




# Artificial Intelligence: Societal Applications and Emerging Frontiers

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**Abstract.** This paper looks at how Artificial Intelligence (AI) is changing the way society operates, and advancing industrial, medical, and communicative experiences. It describes the efficiency, accuracy, and user experience automation can achieve, whether in standard or more complex experiences while remaining human-centric. The study reaffirms that AI is not a replacement for human intelligence; it is a value addition to human intelligence through correction, suggestion, and continuous learning, placing a fundamental importance on human intelligence. There are case examples drawn from industry and healthcare, with attention to diagnostics, patient monitoring, exoskeleton technologies and decision-making systems. In addition, the study describes the evolution of human interaction with AI (for example, in adaptive communication, multimedia applications and support technologies). At the same time, the paper highlights the growing importance for regulatory frameworks, and ethical governance structures, which ensure accountability, transparency and equitable access to the advantages of AI. The analysis points to both opportunities, and limitations, and argues that while AI will make a positive contribution to economic productivity and quality of life, it needs to evolve, within responsible boundaries. Ultimately, this work is about imagining AI as an enabler of societal progress that aligns the technological possibilities of AI, and virtues of human value, creativity and well-being.

**Keywords:** Artificial Intelligence; Societal Applications; Automation; Human–AI Interaction; Healthcare Technology; Ethical Governance; Emerging Frontiers; Conceptual Framework

## 1 Introduction

Artificial Intelligence (AI) has transitioned from being a theoretical undertaking for both computer and cognitive scientists, to also serving as a primary driver of change in the twenty-first century. AI was once solely in the realm of speculative fiction and academic debate in computer science; however, it has now embedded into the fabric of daily life. AI-enabled applications and systems are now positioned in almost every facet of our lives most of which engage with the personal- and/or virtual-connectedness of individuals, business models and service delivery, as well as analyse and respond to highly complex socio-economic issues on behalf of policymakers (Bolaños et al., 2024). Strategies for developing intelligent computational agents - machine learning (ML), deep learning (DL), natural language processing (NLP), and generative AI systems - have ushered in a period of transformation and processing unlike any previous epoch, extending what is possible for humans, and capturing the nature of intelligence.

Today, AI is much more than calculating things automatically; it is also a socio-technical phenomenon that has implications (cognitive, ethical, cultural) to human life itself. As AI becomes more integrated into virtually all the tools and systems that we use, we find that intelligence can now be shared both by humans and machines, rather than limited to just biological. With the increasing use of AI, we return to the question of what is intelligence and whether reasoning based in machines can only imitate human cognition, or exceed it. The very term "artificial intelligence" expresses this tension; "intelligence" indicates independent cognitive capability and "artificial" is something that imitates, or comes out of, or references a human case of design (Du-Harpur et al., 2020). This dialectic highlights an age-old and troubling philosophical problem regarding whether machines can only ever imitate human cognition or perhaps actually exceed it in some capacity. In addition to these issues, we see data privacy and digital surveillance emerge, which become problems, when enormous datasets of individuals' personal data are ingested and/or processed without consent and/or oversight.

These paradoxes raise an underlying challenge: while AI can hasten human advancement, AI can pose very serious societal disruption if humans do not act ethically. A new academic consensus includes that the consequences of AI should not be framed in terms of competition of humans and machines, but rather as a human-AI complementarity with both contributing, in unique ways, to social innovation. Machines can provide in terms of speed, memory, rational optimization, and processing extensive multimodal data sets; while humans have capabilities that are distinct and include, ethical reasoning, empathy, sense-making, and context-based judgement. Therefore, the most enduring and socially responsible AI ecosystems will call for an intermixed hybrid regime, where humans are responsible and act autonomously, and machines amplify cognition. Here, governance is critical because institutions (e.g. across global, national, industry, etc.) are creating ethical standards for AI path development and utilized to prevent the technology from mis-use and, to provide equitable access to benefits among societal stakeholders.

Even with all the regulatory movements underway, these are mostly theoretical and provide little in the way of tangible strategies for organizations to use in practice. In

addition to ethical issues, the use of large data sets without consent or social accountability can present a higher risk for data privacy and monitoring citizens digitally. These antitheses create a fundamental tension: AI encourages human advantage while it also presents a risk of disruption in society on an expansive level if not carefully considered. Academically speaking, there is developing consensus that the future of AI scope cannot be solely treated as a competitive space for humans vs. machines, but rather as a space for hybrid human-AI collaboration that leverages our differences and builds on collective intelligence for the social good.

While machines have speed, memory, rational optimization, and the ability to analyze large multimodal datasets, humans have ethical reasoning, empathy, sense-making, and contextualization. If we want to build a more equitable and socially beneficial resilient AI ecosystem, the solutions will be found in integrated hybrid intelligence, where humans remain as the author of control and machines provide cognitive assistance.

Governance is important to this model. Global institutions, nation states, and associations of industry professionals are all coming together to develop frameworks for ethical AI to address issues associated with the potential negative effects of the use AI has to address challenges of social equity of the inequitable distribution of the benefits of AI. However, the existing frameworks for regulating AI, even if they exist and are enacted, are often little more than suggestions or guidelines without specific operational models for the governing institutions to apply.

This gap creates a need to bring together ethical frameworks with organisational systems to create an appropriate set of guidelines to provide a path of how to enact AI effectively and responsibly in practice. This research seeks to address that gap. The study will create a review of the contemporary landscapes of AI capabilities and AI use-cases from varying industries and associated implications for governance, to create a deeper understanding of the current relationship between AI technology and humanness. The research proposes to create a human-centred Human-AI Implementation Framework, anchored in a value-based human centered approach, the ability to explain how AI is working, and continuously learn from use and integration of the AI.

