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Sustainability

Addressing the “AI” in sustainability

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Key takeaways

- There is a growing disconnect between AI's potential to advance sustainability and its implementation across various ecosystems. According to BofA Global Research, it has become increasingly important that AI innovation and application be environmentally sustainable, socially responsible, and ethically governed.
- According to BofA Global Research, AI could offer solutions for a broad range of global challenges. For example, AI, which has the potential to reduce greenhouse gas emissions by up to five times the amount it generates, also has the power to unlock access to education, health and food as well as deliver on long-term sustainability goals.
- Despite its potential, AI introduces a range of risks if not properly managed. Concerns include data privacy violations, algorithmic bias, environmental impacts from energy-intensive AI models, and the reinforcement of social inequalities.

AI to reshape economies, societies and institutions

As AI becomes more embedded in decision-making and operational processes, understanding how it intersects with sustainability has become both urgent and essential, according to BofA Global Research (Exhibit 1). The positive is that AI offers considerable potential to accelerate outcomes:

- Environmentally, AI enables climate change mitigation and adaptation by supporting more accurate climate modelling, optimizing energy use, improving resource efficiency, and facilitating the transition to low-carbon industries.
- Socially, AI applications are helping reduce bias and promote diversity, contributing to improved health outcomes through diagnostic tools and personalized medicine, enhancing education through adaptive learning platforms, and supporting workforce training and safety initiatives.
- Ethically, in governance, AI improves transparency and oversight through automated auditing, real-time compliance monitoring, and fraud detection, contributing to better corporate accountability.

Exhibit 1: AI adoption, a combination of opportunities and risks
Risks and opportunities by category

Environment	Social	Governance
Opportunities		
Energy optimization and emission reduction	Advancing diversity, equity, and inclusion	Disclosures reporting transparency
Climate and nature monitoring	Enhancing education access	Risk management and compliance
Sustainable product design	Improving healthcare outcomes	Cybersecurity / data privacy
	Tackling food challenges	
Risk		
Increasing energy consumption due to data centers	Training a non-biased AI	Data privacy
	Layoffs	Cyberthreat
	Dehumanization	

Source: BofA Global Research

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The good, the bad, the ugly… and the $10 trillion opportunity

BofA Global Research identified around $10 trillion (tn) of market capitalization leveraging AI that will bring economic growth. Another report from PwC (2017) estimated that AI could contribute up to $15.7tn to the global economy by 2030 with GDP up to 14% higher. Using AI applications for the environment could have a booster impact of up to $5.2tn according to the same analysis, with a range of 3.1% to 4.4% of global GDP, while reducing global greenhouse gas (GHG) emissions by 0.9 gigaton (Gt) to 2.4Gt by 2030.

Despite this enthusiasm, leveraging AI must be balanced with the understanding that AI is not inherently sustainable or equitable. According to BofA Global Research, it must be intentionally designed and implemented to support responsible business.

When AI 'bytes' back

While AI offers transformative opportunities by optimizing energy systems, improving access to education, and enhancing corporate transparency, it also introduces a range of emerging risks if not properly addressed.

These risks range from environmental resource intensiveness and algorithmic bias to accelerating inequalities between and within societies, geopolitical tensions and labor market disruptions (Exhibit 2). Among these, the impact of AI on employment represents one of the most immediate and visible social challenges, with consequences for social equity, job security, and economic inclusion.

Exhibit 2: AI introduces risks associated with energy use, job loss, and lack of transparency
Emerging risks associated with AI

