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AI for Good

Impact Report

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AI for Good

Impact Report

Foreword by ITU

We are at a turning point.

As Heads of State and Government have recognized in the Global Digital Compact, part of the newly adopted UN Pact for the Future, "the pace and power of emerging technologies are creating new possibilities but also new risks for humanity."

Nowhere is this more evident than with artificial intelligence.

Machine-learning models are forecasting weather faster and more accurately, helping us better prepare for the impacts of climate change. AI-powered brain-machine interfaces are giving ALS patients their voice back – just one of many groundbreaking innovations poised to transform healthcare. ITU and more than 40 other UN agencies are using AI to connect schools, improve early warning systems, address social and economic inequalities, and much more.

At the same time, AI-driven automation risks making millions around the world more vulnerable to job displacement. Photos, including those of minors, are being scraped off the web to create powerful AI tools, often without consent. Deepfakes and misinformation are blurring reality and eroding public trust. AI systems are increasingly putting pressure on our planet's resources and our environment.

This report offers us a path forward, showcasing real-world AI use-cases that can accelerate progress across all 17 UN Sustainable Development Goals (SDGs), while providing actionable recommendations to turn this potential into reality.

By establishing collaborations on AI standards, increasing access to AI infrastructure and talent, and fostering global partnerships for responsible AI, we have a unique opportunity to scale these solutions and make AI an engine for inclusive growth, innovation, and sustainable development.

The road ahead is not easy. The rapid pace of AI development means we are constantly playing catch-up in critical areas such as security, trust, and governance.

We must not lose sight of the fact that technological advancement should not come at the cost of human rights and human dignity. Nor can we allow advances in AI to outpace progress in digital inclusion.

Today, one third of humanity remains offline, cut off from the digital world, let alone the AI revolution. This divide is more than just a technological gap; it is both a moral and an economic imperative.

The 'AI for Good' platform, the largest UN system multi-stakeholder platform on AI, shows us what is possible when we all come together to ensure the responsible development and deployment of AI without stifling innovation – and without leaving anyone behind.

I encourage all government, private sector, academia, and civil society leaders to use this AI for Good Impact Report as a guide for writing the next chapter in the story of humanity and technology.

We are the AI generation. Together, let's seize this moment to harness AI as a force for good in support of the SDGs and for all humanity.

Doreen Bogdan-Martin
Secretary-General, International Telecommunication Union

Foreword by Deloitte

The interplay between Artificial Intelligence (AI) and the pursuit of the United Nations Sustainable Development Goals (SDGs) is a topic of profound significance and complexity. As the evolution of AI continues to accelerate at an unprecedented pace, its potential to both facilitate and impede the achievement of the SDGs calls for our attention. The transformative power of AI presents opportunities for innovation, efficiency, and inclusivity, yet it also raises critical questions about ethics, equality, and potential environmental consequences.

In this report, we explore the multifaceted impact of AI on the SDGs, seeking to understand how governments and the public sector can harness its potential for the greater good while mitigating the associated risks. It is crucial that the global community navigates these crossroads with unwavering commitment to responsible and sustainable development, ensuring that AI emerges as a catalyst for positive transformation in our collective pursuit of a better world for all.

Governments are already initiating important steps to address the challenges posed by AI within the SDG framework, while recognizing the endless possibilities AI generates. Aligning AI with the SDGs could offer solutions to the most pressing humanitarian issues, such as climate change, hunger, and poverty. Governments have a pivotal role to play in incentivizing this work and providing guardrails for AI's ethical use.

The development of regulatory landscape supporting companies in their AI journey can directly facilitate advancement and investment from the private sector for the integration of AI technologies across diverse industries, including healthcare, education, energy, agriculture, and financial services. This growing momentum represents a unified effort between the private and public sectors to leverage AI as a catalyst for progress, driving impactful solutions that align with the ambitious objectives outlined by the SDGs.

At Deloitte, our commitment is not only to enhancing our people's skills and expertise but also to the responsible use of AI, addressing its diverse challenges, and harnessing its considerable promise equitably. This aligns with our vision of societal advancement and the realization of the SDGs. We believe that robust collaboration across public and private sectors, as well as civil society, is essential to fully realize the potential of AI. Our collaboration with ITU represents an opportunity to contribute to supercharge the utilization of AI for a better future.

Costi Perricos
Generative AI Leader, Deloitte Global

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Executive Summary

Artificial intelligence (AI) holds great promise in accelerating the achievement of the United Nations Sustainable Development Goals (SDGs). Its rapid development is helping to reshape industries, economies, and societies around the world. Yet, its dual nature–offering both transformative potential and significant risks – requires careful consideration.

AI has demonstrated its ability to drive meaningful advancements in critical areas ranging from healthcare and education to climate change and accessibility. Today, AI is being used in nearly 400 projects across the UN system, spanning all 17 SDGs. However, achieving the SDGs by 2030 is currently off track. With the right approach, AI could be a key driver in getting back on track to meet these global objectives. This report outlines specific ways AI is already enabling effective progress for each of these global objectives, from reducing poverty to combating climate change.

Yet, the power of AI comes with considerable challenges. These include ethical concerns such as bias and privacy, social disruptions like mis-/disinformation and job displacement, exacerbating inequality (e.g. gender or urban V rural) and technical matters like data quality and interpretability. But these challenges can be overcome. By highlighting established and emerging good practices from around the world, innovative solutions and strategies are demonstrating that with concerted effort, AI can be developed and deployed in ways that are secure, equitable, and sustainable.

Key barriers to broader adoption globally include, but are not limited to, insufficient technical skills, the need for extensive upskilling and reskilling, and varying levels of trust in AI technologies. Despite these challenges, the potential benefits are substantial, from automating routine tasks to augmenting human capabilities. As the demand for technical skills evolves rapidly, AI literacy will remain essential but so will emotional intelligence, highlighting the need for a balanced and human approach to future skills development.

The global landscape for AI governance is swiftly advancing, with frameworks emerging and evolving to guide the development and deployment of AI systems. Central to these frameworks is a commitment to upholding ethical principles and human rights, ensuring transparency and accountability, and with built-in safeguards to prevent misuse, whether intentional or accidental. The path forward for global AI governance centers on the collective ability to create interoperable frameworks that strike a balance between regulation and innovation, thereby helping to ensure the safe, ethical, and beneficial advancement of AI technologies on a global scale.

Developing and deploying AI solutions that benefit society as a whole depends on robust collaboration among the public and private sectors and civil society. Ethical AI deployment is essential to help ensure these technologies advance sustainability, reduce inequalities, and enhance societal well-being while mitigating potential risks. International Telecommunication Union (ITU)'s AI for Good serves as a critical platform and resource hub for knowledge-sharing, innovation, and collaboration, ultimately helping to scale effective AI solutions globally. This Impact Report continues the conversation about how AI can be used for good, offering valuable insights into current trends and challenges with AI, and opportunities across the Sustainable Development Goals (SDGs).

Introduction

This AI for Good Impact Report provides an overview of AI trends, governance, and opportunities to support informed decision-making across sectors. It explores global AI regulation and frameworks showing different approaches to managing AI's risks and potential. The report outlines challenges associated with AI and its responsible integration, including established and emerging good practices from around the world.

The report also examines the role of AI in accelerating progress towards the Sustainable Development Goals (SDGs). For each SDG, this report provides insights into current progress and practical examples of the real-world impact of AI solutions on these global objectives. Additionally, the report offers recommendations for policymakers on leveraging AI to accelerate social progress, along with a glossary of commonly used terms in the AI space.

Designed for government officials, policymakers, NGOs, international development organizations (IDOs), and industry leaders, this report serves as a valuable tool to guide the adoption and scaling of ethical AI initiatives. It can help ensure initiatives align with sustainable development priorities while also offering recommendations for mitigating potential risks. Government officials and policymakers will find guidance on regulatory strategies, while NGOs and IDOs will benefit from insights on applying AI to their missions. Industry leaders can use this knowledge to align AI development with broader social impact goals.

AI and Generative AI Trends

This section provides an in-depth look at the evolving AI landscape, focusing on the latest AI and Generative AI (GenAI) trends. Drawing insights from across Deloitte's global network, it examines key AI innovations, evaluates the adoption of AI technologies across various industries and regions, and highlights the areas in which private sector companies are investing in AI and GenAI. It addresses the barriers to broader adoption and implementation as well as the sentiments at different organizational levels. Furthermore, it delves into the impact of AI and GenAI on the workforce, talent considerations, and the skills required now and in the future.

Artificial intelligence is everywhere

The term "artificial intelligence" (AI), coined almost seven decades ago, has garnered significant public attention in recent years due to its synergies with individuals, businesses, governments, and legislation.[1] However, a lack of consensus remains regarding its definition.[2] Public perception often alternates between utopian promises and dystopian visions of the future. Achieving a balance between innovation and control is crucial, highlighting the need for a fundamental understanding of AI to participate in discussions about the latest AI and GenAI trends.

The OECD defines AI as "a machine-based system that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments. Different AI systems vary in autonomy and adaptiveness after deployment."[3] However, this broad definition may not be precise enough for categorizing individual systems. As Stuart Russel, a renowned British computer scientist in the field of AI, notes: "It's surprisingly difficult to draw a hard and fast line and say […] this piece of software is AI, and that piece of software isn't AI."[4] This provides a general understanding of the systems discussed in this report. AI systems are increasingly integrated into everyday applications, spanning from voice-controlled virtual assistants and personalized online shopping experiences to healthcare monitoring and emergency response systems.[5]

From a technical perspective, AI encompasses several key areas, each representing different stages and methodologies in its development. The first wave, symbolic AI,[6] involves early techniques that rely on predefined rules and logic and understandable symbols, like words or numbers, to perform tasks such as reasoning, planning, and problem-solving. While no longer dominant in AI research, symbolic AI is evolving and being integrated into modern AI frameworks. It's still relevant in fields requiring transparency, reasoning, and structured knowledge such as medical diagnosis systems, robotics and natural language processing.[7] The second wave, characterized by machine learning (ML) and data-driven AI, uses large datasets to train algorithms that can make predictions or decisions without explicit programming for each task. This has led to significant progress in fields such as image and speech recognition. For instance, AI-driven translation tools have evolved from rule-based systems to machine learning models that can translate text more accurately by learning from vast amounts of bilingual data.[8]

Understanding the link between AI, machine learning, deep learning, and GenAI is integral to understanding the evolution and capabilities of these technologies. AI serves as the overarching concept and category for the other terms. Machine learning (ML) refers to a subset of methods in AI that enable systems to learn from data and improve performance over time without being explicitly programmed, allowing them to find solutions to problems rather than following

predefined rules. Deep learning (DL) is a subset of ML that leverages artificial neural networks (ANNs) with multiple hidden layers – hence "deep" -, enabling the processing of complex data inputs such as images or speech. The newest and most widely recognized area of AI is called Generative AI (GenAI). It represents a specialized application of deep learning where ANNs can also generate realistic content. GenAI applications of today are based on foundation models. Foundation models are a class of AI models trained on broad datasets and are designed to be adaptable to a wide range of downstream tasks, such as image and video generation, image description, or translation. Most of these models are built on the transformer architecture, which has proven highly effective in natural language processing (NLP) tasks. The versatility of foundation models extends to various other domains or modalities, including computer vision, speech recognition, and even generative tasks, where they can produce new content.[9]

Since the public GenAI race began in November 2022 with the release of OpenAI's "ChatGPT", organizations have increasingly focused on using its potential.[10] The ability to create new content, such as text, images, and videos, in response to user queries has made it popular in sectors like healthcare, finance, and entertainment. Numerous tools have demonstrated practical applications of GenAI, from simulating human conversations to aiding in software development and generating digital images from textual descriptions.[11] While GenAI currently receives the most attention, other areas of AI are also being developed and finding their way into different applications.