This research is organized around three major research questions:

RQ1. How do the different types of AI systems create value in industry and society and what limitations come with that value?

RQ2. What governance principles are necessary to support and govern the ethical and socio-economic opportunities and risks of adopting various categories of AI?

RQ3. How can organizations implement and integrate AI in a systematic manner, while safeguarding human oversight, advancing equity and strengthening accountability?

The paper makes both theoretical and practical contributions. First, it brings together an extensive array of literature from multiple disciplines to outline the state of development of AI, and its implications as it continues to slowly develop. Secondly, it proposes a comparative assessment that links AI categories with industry-specific issues and obligations. Third, it puts forward a usable framework aimed at assisting practitioners, researchers, and policy-makers in responsibly deploying AI systems.

Advancing this cohesive role, the paper emphasises that AI-driven transformation must advance the shared goals of social progress, sustainable innovation, and human dignity. In the end, AI will not only be shaped by technological development but also by our collective human capability to design ethical awareness, accountability, humanity, and emotion as a function of these intelligent systems. AI is meant to be an agent increasing human potential—not undermining it.

The present paper advances this imperative by centering innovation within governance and prioritizing human intelligence as an anchoring condition of technological evolution. In this paper, we position AI as a socio-technical entity and operationalise a schema to better understand its current impact, potential realms of application, and future governance. The research draws from theoretical evidence and industrial case studies and concludes with a Human–AI Implementation Framework that supports responsible use. There are five objectives that underpin the present study and these are in alignment with our research questions:

1. To explore the conceptual foundations and technological development of AI
2. To assess AI’s implications in existing predominantly industrial and societal domains
3. To analyze generative AI and hybrid intelligence as possible transformational paradigms.
4. To offer a framework to help integrate AI in a responsible and human-centred way.
5. To propose new possible research directions and policy needs for the ethical governance of AI.

In so doing this work is contributing to interdisciplinary scholarship into AI adoption towards realizing a future where computational power enhances – rather than replacing – human potential. The next section highlights theoretical perspectives important for situating AI as both a technology and a human-embedded system.

The rest of the article is structured as follows. Section 2 gives a theoretical and conceptual grounding of artificial intelligence, identifying its historical trajectories, typologies and technical base whilst orienting through the shift towards human-centred. Section 3 examines significant applications of AI in society under critical sectors such as healthcare, education, transport, manufacturing and public governance, synthesizing a global perspective of developments occurring in India with the increased global innovations. Section 4 delves into ethical, socio-economic and governance considerations that arise through significant and wide use of AI, including fairness, transparency, labour transition, data protection and regulatory readiness. Section 5 introduces the Human–AI Implementation Framework proposal, identifying its philosophical background and operational levels for embedding responsible and collective intelligence into tangible real-world systems.

Ultimately, Section 6 wraps up the paper by recapping the ramifications of this study, noting limitations, and providing guidelines for next steps in the pursuit of responsible, equitable, and inclusive integration of AI.

## 2 Conceptual Foundations and Theoretical Perspectives on AI

In understanding both the growth and capacity of AI, it is useful to think of AI in relation to frameworks that are informed by the ways in which human intelligence and artificial reasoning are understood. Human cognition includes emotional memory, creativity, moral agency, and lived experience, all of which machines have not yet achieved (Hoskens and De Boeck, 1991). Instead, computers must rely on computing architecture that both models patterns and optimizes actions based on data.

Hintze (2016) provides an influential typology that distinguishes four categories of AI development based on capacity for learning and sophistication of representation. Most contemporary AI is situated largely within the first two types: reactive systems and limited-memory systems. Chess engines categorize game states and map out the best possible moves without emotional nuance. Autonomous vehicles rely on pattern identification from millions of images to identify lanes, obstacles, and pedestrians (Levinson et al., 2021). Recommendation systems compile behavioural data and anticipate consumer behaviours. The transition from rule-based logic to statistical inference has altered the epistemological foundation of AI.

Neural networks enable computer systems to detect patterns in ways they have not been explicitly programmed, and can allow task automation or suggest decision support tasks that were once thought to need human thought processes (Brown et al., 2020). Such systems underpin virtual assistants, robots, and large language model based conversational artificial intelligence that are deployed around the world. There is a growing overlap of conceptual differences between artificial rationality and human adaptability, primarily as affective computing attempts to read emotions and intentions. Ethical concerns abound as predictive and generative agency is projected on the underlying models. Bias imaging, transparency in model processes, intellectual property, and value alignment, suggest the need for innovative governance structures that take into account human rights and social inclusion initiatives (Beauchamp and Childress, 2022). With a grounding in Hybrid Intelligence Theory, the present study adopts the belief that the most complete decision making will require the presently unnatural collaboration of computational modelling and human interpretation.

Rather than being a substitute, augmentation appears to be a sensible approach, with the algorithms extending beyond the capabilities of human cognition while humans provided the contextual, empathetic, objective, and accountable aspects. The implications on the implementation and governance recommendations for organizations will be professed throughout this report.

Artificial Intelligence can be divided into four main categories based on the development of its cognitive capabilities. Reactive Machines are the earliest form of AI, which means they can only respond to the present situation, without the use of past experiences, such as chess engines which evaluate moves in the present but don't change if you play the same move again. Limited Memory AI systems use previous data and learning algorithms to help improve future decisions, making them our introduction to contemporary applications of machine learning, such as self-driving or driver assisted vehicles, as well as predictive analytics. The next two categories are more ad-

vanced and are mostly theoretical. Theory of Mind AI seeks to understand human emotions, beliefs, and social interaction in ways that would allow a more natural and elemental interaction with humans, but the current developments are still at a stage of early research. The highest and yet still theoretical level is Self-Aware AI which are machines that will possess consciousness and self-awareness; while talking about this level has been very popular in futurism and ethical discourse in the technological age, there is yet nothing, at this level, in existence. Table 1 shows these categories.

