt a proactive approach:

- **Upskilling and Continuous Learning:** Developing expertise in AI tools and understanding data analytics is essential. Organizations can support this by providing access to training programs and workshops.
- **Collaborating with IT Professionals:** Working closely with technology teams ensures seamless AI implementation and helps CMAs understand the technical nuances of AI systems.
- **Focusing on Strategic Roles:** With AI handling routine tasks, CMAs can concentrate on providing strategic financial insights and contributing to organizational growth.
- **Adopting a Growth Mindset:** Embracing change and innovation is crucial for long-term success. CMAs should view AI as an enabler rather than a threat to their roles.

Artificial Intelligence is reshaping the landscape of cost management accounting by automating processes, enhancing decision-making, and driving efficiencies. For CMAs, AI is not just a tool but a strategic enabler that amplifies their ability to deliver value. By embracing AI, CMAs can transform their roles from traditional financial custodians to strategic advisors, guiding businesses toward sustainable growth and competitive advantage. As businesses navigate an increasingly complex financial environment, the integration of AI in cost management will be pivotal in achieving both operational excellence and long-term success.

Same Old World, but a New Frame: The Role of Responsible Consumerism and Digital Augmentation in Shaping the Future



Mr. Subhasish Ghosh
General Manager (Finance and Systems)
ITC Limited

Abstract

Humanity has progressed through 100000 years of discoveries, inventions and conquests, yet it now stands at a crossroads marked by ecological crises and rapid technological advancements. The digital revolution, particularly the rise of artificial intelligence (AI) has further transformed human behavior, consumerism and decision-making processes. This article explores how responsible consumerism, coupled with digital augmentation, can address global challenges, foster sustainability, and reshape economic and social paradigms.

Introduction

The rapid pace of human progress has yielded immense knowledge and power but has also ushered in existential crises. From ecological degradation to the advent of AI, humanity faces unprecedented challenges. Despite accumulating vast amounts of information, we continue to struggle with existential questions and sustainable decision-making. This article discusses how digitization, data, and AI can be leveraged to promote responsible consumerism and ensure sustainable global practices.

The Digital Evolution: Empowering Humanity in Real-Time

The digital age has compressed the world's size into handheld devices, providing real-time access to information. This transformation is unparalleled in its scale and speed, empowering individuals to make informed decisions. However, it also brings challenges such as information overload and behavioral changes like the "Fear of Missing Out" (FOMO).

Key Impacts of Digitization on Human Behavior

1. Increased Connectivity: Virtually linking individuals across the globe.
2. Information Dependency: Constant refreshing of data to stay updated.
3. Behavioral Shifts: Altered physiognomics and increased screen dependency.

The Shift in Consumerism: From Transactional to Responsible

Digitization has redefined consumer behavior. No longer confined to price-based decisions, consumerism now considers health, sustainability, and ethical factors.

Factors Influencing Modern Consumer Decisions:

a. Product benefits for health and wellness.

b. Environmental sustainability and ethical production.

c. Social and corporate governance (ESG) compliance.

d. Transparency in supply chain practices.

Consumers now demand value overprice, driving enterprises to adopt sustainable and transparent practices.

Impact of Artificial Intelligence on Industrial Growth and Development

Artificial Intelligence (AI) is revolutionizing industrial growth and development by automating processes, enhancing efficiency, and enabling data-driven decision-making. Unlike traditional tools, AI acts as an independent agent capable of processing vast amounts of information and making decisions without human intervention. This unique capability positions AI as a transformative force across industries.

Key Impacts

1. Automation and Efficiency: AI automates repetitive tasks, reducing human errors and operational costs, thereby increasing productivity.
2. Enhanced Decision-Making: Predictive analytics and AI-driven insights help industries forecast trends, optimize supply chains, and improve resource allocation.
3. Innovation and Product Development: AI fosters creativity by generating new ideas and solutions, leading to the development of innovative products and services.
4. Workforce Transformation: While AI displaces certain manual roles, it creates demand for new skills and roles focused on collaboration between humans and machines.
5. Sustainability: AI contributes to sustainable industrial practices by optimizing energy usage, minimizing waste, and reducing environmental footprints.

AI is not just a tool but a partner in progress, offering industries the opportunity to balance growth with sustainability. By leveraging AI's speed, accuracy, and scalability, industries can drive innovation and remain competitive in a rapidly evolving global marketplace.

The Rise of Responsible Consumerism

With access to comprehensive data, consumers are more informed than ever. This has given rise to "responsible consumerism," where purchasing decisions align with ethical, social, and environmental considerations.

Emerging Characteristics:

1. Conspicuous Consumption: Aligning purchasing decisions with societal values.
2. Sustainability Focus: Prioritizing long-term ecological balance over short-term benefits.
3. Personalized Demand: Enterprises catering to unique, informed consumer needs.

The Role of Digital Augmentation in Consumer Decision-Making

Digital tools play a pivotal role in promoting responsible consumerism by offering transparency, efficiency, and trust.

Key Digital Technologies:

1. Ambient Information Displays:

   Smart Labels and QR Codes: Real-time product details.

   Augmented Reality (AR): Interactive information overlays.

2. AI and Data Analytics:

   Recommendation Engines: Suggesting sustainable products.

   Predictive Analytics: Highlighting the benefits of responsible choices.

3. Blockchain Technology:

   Supply Chain Transparency: Tracking ethical practices.

   Smart Contracts: Ensuring commitments to sustainability.

4. IoT (Internet of Things):

   Smart Appliances: Optimizing resource use and minimizing waste.

Implementation Strategies for Responsible Consumerism

To ensure the success of responsible consumerism, collaborative strategies involving businesses, governments, NGOs, and consumers are essential.

Strategic Pillars:

1. Partnerships: Collaborations between enterprises and tech developers.
2. Standardization: Establishing global ethical standards.
3. Consumer Education: Informing consumers about sustainability benefits.
4. Incentives: Encouraging responsible behavior through rewards.

Case Studies: Success Stories in Responsible Consumerism

1. Patagonia: A leader in transparency, environmental stewardship, and ethical practices. Use digital storytelling to share the origins of its products.
2. The Body Shop: Pioneering cruelty-free and sustainable products.
3. Fair Trade Coffee Movement: Enhancing labor conditions and wages through blockchain-certified transparency.
4. Buycott App: Empowering consumers to align purchases with their values.

Challenges in Digital Empowerment

While digital tools offer immense potential, challenges such as data authenticity, equitable access, and technological literacy remain significant hurdles.

Solutions:

1. Enhanced Data Verification: Using blockchain and AI for accuracy.
2. Bridging the Digital Divide: Ensuring equal access to technology.
3. Education Initiatives: Building awareness and technical proficiency.

Conclusion

Responsible consumerism, driven by digital augmentation, holds the potential to create a sustainable and ethical global marketplace. By fostering awareness, supporting ethical businesses, and leveraging digital tools, consumers can drive transformative societal change. This collective effort can ensure a balanced coexistence of technological progress and ecological sustainability.

Way Forward

1. Increase public awareness around responsible consumerism.
2. Encourage businesses to adopt transparent and ethical practices.
3. Advocate for government policies supporting sustainability.
4. Foster collaboration among stakeholders to address systemic challenges.

Final Thoughts

Responsible consumerism is not just a trend, it's a necessity. With the right combination of digital tools, informed decisions, and collaborative efforts, we can create a future that balances technological innovation with ethical and environmental stewardship.

CMA (Dr.) Arindam Banerjee
Associate Professor
Shiv Nadar University, Chennai

Transformational Impact of Artificial Intelligence on Financial Services: Opportunities, Challenges and Critical Considerations

Introduction

Artificial Intelligence (AI) has emerged as a game-changer in the financial services industry, promising greater efficiency, improved decision-making, and new opportunities to create value for customers and institutions alike. From automated customer support and real-time fraud detection to advanced investment strategies, AI-driven tools are reshaping how banks, insurance providers, investment firms, and fintech companies operate. At the same time, however, AI's widespread adoption poses critical challenges around data privacy, ethical considerations, regulatory compliance, and workforce displacement. As institutions race to integrate AI into their products and services, it is crucial to understand both the technology's transformative benefits and the complexities that lie beneath its surface. This article provides an in-depth exploration of the impact AI is having on financial services, highlighting key applications, benefits, and the critical aspects—potential biases, governance gaps, and regulatory hurdles—that must be addressed to ensure AI-driven innovation is both responsible and sustainable.

1. AI Adoption in the Banking, Financial Services, and Insurance (BFSI) Sector

AI's infiltration of financial services can be traced back several decades, beginning with rudimentary expert systems for credit scoring and branching out into more sophisticated algorithms capable of parsing massive datasets. Today, AI-driven solutions have diversified substantially, encompassing technologies like machine learning (ML), deep learning, natural language processing (NLP), and reinforcement learning. Banks use AI-enabled software to automate routine back-office tasks like document processing, legacy system integration, and Know Your Customer (KYC) checks, freeing human personnel to handle exceptions and more strategic functions. Meanwhile, fintech startups, unencumbered by traditional banking infrastructure, rely on cloud-native AI solutions to deliver personalized financial products—from robo-advisors that manage investments to peer-to-peer lending platforms that expedite loan approvals.