Various industries are adopting AI technologies

For companies, AI adoption is increasingly vital, with 94% of global business leaders viewing AI as critical for their organization's success in the next five years.[12] Notably, 67% of organizations are ramping up investments in GenAI due to its demonstrated value.[13] Global AI market revenue is projected to grow by a 19% Compound Annual Growth Rate (CAGR) over the next decade, surpassing US$2 trillion by 2031.[14] Customized AI technologies are already catering to the specific needs of various industries, with significant potential to drive positive impact in sectors such as healthcare, education, energy, agriculture, and finance. The following section provides a closer look at these industries, featuring typical use cases for illustrative purposes.

In **healthcare**, developments in AI and machine learning are driving innovation and transforming operating models by enabling personalized patient care, predictive analytics for disease prevention, and efficient management of healthcare resources.

In the long run, AI in healthcare is shifting the focus from treating diseases to early diagnosis and prevention.[15] This shift is driven by advanced computing power and smart algorithms that can identify patterns in digital data and images, making diagnosis and treatment more data-driven. For example, a US-based medical imaging startup uses large learning models for early disease detection in stroke care, cardiology, and oncology. Similarly, another startup founded in Belgium, has developed an AI solution, using deep learning algorithms for early detection of traumatic brain injuries. In Singapore, a cloud-based platform for diagnosing retinal conditions such as diabetic retinopathy, macular degeneration, and glaucoma was deployed, which can help address the scarcity of eye specialists in rural areas.[16] These advancements can help enable healthcare providers to identify diseases early, improving patient outcomes and reducing healthcare costs.

AI is significantly accelerating the drug discovery process by conducting numerous experiments and analyzing vast datasets to identify new medications.[17] Pharmaceutical companies use AI to

conduct over 800,000 experiments weekly, combining high-throughput biology and automation with the latest advances in AI. Additionally, AI technologies such as deep learning and natural language processing are being used to detect patterns in genetic data, enabling precision medicine. For example, a South Korean company developed a targeted anti-cancer medication, using its AI platform. This platform employs machine learning and deep learning algorithms to detect patterns within extensive datasets for potential drug candidates, reducing the time and costs associated with drug development.[18]

AI enhances clinical decision support systems, enabling healthcare professionals to make informed decisions based on comprehensive data analysis. For instance, a healthcare app from a major tech company uses AI solutions to empower physicians to make better clinical decisions by analyzing electronic health records, identifying patients who need early hospitalization or specific medication plans, thereby improving patient care and outcomes. Additionally, AI-powered systems analyze large volumes of data to detect early signs of diseases such as cancer and vascular diseases, providing valuable insights that aid in clinical decision-making. A Rwandan-based health tech company aids health care facilities in Rwanda and across East Africa in procuring essential medical supplies with its AI-driven medical procurement platform.[19]

The **education sector** is adopting AI to provide customized learning experiences, developing digital tutors for real-time feedback and support, as well as assessment tools to identify areas where students require additional assistance.[20] These AI-driven solutions aim to enhance the learning experience and improve educational outcomes.

This involves creating customized learning programs tailored to each student's needs, tracking their progress, diagnosing misconceptions, and offering timely guidance and feedback. For instance, machine learning capabilities embedded in online learning programs can alert teachers if a student misunderstands a particular concept, allowing for early intervention. This trend is supported by substantial investments, such as the US$240 million from a well-known foundation for initiatives focused on developing software for personalized learning plans based on student performance, led mainly by private companies. [21]

Intelligent Tutoring Systems (ITS) are one of the most widely used AI applications in education. These systems use AI and machine learning technologies to gather in-depth data on individual students, assess their progress, and offer feedback to promote productive learning behaviors such as self-regulation and self-monitoring. ITS are now commonly used in schools and colleges, particularly in the United States, to provide real-time feedback and support to students as they go through their coursework. This use of AI can also help to bridge the educational gap in developing countries. A pilot project in Rwanda used AI to help 90 high school students to enhance their math skills through personalized learning and practice exercises, complementing their regular lessons.[22]

AI is also being used to develop assessment tools that help educators identify areas where students require additional support. Digital tutors powered by AI can provide real-time feedback and support, enhancing the learning experience. These tools are designed to offer personalized solutions and adapt to the individual needs of students, making education more efficient and effective. This trend reflects a broader move towards using AI to create more interactive and engaging educational technologies, including homework support systems, science simulations, virtual labs, educational games, and online courses.

A US-based start-up and winner of the AI for Good Innovation Factory competition at the 2024 AI for Good Global Summit in Geneva, uses an AI-powered generative metaverse gaming platform to transform education and continuous learning through immersive experiences. It aims to bridge gaps in the education system by using AI and machine learning to personalize learning experiences based on individual interests, delivering customized career-relevant educational pathways that inspire curiosity and drive skill development.

The **energy sector** is another area where AI is used to improve existing structures. While there is no doubt that AI consumes a lot of energy[23], it is also true that AI has the potential to manage and optimize the overall power consumption of whole regions.[24]

AI can improve supply and demand forecasts, and understanding of when renewable electricity is available and needed is crucial for the next generation of electricity systems. By analyzing historical data, weather patterns, and market trends, AI can forecast energy consumption with high precision.[25] This capability is crucial in balancing energy supply and demand, reducing waste, and optimizing energy procurement strategies. These smart grids have high potential in regions like Latin America where improvements of technical and commercial energy loss levels and enhancements of reliability and quality of service are needed.[26]

AI is instrumental in enhancing the efficiency of renewable energy sources like solar, wind, and hydroelectric power. AI-powered forecasting models can predict energy generation patterns, allowing for optimal energy storage and dispatch strategies. This is particularly beneficial for grid-scale energy storage systems, such as batteries and pumped-storage hydroelectricity, which can use AI-based optimization algorithms to maximize energy capture and storage. AI also is used to find new materials for photovoltaic systems that are considered more efficient than traditional ones.[27]

In **agriculture**, AI is used to address food security challenges exacerbated by climate change by making real-time crop-placement decisions, monitoring crop health[28] and enhancing supply chain processes.

AI enhances the data systems necessary for improving agricultural sustainability. By using advanced analytical tools - such as remote sensing, satellite imaging, and earth observation systems - AI significantly boosts computing power, accuracy, cost-efficiency, and accessibility. These tools enable real-time analysis of critical factors like soil health, water availability, weather trends, and pest control, helping farmers make informed decisions. This capability is crucial in adapting to climate change disruptions that threaten agricultural productivity and, by extension, global food security. In India, AI-enabled water management leverages a network of experts and farmers to build scalable applications that improve agricultural decision-making. By analyzing large datasets, AI can provide personalized insights to farmers on optimal pesticide use, crop selection, and irrigation schedules. The collaboration between different organizations highlights the potential for AI to enhance water management practices, by fostering smarter, collective actions and more efficient resource use.[29]

Furthermore, AI improves agrifood systems by optimizing land use, energy consumption, and supply chain efficiency. AI-driven insights allow for precise land use decisions by analyzing climate modelling, ecosystem data, and disaster risk maps to determine the most suitable crops and farming practices. AI also enhances supply chain processes by predicting market demand and preparing distribution networks for climate-related disruptions. This ensures that

food systems operate more efficiently and sustainably, minimizing food waste and reducing greenhouse gas emissions.

The **financial services** industry is experiencing substantial disruption due to AI as well. With its reliance on large volumes of data, AI is used to automate routine tasks, mitigate risks, prevent fraud, and generate new insights.

AI is playing a crucial role in fraud detection within the financial industry.[30] By analyzing large volumes of data, AI algorithms can identify potential fraud cases more efficiently and accurately than traditional methods. This capability is essential for mitigating risks and ensuring the security of financial transactions. AI tools are used to monitor transactions and recognize behavior patterns that could indicate fraudulent activity, thereby enhancing the effectiveness of financial crime prevention.

AI-driven tools like robo-advisors, digital wallets, and chatbots have the potential to democratize financial services by making them more accessible to underserved and previously unserved communities.[31] These tools provide immediate support and guidance, enabling individuals in remote areas to manage their finances more effectively. One example is Mongolia, which is characterized by vast distances and a dispersed population. The government's proactive digital transformation efforts, including platforms and other AI-based initiatives, have significantly modernized the financial landscape, despite the traditionally slow adoption of digital experiences by banks. Key developments like a digital wallet, legislative support for investment banks, and partnerships with international fintech entities are driving financial inclusion and economic growth in Mongolia.[32]

Regional AI adoption and investments vary

The introduction of and progress in AI in different industries varies considerably between regions, influenced by factors such as technological advancements, economic potential, and investment in AI research and development (R&D). Globally, the AI adoption rate in businesses (actively deploying and exploring AI in its business operations combined) stood at 82% in 2023, reflecting a widespread recognition of AI's potential to drive innovation and efficiency.[33] According to a report on global AI adoption, companies from the UAE, China, India, and Singapore are leading in actively deploying AI as part of their business operations with an adoption rate of more than 50%.[34] Leading industries for AI adoption include financial services, retail, professional services, and manufacturing. Experts agree that the economic impact of AI will be substantial, although there are many differing estimates of the exact figures. For example, experts expect GenAI alone to increase global GDP by 7% (or almost US$7 trillion).[35]

As stated, AI adoption is significantly linked to investment activities and available resources in different regions. Key players like the United States, China, and the United Kingdom are dominating AI investments, with other regions like the Middle East, Asia and parts of Europe showing significant growth and interest. The volume of investments in AI differs greatly per region, as the following sections show.