**Table 1:** AI categories and their current stage of development

AI Category	Description	Current Stage of Development
Reactive Machines	Respond only to present inputs; do not store past experiences or learn from them	Fully implemented in narrow AI systems such as chess-playing engines
Limited Memory	Utilize historical data to improve future decision-making; foundational in modern machine learning	Dominant paradigm in contemporary AI (e.g., autonomous vehicles, predictive models)
Theory of Mind	Aim to interpret human emotions, beliefs, intentions, and social interactions	Early-stage and largely experimental (human–AI interaction research)
Self-Aware Systems	Possess consciousness, self-understanding, and subjective awareness	Conceptual and theoretical; currently not achieved

### 3 AI in Industries and Society: Transformational Applications

Today, AI is used by industries around the world not only to automate productivity, but to exploit predictive insight, accuracy, optimization and personalization for differentiation in competitive environments (Burström et al., 2021) In this section, a structured review sets out the most significant areas of AI prominence: manufacturing, logistics, health care, finance, and government.

#### 3.1 Manufacturing and Smart Operations

In manufacturing, AI enhances predictive maintenance by estimating when equipment will fail based on condition monitoring systems that utilize sensors for data collection. Machine learning models are able to process vibration, acoustic, and temperature readings to identify anomaly weeks before a failure causes a breakdown, reducing downtime and cost (Obschonka et al., 2022). Inspection platforms using computer vision can automate quality control; these systems have a higher reliability and accuracy than expert inspectors. AI-enabled scheduling applications are improving throughput by simulating the state of production while dynamically assigning resources. Robots have been improved through sensor fusion and reinforcement learning which compensates

for object handling in real time while at the same time allowing floor processes to be adaptive and resilient/worthwhile. The experience of robots and AI applications in the production and operations area are completely in tune with Industry 4.0 and the digitizing of the industrial ecosystem.

### **3.2 Logistics and Supply Chain Optimization**

Clustering algorithms are often used by transportation managers to facilitate categorization of transport delivery zones to minimize travelled distance while balancing loads. Reinforcement learning can be used to implement efficiency into last mile deliveries through dynamic adjustment of routes constructed based on current traffic conditions (Saha et al., 2024). Inventory forecasting using neural networks can help provide quick-commerce systems that can respond in real time to seasonal changes.

### **3.3 Healthcare**

In healthcare, the impact of AI is profound due to improvements in diagnostic sensitivity and treatment planning specific to each patient. Deep learning methods are being employed to determine the presence of tumours, fractures, and patterns of retinal disease, learning directly from imaging data, that are either as or more accurate than human radiologists (Rajpurkar et al., 2022). NLP (natural language processing) methods are automating documentation and can flag clinically meaningful information to lessen the administrative burden on healthcare providers. Wearable technologies are producing constant biometric data and using anomaly-detection models to identify early warning signals for disease, and exoskeleton systems are using AI to personalize therapy in rehabilitation by adapting support for the patient's motions based on neural feedback (Nguyen et al., 2022).

### **3.4 Financial Services**

In Financial Systems and Customer Services, banks are using AI by employing anomaly detection and behaviour profiling for fraud detection. Customer-facing chatbots are being used to simulate human conversation for basic banking questions, enabling both availability and scalability as well as the rapid resolution of issues.

### **3.5 Governance and administration**

In the context of Governance and Public Administration, governments are utilizing AI in various aspects including citizen engagement, predictive policing, traffic management, and welfare targeting. India's Digital India and the National AI Mission, focused on responsible use of AI's potential to create public value (NITI Aayog, 2023).

## 4 Socio-economic, Ethical and Regulatory Aspects of AI Integration

The rapid spread of Artificial Intelligence in core public and private systems has expedited wealth generation and productivity, but it has also triggered complex and far-reaching socio-economic and ethical issues that require research and policy attention.

A central concern is algorithmic bias, as AI models that are trained on (often historical) biased data may unintentionally replicate or exacerbate inequalities for the marginalized communities of focus. The impact of these biases increases in high stakes scenarios, such as lending decisions, hiring decisions, predictive policing, and healthcare triage, which require fairness, accountability, and transparency. Scholars note that inequity in such contexts are a function of underlying structural inequity in society and that data reflects inequity rather than ameliorating it.

In addition to biases, the increased adoption of intelligent automation requires large scale job transitions. Although many discussions highlight AI creating new entrepreneurial jobs, or stimulating human creativity beyond human capacity, most labor economists highlights that the benefits of AI will be unevenly distributed across specific jobs, and be concentrated in low and mid-skilled jobs. Job displacement is about much more than reskilling jobs, but rethinking education, lifelong learning, and social safety nets more broadly, and will have far reaching implications on emerging economies, where the digital divide may become an AI divide that stratifies more communities, with lack of access to technology or the ability to use it to level the playing field.

Consequently, the ethical governance of AI is a substantial new frontier. More discernment will be required to help explain ideas like respect for data privacy, informed consent, user agency, the explanation of machine decisions, and ethical accountability of autonomous agents more precisely - particularly in the domains of autonomous driving, military robotics, and eldercare. In various countries the response of global policy has predictably had a non-uniform character, which is often distinguishable as innovation-focused or risk-averse. A normative framework that allows for human dignity along with innovation remains a meaningful, and perhaps illusive, goal for academics, regulators, and industry.