Consumer behavior, particularly the shift to digital banking has also propelled AI adoption. The recent acceleration of remote and mobile banking services underscores the need for 24/7 responsive chatbots, predictive fraud monitoring, and algorithmic lending assessments. Yet, incorporating AI is not merely about efficiency gains; it offers the ability to generate real-time insights, anticipate shifting market conditions, and remain innovative in a competitive landscape. Nonetheless, the BFSI sector continues to grapple with questions of transparency, model explainability, and risk management, which grow more complicated as AI systems become heavily embedded in mission-critical processes.

2. Key AI Applications in Financial Services

AI's functional footprint in finance is broad, spanning multiple operational areas and customer-facing solutions. Some of the most prominent use cases include:

- Risk Management: AI-powered risk analytics platforms continuously assess credit, market, and operational risk by analyzing a multitude of indicators—ranging from traditional financial ratios to alternative data points such as social media sentiment.
- Customer Experience: Chatbots, virtual assistants, and voice-based interfaces powered by natural language processing are streamlining customer service. These systems can handle routine queries, guide users through transactions, and even provide initial account troubleshooting.
- Fraud Detection: Machine learning models excel at anomaly detection, studying historical transaction patterns to quickly spot unusual or suspicious behavior. These advanced rule-based systems reduce both false positives and the time to identify genuine threats.
- Investment and Wealth Management: Robo-advisors and algorithmic trading applications rely on ML techniques to optimize portfolio allocations, forecast market movements, and strategically rebalance investments. Hedge funds increasingly exploit AI for high-frequency trading strategies.
- Insurance Operations: Insurers use AI to automate claims processing, detect fraudulent claims, and refine underwriting approaches. Machine learning can analyze the historical claim data of hundreds of thousands of policyholders to anticipate risk factors more accurately.

From front-end user interactions to intricate back-end risk control, AI's hallmark lies in its capacity to parse large quantities of structured and unstructured data, identifying patterns that humans may miss. This capability paves the way for timely insights and proactive interventions—whether in underwriting, investment decisions, or fraud mitigation.

3. Risk Management and Compliance

In an industry shaped by tighter post-2008 regulations, AI-driven risk management solutions represent perhaps the most crucial application of these technologies. By embedding ML models within enterprise risk management frameworks, banks and other financial institutions can rapidly process a variety of risk signals—like changes in interest rates, shifts in macroeconomic indicators, or sudden price fluctuations in specific asset classes. AI solutions also provide stress testing capabilities by simulating scenarios across high-dimensional datasets. However, the complexity of these AI models introduces challenges around model risk. If not properly tested and validated, AI algorithms may overlook some latent correlations or systemic risks. Consequently, regulators worldwide are increasingly scrutinizing how these AI systems are built, trained, and monitored, emphasizing transparency, explainability, and robust model governance practices.

4. Customer Experience Transformation

Historically marked by long wait times, paperwork, and rigid processes, the financial customer experience is dramatically changing in the era of AI. At the retail banking level, the integration of AI chatbots and virtual

assistants provides near-instantaneous responses to queries, delivering personalized recommendations based on a customer's financial history and behavioral data. By analyzing spending patterns and life events, banks can proactively offer tailored financial solutions—like timely loan offers or specialized savings plans. AI's real-time analytics further enables the quick resolution of service interruptions. Yet, as AI-based recommendation engines grow more sophisticated, data privacy concerns intensify, prompting heightened scrutiny of how much personal information is mined and how it is protected.

5. Fraud Detection and Cybersecurity

Financial fraud has grown more intricate with the expansion of digital payment channels. AI can serve as an adaptive shield, continually refining its detection thresholds based on newly identified fraud tactics. Unlike traditional systems reliant on hard-coded rules, AI models self-improve as they analyze new transaction data and event patterns across multiple platforms and devices. Biometric authentication—leveraging facial recognition, voice identification, or behavioral biometrics—further bolsters account security. However, as AI-based defense systems become more advanced, threat actors also adopt AI tactics to automate hacking attempts and social engineering schemes. This escalating "AI arms race" compels financial institutions to invest heavily in robust, multi-layered cybersecurity infrastructures and consistent staff training to keep pace with ever-evolving threats.

6. Algorithmic Trading and Wealth Management

The securities and asset management space has been among the earliest adopters of AI, employing algorithmic trading systems to accelerate decision-making and execute trades at lightning speed. High-frequency trading outfits harness advanced ML models to spot micro-price discrepancies in near real time. Beyond short-term gains, AI-driven portfolio management tools can enhance long-term wealth strategies by sifting through historical data, macroeconomic trends, and alternative data streams—from social media sentiment to satellite imagery—enabling more precise market predictions. Robo-advisors extend these capabilities to everyday retail investors, offering digital platforms that automatically rebalance clients' portfolios based on risk tolerance, financial goals, and real-time price signals. While these automated solutions open the market to a broader audience, some critics question whether AI's reliance on historical data may amplify herd behavior and systemic shocks during volatile periods.

7. Insurance Operations and Underwriting

Insurance companies have discovered that AI can streamline everything from customer onboarding to claims settlement. Intelligent underwriting models integrate data from diverse sources, including a customer's driving record, health metrics, or even IoT-enabled sensors in vehicles and homes. These ML-centric strategies tailor policies and premiums more accurately. Additionally, AI analyzes massive text datasets—like medical documents or damage reports—within claims processing workflows, identifying anomalies that might signal fraudulent activities. Customers, in turn, benefit from faster claim resolutions. This heightened operational efficiency enhances profit margins for insurers but also introduces new ethical and regulatory wrinkles, particularly around how personal data is used to set premiums or deny coverage.

8. Critical Challenges and Pitfalls

Alongside its many benefits, AI in financial services also presents an array of critical challenges and potential pitfalls:

- Data Privacy and Security: Financial data is intrinsically sensitive, and AI solutions often require large volumes of it to learn effectively. Institutions must navigate complex data protection laws while ensuring robust cybersecurity measures. A single data breach can wreak havoc on customers' trust and invite strict regulatory sanctions.

- Algorithmic Bias: AI models mirror the biases in their training data. If historical underwriting or lending data is skewed against certain demographics, these biases may be perpetuated and even magnified in automated systems. Such bias can result in discriminatory outcomes that trigger reputational damage and legal consequences.
- Lack of Explainability: Many AI models—particularly deep learning networks—function as "black boxes," making it difficult to explain why a loan was denied or a particular trade was executed. This opacity poses challenges for compliance, governance, and consumer protection.
- Regulatory Compliance: AI systems operating in a high-stakes environment must comply with regulations such as anti-money laundering (AML), Basel III capital requirements, and data protection frameworks like GDPR. Most regulators have yet to finalize guidelines specific to AI, meaning financial institutions are navigating evolving regulatory landscapes.
- Model Risk Management: AI models must be continually tested for accuracy, fairness, and resilience. Institutions risk severe operational disruptions if a model fails.
- Operational Complexity: Integrating new AI technologies with legacy infrastructure can be costly and technically challenging. Institutions must ensure robust change management practices to avoid implementation failures.

9. The Future Outlook of AI in Financial Services

Looking ahead, AI's role in the financial sector is poised to deepen. Developments in quantum computing may accelerate AI's ability to process complex financial models, while innovations in federated learning could enable institutions to collaborate on shared models without compromising data privacy. Moreover, large language models (LLMs) like GPT-type systems are likely to evolve beyond chatbots to take on more complex tasks—analyzing regulatory text, drafting compliance reports, or even automating certain investment recommendation processes. The "AI arms race" in areas like fraud detection will intensify, with advanced deep learning methods pitted against increasingly sophisticated cyber threats. Meanwhile, rising consumer expectations for hyper-personalized financial services will spur more collaborative efforts between banks, fintech startups, and insurance companies, leading to new AI-driven ecosystems.

However, the rate of AI deployment will vary by geography, regulatory climates, and each institution's digital maturity. Surviving and thriving in this environment may require institutions to cultivate an "AI-first" mindset, systematically revisiting core processes, staff skill sets, and governance frameworks. Those that effectively integrate AI while monitoring bias, safeguarding data, and maintaining transparency stand to gain a competitive edge. Yet, a misstep in data governance or reputational risk could quickly erode those benefits.