North America

- **United States**: The United States is the global leader in AI investment, with a total of US$328.5 billion spent over the past five years.[36] Significant investments come from technology enterprises, which focus on integrating AI into various products.[37] The United States benefits from substantial private sector investments and venture capital, with a peak of US$114 billion in venture capital funding in 2021.[38] Additionally, there are various government grants and incentives available to drive innovation in AI R&D.[39]

Asia

- **China**: China ranks second globally in AI investments, with US$132.7 billion spent from 2019 to 2023.[40] The country is focusing heavily on AI research, patents, and talent retention. By 2027, China plans to invest around US$40 billion in AI.[41]

- **India**: India is a significant player in AI, with US$16.1 billion invested over the past five years.[42] However, India faces challenges in scaling up its investments compared to the top global players due to administrative hurdles, talent shortage, and regulatory and policy inconsistencies, among others.[43]

- **Middle East**: The UAE and Saudi Arabia lead AI investments in the Middle East.[44] The UAE has formed partnerships with global tech enterprises and is heavily investing in AI to diversify its economy away from oil and gas.[45] Saudi Arabia plans to create a US$40 billion AI fund, aiming to become a global leader in AI. The fund aims to finance start-ups in the field of AI technology, including chip manufacturers and the expensive, extensive data centers that are increasingly required to operate the next generation of computing. The funding of its own AI companies is also being considered.[46,47]

Europe

- **United Kingdom**: The United Kingdom is the third-largest AI investor globally with US$25.5 billion spent from 2019 to 2023.[48] Investment is concentrated in the prestigious universities, which poses challenges for regional equity.[49]

- **Germany, France, Sweden**: Germany and France are also significant investors, with US$14.3 billion and US$10.2 billion spent on AI, respectively, over the past five years. Sweden saw the highest growth rate in AI investment, surging by 2310% over five years.[50]

Africa

- According to a report, over 2,400 companies in Africa specialize in AI, with 41% being startups. Over US$2 billion has been invested in **promoting** AI activities across the continent. However, 63% of African AI startups are in the early and intermediate stages of growth (classified as beginners and experimenters), indicating that these investments may take time to produce tangible results.[51] FAIR Forward, a public initiative in Germany, is dedicated to the open and sustainable development and application of artificial intelligence for partnering countries in Africa and Asia[52]. The program is currently collaborating with Ghana, Rwanda, South Africa, and Uganda. One of its primary goals is to enhance access to training data and AI technologies to drive local innovation in those countries.[53]

Latin America

- Venture capital invested in AI startups in Latin America grew over the past years, raising the numbers from US$29 million in 2019 to US$202 million in 2022 but declining in 2023 to US$110 million.[54]

Following the overall trend, GenAI is a key driver for investments. In 2023, GenAI investment increased nearly eightfold from the previous year to reach US$25.2 billion.[55] This significant increase highlights the growing interest and confidence in generative AI technologies. Major players in the GenAI space reported substantial fundraising rounds, underscoring the sector's potential and attractiveness to investors. Despite an overall decline in AI private investment, GenAI managed to attract a significant portion of the funding, accounting for over a quarter of all AI-related private investments.[56] The prominence of GenAI is further reflected in corporate activities and discussions. In 2022, GenAI was the most frequently cited theme in Fortune 500 earnings calls, appearing in 19.7% of all calls, a substantial increase from 0.31% in 2022.[57] This surge in mentions indicates that companies are increasingly recognizing the importance and potential impact of GenAI on their operations and strategies.

Barriers to wider adoption of AI

The adoption of AI in organizations faces barriers beyond financial investments. Deloitte United States's Report on Generative AI in the Enterprise Q3 identifies the top global barriers as: worries about regulatory compliance (36%), lack of technical talent (31%), and difficulty managing risks (30%).[58] The report, based on a survey of around 2,000 business and technology leaders, reveals that while the excitement around GenAI remains high, there are challenges related to trust, workforce adaptation, and the need for tangible results that will be discussed in the following section.

Scaling GenAI from pilots and proofs of concept to large-scale deployment is a primary challenge. It involves coordinated efforts across strategy, process, people, data, and technology. Risk management, governance, workforce transformation, trust, and data management become even more critical during this phase. What worked well in the past might not be as effective with this new technology. The scaling phase is where potential benefits are converted into real-world value, but also where potential challenges become real-world barriers.[59]

Legacy operational structures present a significant barrier to integrating GenAI effectively. These structures often do not support AI's dynamic needs, hindering collaboration and innovation. Fear of the unknown, reluctance to experiment with new technologies, and a tendency to maintain the status quo impede adoption. Ethical considerations and governance concerns also play a critical role. Clear guidelines and governance protocols are needed to ensure responsible use of GenAI. Leaders must address concerns, engage in open dialogues, and break down barriers of fear or misunderstanding to build trust and align the entire organization with the GenAI mission.[60]

Trust is a significant barrier to large-scale GenAI adoption and deployment. Organizations need to build trust in the quality and reliability of GenAI's output, supported by improved transparency and explainability. Additionally, there is a need to build trust among workers that GenAI will make their jobs easier and not replace them. Many organizations measure worker trust and engagement as part of their talent strategies to address this matter. Greater exposure

to GenAI tools can help people become more comfortable with the technology and understand how it can benefit their work.[61]

Workforce access to approved GenAI tools and applications remains low. Deloitte United States's Report on AI in the Enterprise found that nearly one in four surveyed organizations provided approved GenAI access to 20% or less of their workforce. Even among organizations with 'high' GenAI expertise, worker access to approved tools remains the exception rather than the rule.[62] This low penetration rate is often due to concerns around risk management, data security, and the potential for GenAI outputs to be unpredictable and subject to inaccuracies, which can undermine trust.

Upskilling and reskilling the workforce is a critical barrier. Organizations need to redesign work processes and career paths to take full advantage of GenAI. This involves developing new roles, work processes, and an organizational culture that focuses on developing talent at all levels capable of using GenAI to its full advantage. Upskilling and reskilling are essential for capturing GenAI's full value and positioning workers for future success.[63]

Barriers to scaling GenAI include the lack of centralization, the right data management, technology infrastructure, and governance to ensure high-quality inputs and verified, explainable outputs. Building trust through transparency, familiarity, technology, and guardrails is essential for fostering wider adoption.[64]

Worker resistance due to a lack of familiarity, concerns about being replaced, and concerns about control over what GenAI applications are being used within the organization also pose significant barriers. While cautious initial use of GenAI tools makes sense, tight restrictions should be temporary, not long-term. Addressing these barriers is crucial to unlocking GenAI's full potential and driving substantial value creation.[65]

As organizations scale their GenAI initiatives, they must address challenges such as data security, explainability of AI outputs, and workforce trust. Building a culture of curiosity and transparency, along with robust data management and governance, will be essential for realizing GenAI's full potential.[66] Despite challenges, there is optimism regarding the potential of GenAI, with 82% of surveyed leaders stating that AI increases job satisfaction and enhances performance.[67]

Promoting cross-organizational collaboration and establishing an AI center of Excellence (AI CoE) can fuel this optimism. An effective AI CoE embeds AI in the core business and strategy, focuses on observable business impact, provides a comprehensive view of the foundational technology stack in the data and analytics functions and monitors technology trends and competitor activities.[68] Leaders need to shift from being mere observers to active participants and must actively promote and integrate GenAI into the organizational framework, creating trust and psychological safety at the highest levels of the organization. Leaders must visibly commit to the GenAI strategy, not just as a sign of approval but also to signal the organizational direction.[69] [70]

AI is transforming the workforce

AI, particularly GenAI, is reshaping the workforce by automating routine tasks, shifting job roles, and augmenting human abilities. Research from the International Labor Office (ILO) suggests that a maximum of 2.3% of global jobs could be fully automated, but this does not account for the new jobs created by this technology.[71]

For instance, a furniture store chain has implemented an AI bot named Billie to handle routine customer inquiries, which allows their call center agents to focus on more creative and human-centric tasks.[72] This highlights the need for organizations to invest in upskilling initiatives that enhance design skills and human connection, shifting the focus from procedural tasks to creativity and innovation. This approach not only increases efficiency but can also enrich workers' roles, make their jobs more fulfilling and aligned with their capabilities.[73]

The rapid pace of technological change requires a new model where people and technology co-create new knowledge. This model demands deliberate scaling and development of human capabilities. Most executives agree, with 71% stating that their organization's plans for GenAI include using it to advance the human capabilities of their workers.[74] This shift is essential as traditional strategies may only yield short-term gains, while the focus should be on creating value by integrating human and technological capabilities.[75]

GenAI serves as a tool to augment human capabilities. This human-machine collaboration is expected to enhance productivity and innovation, creating value for both organizations and workers. Clear communication about AI's role as a complement, not a replacement, is crucial, along with responsible data practices to build trust and ensure positive impacts on performance and worker well-being. Organizations must also prioritize human-centric metrics, such as job satisfaction and well-being, alongside traditional business metrics, to create a balanced and sustainable work environment.[76]

As roles become more dynamic, the workforce's required skills are evolving. Emotional intelligence, and divergent thinking - a thought process used to generate creative ideas by exploring many possible solutions - are becoming increasingly important as they help workers make judgments in the face of constantly changing data. Additionally, curiosity and resilience are critical skills that enable workers to explore, experiment, and play in safe digital environments. These skills help workers adapt to new technologies and work processes, fostering a culture of continuous learning and innovation. For example, a Japanese pharmaceutical company experimented with a four-day workweek to allow workers to gain experiences outside their jobs, hoping to infuse their digital upskilling and creativity into the business.[77]

In today's workforce, collaboration and social intelligence are highly prized. As work becomes more collaborative, these skills can enable workers to interact effectively within and across teams, boosting overall productivity and innovation. Organizations are increasingly investing in empathy-related training and development, recognizing the importance of these human capabilities. For example, a major hotel chain used virtual reality to help workers better empathize with tired and frustrated travelers. Such development activities often involve placing workers in unfamiliar situations or allowing them to observe and practice empathetic responses, thereby enhancing their ability to collaborate and innovate.[78]

While human capabilities are important, technical skills and AI literacy are crucial. Workers must understand and use AI tools to enhance their work, as the workforce's required skills evolve in response to GenAI integration. Technical skills such as AI tool management, data analytics, and predictive analytics are becoming increasingly important. Professionals need to be proficient in using AI tools, validating AI outputs, and understanding the nuances of large language models (LLMs) and image processing. Continuous learning and upskilling are pivotal, as workers need to adapt to ever-evolving AI technologies. Human-centric skills, including emotional intelligence, critical thinking, problem-solving, and strategic thinking, are also essential for navigating complex problems and leading teams through technological transitions. Adaptability

and flexibility are crucial, as roles and tasks are likely to change rapidly with AI advancements.[79] However, many organizations currently do not provide adequate AI-related skills training, despite the shrinking half-life of skills. Workers need strategies to practice adapting to a range of possible futures, building organizational resilience and improving worker well-being and mental health. Organizations must invest in upskilling initiatives and create environments that promote continuous learning and experimentation to prepare workers for the future.[80]

Janine Berg, Senior Economist at the ILO, emphasizes the importance of social dialogue between employers, workers, and their representatives regarding the potential impact of technology, including AI, on the workplace and the labor market. This dialogue is crucial for developing qualification programs to train workers for new career opportunities.[81] Creating relationships with workers based on trust, transparency, and sharing benefits broadly across the enterprise and beyond will also help to pave the way to a quantified organization. A quantified organization takes a strategic approach to measuring what it should, not just what it can. It takes a responsible approach to using new data sources and AI tools to create value for stakeholders across the organization, improving workforce trust and driving the organization forward to new levels of financial, reputational, and operational performance.[82]

AI and GenAI trends from industry adoption and regional differences, to the barriers of wider adoption and the impact on the workforce are complemented by rising activities within the regulatory and governance landscape. The next chapter will cover AI policies and strategies globally, regionally, and nationally.