Altogether, the socio-economic and ethical aspects of AI integration shows a duality, which is not surprisingly, a contagion-like notion: the collective public benefits, and new vulnerabilities, and existing power imbalances. The degree to which the future of AI in society becomes forged will rely not only on how the research and policy communities mediate between very different conceptions of governance, but also very different conceptions of transparency, equity, and humane ideals, in order to demonstrate the many safe, innovative, and transformative potentials of AI.

### 4.1 AI in Developing Countries: Opportunities and Institutional Resilience

In lesser-developed nations, AI may be a possible accelerant of long-term sustainable development benefits. The use of AI in society in ways that create sustainable public benefits in the areas of agriculture, telemedicine, disaster resilience, smart mobility, and

education can have a significant impact on public and community well-being, while at least discursively increasing the efficiency of the use of scarce resources in environments with infrastructure challenges.

Precision agriculture technologies may provide farmers with the ability to understand when to expect rainfall, inform them as to whether their crops have experienced early stage crop disease, and even increase yields and economic well-being in rural areas based on data. The use of remote diagnostics and other AI-supported health monitoring will be another way to increase access to quality health care in communities that limited access.

However, the successful implementation of those types of technologies will depend on institutional capacity; governance frameworks, cyber defences, research capacity, human capital, etc, will certainly impact scalability and institutional adoption. In the Global South especially, many countries are still dealing with systemic issues, such as broad band penetration, computing infrastructure, ability to support research at technology frontiers, and disconnected policy ecosystems. These structural bottlenecks may prevent adoption or adaptation of AI solutions from piloted technologies to satisfying meaningful systems on a national stage.

The geopolitical dimensions of AI are also shaping the paths of developing nations. A heavy reliance on foreign technology imports for AI may drive a technology dependency that only decreases digital sovereignty and autonomy. Hence, developing local innovation ecosystems, cultivating local startups, university–industry–government partnerships, and creating incentives for ethical AI entrepreneurship will be paramount. International partnerships should be regarded as a means of capacity building, and not as a means of dependence.

In conclusion, while AI offers developing economies an opportunity of a generation to leap throughout the classic stages of industrialization, whether they succeed or fail will depend on institutional capacity, equitable participation, and governance models (that include the voice of marginalized communities), that enable the development of AI to address a national priority. This will require the right investment — not only in hardware and data infrastructure but also in human-centred training and building locally specific intelligent ecosystems.

## **4.2 Ethical, socio-economic and Governance Challenges**

While the potential for the integration of AI into social systems is significant, it also raises complex ethical and governance challenges that require urgent attention.

### **Bias, Fairness and Inclusion**

AI systems are only as fair as the data on which they are trained. Any datasets that embody the inequalities of society, will produce models that discriminate in hiring, lending, policing, etc. This is further complicated in regions where groups are under-represented or not well represented in other data contexts. If biases are not actively mitigated, AI will only amplify structural inequalities.

The goal of bias mitigation requires a governance approach. Algorithmic audits, fairness-aware learning methods, and participatory design are all important elements to varying degrees. Stakeholders should question whether or not the predictions are fair, but also what it means to deploy such systems at scale in society.

### **Transparency and Explainability**

Numerous AI systems function as "black boxes" and as such, are hard to assess how they come to make a decision. In high-stakes or consequential decision-making contexts (e.g., health care, criminal justice), there is a risk that lack of transparency or accountability will undermine public trust in an AI-driven system. Explainable AI methods, that can present some internal logic through different approaches (e.g., feature attribution, surrogate models, or decision logs), are absolutely necessary.

However, explainability alone, is not sufficient. Organizations must also have a plan to embed human oversight as well: decision-makers, auditors, or end users or individuals have to have opportunities to intervene, amend or contest the AI outputs. They must also consider transparency policies related to data provenance, design process and any human role in oversight or adjusting the machine learning system.

### **Labour, Automation and Economic Disruption**

AI will pose considerable challenges to labour markets almost across the board. AI will augment some jobs, while others—especially routine, repetitive tasks or roles—will be eliminated. The ensuing economic disruption may exacerbate existing inequalities unless we plan for this in advance.

Policymakers and institutions must plan for reskilling and resilience. Educational systems must consider embedding AI literacy and hybrid working skills as well. This may also require considering re-imagined social safety nets in advance of that world where human work becomes supplemented with intelligent machines.

Co-working models, in which humans and AI work together, can alleviate risks by maintaining human judgment and professionals with new job opportunities.

### **Data Governance and Privacy**

AI systems usually rely on large amounts of data, which raises important questions about user privacy, data ownership, and informed consent. The recent Digital Personal Data Protection Act, 2023 in India has established a regulatory framework: data fiduciaries are expected to exercise transparency, accountability, and security in the processing of data (NITI Aayog, 2023). However, generative AI creates a new layer of complexity, if models re-use or replicate sensitive information.

Effective governance, therefore, requires careful stewardship of data, techniques for anonymization, strict limits on purpose, and strong rights of users over their personal data. In many jurisdictions, legal frameworks are still addressing the scale and sensitivity of generative systems.

### **Policy and Institutional Readiness**

Institutional capacity is essential for responsible AI. There is a need for non-governmental and civil society organizations, governments, academia and industry to coordinate and create oversight mechanisms, define liability regimes, and create multi-stakeholder bodies to govern AI. NITI Aayog's "Responsible AI for All" strategy includes seven ethical principles based on the Constitution of India, including equity, accountability, privacy and safety, that AI must be aligned with (NITI Aayog, 2021). Putting these principles into practice requires agencies focused on these issues, funding within the institution, and reform to the law.

The absence of a cohesive global governance framework also compounds the complexity. Cross-border coordination, standard-setting bodies, and international agreements will become essential if AI is to continue interweaving with public interest across boundaries.