Environmental risks AI is not a direct emitter like heavy industry but its environmental impact is increasingly significant due to…	
Energy use	Training large AI models (like GPT) consumes enormous computational power, leading to high electricity use
Carbon footprint	Data centers running AI applications often rely on non-renewable energy, contributing to greenhouse gas emissions
Electronic waste (E-waste)	Rapid hardware iteration driven by AI demands increase disposal of servers, graphic processing units, and other electronics components
Water usage	Data centers using significant water resources for cooling, stressing local water supplies
Resource extraction	Manufacturing of AI hardware involves rare earth elements and metals, with potential ecological damage from mining
Social risks AI systems can exacerbate inequality or cause harm if not managed responsibly	
Bias and discrimination	AI models can reflect and perpetuate societal biases, leading to unfair treatment in hiring, policing, lending, etc.
Job loss	Automation and robotization owing to AI threaten jobs in multiple sectors (transport, manufacturing, customer service)
Privacy violations	AI-driven surveillance and data analytics can lead to invasive tracking and data misuse
Misinformation and deepfakes	Generative AI can produce realistic but false content, threatening public trust and democracy
Lack of transparency	Black-box decision-making models making it hard to hold systems accountable for negative impacts
Digital divide	Unequal access to AI and digital tools may widen gaps between rich and poor or urban and rural areas
Psychological and social manipulation	AI systems in advertising and social media can influence behavior and mental health through recommendation algorithms
Human rights concerns	Use of AI in law enforcement or by authoritarian regimes raises risks of surveillance and suppression of dissent
Governance risks Failures in oversight, ethical use, and corporate responsibility are key	
Regulation gaps and oversight	Rapid development outpaces legal and ethical frameworks, creating governance vacuums
Insufficient risk management	Companies deploying AI without fully understanding the risks or consequences
Accountability gaps	Difficulty to determine who is liable when AI systems cause harm

Exhibit 2: AI introduces risks associated with energy use, job loss, and lack of transparency
Emerging risks associated with AI

Intellectual property risks	Use of copyrighted or proprietary data in AI training can result in legal and reputational issues
Poor ethical standards in development	Without strong governance, the risk is for companies to prioritize performance or profit over responsible AI
Security and cyber threats	AI can be both a tool for, and target of, sophisticated cyberattacks
Misuse by bad actors	Lack of safeguards can enable AI to be used in scams, cyberwarfare, or autonomous weapons

Source: BofA Global Research

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Energy optimization and emissions reduction through AI

AI-based solutions can lead to substantial energy savings and a more sustainable energy system globally. The technology can transform the energy and utilities sectors by optimizing energy consumption, improving grid reliability, and reducing emissions. New advancements made possible with the use of AI coincide with growing complexities in electricity networks driven by increasing integration of renewable energy sources and greater digitalization.

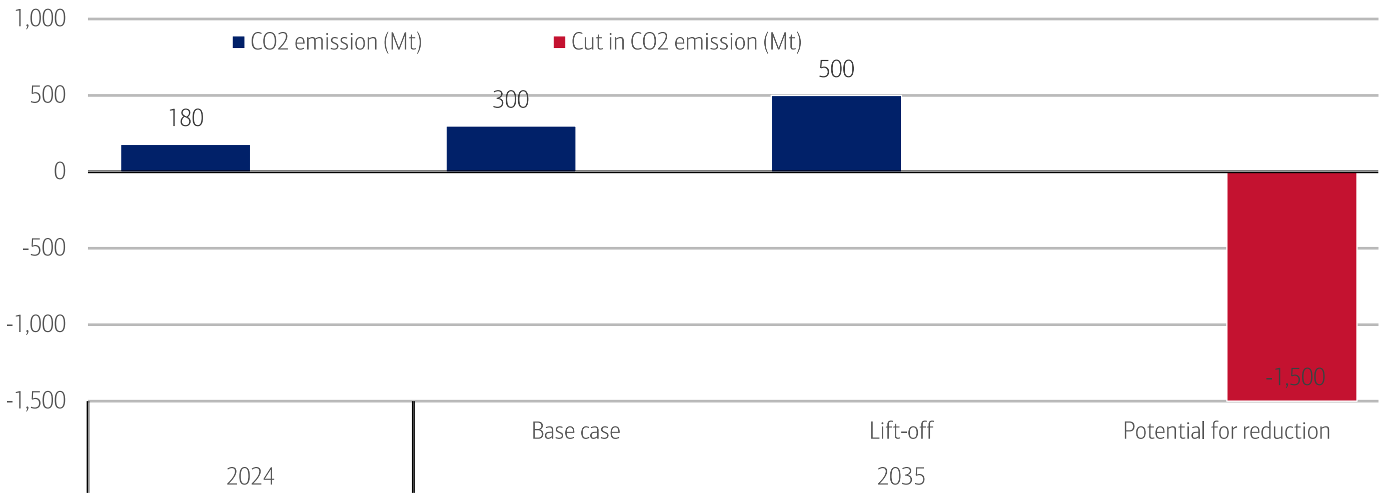
Moreover, AI applications are not limited to the energy sector. Industries such as consumer goods, retail, and automotive are also expected to benefit from improved energy efficiency, better resource utilization, and reduced waste through AI-enabled systems, according to BofA Global Research.