AI regulations and the role of frameworks

This section explores the latest global developments in AI regulation, highlighting key policies, agreements, and regulatory bodies shaping AI platforms, tools, and technologies. While the EU AI Act stands as the first comprehensive AI legislation, we have provided a broader overview of how national and regional strategies are evolving worldwide.

It discusses the UN's role in international AI governance, focusing on its contributions to global policies and frameworks. This section analyzes governance aspects, including how ethical matters such as bias, transparency, accountability, and responsibility are being integrated into AI regulation across different regions.

Regulations and frameworks on different levels

AI has evolved rapidly from a specialized technology to a key element of modern industry, governance, and society. It has created vast opportunities across sectors, impacting areas such as health care, finance, transportation, and education. AI is now deeply integrated into systems that drive economies and address global challenges, outlined in the UN SDGs.

However, this rapid expansion of AI technology also brings significant risks. These include ethical concerns like algorithmic bias, which can perpetuate or even exacerbate existing inequalities, and privacy violations, where personal data might be misused. Additionally, AI can be weaponized by individuals or organizations, including through cyberthreats, in ways that harm public trust, such as through the creation of deepfakes. The potential misuse of AI by malicious actors or the unintended consequences of poorly designed systems necessitates a robust framework for governance.

In response to the opportunities presented by AI as well as the risks it poses, there have been comprehensive international developments aimed at establishing comprehensive AI governance frameworks. These developments encompass a wide array of initiatives, ranging from high-level strategic planning to the formulation of codes of conduct, and even the implementation of binding regulatory measures. These efforts are being undertaken across multiple levels of governance, including at the state level, on a regional level as well as on the global scale – reflecting the complex and interconnected nature of AI's impact on the world.

Today, AI governance is inherently a multi-layered effort, involving a diverse range of stakeholders who operate at these different levels. Each level of governance contributes uniquely to the overall framework, addressing specific aspects of AI development and deployment. At the global level, international organizations and coalitions work to set broad standards and foster international cooperation, facilitating a coordinated approach to managing AI's global implications.

The overarching goal of these multi-tiered frameworks is to strike a careful balance between fostering the innovation and investment that drive AI's growth and deploying these technologies in a responsible and ethical manner. Central to this objective is the implementation of safeguards designed to protect individuals, communities, and societies from the potential harm associated with AI. These safeguards aim to address a wide spectrum of concerns, from mitigating ethical matters such as bias and discrimination to protecting privacy and ensuring that AI systems are transparent and accountable in their operations.

As AI governance frameworks evolve, it is important for stakeholders to address key challenges that will enhance their effectiveness. While global convergence on AI governance could be one approach, the focus should be on creating adaptable frameworks that balance national and regional needs. Ensuring interoperability between systems is essential, as it will allow AI technologies to function seamlessly across borders and industries. Aligning governance strategies can deliver substantial benefits, including more effective AI regulation, enhanced innovation, and stronger protection of public interests. This challenge is further complicated by the need to coordinate frameworks such as policies or standards internationally and create shared agreements between countries worldwide. Despite the difficulties, such agreements are essential for creating a unified approach to AI governance that can address the technology's borderless nature. Indeed, the implications of AI often extend far beyond national boundaries, making robust international coordination a necessity. Without this coordination, efforts to govern AI could be undermined by jurisdictional inconsistencies and regulatory gaps. The borderless nature of AI demands an international approach, so no region or country is left out of the debate.

To effectively address these challenges, it is essential to explore the distinct layers and approaches that exist across various regulatory levels. By examining the different global, regional, and state-level efforts, we can better understand how these initiatives interact, overlap, and sometimes diverge. This will highlight how different frameworks can collectively contribute to a more cohesive global strategy, while also highlighting the unique contributions and challenges posed by each level of governance.

AI governance frameworks operate on global, regional, and state/national levels, each addressing different aspects of regulation and oversight. Global frameworks aim to set universal ethical standards that transcend borders, offering guidelines for responsible AI use and development worldwide. Regional frameworks, such as those implemented by specific groups of countries and jurisdictions, focus on harmonizing regulations within a certain geographic area, ensuring consistency and cohesion among member states. State or national frameworks are more specific, and tailored to the unique legal, cultural, and technological environments of individual countries, providing localized governance that aligns with broader regional and global standards. Each of these approaches plays a distinct role, contributing to a holistic approach that can accommodate the diverse needs and challenges of AI deployment worldwide.

Global level

In the rapidly evolving landscape of AI governance, international entities are adopting distinct strategies to address the ethical, regulatory, and safety challenges posed by AI technologies. The UN, the Group of Seven (G7), and the recent AI Safety Summits each bring unique approaches to shaping a global framework that balances innovation with responsibility.

The UN plays a critical role in international AI governance, actively promoting ethical standards, international cooperation, and discussions among member states to ensure that AI development aligns with human rights, peace, and the SDGs. The United Nations Secretary-General's High-level Advisory Body on Artificial Intelligence (HLAB-AI) released "Governing AI for Humanity" in September 2024,[83] which serves as a strategic blueprint for addressing AI-related risks while realizing its transformative benefits globally. The report identified urgent needs for cohesive global governance to manage AI's rapid development, highlighting its impact on critical sectors like healthcare, energy, and public services.

The report stressed the concentration of AI regulation decision-making in wealthier nations, excluding many countries from vital discussions on AI governance. It calls for enhanced global cooperation to bridge this gap, helping to ensure a shared understanding of AI's potential risks and uncertainties, supported by unbiased, globally pooled specialist knowledge. One key recommendation is the establishment of a specialized AI office within the UN to serve as a central coordinating entity. The report also emphasized the need for a new social contract for AI, engaging governments, civil society, industry, and researchers to ensure AI serves as a force for good, promoting fair and positive outcomes for everyone.

The HLAB-AI's call aligns with the UN's broader efforts across multiple levels to tackle the ethical and practical challenges posed by AI technologies. For instance, UNESCO, as a specialized UN agency, has set global ethical guidelines for AI through its "Recommendation on the Ethics of Artificial Intelligence". These guidelines outline principles that emphasize the importance of human rights, inclusivity, and environmental sustainability in AI development.

In addition to establishing ethical standards, the UN plays a crucial role in fostering international cooperation by providing platforms for countries, experts, and stakeholders to engage in dialogue about the challenges and opportunities presented by AI. These global discussions are essential for developing a cohesive international framework capable of addressing the inherently cross-border nature of AI technologies. The UN strategically aligns AI governance with its broader mission by emphasizing how AI can contribute to achieving the SDGs. It advocates for the responsible use of AI to address global challenges such as reducing poverty, enhancing education and healthcare, helping to ensure that AI technologies are developed and deployed in ways that support progress in these critical humanitarian areas.

Since 2017, the International Telecommunication Union (ITU) has led the "AI for Good" initiative. This program aims to harness the potential of AI in addressing global challenges, particularly those aligned with the Sustainable Development Goals (SDGs). AI for Good serves as a collaborative platform that brings together AI innovators, experts, and stakeholders from diverse sectors, including governments, academia, industry, and civil society. Its primary objective is to facilitate the development and implementation of AI solutions that can have a positive impact on society, especially in areas such as healthcare, education, environmental and sustainability, and disaster response. The initiative hosts annual global summits where participants share insights, discuss ethical and technical challenges, and explore practical AI applications that can significantly enhance people's lives.

During the most recent summit in May 2024, the AI Governance Day featured discussions on the complex challenges posed by the rapid development and deployment of AI. This event brought together a diverse array of stakeholders, including policymakers, industry leaders, academics, and representatives from civil society, to engage in high-level discussions on the ethical, regulatory, and social implications of AI. These discussions underscored the challenge of implementing effective AI governance frameworks, particularly regarding compliance and enforcement, given the complex landscape of national and regional regulations. Achieving global consensus on AI governance is crucial yet challenging due to the intricacies of existing governance structures. The borderless nature of AI demands robust international coordination to address its wide-reaching implications. Central to these discussions was the establishment of trustworthy standards for AI, drawing on lessons from established models like telecommunications and postal services, with a focus on ethics, fairness, and transparency.[84] [85]

Other approaches at the global level mostly focus on GenAI and its risks. In accordance, the G7 countries (Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States), and the EU as an observer have taken a proactive approach to establishing principles for AI governance through the G7 Code of Conduct (CoC). Moderated by the Japanese G7 presidency, the document is termed the "Hiroshima process." The G7 CoC is a voluntary framework that sets high expectations for the responsible development and deployment of AI technologies.[86] Key components of the G7 CoC include encouraging transparency and accountability throughout the AI lifecycle, from development to deployment. The Code also promotes risk management strategies that anticipate and mitigate potential harms, such as biases in AI decision-making or vulnerabilities that could be exploited by cyberattacks. Furthermore, the Code touches upon themes such as incident reporting, watermarking, data privacy and intellectual property as well as common research and the development and use of international technical standards. While this allows for flexibility and innovation, it also relies heavily on the willingness of companies and governments to adopt and enforce these principles.