### **4.3 AI and Regulations**

Regulation generally denotes rules that a governing body has created to construct the behaviour of individuals and organizations. The word regulation or governance, for many, is negatively associated with an authoritative rigidity of outdated institutions enforcing rules that keep us mired in antiquated practices, while regulation is touted as a fix-all for broadly identifying social ills. This is usually the dichotomy when the discussion ranges to the AI revolution. The reality of the situation is somewhere in the middle. Companies are profit driven, or stock driven, so some harms due to AI result in reputational harm to the company and thereby motivation to resolve that harm. Other harms may be indirect or too diffuse, or involve other parties aside from the company or its users, therefore, it is not within the best interest of the companies to spend the time or money to alleviate any harm. For example, toxic speech and offensive outputs in earlier iterations' of language models was commonplace. This causes users not to interact with a chatbot or some other offering, therefore, the companies that make these models (eg. OpenAI, Anthropic and Meta) all invested significant resources to rein in these issues (\$1 mil).

In contrast, the loss of income that artists suffer and the loss of time that teachers suffer resulting from generative AI does not affect the bottom lines of companies and thus these losses are not received by companies as harm. And when companies have no incentive to respond to the harms of their own business, they need regulation. You will hear more about regulation later. Regulation has been very important to the public interest in very different situations. In food safety regulation, for example, regulation takes the form of ensuring food manufacturers meet certain hygiene and quality standards to minimize the risk of foodborne illness to the health of consumers. Environmental Protection regulation, such as the Clean Air Act and Clean Water Act in the United States, places restrictions on the pollutants that can be emptied into the environment. Or another example is the labour rights regulation like a minimum wage, governing payment and hours worked, and things like safe working conditions meant to protect workers from exploitation. Now, We are by no means saying all regulation is good, effective, or necessary (and will have many clear examples of over or badly informed

regulation connected with generative AI shortly) but a world with no regulation is also not indicative of a better or more innovative space.

Indeed, in several instances stated earlier regulation is the key to providing sufficient space for people and organizations to innovate. Another common myth is that the political and regulatory responses to govern AI are in their infancy and it will require a new set of rules to regulate the entire arena of AI. However, in many jurisdictions, the frameworks to regulate AI already exist. Regulatory responses to AI differ in scope among different countries/jurisdictions. For instance, in the U.S., AI regulation is vertical. In other words, rather than having a broad agency that governs all air-products and service, regulation of air is in the authority of federal agencies for individual and specific sectors for regulations of AI, the list of which is hundreds of federal agencies and sub-federal agencies; for example the Consumer Finance Protection Bureau protects consumers in the financial marketplace from deceptive claims and discrimination on the other hand the Food and Drug Administration governs and regulates artificial intelligence that is used in various medical settings. This emphasis on regulation came into to focus in October 2023 when the White House issued an executive order on Artificial Intelligence, it was about 20,000 words long and attempted to address the entire range of benefits and risk associated with AI and how to approach the regulation of AI.

The White House has assigned 150 distinct tasks to the 50 federal agencies outlined above, which are essentially organizations such as the Executive Office of the President, the Department of Commerce, and the Department of Homeland Security. This shows a wide range of existing frameworks to regulate AI. In comparison, the EU has written horizontal rules for regulating aid that will apply across sectors. There are many laws that apply to many aspects of AI in certain areas, for example the General Data Protection Regulation governs how companies collect, store and use personal data, such as telling AI systems to promote and ensure AI features respect privacy. The Digital Services Act requires transparency and audits on the use of AI in online platforms and social media. The Digital Markets Act seeks to promote competition in online platforms, for example, preventing large online platforms from self-referencing the specific results. First and foremost, the proposed sector-specific regulations include a risk-based taxonomy of AI applications, where the developers of applications classified as high-risk, for example, AI for hiring, AI for educational assessment, etc, in terms of workforce management would have many transparency requirements.

China's inflexible approach incorporates certain characteristics of vertical and horizontal elements. In the past, the country's government has adopted a stricter vertical approach to AI regulation; for example, it developed vertical-based regulations about transparency, specifically dealing with online recommender systems in 2017 and the recent leap synthesis systems, such as AIs who can generate images, videos, and text in 2022. Draft regulations concerning generative AIs were released in April 2023 following ChatGPT being released and new public interest in generative AIs. A distinct aspect of the draft AI regulations requires that all AI-generated content must reflect *core socialist values*. There is little doubt that chatbots will join other methods to implement through the Chinese government to oversee the information is available to citizens and with what citizens can do or say. These draft regulations are a vertical approach, focusing on targeted regulations within an application of AI. However, shortly

after this announcement, in June 2023, regulators announced that they would build upon the vertical regulations to develop a horizontal AI law. This is the same kind of methodology and ideological principle that China has used in previous rounds of Internet regulations, moving a narrow vertical law to a broader application lending to a law, for example, like the Cyber Security Law passed in 2017.

The particulars of these regulations are interesting, but it does not pertain to our point. The point is that regulators across the globe are already thinking about regulatory frameworks for AI and work is being done to find better or holistic regulation of AI. There is no one size fits all way to regulate AI and while that may sound bad there is variety in approaches which allows us to learn what works, what doesn't, and this will help build toward good principles for regulation.

Again, regulation consistently lags behind the development of technology and to some extent this is filled by how complex technology can be which may be intimidating to people who are not literate in technology, but law is not always about technical details some law is founded on principles. The first amendment of the United States constitution which provided for freedom of speech was wrote centuries before the internet came into existence which means that what is believed is incorrect.