AI to double its CO_2 emissions, but help cut 5x more

While the adoption of AI increases electricity consumption, its potential to reduce emissions across sectors could far outweigh this impact. According to the International Energy Agency (IEA), the emissions from data centers are projected to remain below 1.5% of global emissions through 2035, despite growing energy needs.

In its base case, the IEA estimates AI and data center-related CO_2 emissions could rise to 300 million tons (Mt) by 2035 (or up to 500 Mt in the "lift-off" scenario which assumes stronger growth in AI adoption than in the base case) (Exhibit 3). However, AI, also has the potential to reduce CO_2 emissions by up to five times the amount it generates as scaling current AI applications could save up to 1,500 Mt in CO_2.

Exhibit 3: AI could more than double its CO_2 emissions by 2035, but help cut five times more
Carbon emissions uplift and potential reduction due to AI by Mt



Source: IEA

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A separate study by Boston Consulting Group estimated that effective use of AI could help mitigate 5-10% of global GHG emissions by 2030. This equates to 10-20% of the Intergovernmental Panel on Climate Change's 2030 interim reduction target (45% CO_2, vs. 2010 levels).

However, risks that would offset benefits still exist. For example, increased production due to lower costs owing to AI or shifts in mobility from public transport to autonomous vehicles, which could drive higher consumption of goods and services and, in turn, higher overall CO_2 emissions.

Despite rising demand from large-scale technology companies that provide massive computing resources and services, BofA Global Research expects AI's emissions net impact is likely to be positive, particularly as data centers increasingly source power from low-carbon energy, including renewables and more nuclear in the near future.

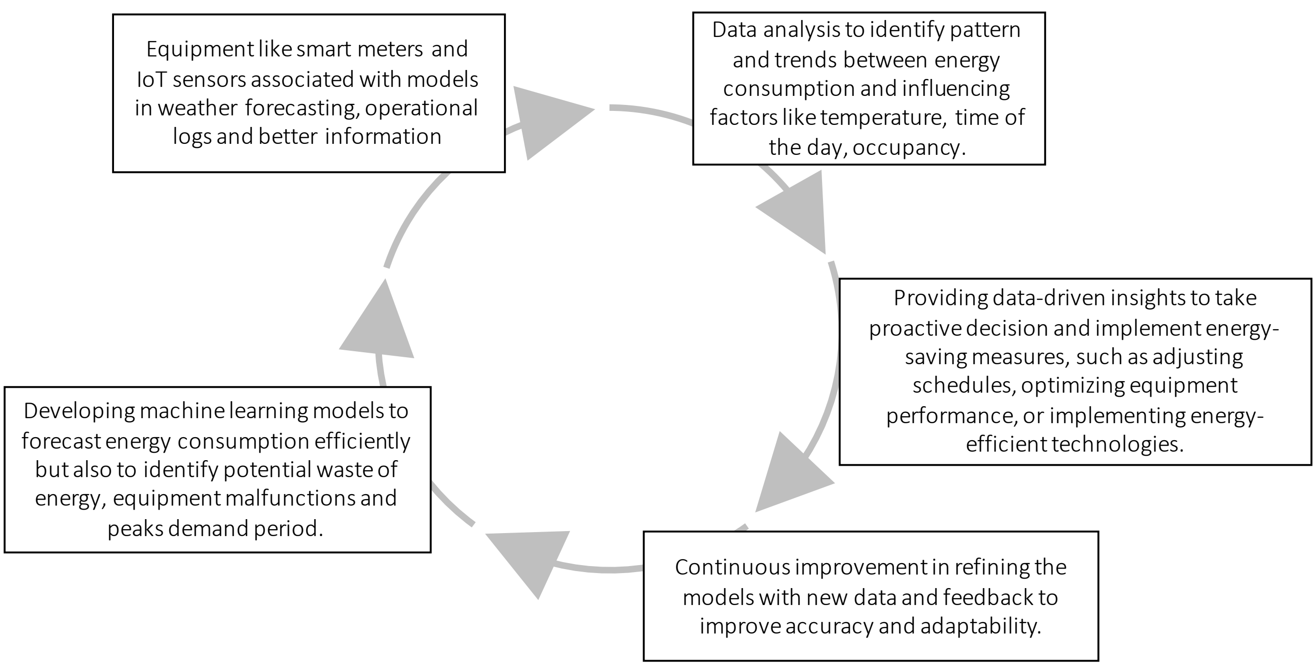
Plus, with larger and newer AI-focused data centers, water consumption is increasing alongside energy usage and carbon emissions. Data center developers are increasingly tapping into freshwater resources and large data centers can consume up to five million gallons per day, equivalent to the water use of a town populated by 10,000 to 50,000 people, according to the Environmental and Energy Study Institute.