A series of "AI Safety Summits" were kicked off by the United Kingdom government in November 2023, hosting the Bletchley Park Summit. For the first time governments and companies on a global scale came together to discuss mitigating risks of AI technologies, specifically so-called frontier models, the most advanced and sophisticated AI models. Governments and AI companies recognized their shared responsibility in ensuring the safety of these models, particularly in areas critical to national security, societal well-being, and public safety. At the end of the Summit, 29 governments and international institutions signed the Bletchley Declaration. The declaration reinforces the global regulatory framework by addressing the safe use of AI. Moreover, it focuses on a set of concrete measures aimed at enhancing the safety and responsible development of frontier AI technologies. This approach emphasizes the shared responsibility between governments and AI model developers to ensure that these technologies are rigorously assessed for potential risks, particularly those that could impact national security, public safety, and societal well-being. In addition to safety testing, the declaration also calls for the development of shared international standards and best practices for AI governance. A further measure outlined in the declaration is the establishment of a collaborative framework for testing AI models both before and after deployment. The initiatives agreed upon at Bletchley Park, including the establishment of the United Kingdom's AI Safety Institute,[87] lay the groundwork for ongoing international collaboration in AI governance, ensuring that the development of AI technologies can proceed safely and responsibly. A further summit took place in the Republic of Korea in May 2024[88]. Since then, other governments including the United States[89], Canada[90], Japan[91], the Republic of Korea,[92] and Singapore[93] have announced the establishment of AI Safety Institutes. In February 2025 France will be hosting the next session of the AI Safety summits – coined the AI Action Summit.[94]

In 2023, the OECD revised its definition of AI systems to reflect the latest advancements in technology, providing a foundational framework that governments can use to legislate and regulate AI. This updated definition not only enables harmonization among national policies but also contributes to the development of cohesive global policy frameworks for AI.[95] The EU AI Act – elaborated in the following sections – aligned its definition with the one drafted by the OECD.

These three approaches—the UN-led ethical frameworks, the G7's voluntary code of conduct, and the practical safety measures from the AI Safety Summits, accompanied by the OECD's definition of AI—demonstrate diverse yet complementary strategies for global AI governance.

The UN's work, supported by the ITU, focuses on embedding ethical considerations and fostering international collaboration, all while advancing the SDGs. The G7 emphasizes creating a flexible framework for transparency and accountability, while the Bletchley Declaration promotes cooperative safety measures for frontier AI technologies. Complementing these efforts, the OECD's 2023 definition of AI systems may provide a foundational framework that supports harmonization among national policies and contributes to the development of cohesive global AI governance.

Standard setting

The development of AI policies and regulations, including frameworks and the standardization of AI, are closely interconnected, with each process reinforcing and complementing the other. Standards provide the technical specifications and best practices that are crucial for the creation of robust regulatory and policy frameworks and a means of assuring that those regulatory requirements are being met. They lay the groundwork for ensuring interoperability between AI systems. Conversely, policy frameworks and regulations shape the evolution of these standards, ensuring that they adequately address legal, ethical, and societal concerns.

Given this concerted effort, it is essential to consider the technical foundations upon which AI standards are built. Several organizations are actively engaged in the development of AI standardization, working together to create comprehensive standards that span from broad ethical guidelines to specific technical requirements. These standards are designed to be applicable across a wide range of industries and technologies, ensuring that AI is implemented safely and effectively.

When discussing cooperation on AI standardization, the World Standards Cooperation (WSC) plays a pivotal role. The WSC is a collaborative initiative between the International Organization for Standardization (ISO)[96], the International Electrotechnical Commission (IEC)[97], and the International Telecommunication Union (ITU). Its mission is to enhance the global framework for AI standards by advancing a consensus-based system that promotes the safe, responsible, and effective use of AI across industries through international cooperation. Central to the WSC's efforts is fostering collaboration among international stakeholders, sharing expertise, and shaping the future trajectory of AI governance. In line with these goals, the WSC recently issued a call for collaboration on AI standards through the AI for Good initiative, urging governments, industry, and other stakeholders to work together to establish robust standards for AI. Reflecting its commitment to AI governance, the WSC will host the AI for Good International AI Standards Summit in New Delhi, India, in October 2024. This summit will focus on multi-stakeholder cooperation to develop global standards for AI watermarking, multimedia authenticity, and deepfake detection technologies, further advancing the work of the WSC in these areas.

A key contributor to these efforts is the ITU, which has already published or is developing over 220 AI standards. These standards span a wide range of areas, providing essential guidelines and frameworks to ensure the safe and ethical deployment of AI technologies. The ITU's standards work includes pre-standardization Focus Groups on topics like AI and Health (in collaboration with World Health Organization), AI and Autonomous and Assisted Driving, AI and Environmental Efficiency, AI and Natural Disaster Management (with World Meteorological Organization and United Nations Environment Programme), AI and 5G, AI and Internet of Things (IoT) for Digital Agriculture (with Food and Agriculture Organization), and the AI for Road Safety Initiative.

The objectives of the WSC standards collaboration include providing a global platform for dialogue on priority areas and technical standards for AI watermarking, multimedia authenticity, and deepfake detection technologies. It aims to map the existing landscape of standards in these fields and explore how they align with policy and regulatory requirements for governments, ensuring transparency and compliance with legal obligations, such as privacy protection, consumer rights, and intellectual property rights. The collaboration also seeks to facilitate the sharing of knowledge and lessons learned from diverse stakeholders, promoting the dissemination of emerging standards and technologies that address the challenges posed by deepfakes and the authentication of GenAI content. Furthermore, it aims to identify gaps in current standards and develop new standards as necessary, given the rapidly evolving nature of GenAI and deepfake technologies.

Furthermore, ISO has established a series of standards that provide guidelines, frameworks, and best practices for the development, deployment, and use of AI technologies. These standards are intended to foster the safe, ethical, and effective application of AI across diverse industries. A notable example is the ISO/IEC 22989:2022[98] standard, which is foundational in the AI field. It provides a unified and consistent understanding of AI concepts and terminology by establishing a specialized vocabulary that serves as the basis for related standards.

In addition, the IEC plays a significant role, particularly in the integration of AI with electrotechnical systems. Through the ISO/IEC Joint Technical Committee 1 (JTC 1),[99] the ISO and IEC collaborate to develop critical standards for AI technologies. This joint effort encompasses both broad and technical aspects, facilitating the seamless incorporation of AI systems. The International Telecommunication Union (ITU) also contributes to AI standardization, particularly in the context of telecommunications and information and communication technologies (ICT). For example, ITU-T Y.3172[100] outlines how AI can enhance network performance, manage resources, and optimize services, reflecting the ITU's commitment to using AI for improved telecommunication networks.

To ensure compliance and address complex matters such as bias, detailed definitions and catalogues are necessary. In the medical field, efficacy is established through rigorous trials—a stringent approach that could similarly be applied to AI systems. Moreover, AI governance standards should be rooted in a human-centric approach that prioritizes ethical considerations over mere effectiveness, ensuring that human rights and broader ethical implications remain central to AI development and deployment.

European Union

On a regional level, the European Union (EU) AI Act is the most notable approach to regulating AI – it is the first comprehensive AI regulation. It entered into force on 1 August 2024 and is now applicable across all 27 member states of the European Union with significant extra-territorial reach for AI providers that offer their products or services on the EU market.

Infobox: The European Union AI Act in a nutshell

The development of the EU AI Act has been a carefully orchestrated process, beginning with the formation of a 'High-Level Expert Group on AI' by the European Commission. This group was tasked with drafting policy recommendations focused on advancing trustworthy AI. Following these initial efforts, the **European Commission** released its European approach to AI in February 2020 and subsequently presented the first proposal for the EU AI Act in April 2021. The AI Act represents the result of a five-year political process aimed at balancing innovation with the need for secure and reliable AI systems. Its primary objective is to enhance the functioning of the single market concerning AI products and services, while also promoting a human-centric approach to AI development and deployment, putting the protection of EU citizens at the forefront of this regulation. The Act applies to a broad range of stakeholders, including providers, deployers, importers, and distributors of AI systems within the EU, as well as non-EU entities whose AI systems are used within the EU. This approach reflects the regulatory framework seen in the General Data Protection Regulation (GDPR), emphasizing the importance of safety and innovation in equal measure.

The EU AI Act establishes a comprehensive framework for regulating the deployment and use of AI within the EU, creating a standardized process for the market entry and operational activation of AI systems. This framework drives a harmonized approach across all EU Member States. Serving as a product safety regulation, the Act employs a risk-based classification system, categorizing AI systems based on their use cases and assigning compliance requirements according to the level of risk they pose to users. This includes prohibiting certain AI applications deemed unethical or harmful, as well as imposing stringent requirements on high-risk AI applications to effectively manage potential threats. Additionally, the Act sets out transparency obligations for AI technologies associated with various risks, ensuring that the regulation remains adaptable to future developments in AI technology.

Given the widespread adoption of general-purpose AI technologies, the Act distinguishes between single-purpose AI, designed for specific tasks, and general-purpose AI, which can perform a wide range of functions. Regardless of the risk associated with specific use cases, the AI Act establishes comprehensive rules governing the market entry, oversight, and enforcement of general-purpose AI models, to establish public trust and the integrity of AI innovations.

To support the implementation of the AI Act, a new governance structure has been established at both the EU and Member State levels. At the EU level, the European Commission created the European AI Office in February 2023 to oversee the Act's implementation. The AI Office will be responsible for enforcing obligations related to general-purpose AI models. This includes developing tools, methodologies, and benchmarks in collaboration with academia and industry to evaluate these models and identify those with systemic risks. Furthermore, the AI Office will also be responsible for developing implementing guidelines regarding the EU AI Act through delegated and implementing acts for all providers and deployers in scope, such as defining criteria for high-risk AI systems and overseeing conformity assessments.

Infobox: The European Union AI Act in a nutshell (Continued)

At the national level, Member States are required to designate supervisory authorities to enforce the AI Act's obligations concerning AI systems. These supervisory authorities will ensure that AI systems comply with the established standards and regulations. For instance, they will oversee the accuracy of conformity assessments conducted by providers of high-risk AI systems to ensure these systems meet specific standards, regulations, or requirements. During investigations, market surveillance authorities will have the authority to access necessary documentation, including training, validation, and testing datasets used in the development of high-risk AI systems, as well as the source code of such systems. Providers of high-risk AI are obligated to cooperate fully with these authorities, ensuring that AI technologies adhere to the rigorous standards set forth by the EU AI Act.