Another misconception is that tech regulation is useless because policymakers do not understand technology in reality policymakers are not experts in any of the areas they regulate they do not have PhDs in civil engineering or construction management but we have their construction codes to help regulate make sure our buildings are safe it is true that policymakers may not have expertise in the area but they are not going it alone they are ultimately delegating to and do some experts at the local level, regional level and state level to figure out all the details in the various domains to ensure safety. Regulatory agencies can at times be more reactive than proactive but again this does not mean throw away regulations it just means that we need to adjust and improve a regulatory process that will enable the regulations to be more responsive, flexible and informed to new issues that emerge from changing technology . There is an argument to be made for developing them in parallel to the pace and in line with the speed of innovation. Funding should scale with technology innovation so that regulatory agencies are focusing on resources for the most not vs overall tech companies, and the resources should be sufficient to understand the tech better than tech companies so that an agency once functional can explore a better regulatory framework and usage food regulations.

## **5 Human-AI Implementation Framework**

To this end, I introduce the Human-AI Implementation Framework, a six-stage framework to implement responsible AI adoption based on a collaboration between humans and machines (Given in Figure 1).

## 5.1 Philosophical Principles

The basis of this framework is the concept of Hybrid Intelligence - AI has value only if it enhances human judgement and does not replace it. This is supported with a precautionary but positive outlook towards risk and innovation; we need to pursue innovation where we can and take a precautionary approach to risk. It draws upon India's own approach to responsible AI, namely NITI Aayog's (2021) approach document that articulates important ethical principles (transparency, accountability, inclusiveness, and non-discrimination) (NITI Aayog, 2023). Finally, the framework uses and aligns with international discussions of multi-stakeholder governance, value-sensitive design, and rethink agnostic innovations.

## 5.2 Stages of the Framework

### Strategic Alignment

Organizations begin by clarifying their vision for AI. They will articulate strategic objectives that identify innovative outcomes (e.g., efficiency, creativity) and match them with social values (e.g., equity, trust). Early work will be to classify risks, including the risk of systems, based on societal impact, types of data, and subject matter, and direct governance attention accordingly.

### Data Integrity & Fairness

This step involves curation of datasets to be diverse, obtaining explicit consent, and evidence for bias. Mechanisms of data governance will be established (for example: data access committees, anonymization procedures, and fairness impact assessments). Compliance with the DPDP Act in the Indian context will have been operational and defined among the stewards of data, users of data, or transparency channels.

### System Design & Transparency

AI systems have been designed with explainability. Teams rely on interpretability tools (feature attribution, local surrogates), sustained decision logs, and documented provenance of models. Documentation includes structural choices for architecture, sources of training data, etc. Human involvement in AI-generated outputs or decisions will also be recorded. Systematic review would be informed by institutional logic (example: IndiaAI with the AI Safety Institute).

### Human Oversight & Collaboration

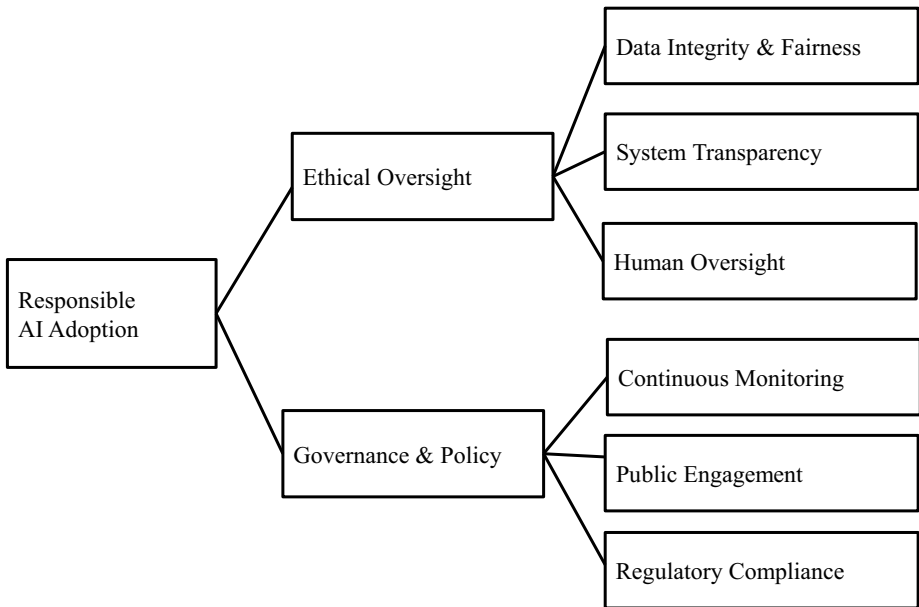
Human-in-the-loop processes will be common components of high-stakes decisions. Outputs from AI will always remain suggestions: the human will interpret, validate, and determine a course of action. In creative and/or research scenarios, AI-enabled works will be curated, refined, modified, and enriched by human involvement. Associated governance structures will ensure that oversight remains meaningful, including internal error reports, specific dispute pathways, or accountability flows.

**Continuous Learning & Feedback**

With notice of deployment, an iterative cycle of monitoring will commence (both quantitatively and qualitatively). Tracking performance measures, gathering user feedback, and mapping social impact will be possible. Audits of AI, and the context within which it is used, will determine unintended consequences. Using feedback loops will allow for learning and refinement. Governance mechanisms then adapt in response to the ways in which they are learning. An AI Safety Institute can institutionalize the process by enabling audits, certifications, and learning between sectors.

**Public Engagement and Co-Creation of Policy**

It is essential to engage broadly. A range of stakeholders like policymakers, civil society, academic institutions, and end-user communities will be involved in co-creating governance mechanisms. Public consultations, workshops, and multi-stakeholder platforms will enable deliberations about ethics, regulation, and societal values. National AI strategies—like IndiaAI’s mission structure—will provide institutional scaffolding to participatory governance.