Conclusion

AI has undeniably emerged as a transformative force in financial services, offering the potential for greater efficiency, improved customer experiences, predictive risk management, and more profitable investment strategies. Nonetheless, its adoption comes with considerable complexities related to data quality, systemic risk, regulatory compliance, and ethical concerns such as biased decision-making. While AI-driven solutions promise a new frontier of innovation, financial institutions must navigate these critical aspects with diligence, transparency, and strategic foresight. Establishing robust governance, aligning technology initiatives with regulatory mandates, and investing in workforce capabilities will be paramount. In an increasingly digital economy, institutions that balance AI's powerful capabilities with responsible use stand to lead the next wave of progress in financial services.

The Role of Artificial Intelligence in Reshaping Jobs and Industries

Artificial Intelligence (AI) has emerged as one of the most transformative technologies of the 21st century, significantly impacting jobs, industries, and economies worldwide. As industries adapt to this wave of innovation, understanding its implications is critical, particularly for professionals in Banking, Financial Services, and Insurance (BFSI). This article explores how AI is reshaping the job market and industrial landscape, focusing on the BFSI sector while providing relevant data, facts, and actionable insights.

Dr. Saurabh Maheshwari
International Trainer
Author and Digital Transformation Consultant

The Growing Adoption of AI Across Industries

AI adoption is on an unprecedented rise. According to a report by PwC, AI could contribute up to $15.7 trillion to the global economy by 2030, with $6.6 trillion from increased productivity and $9.1 trillion from consumption effects. The BFSI sector, a significant contributor to the global economy, is at the forefront of this transformation. Financial institutions increasingly leverage AI for predictive analytics, fraud detection, customer service, and operational efficiency.

Key Statistics

- **Gartner** predicts that by 2025, 70% of organizations will deploy AI to automate tasks, up from 50% in 2022.
- The global AI market size in BFSI was valued at $8.3 billion in 2021 and is projected to reach $80.3 billion by 2030, growing at a CAGR of 29.8% (Source: Allied Market Research, 2024).

AI Adoption in Other Sectors

While BFSI leads in AI adoption, other sectors like healthcare, retail, and manufacturing are not far behind. In healthcare, AI is being used for early disease detection and personalized treatment plans. Retailers leverage AI-driven recommendation engines to enhance customer experience, while manufacturing industries are utilizing AI for predictive maintenance and supply chain optimization.

Regional Trends in AI Adoption

AI adoption varies globally. Countries like the US and China are pioneers in AI research and application. However, India's AI adoption rate is growing rapidly, particularly in BFSI, where institutions are leveraging AI for financial inclusion.

How AI is Reshaping Jobs

Automation and Job Transformation

AI-driven automation is eliminating repetitive, rule-based tasks across industries. In the BFSI sector, for instance, traditional roles such as data entry, customer onboarding, and basic underwriting are now largely automated. However, AI is not just replacing jobs; it is creating new opportunities that require advanced skills.

Examples:

1. **Customer Interaction:** Chatbots and virtual assistants powered by Natural Language Processing (NLP) are handling millions of customer queries daily, reducing dependency on human agents.
2. **Credit Scoring and Risk Assessment:** AI models analyse vast datasets to provide accurate credit scores, reshaping the roles of credit analysts.

Impact on Employment: A report by the World Economic Forum (WEF) estimates that while AI could displace 85 million jobs by 2025, it will also create 97 million new roles in areas such as AI development, data analysis, and cybersecurity.

Emerging Roles

As automation handles repetitive tasks, demand for roles requiring cognitive skills and AI expertise is surging. These include AI ethics specialists, machine learning engineers, and data scientists.

Skill Evolution

- Professionals need to upskill in AI-related domains, including data visualization, coding, and algorithm development.
- Collaborative skills are critical for human-AI interaction roles, such as AI trainers and explainability experts.

AI's Impact on Leadership Roles

Leadership roles are also evolving. Executives must now make data-driven decisions, requiring them to understand AI's capabilities and limitations. AI is also assisting leaders in identifying market trends, improving strategic planning.

Socioeconomic Impacts of AI

While AI is transforming the workforce, it also poses challenges such as income inequality and skill mismatches. Policymakers must address these challenges by fostering inclusive growth through education and reskilling programs.

Case Study: AI in Fraud Detection in BFSI

Fraud costs the global economy billions annually. AI has revolutionized fraud detection in the BFSI sector, significantly improving accuracy and response times. For example, JP Morgan Chase uses AI algorithms to monitor millions of transactions daily, identifying anomalies in real-time. The result? A reported 20% reduction in fraudulent activities within their operations.

Key Technologies

- **Machine Learning (ML):** Identifies patterns and predicts fraudulent behaviour.
- **Behavioural Biometrics:** Enhances customer authentication.
- **Predictive Analytics:** Forecasts and mitigates fraud risks proactively.

Wider Impacts

Beyond fraud detection, AI ensures compliance with regulatory requirements by automating processes like anti-money laundering (AML) checks. Institutions like HSBC have reported a 25% improvement in AML operations after deploying AI tools in 2024.

AI in Cybersecurity

With growing cyber threats, AI is crucial for cybersecurity. Tools powered by AI can detect and neutralize threats in real-time, safeguarding sensitive financial data. This has reduced cyber-attack incidents by approximately 30% in the BFSI sector (Source: McKinsey, 2024).

Industry-Specific Impacts of AI

Banking

AI is revolutionizing banking through personalized financial services, smart contracts, and digital banking platforms. A notable example is ICICI Bank's AI-based chatbot, "iPal," which handles over 6 million queries monthly, enhancing customer satisfaction.

Insurance

The insurance industry is leveraging AI for personalized underwriting, claims processing, and customer engagement. AI-powered systems can analyse satellite imagery to assess property damage post-disaster, reducing claim settlement times.

Financial Services

In investment management, AI-powered robo-advisors, such as Betterment and Wealthfront, provide personalized investment advice at a fraction of traditional advisory costs. These platforms manage over $200 billion in assets globally.

Healthcare

AI is reshaping healthcare by enabling early diagnosis of diseases, automating administrative workflows, and facilitating telemedicine. For example, AI-powered imaging tools have improved the accuracy of cancer detection by over 90%.

Retail

Retailers are leveraging AI for personalized marketing, inventory management, and dynamic pricing. Amazon's AI recommendation engine reportedly drives 35% of its total sales.

Manufacturing

AI-powered predictive maintenance reduces equipment downtime by predicting failures before they occur. Robotics integrated with AI is automating assembly lines, boosting productivity.

Logistics

AI algorithms optimize supply chains by predicting demand, managing inventory, and improving route planning. DHL reported a 15% increase in efficiency after implementing AI-driven logistics solutions.

Education

AI is personalizing learning experiences by analyzing individual student data to tailor curriculum and instructional methods. AI tutors are also providing supplementary education, improving learning outcomes globally.

Agriculture

Precision farming enabled by AI optimizes resource utilization, increases crop yield, and reduces environmental impact. AI tools analyze weather patterns and soil conditions to guide farmers in decision-making.

Energy

AI enhances energy management by predicting consumption patterns, optimizing grid operations, and integrating renewable energy sources effectively.

Emerging Areas

- **Wealth Management:** AI enables hyper-personalized investment strategies by analysing market trends and client profiles.
- **RegTech:** Compliance management tools powered by AI are minimizing regulatory breaches.

AI in Microfinance

AI is also aiding microfinance institutions by assessing creditworthiness of individuals in rural areas through alternative data, including mobile usage and social behaviour.

Challenges in AI Adoption

Despite its transformative potential, AI adoption is not without challenges:

1. **Skill Gaps:** The demand for AI specialists far outweighs the supply, leading to a talent shortage.
2. **Ethical Concerns:** Issues like bias in AI algorithms and data privacy breaches remain significant hurdles.
3. **Cost:** High implementation costs can be prohibitive, particularly for smaller institutions.

Example: The BFSI sector's reliance on legacy systems often complicates AI integration, requiring substantial investment in modernization.

Mitigating Challenges

- **Upskilling Workforce:** Institutions must invest in training programs.
- **AI Governance:** Establishing robust frameworks ensures ethical and unbiased AI deployment.
- **Collaboration with Startups:** Partnering with AI-focused startups can bring innovation at reduced costs.

Preparing for the AI Revolution

Upskilling and Reskilling

Professionals in the BFSI sector must embrace continuous learning. Organizations should invest in training programs focused on AI, machine learning, and data analytics.

Notable Initiatives

- The Reserve Bank of India (RBI) has introduced regulatory sandboxes to foster innovation, encouraging financial institutions to experiment with AI technologies in 2024.

Ethical AI Practices

Adopting ethical AI frameworks is essential to ensure transparency and fairness. Institutions must prioritize explainable AI (XAI) to maintain trust with stakeholders.

Collaboration Between Stakeholders

Partnerships between academia, industry, and government can accelerate AI adoption. For instance, collaborations like the AI Research Centre of Excellence established in India in 2024 aim to bridge skill gaps.

Future Trends in AI and BFSI

Generative AI

Generative AI tools, such as ChatGPT and DALL-E, are being explored for creating marketing content, automating report generation, and providing insights.