The Council of Europe, an international organization established in 1949 to promote human rights, democracy, and the rule of law across Europe, currently includes 46 member states, extending beyond the European Union's 27 Member States. In the context of global AI frameworks, the Council of Europe has taken a leading role by adopting the first-ever legally binding international treaty on AI in May 2024: the "Framework Convention on artificial intelligence and human rights, democracy, and the rule of law."[101] The Framework Convention applies to the entire lifecycle of AI systems utilized by both private entities and public authorities, with a clear focus on aligning AI with core human rights principles and democratic values. Its primary goal is to ensure that AI systems are developed, designed, and deployed in accordance with existing international standards and European values while addressing potential legal gaps arising from rapid technological advancements.

Unlike the EU AI Act, the Framework Convention is technology-neutral, meaning it does not regulate specific AI technologies but instead mandates adherence to overarching principles that prioritize a human rights-centered approach.. It also imposes procedural safeguards, guaranteeing the protection of individuals impacted by AI systems. This includes the right to access sufficient information to challenge decisions made or heavily influenced by AI, as well as ensuring transparency in interactions with AI systems themselves. Furthermore, the Framework Convention mandates the right to lodge complaints with relevant authorities and emphasizes the importance of conducting risk and impact assessments to mitigate potential threats to human rights, democracy, and the rule of law. Importantly, it allows authorities to impose bans or moratoria on certain high-risk AI applications when necessary.

In September 2024, the Council of Europe opened the treaty for signature to other states and organizations. The Framework Convention has since been signed by Andorra, Georgia, Iceland, Norway, the Republic of Moldova, San Marino, the United Kingdom, as well as Israel, the United States and the EU. Its broader human rights focus complements the EU's AI Act, providing a shared ethical and legal foundation upon which further AI regulation within the EU and other jurisdictions can be built.

To allow organizations within its scope sufficient time to meet the requirements of the EU AI Act, the full application of the Act is scheduled for August 2027, with a few minor exceptions extending to 2030. Due to the Act's extraterritorial reach, AI providers based outside the EU will also need to comply with these rules if they offer their products or services in the EU market. It

is anticipated that this could lead to another "Brussels effect," similar to the impact seen with the GDPR. Therefore, while the EU AI Act will have a global impact on businesses, it is also likely that some governments will incorporate elements of the EU's law into their legislation. Key aspects of the EU AI Act that may be adopted by other countries or regions include the risk-based approach to AI applications, the protection of citizens, obligations for general-purpose AI, as well as transparency and cybersecurity measures. Ultimately, in the context of the Act's extended timeline for full applicability, there is potential for regulatory "cherry-picking" by other governments. As the EU demonstrates its capacity to implement successful AI governance, other nations might selectively adopt certain provisions that align with their domestic priorities while bypassing others. This selective adoption could be influenced by the demonstrated effectiveness of the EU's implementation. As a result, while the EU AI Act sets a comprehensive framework, its influence may lead to a varied global regulatory landscape where different governments tailor their AI governance frameworks by integrating specific elements of the EU's model.

National level

Additionally, many governments have started to develop ethical frameworks to address these matters. These approaches range from regulations, to codes of conduct or AI strategies. Efforts are diverse yet share common goals of ensuring ethical use and mitigating risks. Across these diverse approaches, there is a clear consensus on the need for frameworks that ensure AI systems operate transparently, fairly, and responsibly. These regulations and strategies collectively reflect a global commitment to addressing the ethical and societal impacts of AI, aiming to foster technology that aligns with core values of human rights and public trust.

However, the implementation of these frameworks is often inconsistent and varies greatly between countries. For instance, while some countries like Singapore[102] and the United Kingdom[103] have developed comprehensive ethical frameworks for AI, others are still in the early stages of this process. Even when ethical frameworks exist, there can be challenges in enforcing them and ensuring compliance.

China's regulatory landscape reflects a focus on comprehensive oversight and national security, particularly in ensuring the safe use of AI. This focus is underscored by China's recent framework addressing the security governance of AI.[104] The framework is designed to ensure that AI systems are adaptable and flexible, capable of effectively responding to evolving environments while maintaining stringent safety standards. It also advocates for a proactive approach to secure and responsible AI development, prioritizing the identification and management of AI-related risks through robust technical measures. Further key regulations, such as the Personal Information Protection Law (2021)[105] and the Data Security Law (2021),[106] emphasize informed consent, data protection, and algorithmic fairness. Furthermore, recent regulations like the Gen AI Regulation (2023)[107] specifically address the challenges posed by GenAI technologies.

In Canada, the emphasis is on transparency and accountability in AI systems. The Directive on Automated Decision-Making (2019)[108] and the draft Artificial Intelligence and Data Act (2022)[109] are designed to ensure that AI technologies are developed and deployed responsibly, with a focus on managing risks and maintaining fairness and include provisions for transparency, accountability, and the protection of privacy.

Around the world, numerous countries are actively developing and implementing AI strategies to address the ethical, societal, and regulatory challenges posed by these technologies. According to the OECD,[110] by 2021, 70 states, including many countries of the Global South, had already

published AI strategies or guidelines, reflecting a widespread and growing commitment to shaping the future of AI in ways that align with core values of human rights, transparency, and public trust.

The AI for Good Governance Day report also includes a list of major multilateral and national initiatives as of the end of May 2024.[111]

Common themes of AI governance frameworks

A closer examination of existing AI frameworks reveals that, despite differences in their specific legal (regulation or codes of conduct) and cultural contexts, they share several overarching themes. These commonalities reflect the shared concerns and objectives in the governance of AI.

Ethical principles and human rights

Central to these frameworks is a commitment to ensuring that AI systems are developed and deployed in ways that uphold fundamental ethical principles and human rights. This commitment is reflected in documents such as UNESCO's Recommendation on the Ethics of AI or the EU AI Act, both of which emphasize the critical importance of protecting human dignity, privacy, and freedom amid the rapid advancement of AI technologies.

Safeguards

Safety considerations are paramount, reflecting widespread concern over the potential risks inherent in AI technologies. Ensuring the robust and secure operation of AI systems is a top priority, particularly in high-stakes environments such as health care, transportation, and critical infrastructure. Regulatory frameworks increasingly demand that AI systems be designed with built-in safeguards to prevent misuse, whether intentional or accidental. This includes measures to protect against vulnerabilities that could be exploited by malicious actors, as well as protocols to ensure that AI systems can respond effectively to unforeseen challenges or errors. Additionally, there is a strong focus on establishing rigorous testing and validation processes, both before and after deployment, to verify that AI systems perform reliably and do not pose undue risks to public safety. The overarching goal is to create AI systems that not only advance innovation but do so in a manner that prioritizes the well-being and security of individuals and society.

Transparency and Accountability

Another central theme in AI governance is the emphasis on transparency and accountability within AI systems. Across various regulations, there is a clear requirement that AI processes must be explainable, ensuring that stakeholders understand how decisions are made and that the output is comprehendable. Moreover, those responsible for deploying AI systems are expected to be accountable for their outcomes, reinforcing the importance of ethical AI usage. Data protection and privacy also emerge as critical concerns, highlighting the widespread recognition of the sensitive nature of the data that powers AI systems.

At the same time, there is a shared commitment to fostering innovation and economic growth, with many frameworks striving to balance regulatory needs with the imperative to support technological progress. Objectives such as ethical principles, transparency, accountability, data protection, and safety are closely aligned with the UN SDGs.

Interoperability and Technical Standards: The Foundation for Global AI Governance

As AI continues to evolve at an unprecedented pace, the need for a cohesive and unified global governance framework becomes increasingly urgent. Various approaches – ranging from the UN's ethical guidelines, the G7's voluntary code of conduct, the practical safety measures initiated at the AI Safety Summits, and the OECD's definition of AI as well as the work by the standard-setting bodies – provide a foundation. However, the future of AI governance will largely hinge on the ability to ensure interoperability across these frameworks. The development of AI policies, including the creation of frameworks and the standardization of AI, are deeply interconnected, with each process reinforcing and complementing the other. Technical standards provide the essential specifications and best practices that form the backbone of robust regulatory and policy frameworks.

Interoperability refers to the capacity of different AI governance frameworks to work together seamlessly, despite diverse legal, cultural, and technical contexts. This is critical for several reasons. First, it enables the sharing of best practices, technical standards, and ethical guidelines, fostering a collaborative approach that includes all stakeholders – governments, industry, civil society, and international organizations. Therefore, the application of technical standards is vital for the safe application of AI. Learning from past standard-setting experiences, such as those in telecommunications and postal services, can be highly beneficial. These models were founded on values like fair market practices, competition principles, trust, and transparency – values that are equally vital in AI governance. However, standards must be trustworthy and not rushed to maintain their credibility. This requires detailed definitions and catalogues, particularly for complex challenges like bias, to ensure effective compliance checking.

Second, interoperability allows for consistency in applying AI regulations across jurisdictions, reducing the complexity and costs for internationally active organizations and businesses. Interoperability is moreover about fostering a shared understanding and commitment among global actors. This is where the work of the UN and its agencies, such as ITU or UNESCO, becomes vital. The UN's emphasis on ethical principles, human rights, and inclusivity ensures that the global governance of AI is rooted in values that transcend borders. The success of these and future initiatives will depend on the ability of the global community to work together, build bridges between different regulatory approaches and ensure that AI governance frameworks are not only compatible but also complementary.

Implementing AI governance frameworks is a global challenge that spans multiple sectors as well as the entire AI supply chain. Striving for as much global consensus as possible is important for effective governance, yet the complexity of national and regional regulations or guidelines makes political solutions at the global level both challenging and crucial. AI governance must address the borderless implications of the technology, requiring robust international coordination. While governance frameworks must not stifle innovation, it is equally important that competition between companies and countries does not undermine the integrity of these frameworks. Practical steps toward achieving interoperability include the development of AI Safety Institutes that are aligned to the same set of standards and principles as well as conducting rigorous testing and sharing the outcomes of that testing to increase public trust, ensuring that AI models meet international benchmarks for safety and ethics. These institutes should collaborate globally to share insights and harmonize their approaches, thereby reducing redundancy and enhancing the effectiveness of governance efforts.

How organizations implement AI regulatory frameworks

In this context, the organizational side must be considered alongside the governance perspective. Companies, and other entities subject to these regulations must also prepare for compliance by investing in organizational AI readiness. While regulatory requirements can be seen as helpful in the implementation of AI use cases as they provide a general framework, organizations often face the question of concrete operationalization. What does a regulation mean in daily practice? Where does it apply? Who is affected? In the case of AI in particular, robust governance is essential, as it is used in many different areas of a company and can have different impacts on stakeholders, processes, and finances. To build AI governance, digital ethics has proven its value in implementing both ethical and regulatory requirements into operative processes. As a systematic, multifaceted approach to examining digital solutions from an ethical perspective, digital ethics plays a critical role in establishing effective governance for responsible AI and digital practices.