**Fig. 1.** Multi-Level Theoretical Framework of Artificial Intelligence’s Societal Impact. This framework illustrates how AI influences and is influenced by interconnected micro, meso, and macro-level structures, emphasizing a socio-technical systems perspective.

Artificial Intelligence (AI) is no longer constrained by a strictly technical development, but has emerged as a social entity with a tremendous impact on individuals, organizations, and even nation-states. Yet, scholarly inquiries and policy efforts to address AI, tend to focus and explore either the technical development or the moral aspect of AI. To address this dividing focus, this research project explores a Multi-Levels of Theoretical Effect of AI on Society (Fig. 2), which builds on socio-technical systems theory, and is advanced from contemporary work in technology acceptance, governance studies, and digital transformation studies. The framework is situated across, micro (individuals), meso (organizations), and macro (society and to some extent nation-states), as three nested and leveraged levels of AI effect. As a collective, the levels are resistive agents, where technological capacities and human structures constitutively develop and adopt each other. Figure 2 shows the impact factors for the three levels.

Evaluating the effectiveness of AI as a social technology is ultimately about the combination of governance norms and processes, organizational behavior, and human acceptance, which is under-amplified, and primarily with computational efficiency. The sub-sections below are about what is occurring at each of those levels and how they are connected.

### **5.3 Micro-Level Influences: The Role of the Individual as an Actor at the Micro-Level in the Implementation of AI**

At the most basic level of social change are the experiences, behaviors, and perceptions of individual citizens, workers, consumers, and learners who engage directly with AI-enabled systems. These micro-level influences include:

- Digital skills development and reskilling pressures
- Trust and acceptance of AI-generated recommendations
- Perceptions of autonomy and privacy implications
- Use behaviors informed by perceptions of algorithmic transparency and fairness

Trust and perceived usefulness are among the most important AI implementation and adoption influences in everyday settings, like health care support systems, educational recommendation systems, and intelligent virtual assistants. In the absence of transparency and trust, social actors may resist or disengage from AI-enabled systems that could otherwise support their goals and intentions. Conversely, if well-aligned, human-AI collaboration can extend cognitive capacities and support equitable access to knowledge, expertise, and services. Thus, behavior at the micro-level is ultimately where influences on individual action occur, but also acts as the social and behavioral substrate that higher levels of institutional change rely on.

### **5.4 Meso-Level Impacts: Organizational Change and Responsible AI Governance**

The meso level refers to the space between individuals and society and encompasses firms, public institutions, universities, and non-profit organizations. AI is both operational and strategic in this level, transforming workflows, decision-making, and value creation. Some issues at the meso level include:

- Algorithmic governance and oversight
- Redesigning the workforce and augmenting human intelligence
- Deployment of ethical approaches that are consistent with institutional values
- Innovation and competitive advantage for organizations

Organizations intermediate conversion of AI's capabilities to real value. Choices made by organizations determine whether AI substitutes for workers, augments human intelligence or advances inclusive economic opportunity. Governance approaches - bias reviews, responsible algorithms committees, institutional policies, and transparency about data use - become important to maintain legitimacy. Thus, choices at the meso level act as both a regulatory filter and moral lens between the possibility of the technology and an outcome for society.

The meso layer also supports knowledge diffusion, establishing values surrounding the safe, reliable and ethical use of AI that move outward to the macro level while shaping internal expectations and behavior at the micro level.

### **5.5 Macro-Level Impacts: Society Governance, Equity and Future-Wise Transformations**

At the largest level, AI impacts complex systems that constitute societal functioning, including economies, legal frameworks, cultural norms, and geopolitical realities. Macro-level impacts may vary.

- Economic restructuring, productivity changes, and industrial competitiveness
- Policy and regulatory frameworks, and governance of algorithmic power.
- Social equity concerns — bias, access, and job inequality.
- Sustainability transitions and climate resilience.

Agencies of governments and international organizations broadly provide a critical role in guiding innovation in a direction intended to serve the public good. Specifically, their regulatory regimes (e.g., the EU AI Act, India's Digital India Mission, OECD AI Principles) are aimed at allowing artificial intelligence to facilitate prosperity and progress while consistently protecting rights and democratic values. When it comes to macro contexts then, a consideration is whether AI will materially create a just transition or only exacerbate already existing systemic issues in society through digital divides and concentration of power.

### **5.6 Inter-Level Relationships: A Socio-Technical Feedback Loop**

The model is designed such that these three levels do not exist in a form of hierarchy going in only one direction; rather, each level constitutes practices of the other levels in more dynamic ways: Bottom-Up: micro behaviors (e.g., an individual's willingness to engage with, adopt, and legitimize AI tools) constitute collective behavior at organizational and sectoral levels to enhance or attract attention to priorities and standards in institutions at a national level. Top-Down: National policy, principles and ethical standards are made tangible through organizations governance, and mean something for user trust - at the individual level.

These relationships then produce feedback loops, for example: 1. if policy requires algorithmic transparency, organizations should pursue fairness auditing, users will trust it, and ultimately support efforts to actualize responsible AI scaling. 2. if organizations deploy AI that is ill-governed, individuals will resist, policymakers will impose stricter regulations, and it will either slow down innovation or cause fragmentation. Thus, moving toward responsible AI is not just a technical challenge, it is about determining a confluence of incentives consistently at each level of a three-level achievement system.