Quantum Computing

Quantum-powered AI can process complex financial models and simulations, revolutionizing risk management and portfolio optimization.

Autonomous Banking

Fully automated branches driven by AI and IoT are emerging, particularly in rural areas, to improve financial inclusion.

AI and Sustainability

AI is also aiding in green finance initiatives by analysing environmental data to assess the impact of investments, helping BFSI institutions align with global sustainability goals.

Industry 5.0 and AI

The integration of human creativity and AI capabilities is driving Industry 5.0, where humans and robots collaborate, offering personalized solutions across various sectors.

AI in Space Exploration

AI is playing a pivotal role in space exploration by analyzing vast datasets, optimizing spacecraft operations, and aiding in the search for extraterrestrial life.

The Way Forward

AI is not just a technological advancement; it is a paradigm shift reshaping industries and redefining the future of work. For the BFSI sector, this presents both opportunities and challenges. Professionals and organizations must proactively adapt to harness AI's full potential while addressing its challenges responsibly.

Conclusion: As AI continues to evolve, it promises to unlock unprecedented value, driving efficiency, innovation, and growth. For BFSI professionals, embracing this transformation with a proactive, forward-looking approach will be the key to thriving in the AI-driven future.

References:

1. PwC, "Global Artificial Intelligence Study," 2024.
2. Gartner, "AI Adoption Trends," 2024.
3. Allied Market Research, "AI in BFSI Market Analysis," 2024.
4. World Economic Forum, "Future of Jobs Report," 2024.
5. JP Morgan Chase, "AI in Fraud Detection," 2024.
6. HSBC, "AML Compliance Enhancement," 2024.
7. McKinsey, "AI in Cybersecurity," 2024.
8. DHL, "AI-Driven Logistics Optimization," 2024.
9. Amazon, "Impact of AI on E-Commerce," 2024.
10. WHO, "AI in Healthcare: Benefits and Challenges," 2024.
11. FAO, "AI and Precision Farming," 2024.
12. IEA, "AI in Energy Management," 2024.
13. NASA, "Role of AI in Space Exploration," 2024.

INDUSTRY TITBITS

CMA Industry Insights: November - December 2024 Issue

Infrastructure News

❖ The government has approved Rs 398 crore for 19 Arunachal Pradesh road development projects

Under the Central Road and Infrastructure Fund (CRIF), the Union government has authorized Rs 398 crore for 19 road development projects in Arunachal Pradesh for the fiscal year 2024–2025. By enhancing last-mile connection in the border regions of the northeastern state, the initiative hopes to boost socioeconomic development and accessibility in isolated places. Nitin Gadkari, the Union Minister for Road Transport and Highways, underlined the government's dedication to improving infrastructure in underprivileged communities. In the northeast, 190 projects totaling Rs 81,540 crore are now being built; completion is anticipated in September 2028. The investment will boost socioeconomic development, improve connection, and raise living standards in rural areas, according to Chief Minister Pema Khandu, who hailed the allocation as transformative. The initiatives demonstrate the government's commitment to improving infrastructure in disadvantaged areas, Union Minister Gadkari emphasized. In a social media post, he stated, "This initiative will result in regional growth and will uplift livelihoods in the North-east." Currently, 190 projects totalling 3,856 kilometres and valued at Rs 81,540 crore are being built in the northeast. By September 2028, these projects should be finished. The government's commitment to a long-term vision for the growth and development of the region is reflected in the planning of these projects. Chief Minister Pema Khandu expressed his appreciation for the grant and described it as a "game-changer." According to him, the investment will improve socioeconomic growth, boost connection, and raise living standards in the state's more rural areas.

(Source:https://www.financialexpress.com/business/roadways-govt-approves-rs-398-crore-for-19-road-development-projects-in-arunachal-pradesh-3695592/)

❖ Bengaluru-Chennai Expressway: 34 bridges and 6 toll plazas are on track; 65% of the 105.7 km project is finished

The construction of the Greenfield Bengaluru-Chennai Expressway, a ₹17,000 crore project, is progressing with 65% of the work completed. The project spans 105.7 km across several districts and will connect Sriperumbudur in Tamil Nadu to Gudipala in Andhra Pradesh before heading towards Bengaluru. The expected completion date for the Karnataka stretch is 2025. The most advanced section is the 24.50 km stretch from Walajapet to Arakkonam, which has seen the highest percentage of work completed. The fourth package covers the 31.007 km route from Kancheepuram to Sriperumbudur, with 64% of the work completed. The third package, running from Arakkonam to Kancheepuram, is currently the least progressed, with only 52% of the work completed so far. Engineers highlight that land acquisition has not been an issue due to the project being a greenfield venture. Once completed, the expressway will include 34 major and 31 minor bridges, covering a combined length of 15 km. Six toll plazas will be strategically placed along the route to manage traffic flow.

(Source: https://www.oneindia.com/bengaluru/bengaluru-chennai-expressway-65-of-work-on-105-7-km-project-completed-34-bridges-6-toll-plazas-o-3983971.html)

❖ Infrastructure projects around Rs 24,276 crore approved for Amaravati capital infrastructure

The Andhra Pradesh Capital Region Development Authority (APCRDA), chaired by Chief Minister N Chandrababu Naidu, has approved infrastructure works worth Rs 24,276 crore in greenfield capital Amaravati. The approval was made during the 43rd APCRDA meeting, which focuses on trunk roads, layouts, and iconic buildings. A total of Rs 45,249 crore funds have been approved in the past four CRDA meetings. The upcoming Assembly building will be built on 103 acres, covering 11.2 lakh sq ft and reaching a height of 250 metres. The 20.32 lakh sq ft High Court building will be built on 42 acres, rising to a height of 55 metres and consisting of eight storeys.

(Source:https://economictimes.indiatimes.com/news/economy/infrastructure/infra-works-worth-rs-24276-crore-approved-for-amaravati-minister-p-narayana/articleshow/116385276.cms)

❖ According to a Knight Frank India report, India requires $2.2 trillion in infrastructure investment to become a $7 trillion economy by 2030

India needs $2.2 trillion for infrastructure development to become a $7 trillion economy by 2030, according to Knight Frank India's report. The report highlights the need for radical measures to encourage private participation in this area, as the country's economy needs to grow at a CAGR of 10.1% between 2024-2030. The heavy reliance on infrastructure investments by central and state governments could strain fiscal deficit targets. Private participation in infrastructure development in India has decreased significantly, from $160 billion (46.4% of total investments) between 2009-13 to $39.2 billion (7.2%) between 2019-23. This shift has led to a larger share of government-led investments, potentially widening the fiscal deficit. Strong impetus on infrastructural development and increased budgetary allocation by the government have improved India's ranking in the Logistics Performance Index from 54 in 2014 to 38 in 2023. However, this report also highlights about bottlenecks that limits this scope, and radical measures are required to induce a higher allocation of private investments towards infrastructure development to balance fiscal prudence and bring inclusive and long-term sustainable economic growth. Maintaining a controlled fiscal deficit is crucial for long-term economic stability and effective debt management. The central government aims to reduce its gross fiscal deficit to below 4.5% by 2025. According to this, increasing private sector participation in infrastructure development would help balance fiscal deficit targets and redirect expenditure towards other key segments of economic growth. This report further stated certain focused sectors such as renewable energy, data centres, roads and highways, warehousing, and logistics hold massive investment opportunities.

(Source:https://www.ndtvprofit.com/economy-finance/india-needs-22-trillion-infrastructure-investment-to-become-7-trillion-economy-by-2030-report)

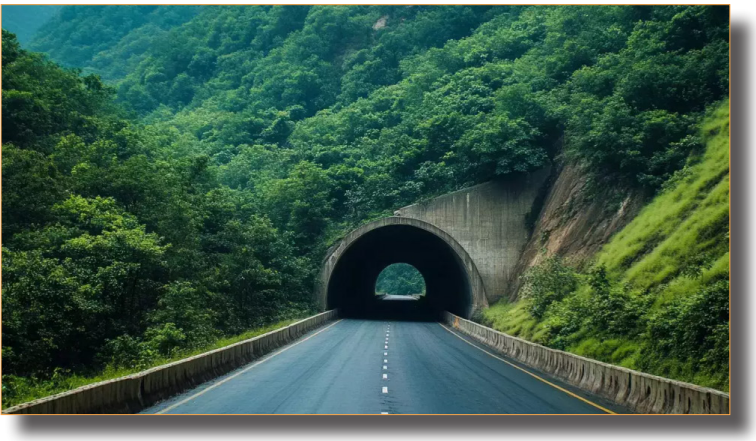
❖ Road ministry to automate highway construction

The Ministry of Road Transport and Highways in India is set to pilot the use of Automated & Intelligent Machine Aided Construction (AIMC) on some existing expressways to improve quality and efficiency in highway construction. The move follows positive feedback from the National Highways Authority of India (NHAI) for the first time using AIMC in the Lucknow-Kanpur Expressway Project. The ministry plans to begin AIMC in NH construction on a pilot basis in a few projects, including the provision of

automated and intelligent construction machines such as GPS-aided Motor Grader for earthworks, subbase and base, and intelligent compaction roller for soil or subbase compaction. India has a National Highways network of 1.46 lakh km, with 3000 km of it being high-speed corridors. The ministry believes that the time to adopt AIMC is now due to technological advancements and the availability of intelligent road construction machines. Benefits of AIMC include using digitized construction data to achieve high adherence to design specifications, enhancing efficiency and reducing wastage, improving rideability, performance, longevity, productivity, real-time documentation, better transparency, and minimal human intervention.