Providing digital-ethical frameworks can enable organizations to define clear responsibilities, roles, and processes, helping to create a secure environment for employees and ensure they can navigate the rapidly changing landscape with confidence. Moreover, digital ethics fosters a culture where the use of AI applications is seen as a trusted asset that promotes innovation. Operationalizing digital ethics in organizations involves several critical steps and approaches to ensure that ethical principles are effectively integrated into business practices. The first step is to create a suitable entry point by developing digital ethical guidelines tailored to the specific industry and organizational values. These guidelines serve as a commitment tool for employees and a demonstration of principles to external stakeholders. The process also includes conducting a digital ethics status quo and maturity analysis to identify current ethical risks and challenges and evaluating the organization's maturity in handling digital ethical matters.[112]

Bridging the gap between principles and practice is the next step. This involves translating value-derived requirements into guiding principles and governance processes for AI projects. These principles impact operationalization by shaping corporate culture and internal communication. To manage digital ethical risks effectively, organizations need to define clear roles, decision-making powers, and responsibilities, which facilitate faster and more reliable decision-making. This structured approach ensures that digital ethics are embedded at the governance level, providing employees with a sense of security and guiding them in their daily operations.

In another step, effective operationalization requires ensuring employee commitment. This involves regular and targeted training to spread digital ethics guidelines across the organization, enabling employees to incorporate ethical principles into their everyday operations. Assigning roles and responsibilities, along with allocating adequate resources, are the crucial last step for implementing digital ethics actions across all levels and departmental silos. In conclusion, a unified approach to digital ethics aligns with the organization's overarching vision and mission, making it an integral part of organizational culture and identity. This holistic approach transforms regulations from a restrictive factor to an enabling mechanism, fostering customer and stakeholder trust and positioning organizations to navigate the complexities of the digital world successfully.

The goal of the AI frameworks is to address global challenges like inequality, climate change, and peace, which are inherently supported by frameworks that prioritize ethical AI development. By ensuring that AI systems respect human rights and dignity, these frameworks for example contribute to the achievement of SDG 16, which promotes just, peaceful, and inclusive societies.

The focus on transparency and accountability in AI governance further supports various SDGs by encouraging strong, accountable institutions. Additionally, the emphasis on protecting data privacy and ensuring safety within AI systems aligns with several SDGs, particularly those related to reducing inequality and promoting innovation. In this way, the goals of AI governance and the SDGs are intertwined, with both striving to create a more equitable and secure world through responsible technological development.

The path forward for global AI governance lies in our collective ability to create interoperable frameworks, based on technical standards, that balance regulation with innovation. By embracing interoperability, the international community can ensure that AI technologies are developed and deployed in ways that are safe, ethical, and beneficial to all. As we continue to navigate the challenges and opportunities presented by AI, interoperability will be the key to building a cohesive, global governance framework that supports the responsible advancement of this transformative technology.

Addressing AI's challenges

AI's development and implementation bring a range of social, environmental, or technical challenges, such as data privacy concerns and the significant energy consumption required to support AI systems. These challenges are closely tied to the evolving nature of technology, making it critical for policymakers to develop effective, forward-thinking legislation. This section aims to identify key risks associated with AI and present solutions to address them. For each challenge, the report will provide a clear, high-level overview, followed by examples of governmental or intergovernmental initiatives that offer either current or established practices or emerging approaches to managing these risks.

Policy and Governance

Focus area: Data Privacy and Security

Data privacy and security are critical challenges in the rapidly advancing field of AI with 80% of data experts surveyed saying that AI is making data security more challenging.[113] AI tools use vast amounts of data from various sources to train and learn from, often personal data, and there is a risk that personal data could be integrated into the model and shared with other users. Additionally, AI models can be tampered with and could therefore provide access to the content and the personal data of end users.[114]

Data privacy and security are pivotal to ensure that the technology is designed with minimal risks of data breaches. Governments have a role to play in requiring companies to integrate the principle of privacy by design into AI systems or to reduce the holding of unnecessary data. The following approaches are examples of such practices being used by governments:

Established practice: Generation Data Protection Regulation of the European Union

The European Union's General Data Protection Regulation (GDPR) has set a global standard for data privacy and security.[115] One of its key principles is privacy by design, which requires organizations to integrate data protection into the development of their products and services from the very beginning. Additionally, under GDPR, organizations must practice data minimization, meaning they should collect and process only the personal data that is necessary for a specific purpose. This reduces the amount of data at risk if a breach occurs and lowers the chances of data misuse.

While GDPR was not designed solely for AI, many of the principles mentioned above are still relevant for this technology.[116] Yet, those principles may conflict with the nature of AI as it requires large data quantity to be trained. Hence, in the implementation of the requirements, specific AI aspects should be considered. For data minimization, this could mean removing any personal aspects from the data or for data holding this could require the reuse of data in a way that is not incompatible with the way the data was initially sourced. Adapting GDPR practices to the specificities of AI is valuable as GDPR has led to important benefits towards governance, monitoring and decision-making for personal data.[117]

Emerging practice: California Consumer Privacy Act of the State of California, United States

The California Consumer Privacy Act (CCPA), enacted in 2018, aims to enhance privacy rights and consumer protection.[118] CCPA provides California residents with the ability to control how

businesses process their personal information. California residents can request to access, delete, and opt out of sharing or selling their information.

For AI, this could mean that users are informed on how their data is being used to train the AI model and are given the right to remove such data from the model.[119] While GDPR mandates organizational measures such as privacy by design, the CCPA is more focused on granting consumer rights to their data.

Economic Impact

Focus Area: Job Displacement & Education

As AI evolves, its impact on employment and education is becoming increasingly significant. AI can allow workers to focus on tasks with higher value. Additionally, it can also disrupt some industries by automating tasks and reducing the need for human involvement. Accommodating for this transition will require retraining of workers and rethinking education in general. Finally, while AI has important implications for employment and education, the opposite is also true. The AI transition will require a transformation of the workforce with the development of new skills and habits.

Those changes are prompting governments around the world to develop policies that address both the opportunities and challenges posed by this transformative technology.

Established practice: China's Next Generation Artificial Intelligence Development Plan

China's Next Generation Artificial Intelligence Development Plan, launched in 2017, underscores the country's ambition to become a global leader in AI by 2030.[120] Recognizing the potential societal impacts of AI, the AI Development Plan includes initiatives focusing on workforce retraining to support the AI transition. In line with this, the government has invested in various initiatives designed to equip workers with the skills needed to thrive in an AI-driven economy. The government is also focusing on providing a new AI-driven curriculum that will consider collaboration between AI and various research topics.

Additionally, the potential of AI to automate the least interesting aspects of certain jobs is also mentioned as a key value-add from the technology. The aim is to use AI to support the development of high-quality jobs while making sure that those new jobs can also support the AI transition.

Emerging practice: India's "Responsible AI for Youth" program

India's "Responsible AI for Youth" program, launched in 2020, takes an inclusive approach to AI education by focusing on younger generations and underserved communities.[121] Unlike many traditional policies that prioritize higher education and advanced technical training, this initiative aims to explain AI and introduce foundational skills to school students, particularly those in rural and economically disadvantaged regions.

Recognizing the importance of preparing the youth for the technological forces that are shaping the future of work, this initiative seeks to foster an early interest in technology and innovation, equipping students with the necessary skills and knowledge to pursue further education and careers in AI-related fields. This program is targeted at students from the ages of 8 to 12 across all government districts. Additionally, the vision of the program is to make sure that all young

people in India can "become human-centric designers who can create real AI solutions to solve economic and social impact issues of India." This would help India benefit from the technology to drive its own economy and social agenda.

Focus Area: Research and Development

As stated in the previous section, regional AI adoption and investments vary, with billions being invested in AI solutions worldwide. However, the financial aspect must be viewed comprehensively to prevent any adverse effects. First, the investment in AI research and development must balance resources with other critical areas of the economy. Second, most of the AI investment is provided for use cases with a commercial angle, and the social or environmental potential of use cases is not always prioritized over the economic impact.[122]

One governmental approach is to establish clear investment guidelines and policies that prioritize funding for AI projects with broad societal or environmental impact. This requires a concerted effort from the public and private sectors to create collaborative funding models, where investments are co-financed by government grants, private capital, and international organizations, ensuring a balanced allocation of resources.

Established practice: Japan, AI Technology Strategy

Japan is a leader in the AI domain with its "AI Technology Strategy," which forms a crucial component of the broader "Society 5.0" initiative.[123] This policy aims to harness the potential of AI to address a range of pressing societal challenges, including an ageing population, labor shortages, and the need to boost economic productivity.

To enable AI to transform society, the importance of research and development is directly addressed. Research on the technology is being supported by the government and various research initiatives focused on education or human resources are directly driven by the government. Additionally, the importance of private companies in promoting R&D is recognized and to support them in this endeavor, the government has designated having access to the right infrastructures as one of their initiative's pillars. Finally, as AI influences various research themes, the document suggests pursuing synergies between private and public actors to make sure that the research can be developed in collaboration.

Emerging practice: Estonia KrattAI Strategy

Estonia, a country known for its digital innovation, has taken a bold and innovative approach to AI integration with its "KrattAI Strategy."[124] This policy represents a pioneering effort to embed AI into the fabric of public services, aiming to make government operations more efficient, accessible, and responsive to citizens' needs. The national AI strategy relies on four pillars: boosting AI in the government, AI in the economy, skills along with R&D, and the legal environment.[125]

To support the development of this vision, the government aims to invest around €10 million for the implementation of 50 proposed use cases. This money will support the private sector to conduct research and deployment for those use cases in line with the needs of the government and public services. This strategy enables the research of AI use cases in line with the needs of society and thus can help develop and deploy an AI landscape that drives societal benefits.

Societal Implications

Focus area: Ethical Considerations

The ethical challenges posed by AI are complex, requiring careful consideration to ensure that the technology is developed and deployed responsibly.[126] Key ethical matters include bias and lack of transparency or accountability. Examples of AI leading to negative social impact include biases in the hiring process that favor men over women,[127] more severe judgement of minorities,[128] or chatbots becoming sexist and/or racist.[129] However, an increasing number of advocates argue that, if implemented thoughtfully, AI has the potential to mitigate biases in human decision-making and promote ethical considerations.[130]

Governments have a crucial responsibility to address these challenges by establishing and enforcing regulatory frameworks that set clear standards for the ethical use and deployment of AI.