Fig 2. The three-level achievement system with their component factors

## 5.7 Contribution of the Framework to AI Research and Practice

The multi-level model provides three key advantages for researchers: 1. Holistic synthesis: it brings together ethical, technological, and institutional perspectives on responsible AI that are frequently discussed in isolation in the AI literature. 2. Political / Governance recommendations: the model provides a systems view to inform national strategies that balance innovation with rights, equity and inclusion. 3. Foundation theory of responsible AI: it provides a foundation for empirical research that will assess interactions across multiple levels employing quantitative or mixed methods, leading to a robust measurement of responsible AI maturity in society.

## 6 Conclusion

The rapid development of Artificial Intelligence has very quickly emerged a fundamental technology engine of social change through numerous alterations to industries, governance systems, and social processes. In this paper we illustrated and modelled the various vectors of the applications for AI in society and the potential positive impact for example areas such as, health care, industry, education, environmental sustainability, and the developing world. Given the emergent significance of AI in these sectors, it is understood as not only a computational breakthrough, but as an structural catalyst in the process of reframing socio-economic development.

Overall, the review details how AI technology can facilitate speedy decision-making, increased access to information, enhanced efficiencies, and increased customization or personalization in service provision. From health monitoring for pre-emptive diagnostic medicine based in predictive data analysis to automated work procedures in manufacturing or intelligence systems in schools and smart cities, AI systems are enabling an acceleration in the direction of more intelligence, resiliency, and data/type informed systems and lifestyle options. The promise of productivity benefits enables AI to become and maintain an optimized input to enhance competitiveness for countries willing to invest resources for the necessary research, implementation, and investments in the sustainability of the future.

While there are numerous possibilities for innovation, the review indicates that the rapid acceleration of artificial intelligence has created significant social vulnerabilities. Algorithmic bias, privacy violations, lack of accountability, job loss, and unequal access to digital opportunities are social vulnerabilities that cannot be minimized. New ethical and governance problems created by the advancement of technology will always require an innovation ecosystem to be backed by a public policy environment. More specifically, developing countries are on a precipice - AI can be an opportunity to alleviate socio-economic inequities; or without investments prioritized on institutional capacity, digital infrastructure, and equitable policy measures, it can instead be a pathway to worsening inequities and inequalities. As a result, a just future driven by AI rests on the inclusion of transparency, explainability, social inclusion, and democratic participation in national AI action plans. In closing, this paper suggests that the next phase of artificial intelligence should be informed by responsible innovation that aims to achieve socio-technical advancement that aligns with the common good and promotes individual rights.

### 6.1 Future Work and Implications for Research

The work presented throughout the paper presents significant opportunities for future research and improvement in social responsibility in AI. Given that the social infrastructures into which AI applications are being embedded will become further deeply seated in our core social infrastructures, future research must address the complexity and unresolved risks in ways that are increasingly rigorous. There is an important area to be worked on in the future, which is about developing some ways to mitigate social bias in AI systems which are at the same time explainable.

The path forward consists of bringing more multi-stakeholder approaches to the fore, allowing post-makers, researchers, industry, civil society to co-create, build, and sustain AI ecosystems that are searching for ethical resilience, fairness of access, equity of opportunity, and advancing sustainability within society. At the end of the day, AI is not a robotic project; it is co-constructed alongside people for whom it is meant; and at the end of the day, the true promise of AI is only realized when human values are traveling alongside technology. The Multi-Level Theoretical Framework of AI Societal Impact offered in this paper is framed by emphasizing AI is not just a calculational aide; it is a change agent within sociotechnical systems. If we want to effectively, ethically, and equitably implement AI, this can only happen effectively with coordinated alignment across capabilities of individuals, practices of organizations, and sociotechnical governance structures; additional and further theorization and empirical research should take into consideration and engage with the multiple levels we have alluded to above.

Transparent model architectures and interpretable policy choices are necessary to create more accountability in sensitive sectors like healthcare, law enforcement, and financial inclusion. Continued research should focus on participatory model-building process that spends time engaging with marginalized agent to inform the data governance, and evaluation process, to ensure AI serves social justice instead of reinforcing structural inequities.

The socio-economic consequences of AI-based automation, requires continued longitudinal research. Applied and mixed method exploration of labor force transitions and skill changes, and the impact of reskilling programs fluidly applied using data collection methods, is warranted. The transformation presents the generational challenge of a pressing need to co-create complementary human-AI solutions that maximum augment the capabilities of both - through human commitment and success in new, improved job roles, and lifelong learning throughout learning ecologies. It is also an exciting future with respect to climate resilience. There may be opportunities to explore the carbon footprint implications of large AI models, and imagine greener computational approaches (e.g., Edge AI or federated learning or energy efficient neural architecture). Research that explores how AI innovations intersect with climate resilience strategies in agriculture, water management, and circular economies may support global sustainability. Another area of study that is increasingly being recognized is the global challenge of governing AI at scale. Different regulatory frameworks also tend to hinder efforts to create ethics that are comparable around the globe.

We must consider comparative policy frameworks, models and governance sandboxes so that the diffusion of technology does not promote systemic geopolitical imbalances or even digital colonisation. There is no more pressing challenge for scalable and inclusive deployments than in the less developed world where scalable and inclusive deployments may also foster responses that become of global significance.

There are also promising avenues for environmental sustainability. In the future it may be possible to study carbon footprints for large AI model and develop trajectories towards greener computation strategies. (e.g., edge AI, federated learning, energy effi-

cient neural architectures) Also developing research on how AI innovations can contribute to climate resilience objectives; agriculture, water management and circular economies are all positive developments to achieving sustainability objectives globally.

It is worth engaging in comparative analysis of policy frameworks, international cooperation models, and governance sandboxes on the understanding that the diffusion of technology does not produce geopolitical asymmetries or digital colonization. There are few other contexts where scalable and inclusive deployments matter, arguably, more than in the less developed world, which, consequently, may have global implications.

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