(Source:https://economictimes.indiatimes.com/news/economy/infrastructure/road-ministry-to-automate-highway-construction/articleshow/116375574.cms)

❖ Nearly 75 tunnel projects in India are being built at a cost of Rs 49,000 crores: Union Minister Nitin Gadkari



India's Union Minister Nitin Gadkari has highlighted the significant potential in the infrastructure sector, stating that the country has around 75 tunnel projects worth Rs 49,000 crore under construction. The Minister for Road, Transport and Highways highlighted the importance of having an international standard of infrastructure for India's goal of becoming the world's third-largest economy. NHAI has completed 35 tunnel projects, costing Rs 20,000 crore, and is currently working on 75 projects of 146 km in length. Gadkari also mentioned that 78 tunnel projects worth Rs 1.10 lakh crore are upcoming, covering a distance of 285 km. He highlighted the potential of tunnels not only for road networks but also for hydro projects, metro, and railways. Gadkari also stated that the government has given the highest priority to the development of good infrastructure in the country.

(Source:https://economictimes.indiatimes.com/news/economy/infrastructure/around-75-tunnel-projects-worth-rs-49000-cr-under-construction-in-india-nitin-gadkari/articleshow/115980549.cms)

❖ Almost 3,500 projects in Jammu and Kashmir were finished under PMGSY

Over the past two decades, the centrally sponsored Pradhan Mantri Gram Sadak Yojana (PMGSY) has completed nearly 3,500 projects, including 217 bridges, in Jammu and Kashmir. The information was shared at a meeting chaired by Joint Secretary, Ministry of Rural Development, Amit Shukla, to conduct a comprehensive review of the PMGSY implementation in the Union territory. The review aimed

to expedite project completion, ensure quality standards, and enhance rural connectivity across the region. The PMGSY was launched in 2001-02 to provide all-weather connectivity to unconnected habitations in rural areas with a population of more than 250. Since its inception, 3,742 projects, including 305 bridges, with a road length of 20,801 kilometers have been sanctioned for J&K. Out of the sanctioned programme, 3,429 projects, including 217 bridges, have been completed so far, resulting in an expenditure of Rs 12,650 crore. The implementation of the PMGSY in J&K has been given focused attention over the last five years, enhancing rural connectivity, particularly in remote and hilly regions, aligning with the vision of "Sabka Saath, Sabka Vikas". Shukla emphasized the need for a daily monitoring mechanism to meet project timelines and address challenges effectively.

(Source:https://economictimes.indiatimes.com/news/economy/infrastructure/nearly-3500-projects-completed-under-pmgsy-in-jk/articleshow/115861563.cms)

Insurance Sector News

❖ Finance Ministry proposes 100% FDI limit in insurance firms

The Ministry of Finance proposed that the foreign direct investment (FDI) limit in domestic insurance companies be raised from 74% to 100%. The Ministry also recommended that insurers be permitted to handle all insurance kinds. If this change is authorised, insurers will be able to offer health, life, and general insurance products under a single organisation. Currently, health insurance cannot be sold to life insurers, and vice versa. Additionally, the Ministry suggested lowering the current Rs 5,000 crore minimum net-owned funds for foreign re-insurers to Rs 1,000 crore. On a case-by-case basis, the insurance regulator, IRDAI, would also have the authority to impose reduced capital requirements (at least Rs 50 crores) on businesses that service underserved areas. "The proposed amendments primarily focus on promoting policyholders' interests, enhancing the financial security of the policyholders, facilitating entry of more players in insurance market leading to economic growth and employment generation, and enhancing efficiencies of the insurance industry," said the Finance Ministry.

❖ LIC aims to enrol 1 lakh Bima Sakhi in 12 months

LIC aims to recruit 1 lakh Bima Sakhi over the next year, investing up to Rs 840 crore in stipends as a part of its women empowerment drive. The insurer projects Rs 4,000 crore in new business through this program and plans expansion to every Gram Panchayat. Speaking about the scheme launched by Prime Minister Narendra Modi here, LIC MD and CEO Siddharth Mohanty said, "Bima Sakhi is expected to garner new business of five times of our spending. So, we are hoping that they can bring Rs 4,000 crore new business in the first year," he said. The stipend for the first year would be Rs 7,000 per month, Rs 6,000 per month next year and Rs 5,000 per month in the third year.

❖ LIC's unclaimed maturity amounts stand at Rs 881 crore in FY24

Life Insurance Corporation (LIC) has unclaimed maturity amounts of Rs 880.93 crore in 2023-24. In a written response to the Lok Sabha, Minister of State for Finance Pankaj Chaudhary stated that up to 3,72,282 policyholders

did not claim maturity benefits during FY2024. He added that, LIC has taken a number of steps to lower the number of unclaimed and outstanding claims, such as advertising in print and digital media in addition to radio jingles encouraging policyholders to submit claims for their owed money.

❖ Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY) has provided Rs 2 lakh life insurance coverage to over 21 crore beneficiaries: Finance Ministry

The Finance Ministry said that the Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY) has provided Rs. 2 lakh life insurance coverage to over 21 crore beneficiaries, ensuring financial security for families in times of uncertainty. The Ministry also said that the cumulative enrolment under the PMJJBY has recorded at 21.67 crore, and the cumulative number of claims received was 860,575, worth Rs 17,211.50 as of October 20 this year. PMJJBY is a one-year life insurance scheme renewable from year to year, offering coverage for death due to any reason. Persons in the age group of 18-50 years having an individual bank or a post office account are entitled to enrol under the scheme.

Banking Sector News

❖ RBI imposes Rs 27.30 lakh penalty on IndusInd Bank

The Reserve Bank of India (RBI) has fined IndusInd Bank with rupees 27.30 lakh for non-compliance with certain provisions of norms relating to deposit interest rate regulations. The penalty is based on deficiencies in regulatory compliance and is not intended to pronounce upon the validity of any transactions or agreement entered into by IndusInd Bank with its customers.

(Source:https://legal.economictimes.indiatimes.com/news/regulators/rbi-imposes-rs-27-30-lakh-penalty-on-indusind-bank/116512410)

❖ ICICI Bank and Times Internet launch super-premium credit card

ICICI Bank and Times Internet has launched a super-premium credit card, 'Times Black,' crafted from a metal alloy derived from historic Times of India printing plates which targets ultra-high-net-worth individuals. The card offers exclusive benefits like reward points, unlimited lounge access, and even helicopter rides. The annual fee of the card is rupees 20,000, waived for yearly expenditures of rupees 25 lakh.

(Source:https://economictimes.indiatimes.com/industry/banking/finance/banking/icici-bank-and-times-internet-launch-super-premium-credit-card/articleshow/116448933.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)

❖ RBI Increases Collateral-Free Agricultural Loan Limit from ₹1.6 to ₹2 Lakh

The Reserve Bank of India (RBI) raised the limit on collateral free agriculture loans which will ease the stress being faced by banks in their farm loan portfolios over the past two quarters, and to nudge them to get their books in order and thus, the RBI notified banks to waive collateral security and margin requirements for agriculture loans, including loans for allied activities, up to rupees 2 lakh per borrower, from rupees 1.6 lakh earlier. The increase in the limit of collateral free agriculture will allow farmers and small borrowers to borrow more money freely.

(Source:https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2084395)

❖ Indian banking liquidity deficit hits highest in six months

The liquidity deficit in the Indian banking system hit the highest in nearly six months on advance tax payments by companies and likely dollar sales by the central bank to curb rupee volatility. The banking liquidity may widen further on the prospect of the RBI intervening in the currency market to curb currency losses amid a rising trade deficit and a stronger dollar.

(Source: https://economictimes.indiatimes.com/industry/banking/finance/banking/indian-banking-liquidity-deficit-hits-highest-in-six-months/articleshow/116397804.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)

❖ Bad loans of peer-to-peer lenders more than double to Rs 1,163 crore in FY24

Non-performing assets (NPAs) of peer to peer (P2P) lending entities more than doubled to rupees 1,163 crore in financial year 2024, rising from ₹472.1 crore in financial year 2023. This surge, representing 17% of total P2P lending, comes as stricter regulations, including limits on borrowing and lending, aim to stabilize the sector but also pose challenges to its growth.