Data analysis and predictive modelling promoting energy efficiency

Through advanced data analysis and predictive modelling, AI also allows for more accurate forecasting, fault diagnosis, and automation of human tasks (Exhibit 4). Data-driven approaches help optimize storage and distribution of electricity, ensuring greater availability and minimizing energy waste.

In electricity infrastructure, AI enhances grid reliability by detecting and responding to faults in real time, mitigating outages, and improving system resilience. Predictive tools powered by AI can also anticipate disruptions from extreme weather events or cyber threats.

Exhibit 4: How data analysis and predictive modelling may improve energy efficiency
An iterative model using machine learning life cycle and use cases



Source: BofA Global Research

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AI powering climate and nature monitoring

AI algorithms analyze imagery and radar data to improve climate modelling, track emissions, and support disaster preparedness (Exhibit 5). By analyzing earth observation data from satellites, AI also helps monitor methane leaks, deforestation, and greenhouse gas emissions, aiding climate change mitigation efforts.

AI-powered solutions to help nature and biodiversity

Satellite images with the combination of AI and ecology expertise are used to map the impact of deforestation as well as provide solutions to reduce waste and pollution. AI-powered solutions also exist to help companies track, trace and reduce their GHG emissions, site by site.

Additionally, solutions using drones paired with AI can help with reforestation. By analyzing aerial data, drones identify the best areas for planting, ensuring that the right species are planted in locations where they are most likely to thrive. This targeted approach increases the success rate of reforestation projects and improves the overall health of restored ecosystems.

Exhibit 5: AI and satellites can assist with deforestation and sea level monitoring
Climate monitoring solutions powered by AI and associated applications by type

AI and satellites/radar imaging	Applications
Deforestation monitoring	Analyzing satellite imagery to detect deforestation, identify illegal logging activities, and monitor changes in forest cover.
Carbon cycle understanding	Estimating atmospheric carbon flux by analyzing satellite and sensor data, providing insights into how much carbon dioxide ecosystems absorb and release.
Disaster preparedness	Helping predict and prepare for natural disasters like floods, wildfires, and extreme weather events.
Sea level rise monitoring	Analyzing satellite data to track changes in sea levels and assess the impact of rising tides on coastal areas.
Greenhouse gas emissions	Detecting and tracking greenhouse gas emissions from various sources, including industrial facilities and transportation.

Source: BofA Global Research

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Automation of routine and robotization replacing human tasks

AI-based automation can manage resource allocation, monitoring, and analysis, freeing up human workers for higher-value tasks. AI's ability to automate both routine cognitive and manual tasks puts many jobs at risk, especially in industries where repetition, predictability, and access to large datasets interrelate.