(Source:https://economictimes.indiatimes.com/industry/banking/finance/banking/bad-loans-of-peer-to-peer-lenders-more-than-double-to-rs-1163-crore-in-fy24/articleshow/116375521.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)

Entrepreneurship and Startup News

- The GST council of India hikes goods and services tax (GST) on resale of Electric Vehicles (EVs) by business from 12% to 18% on the margin value between the purchase and selling price. However, the new electric vehicles (EVs) will continue to be taxed at 5% goods and services tax (GST) rate while the sale of used EVs between individuals will remain GST exempted.
- The government of India has opened a second round of bids for its India AI Mission, focusing on diverse areas like watermarking, labelling, ethical AI and risk assessment which aims to create an AI ecosystem, offering supercomputing capabilities comprising over 10,000 graphic processing units (GPUs) to various stakeholders. It also aims to develop AI applications for critical sectors, and tackle challenges identified by central and state governments and also government run institutions.
- Andhra government has partnered with edtech startup Physics Wallah to set up the state's first deep tech and AI-focused Institute of Eminence (IoE) where the purpose is to create an institution that combines academic learning with industry relevance where Physics Wallah will invest up to INR 1000 crore by GSV Ventures of US and other investors. The institute is established with the idea of blending academic excellence, innovation, and research, where its focus is planted on addressing challenges in education and employability.
- The National Skill Development Corporation (NSDC) recently launched Bharat Innovation Global Private Limited (BIG) initiative in collaboration with edtech startup Physics Wallah. The programme aims to develop India into a global education hub which will focus on bridging the gap between education and employability through flexible, technology driven learning pathways, a statement from the edtech read, adding that it will integrate AI-driven career guidance, gamification, adaptive learning tools, and secure Learning Management System (LMS) platforms for individuals.
- Indian deep tech startups have seen 5.3 times increase in average seed check size over the past eight years, fueled by government initiatives and VC confidence. However, alternative funding such as venture debt, asset financing and project financing during their initial stages to address the science risk is crucial to navigate initial challenges.

ESG Related News

- Carbon removal project developer Deep Sky announced that it has secured a USD $40 million grant commitment from Breakthrough Energy Catalyst, a climate solutions-focused initiative founded by Bill Gates, with proceeds aimed at supporting the construction of the company's first Direct Air Capture Facility, Deep Sky Alpha.

  (Source:https://www.esgtoday.com/bill-gates-backed-climate-solutions-fund-invests-40-million-in-canadian-carbon-removal-startup-deep-sky/)

- Australia-based JET Charge, which supplies and installs chargers for electric vehicles, has raised AUD $72 million (USD $45 million) in a new funding round, with proceeds aimed at supporting its buildout of EV charging infrastructure across Australia and New Zealand.

  (Source: https://www.esgtoday.com/ev-infrastructure-provider-jet-charge-raises-45-million/)

- Global professional services firm Accenture announced on 17th December 2024 an agreement to acquire Italian engineering services provider IQT Group, in a move aimed at strengthening Accenture's capabilities for net zero infrastructure projects.

  (Source:https://www.esgtoday.com/accenture-acquires-iqt-group-to-target-net-zero-infrastructure-opportunities/)

- Carbon removal buyer coalition Frontier announced that it has facilitated $80 million in offtake agreements on behalf of buyers including Google, H&M, Stripe and Salesforce, among others, for the removal of nearly 300,000 tons of CO2 through technologies that integrate carbon removal into existing industrial processes. The offtake agreements were signed with CO280, a developer of Biomass Carbon Removal and Storage (BiCRS) projects at pulp and paper facilities, and CREW Carbon, which removes CO2 from the wastewater treatment process.

  (Source: https://www.esgtoday.com/carbon-removal-coalition-frontier-facilitates-80-million-in-new-offtake-agreements-for-google-hm-stripe-and-others/)

- The Canadian Sustainability Standards Board (CSSB) announced the publication of its finalized Canadian Sustainability Disclosure Standards (CSDSs), largely aligned with the global standards released by the IFRS Foundation's International Sustainability Standards Board (ISSB), but adding more time for companies to prepare for some key elements of reporting, such as on value chain GHG emissions, compared to the ISSB standards. The release of the new standards marks a significant step in the multi-year process towards establishing a new sustainability reporting system in Canada, beginning in 2021, with a directive from Prime Minister Justin Trudeau to cabinet ministers to move towards a system of reporting based on the Task Force on Climate-related Financial Disclosures (TCFD).

  (Source:https://www.esgtoday.com/canadas-cssb-releases-ifrs-based-sustainability-and-climate-reporting-standards/)

- Leading enterprise resource planning (ERP) software company SAP announced on 15th December 2024 the general availability of SAP Green Ledger, a new carbon accounting solution aimed at enabling companies to track and report the carbon footprint of their products, services and business units. Initially unveiled in 2023, and forming part of SAP Sustainability solutions, the new solution provides a carbon accounting system that directly integrates with a company's financial data, according to SAP, by allocating emissions to economic activities and transactions captured by SAP's ERP solutions.

  (Source:https://www.esgtoday.com/sap-launches-solution-enabling-companies-to-track-and-report-carbon-footprint-of-products-and-services/)

- HVAC and climate control solutions company Trane Technologies announced on 18th December 2024 the

appointment of Mauro Atalla as Chief Technology and Sustainability Officer. Atalla will report to Chair and CEO Dave Regnery as part of the executive leadership team and will lead the product development, innovation and sustainability strategies for Trane Technologies globally. In his new role, Atalla will be responsible for leveraging technologies that drive innovation and business growth and deliver sustainable solutions to the global market, the company said. He will focus on integrating technologies into product road maps to align with the company's 2030 Sustainability Commitments.

(Source: https://www.esgtoday.com/trane-appoints-mauro-atalla-as-chief-technology-and-sustainability-officer/)

- German asset management firm DWS Group has announced that it has raised €323 million (USD$340 million) at the first close of its ESG Infrastructure Debt Strategy (EIDS), aimed at investing in senior secured debt for projects and corporate borrowers operating across sustainability-themed sectors such as renewable energy, energy efficiency and utilities, digital infrastructure, clean transportation, and circular economy projects. DWS added that it is aiming to raise €500 to €750 million for the sustainability-focused infrastructure strategy. EIDS is DWS's second senior European infrastructure debt series, following the deployment of more than €850 million under the first vintage.

  (Source: https://www.esgtoday.com/dws-raises-340-million-for-sustainable-infrastructure-fund/)

- California State Senators Scott Wiener and Henry Stern, authors of recently-passed legislation requiring large companies to disclose their value chain emissions and report on climate-related financial risks, have sent a letter to the California Air Resources Board (CARB), threatening the regulator with legislative oversight hearings over its plans to delay enforcement of the new climate reporting regulation. The letter follows the release of an enforcement notice earlier this month by CARB, the regulator charged with developing and enforcing the new climate reporting regulations, announcing that it will ease the new emissions reporting requirements and not pursue enforcement action in the first year of reporting, in order to give companies more time to prepare to comply with the new rules, as long as companies make good-faith efforts at compliance.

  (Source:https://www.esgtoday.com/california-lawmakers-threaten-regulator-over-delayed-enforcement-of-climate-reporting-law/)

MSME Sector Related News

- The Contracts and Materials Department of NTPC Simhadri hosted a special vendor development program on December 19, 2024, aimed at empowering Micro, Small, and Medium Enterprises (MSMEs) with critical insights into government policies and procurement processes. This initiative reflects broader national efforts to enhance MSME participation in the economy. A key driver of this transformation is the Trade Receivables E-discounting System (TReDS), which plans to onboard a million MSMEs over the next

few years. Recent discussions between the Reserve Bank of India (RBI) and TReDS operators addressed issues such as integrating insurance companies as a fourth participant in the platform and linking TReDS with the Goods and Services Tax Network (GSTN)

- India's iron and steel imports dropped sharply by 28% in November, falling to $1.7 billion compared to $2.4 billion the previous year. This decline comes amid delays in No Objection Certificates (NOCs) from the Steel Ministry for imported consignments. While large steel firms advocate for safeguard duties to restrict imports, MSMEs warn such measures could harm small businesses and exports.
- In West Bengal, the twin districts of East and West Burdwan are witnessing significant growth in the MSME sector, with investment proposals worth ₹4,650 crore expected to reach ₹10,000 crore in the coming years, according to state MSME Minister Chandranath Sinha. At the "Synergy & Business Facilitation Conclave 2024-25," Sinha highlighted that bank lending to MSME units in these districts is projected at ₹7,371 crore for 2024-25. As of December 15, 2024, the number of registered MSME units in East and West Burdwan reached 1,19,703, with East Burdwan accounting for 69,656 units and West Burdwan, known for heavy industries, housing 50,047 units.
- The West Bengal Small Industries Development Corporation (WBSIDC) is accelerating the development of three new industrial parks in the Burdwan region. These include a ₹11.72 crore Common Facility Centre for the Refractory Brick Cluster at Salanpur, employing 5,100 workers, and a ₹14.51 crore industrial park in Salanpur's Dharma area on 7.09 acres for 27 MSME units. Additionally, Phase II of the ₹75.38 crore Durgapur Industrial Park on 27.32 acres is progressing, while nearly completed infrastructure at the ₹15.18 crore Shaktigarh Industrial Park on 15.76 acres is poised to attract more MSMEs. Two state-aided private parks at Andal, Durgapur, are under development, accommodating 61 MSME units with an investment potential of ₹150 crore.
- The Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE), established in 2000, recently reached its milestone of 1 crore guarantees for collateral-free loans to MSEs. As of October 31, 2024, CGTMSE approved guarantees worth ₹7.58 lakh crore, with Maharashtra recording the highest approved guarantees at ₹90,376 crore, followed by Uttar Pradesh, Gujarat, Karnataka, and Tamil Nadu. These efforts underscore a robust ecosystem for MSME growth in India.