As a result, AI is being integrated into economies across sectors and borders, though not uniformly or equitably. According to BofA Global Research, certain sectors like manufacturing will benefit from automation of assembly, while financial services is incorporating AI in fraud detection (Exhibit 6).

Exhibit 6: Where is the AI threat to jobs?
AI employment risks and implications by sector

Sector	AI employment risk	Implications
Agriculture	Precision farming, drone monitoring, AI-assisted planting, and harvest.	Displacement of seasonal labor, opportunity for youth employment in ag-tech if well-supported.
Financial Services	AI in routine tasks in accounting and contract review, in compliance, in fraud detection, in reporting.	Ethical use of AI in hiring and lending, reskilling analysts, transparency in AI-driven decisions.
Healthcare	AI diagnostics and admin automation.	Potential for job augmentation, risks of skill gaps and unequal access to new tools across regions.
Manufacturing	Automation of assembly, quality control, and logistics.	Job losses in low-skill roles, pressure on gender and age diversity, need for reskilling.
Retail	Chatbots and recommendation, automation of checkout, inventory, customer service.	Implications for call centers and frontline retail roles, inequitable effects on part-time and female workforce, opportunity to upskill toward digital retail roles.
Transport & Logistics	Autonomous vehicle and self-driving tech and optimization systems.	Major potential job displacement (truck drivers, taxi drivers), need for regional reskilling and infrastructure.

Source: BofA Global Research

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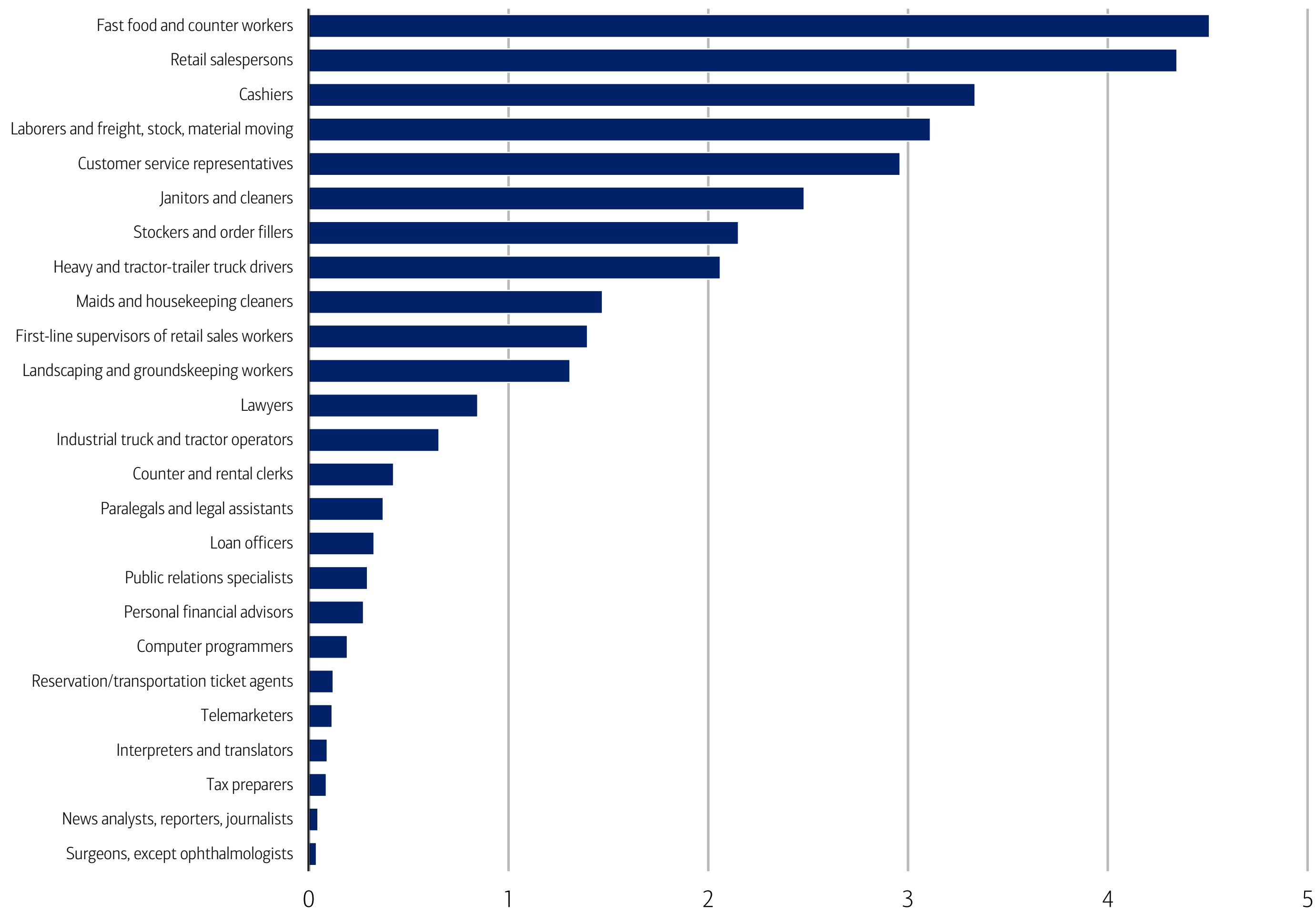
Low-skilled jobs, with many routine and repetitive tasks, will likely be automated with the help of robots and AI. Such shifts are leading to job displacement. Although in many scenarios AI is expected to complement rather than fully replace human labor, automation and AI is not without risk for a fair social transition, according to BofA Global Research.