(Source: Compiled from various newspaper reports and government websites)

Space Sector News

- The European Space Agency (ESA) is set to launch its Proba-3 mission aboard ISRO's Polar Satellite Launch Vehicle (PSLV) on December 4, 2024, from the Satish Dhawan Space Centre. This marks India's third collaboration with ESA for the Proba satellite series, following Proba-1 and Proba-2.
- However, Proba-3 is distinct in its focus on solar observation, aimed at advancing our understanding of the Sun's corona. The mission signifies a milestone in Indo-European space cooperation.
- ISRO is gearing up for a dynamic end to 2024 with a series of high-profile missions. Among these, the GSLV rocket launch carrying the NVS-2 NavIC navigation satellite is slated for December 31, 2024. Initially planned for the Nisr mission, this launch has been repurposed, pushing the Nisr mission to the following year. Another pivotal mission, the Space Docking Experiment (SPADEX), is expected to launch on December 20, 2024.
- SPADEX will test technologies crucial for India's human spaceflight and space station ambitions. The experiment involves deploying a satellite that separates into two components, which will then reunite in orbit, demonstrating India's capability for advanced orbital operations.
- On December 4, 2024, ISRO and ESA signed a Technical Implementing Plan (TIP) for Ground Tracking Support for Gaganyaan Missions. The document, signed at the Satish Dhawan Space Centre by Dr. Anilkumar A. K., Director of ISTRAC, ISRO, and Mr. Dietmar Pilz, Director of ESTEC, ESA, formalizes ESA's role in providing ground station support for Gaganyaan.
- This collaboration will ensure seamless data flow and communication with the Orbital Module for monitoring and operational purposes. The signing ceremony, attended by ISRO Chairman Dr. S. Somanath and Belgian Ambassador Didier van der Hasselt, underscores the enduring partnership between ISRO and ESA, which has facilitated numerous successful missions and lays the groundwork for future collaborations.
- Additionally, the training of two Indian astronauts, Group Captain Shubhanshu Shukla and Group Captain Prasanth Balakrishnan Nair, for the joint ISRO-NASA Axiom Mission 4 (Ax-4) to the International Space Station is progressing in the U.S.A.
- Starting in August 2024, the Gaganyatris have successfully completed the initial phase, including facility tours, mission launch phase briefings, SpaceX suit fittings, and familiarization with selected space food options. These developments reflect ISRO's growing global collaboration and readiness for advanced space exploration.

(Source: Compiled from various newspaper reports and government websites)

Market Report: A Recap of the Key Developments for the month of November and December 2024

Developments in Indian stock market

In November and December 2024, the Indian stock market exhibited notable volatility and encountered various challenges, indicative of a complex interaction between domestic and global factors. The market exhibited initial strength in September, succeeded by a significant decline in October.

Based on the comprehensive research reports provided, following are the key developments in the Indian stock market during November and December 2024:

- **Market Performance**

1. Indices Performance

- As of December 26, 2024, the Nifty 50 index was trading above 23,800, showing an increase of 104.25 points or 0.44%.
- The S&P BSE Sensex index was trading 375 points higher at 78,837, marking an increase of 0.48%.
- Both indices experienced fluctuations throughout late December, with periods of slight decreases followed by gains.

2. Annual Performance

- The S&P BSE Sensex index has increased by 6,233 points or 8.63% since the beginning of 2024.
- The Nifty 50 index has shown significant growth since the pandemic low in March 2020, climbing over 200%.

3. Market Consolidation

- The Indian stock market experienced a period of consolidation in November and December 2024, with mixed performance influenced by global economic conditions and domestic factors such as inflation and corporate earnings.

- **Corporate Events and IPOs**

1. Major Mergers and Acquisitions

- Reliance Media and Disney India announced an $8.5 billion merger, creating a dominant media entity in India.
- Air India and Vistara merged, strengthening Tata Group's position in the Indian aviation sector.
- Tesla acquired a 20% stake in Tata Motors' electric vehicle division.
- Adar Poonawalla's Serene Entertainment acquired a 50% stake in Dharma Productions for Rs 1,000 crore.

2. Significant IPOs

- Hyundai Motor India's IPO raised $3.3 billion, highlighting the growing appetite for automotive stocks.
- Swiggy's IPO was one of the largest tech IPOs in India, raising over $1 billion.
- NTPC Green, Ola Electric, and Bajaj Housing Finance also launched notable IPOs.
- Vishal Mega Mart's trading debut saw shares surge over 40%.

Regulatory Changes and Policy Announcements

1. SEBI Initiatives

- Introduction of new secondary market trading options, including UPI block mechanism and 3-in-1 trading accounts.
- Expansion of the T+0 settlement cycle to the top

500 scrips by market capitalization.

- Relaxation of regulatory requirements for Investment Advisers and Research Analysts.
- Streamlining of the rights issue process, reducing the timeline to 23 working days.
- Introduction of a new mutual fund product bridging the gap between mutual funds and portfolio management services.
- Implementation of a "MF Lite" framework for passively managed mutual funds.
- Allowance for self-attestation of documents by market participants.

Sectoral Insights

1. IT Sector Performance

- The IT sector emerged as a significant performer, with stocks like TCS and Infosys showing robust growth potential driven by digital transformation and advancements in AI and cloud computing.

2. Pharma Sector Outlook

- The pharma sector was projected to grow by 9-11% in FY26, with companies like Lupin and Max Healthcare being top picks for 2025.

Global Economic Factors

1. Interest Rates and Monetary Policies

- Changes in global interest rates, especially those set by the U.S. Federal Reserve, continued to impact FII flows and investor sentiment in the Indian market.

2. Geopolitical Tensions

- Ongoing conflicts in the Middle East and Eastern Europe contributed to market volatility and investor uncertainty.

3. Crude Oil Prices

- Fluctuations in oil prices, influenced by geopolitical tensions, affected input costs for companies and impacted stock prices.

4. U.S. Dollar Strength

- The value of the U.S. dollar continued to influence foreign investment flows in and out of India.

5. Global Economic Slowdowns

- Economic slowdowns in major regions, such as Europe, had ripple effects on the Indian stock market.

In conclusion, the Indian stock market in November and December 2024 demonstrated resilience amidst global economic challenges, with key indices showing overall positive performance. The period was marked by significant corporate activities, regulatory reforms aimed at enhancing market efficiency, and continued influence of global economic factors. The market's performance reflected India's growing economic strength and its increasing integration with global financial markets.

Global Market Performance

The global financial markets in November and December 2024 were characterized by volatility and mixed performance across different regions and asset classes. This period was marked by significant geopolitical events, economic indicators, and policy decisions that collectively shaped market dynamics.

Key Market Trends

1. Equity Markets Performance

- The S&P 500 experienced significant fluctuations, opening at 5,984.63 points in early December but later hitting a one-month low. It closed at 5,930.85 by the end of the week of December 20, marking a decrease of 120.24 points for the week.
- The FTSE 100 showed resilience with minor fluctuations but declined by 2.60% in the week ending December 20, 2024.
- Japan's Nikkei 225 demonstrated a notable recovery, surging above 39,000 points in December after initial losses, indicating strong buying pressure.
- Germany's DAX index faced challenges, dropping by 2.55% in the week ending December 20, 2024.

2. Currency Markets

- The US dollar demonstrated significant strength

against major currencies like the Euro (EUR), British Pound (GBP), and Japanese Yen (JPY).

- The Euro experienced a sharp drop in November, reaching a two-year low.
- The Japanese Yen showed potentially bearish momentum against the USD.
- The British Pound saw a decline of nearly 3% in November but had a historic bullish tendency in December.

3. **Commodity Markets**
   - Gold prices were influenced by the strength of the US dollar and key US economic data.
   - Crude oil prices were mostly stable.
   - Bitcoin experienced a significant breakout, surging more than 21% off the November open.

Notable Events and Their Impacts on Global Market

1. **U.S. Presidential Election**
   - The election of Donald Trump as the 47th president of the United States led to sharp increases in major stock indexes, a new record high for Bitcoin, a spike in Treasury yields, a fall in bond prices, and a rise in the dollar.
2. **Geopolitical Tensions**
   - Ongoing conflicts, including the Israel-Hamas war and Russia's invasion of Ukraine, continued to introduce uncertainty into global markets, affecting sectors like energy due to supply chain disruptions.
   - The expansion of BRICS to include new members like Saudi Arabia and Iran suggested a shift in global economic alliances, potentially impacting trade and investment flows.
3. **Economic Indicators**
   - **Inflation:** The U.S. Consumer Price Index (CPI) increased by 0.3% in November 2024, with a year-over-year increase of 2.7%.
   - **GDP Growth:** U.S. real GDP growth was reported at an annual rate of 3.1% for the third quarter of 2024, with projections suggesting a slowdown to around 0.7% for 2024.
   - **Global Growth:** The IMF projected stable but underwhelming global growth at 3.2% in 2024.
4. **Central Bank Policies**
   - The Federal Reserve's commentary and decisions on interest rates significantly influenced market sentiment, contributing to volatility in equity markets.
   - The Bank of Japan's approach to monetary policy normalization affected the performance of the Nikkei 225.

Regional Market Insights

1. **North America**
   - U.S. markets were heavily influenced by the presidential election outcome and Federal Reserve policies.
2. **Europe**
   - European markets, including the FTSE 100 and DAX, faced downward pressure due to concerns over potential U.S. trade tariffs and interest rate outlooks.
3. **Asia**
   - Asian markets, particularly Japan's Nikkei 225, showed resilience with strong recoveries despite initial setbacks.
4. **Emerging Markets**
   - Emerging markets were influenced by global economic conditions, commodity prices, and local economic policies. The MSCI Emerging Markets Index served as a key benchmark for assessing performance in these regions.

Market Outlook and Investor Strategies

1. The uncertainty introduced by geopolitical events led to increased market volatility, prompting investors to maintain diversified portfolios and focus on long-term investment goals.
2. Gold was identified as a tactical hedge against geopolitical risk, with increased demand from central

banks in response to geopolitical tensions.

3. The moderating inflation environment and steady, albeit slow, GDP growth presented a mixed outlook for global markets, with potential positive impacts from easing monetary policies balanced against risks from slower economic growth.

In conclusion, the global market performance during November and December 2024 was characterized by significant volatility driven by a combination of geopolitical events, economic indicators, and policy decisions. While some markets showed resilience and recovery, others faced persistent challenges. The period underscored the importance of diversification and strategic long-term planning in navigating the complex global financial landscape.

Developments with Reserve Bank of India

In November and December 2024, the Reserve Bank of India (RBI) implemented several significant measures to address economic challenges and promote financial stability.

- **Monetary Policy Decisions:** In its December meeting, the RBI maintained the policy repo rate at 6.5% for the eleventh consecutive time, emphasizing its commitment to controlling inflation while supporting growth. Additionally, the RBI reduced the Cash Reserve Ratio (CRR) by 50 basis points to 4.0%, injecting approximately ₹1.16 trillion into the banking system to enhance liquidity.
- **Economic Projections:** The RBI revised its GDP growth forecast for the fiscal year 2024-25 from 7.2% to 6.6%, acknowledging global and domestic economic headwinds. Concurrently, the inflation estimate was raised from 4.5% to 4.8%, reflecting persistent price pressures.
- **Foreign Exchange Interventions:** To mitigate the depreciation of the Indian rupee, which reached a record low of 85.10 against the U.S. dollar, the RBI actively intervened in the foreign exchange market by selling dollars through state-run banks. These actions aimed to stabilize the currency amid global financial volatility.
- **Regulatory Actions:** On December 18, 2024, the RBI imposed a monetary penalty of ₹27.30 lakh on IndusInd Bank Ltd. for non-compliance with certain provisions of the 'Reserve Bank of India (Interest Rate on Deposits) Directions, 2016'.

Developments with SEBI

In November and December 2024, the Securities and Exchange Board of India (SEBI) introduced several regulatory measures to enhance market integrity and investor protection.

Equity Derivatives Framework: Effective November 20, 2024, SEBI implemented changes in the equity derivatives market, including an increase in contract sizes for index derivatives, rationalization of weekly index derivatives products, and enhanced tail risk coverage on options expiry days. These measures aim to strengthen market fundamentals and mitigate risks associated with retail participation in derivatives trading.

Mutual Fund Regulations: SEBI introduced new disclosure requirements for mutual funds, effective December 5, 2024. These include separate disclosures for direct and regular plans, standardized risk labeling with color codes, and enhanced transparency in portfolio disclosures. Additionally, regulations concerning overseas investments by mutual funds were updated to ensure better compliance and risk management.

Corporate Bond Market: To enhance liquidity in the corporate bond market, SEBI introduced a buyback option for listed corporate bonds, effective November 1, 2024. This initiative is expected to benefit lower-rated companies and first-time borrowers by providing an exit option for investors, thereby improving market confidence and participation.

Same-Day Settlement Cycle: SEBI announced the expansion of the optional same-day (T+0) settlement cycle to include the top 500 stocks by market capitalization, effective January 31, 2025. This phased implementation aims to enhance market efficiency and reduce settlement risks, aligning with global best practices.

These developments reflect SEBI's ongoing commitment to fostering a robust, transparent, and investor-friendly capital market environment in India.

NOTES

NOTES

MEMBERS IN INDUSTRY & PSUs COMMITTEE 2024 - 2025

CMA Bibhuti Bhusan Nayak — President
CMA T.C.A. Srinivasa Prasad — Vice President

Chairman

CMA Avijit Goswami

Members

CMA Manoj Kumar Anand
CMA Navneet Kumar Jain
CMA Chittaranjan Chattopadhyay
CMA Vinayaranjan P.
CMA Suresh Rachappa Gunjalli
CMA Ashwin G. Dalwadi
CMA Gagan Bihari Swain, Co-opted
CMA Aleti Jammaya, Co-opted
CMA Prasanna Kumar Acharya, Co-opted

Secretary - MII & PSUs Committee; Editor - Industry Insights

CMA (Dr.) Debaprosanna Nandy, Secretary (Officiating)

CMA Ria Chowdhury, Assistant Director

OUR CONTRIBUTORS IN THIS ISSUE

CMA (Dr.) Paritosh Basu
Senior Director (Services)
Stragility Consulting Pvt. Ltd.

Dr. Ashish Kumar Sana
Professor & Former Head
Department of Commerce
University of Calcutta, Kolkata

CMA (Dr.) Arindam Banerjee
Associate Professor
Shiv Nadar University, Chennai

Dr. Saurabh Maheshwari
International Trainer
Author and Digital Transformation Consultant

Mr. Subhasish Ghosh
General Manager - Finance and Systems
ITC Limited

Dr. Biswajit Paul
Assistant Professor
PG & Research Department of Commerce
University of Gour Banga, Malda

Dr. Bappaditya Biswas
Assistant Professor
Department of Commerce
University of Calcutta, Kolkata

CMA Sandip Basak
Research Scholar
Department of Commerce
University of Calcutta, Kolkata

Mr. Debasish Naskar
Assistant Professor
Department of Commerce
Raja Peary Mohan College, Hooghly

Mr. Priyajit Kumar Ghosh
Assistant Professor
Department of Commerce
Sister Nivedita University, Kolkata

Mr. Rohan Prasad Gupta
Research Scholar (SRF)
Department of Commerce
University of Calcutta, Kolkata

Mr. Priyajit Ray
Research Scholar (SRF)
Department of Commerce
University of Calcutta, Kolkata

Mr. Mantosh Sharma
Research Scholar (JRF)
Department of Commerce
University of Calcutta, Kolkata

Ms. Moumita Acharya
Guest Faculty
Department of Commerce
Maharani Kasiswari College, Kolkata

Ms. Sailza Sharma
Assistant Teacher
Vivekananda English Academy, Hooghly

Behind every successful business decision, there is always a CMA

THE INSTITUTE OF COST ACCOUNTANTS OF INDIA

Statutory Body under an Act of Parliament

www.icmai.in

mii-psu@icmai.in

Headquarters
CMA Bhawan, 12, Sudder Street, Kolkata - 700016
Ph: 033-40364777/40364722/40364726

Delhi Office
CMA Bhawan, 3, Institutional Area, Lodhi Road, New Delhi - 110003
Ph: 011-24622156/24622157/24622158

Behind every successful business decision, there is always a CMA