An analysis by the US Bureau of Labor Statistics (BLS) estimated the jobs most at risk are in customer service roles (Exhibit 7). For example, fast food kiosks could replace cashiers.

Exhibit 7: Retail and logistic jobs most at risk from AI and automation
US jobs considered as high risk for automation (number of jobs in million, 2009-2029)



Source: BLS

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The rise of the "finger economy"

A more nuanced understanding of post-AI labor trends is captured by the notion of the "finger economy." According to BofA Global Research, this is driven by workers whose primary interface with their labor is through screens, devices, and digital tools, often using their fingers more than their full bodies.

This new economy poses unique challenges. For example, many of these jobs would fall outside traditional labor protections and mostly require limited skills, potentially inducing low wages and job insecurity. Additionally, constant screen exposure and productivity pressure can impact wellbeing and mental health.

Navigating the (fair) employment transition

More broadly, a fair and forward-looking transition must aim not only to protect existing workers but also to proactively shape the labor market to create new, quality jobs. Therefore, many roles will evolve rather than disappear, according to BofA Global Research.

This requires public and private coordination with policy frameworks in place to encourage businesses to adopt AI in a way that augments workers and supports job creation, with incentives for inclusive innovation. Done right, AI adoption can lead to net job creation, particularly in emerging fields such as renewable energy technology, digital health, cybersecurity, and AI model training and governance. This is where education through reskilling and upskilling programs is key, although it requires governments and employers to invest significantly in lifelong learning, according to BofA Global Research.

Unlocking access to education, health and food

AI holds transformative potential across a wide range of societal outcomes. From revolutionizing healthcare delivery and expanding educational access to enhancing workplace diversity and inclusion, AI applications could drive significant social progress.

A 2020 study published in the journal *Nature* found that AI could support the achievement of 67 targets across nine United Nations Sustainable Development Goals (SDGs) related to societal wellbeing. This equates to AI enabling 82% of the UN's societal SDG targets. AI-powered technologies can assist in delivering essential services such as food, water, healthcare, and energy, and contribute to the development of circular economies.

However, potential drawbacks exist. The same study found that AI could negatively impact 31 targets, or 38% of societal SDGs, especially those concerning inequality. This underlines the need for governance, oversight, and ethical frameworks to ensure AI development aligns with sustainable social progress.

Enhancing education access

AI is emerging as a transformative tool to improve education access and quality. AI-powered platforms can bridge gaps in access for underserved populations, support educators, reduce classroom inequalities, enable inclusive, personalized learning experiences and empower education systems with data for better decision-making.

However, the use of AI in education must be guided by ethical principles, including privacy, bias mitigation, transparency, and human oversight, according to BofA Global Research. Meanwhile, enhancing education access will depend on equitable access to digital infrastructure and devices, AI literacy and training for teachers and administrators, and localized solutions that respect cultural and linguistic diversity.

Up to $150bn saved in healthcare costs annually by 2026 in the US

The World Health Organization estimates that almost a third of the worldwide population does not have access to essential medicine. This rises to half of the population in low-income countries. According to BofA Global Research, medical studies estimate up to $150 billion in savings in healthcare costs annually in the US by 2026.

Cancer diagnosis has also improved, with 91% detection of early breast cancer using AI compared to 74% for radiologists. As such, AI should redefine healthcare by improving diagnosis, treatment, and administrative efficiency, but also by providing easier, faster, and better access to medicine. AI-powered applications include early disease detection and personalized treatment planning, streamlined healthcare administration, population health analysis, and accelerated biomedical research, while overall reducing costs.

AI in AgTech to enhance productivity and sustainability in agriculture

AgTech (agriculture technology) encompasses innovations aimed at protecting crops, improving efficiency and yields, increasing profitability, and building sustainability and resilience. It includes devices, sensors, robotics and automation, all driven by AI.

By improving farm productivity and resource efficiency, AI-powered agricultural technology is seen as vital for smallholder farmers. These farmers produce over 30% of the world's food while facing persistent challenges in yield, disease management, and climate resilience. And a study by Cornell University (The New Agronomists: Language Models are Experts in Crop Management) found AI-powered crop management systems can drive up to a 49% improvement in profit for maize crop production compared to traditional methods.

According to BofA Global Research, high costs are the biggest obstacle to adopting new agriculture technologies. But as input costs rise, the appeal of AgTech solutions is growing, with the potential to reduce chemicals, labor and fossil fuel use (by 25% on average), while increasing yields. Economies of scale from increased adoption of AgTech solutions may bring down costs and enable necessary advancements in efficiency.

Privacy and data security at risk

Still, risks remain with AI adoption. Pointedly, AI could be a threat to privacy and data security due to its operational model, which relies on collecting, analyzing, and using vast amounts of personal data, often without explicit consent or lack of transparency. The associated risks are data breaches and/or misuse of personal information. Moreover, AI systems can be vulnerable to malicious attacks, such as deepfakes and automated hacking, which can further compromise privacy and security.

Overall, organizations need to understand but also embrace these risks when adopting and developing AI applications and uses (Exhibit 8). According to BofA Global Research, they must ensure that AI is used responsibly and ethically and take steps to mitigate the potential harm to individuals' privacy and data security, while avoiding bias.

Exhibit 8: AI technology and the threats to data privacy, use of biased information, and regulation

Actions, risks and implications of AI

Action	Risks	Implications
Data collection and usage	Risk of collecting data without explicit user consent or transparency.	Ethical and legal concerns
	Data collected with consent but to be used beyond purposes initially disclosed.	Privacy violations
	AI to analyze data in ways that reveal sensitive information about individuals, even if that information was not explicitly provided.	Privacy violations
Data breaches and security weaknesses	Large amounts of data used by AI systems being attractive targets for cybercriminals.	Privacy violations
	AI used for automated and scaled cyberattacks, making them more sophisticated and harder to detect.	Ethical and legal concerns
	Deepfakes, created by AI, used for blackmail, or spreading misinformation.	Ethical and legal concerns
Transparency and consent	Opaque AI systems, making difficult to understand how data is collected, used, and protected.	Ethical and legal concerns
	Pressure to users of certain AI-powered services to agree to data collection practices, with potential implications for the use of personal data.	Ethical and legal concerns
Bias and discrimination	Risk of AI to use and be trained with biased data leading to unfair or discriminatory results.	Ethical and legal concerns
Pace of development	Acceleration in AI development and adoption outpacing the development of regulations and ethical guidelines. Loophole in data privacy and security.	Regulatory and ethical concerns

Source: BofA Global Research

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Sources

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Disclosures