Established practice: European Union's Ethics Guidelines for Trustworthy AI

The EU's "Ethics Guidelines for Trustworthy AI" stands out as the leading framework in addressing the ethical challenges of AI.[131] The guidelines emphasize that AI should "ensure that the development, deployment and use of AI systems meet the seven key requirements for Trustworthy AI: Human agency and oversight, Technical robustness and safety, Privacy and data governance, Transparency, Diversity, non-discrimination and fairness, Environmental and societal well-being and Accountability."

The actionable nature of these guidelines is one of their strongest attributes. For instance, the guidelines suggest methods for ensuring transparency in AI algorithms, such as making decision-making processes understandable to non-experts and ensuring that AI systems can explain their outcomes in human terms. As a major regulatory power, the EU has a significant impact on global discussions about AI governance.

Emerging practice: UNESCO "Recommendation on the Ethics of Artificial Intelligence"

The UNESCO "Recommendation on the Ethics of Artificial Intelligence" states that "The protection of human rights and dignity is the cornerstone of the Recommendation, based on the advancement of fundamental principles such as transparency and fairness, always remembering the importance of human oversight of AI systems." [132]

To support this, the text put forward a set of 10 principles: 1) Proportionality and Do no harm, 2) Safety and security, 3) Fairness and non-discrimination, 4) Sustainability, 5) Right to privacy and Data protection, 6) Human oversight and determination, 7) Transparency and explainability, 8) Responsibility and accountability, 9) Awareness and literacy, and 10) Multi-stakeholder and adaptive governance and collaboration. These principles are designed to establish a universal baseline for ethical AI, ensuring that all AI systems align with fundamental human rights and ethical standards. The UN principles are designed to be universally relevant. This broad scope makes them accessible to countries and organizations across different cultural, economic, and legal landscapes, including those that may not have the resources or expertise to develop their own detailed AI ethics frameworks.

Focus Area: Rising Inequalities

As AI continues to reshape industries and societies, ensuring that its benefits are distributed equitably across different demographics and regions has become a critical concern.[133] The transformative potential of AI should not be reserved for the most privileged, but rather, it must help to reduce inequality and foster social equity. It is also important to make sure that the Global South can benefit from AI solutions in an equal manner to the Global North.

Governments should continue to find new development approaches that can include users from all backgrounds, as well as drive collaboration with other countries to share best practices or support where needed.

Established practice: FAIR Forward – Artificial Intelligence for All

Fair Forward is an initiative from the Federal Ministry for Economic Cooperation and Development in Germany that is "dedicated to the open and sustainable development and application of artificial intelligence and particularly supports partnering countries in Africa and Asia".[134]

This initiative focuses on three goals: 1) Strengthen local technical know-how on AI in Africa and Asia, 2) Improve access to training data and AI technologies for local innovation, and 3) Develop policy frameworks for ethical AI, data protection and privacy. FAIR Forward is already active in five countries. Ghana, Rwanda, South Africa, Uganda and India, and is supporting the fair development of AI in the Global South. One interesting use case is the development in Rwanda of open AI training data sets in the local language, Kinyarwanda, to make sure that AI-driven apps and solutions are accessible to all.

Emerging practice: Brazilian Artificial Intelligence Strategy

Brazilian Artificial Intelligence Strategy (EBIA), launched in 2021, represents an innovative approach to integrating human-centered values and fairness into the national AI agenda.[135] This strategy is particularly focused on addressing social inequalities through the responsible development and deployment of AI technologies. The EBIA's ethics guidelines are designed to ensure that AI systems do not reinforce existing social disparities but instead contribute to greater inclusivity and fairness.

The EBIA recommends implementing a national framework for AI ethics, incorporating review mechanisms for AI usage by both private and public entities. Additionally, it proposes integrating features in AI public solutions to mitigate bias risks, such as setting a false positive threshold for face recognition to minimize identification biases. Furthermore, the text advocates for promoting transparency in AI-driven actions to ensure alignment with democratic principles and human dignity.

Technical Feasibility and Infrastructure

Focus Area: Sustainability of AI

The significant energy consumption of AI systems poses serious environmental concerns, particularly in the context of climate change. Training large AI models can require vast amounts of electricity that usually do not come from renewable sources.[136] Additionally, the impact of AI on water and waste creation is also largely underestimated, as the underlying technology requires important water quantity to cool down the servers, which are also challenging to

recycle. As AI becomes more integrated across various industries, the cumulative demand will increase, exerting additional pressure on the planet's boundaries.

Governments need to support the development of new hardware solutions that will generate a lower environmental impact.

Established practice: European Union AI Act

The EU AI Act acknowledges the environmental impact of AI, and provides recommendations to make sure that AI systems "are developed and used in a sustainable and environmentally friendly manner as well as in a way to benefit all human beings, while monitoring and assessing the long-term impacts on the individual, society and democracy".[137] Additionally, the text suggests for the voluntary disclosure around the following theme: "Assessing and minimizing the impact of AI systems on environmental sustainability, including as regards energy-efficient programming and techniques for the efficient design, training and use of AI."

While the EU AI Act agrees on the importance of the environment for AI development, it proposes mostly voluntary approaches to support this synergy and does not yet bind the development of AI technologies to environmental impact.

Emerging good practice: Various

Currently, limited regulations are forcing the development of AI solutions in line with environmental considerations.[138] The environmental impact of AI is, however, raising important concerns for global actors, and many voices are advocating for a change. The OECD, for example, published a paper on "Measuring the environmental impacts of artificial intelligence compute and applications" in 2022. The Global Partnership on Artificial Intelligence also created a working group in 2022 called Raise (Responsible AI Strategy for the Environment) to account for the environmental impact of the solutions.[139]

As the topic is being addressed more and more by international actors, this topic is expected to rise and grow. However, this is currently a topic that is missing from current legislation and policies.

Achieving the SDGs with AI

Evaluating Progress: AI implementation across the SDGs

The SDGs, also known as the 2030 Agenda, include 17 goals and 169 targets that outline a sustainable future.[140] These goals cover a wide array of social, environmental, and economic dimensions, offering a comprehensive framework for assessing sustainability. Despite their pivotal role in driving actions towards a sustainable future, most SDGs are unfortunately not progressing as intended, with some even regressing.[141] This lack of progress poses a significant risk to the quality of life for billions of people and strains the limits of our planet.[142] Moreover, the incomplete data availability for all goals further complicates the assessment of the current situation, raising concerns about the accuracy of the overall picture.[143]

Despite the current outlook, an increasing number of people are advocating the use of technology to reverse this trend. The aim is that technology could equip governmental and non-governmental actors with the necessary tools to mitigate negative environmental effects while encouraging positive social impacts. AI has evolved as a technology with numerous use cases that support the alignment of the SDGs with technological advancements.[144] [145] For instance, AI can enhance data availability in previously unmeasurable areas, such as using satellite images to monitor deforestation.[146] The existence of numerous other AI use cases underscores the potential of AI in shaping a more sustainable future.[147]

To ensure that AI is used to advance the SDGs, governments and users must address the diverse challenges posed by AI. Concerns have been raised regarding AI's potential for biases, the development of technology and knowledge monopolies, and the impact on jobs.[148] It is important to align the next steps of AI development with a sustainable future and incorporate the appropriate enabling factors from the outset. Governments play a key role in creating a supportive landscape by addressing aspects such as private-public collaboration, regulations, transparency, and other relevant considerations.

To assist governments in this endeavour, this chapter aims to initially outline specific AI use cases for each SDG, providing a clear understanding of AI's potential impact on each goal. Using AI sources such as the AI for Good: Innovate for Impact report, the AI for Social Good report, the UN Activities on AI report, and others, this chapter will highlight potential use cases for each SDG. Subsequently, it will present specific opportunities and risks of AI for each SDG, offering insights to contextualise the technology's influence on the 2030 Agenda. Additionally, special considerations regarding trade-offs or synergies between the SDGs will be included.

Sustainable Development Goal 1: No Poverty

End poverty in all its forms everywhere

SDG 1 is facing a critical situation, with none of its 7 targets on track as of 2024.[149] The UN warns that if current trends persist, an estimated 575 million people will still be living in extreme poverty by 2030, greatly impacting their quality of life and well-being.[150] The UN further highlights that global efforts to eradicate extreme poverty have suffered setbacks due to the COVID-19 pandemic and other major shocks, leading to the first increase in extreme poverty in decades and reversing global progress by three years.[151]

AI and SDG 1

AI solutions and technologies can have various impacts on SDG 1. First, the technology may indirectly contribute to SDG 1's advancement by strengthening other SDGs such as SDG 9 or SDG 8. [152] [153] By enabling research and innovation, the benefits generated could trickle down to SDG 1 via the creation of new products or services that are more affordable or better suited to the needs of the most vulnerable communities. For instance, using AI to reduce the costs associated with agricultural practices (e.g., minimizing the use of fertilizers) could enable communities to enhance their quality of life.[154] This indirect influence represents the most significant positive impact of AI on SDG 1. Moreover, government support for AI in innovation and economic growth could indirectly lead to improvements in SDG 1.

Specific use cases linked to each target of SDG 1 can yield additional impact. For example, AI can enhance the efficiency of the financial sector, thereby increasing accessibility for the 1.7 billion adults lacking access to financial services.[155] However, the number of AI use cases for SDG 1 is less than other SDGs, reducing the collaborative efforts between the technology and the Goal. For instance, based on two UN reports, there are only 2 use cases out of 40 in the *AI for Good: Innovate for Impact* report,[156] and around 70 use cases out of 408 in the *UN Activities on AI* report.[157]

While AI can generate positive impacts for SDG 1, the potential risks associated with the technology for this Goal must be considered. AI could widen inequality between countries,[158] and individuals.[159] [160] Ownership of AI solutions could further create monopolies, leading to a further concentration of wealth and power without equitable compensation for the content providers. Additionally, investments in AI and its infrastructures, such as robots in agriculture, can be costly and may hinder access to technology for the poorest communities, further widening the wealth divide.[161] To assure fairness and value for all, governments should account for new value-sharing models in their legislation.

Key Considerations for Stakeholders

- **Technology access:** A significant constraint in AI adoption is the cost of associated access to market, in terms of AI hardware and software. For instance, not everyone can afford robots to assist in their operations in agriculture.[162] Implementing a sharing model or subsidizing hardware costs could mitigate this risk.
- **Ownership sharing**: To mitigate the risk of technology monopolies, it is important to explore new business models that distribute value differently,[163] aiming to minimize inequality growth and fairly reward all contributors.

Impact

According to a study on the impact of AI on SDG 1 could act as an (positive) enabler for 100% of the targets and act as an inhibitor (negative) for 86% of the targets. (Nature Communications, 2020)

Use case 1

Using AI to make the process faster for micro-finance loans and to provide access to financial services to communities that traditionally have been underserved.

link

Use case 2

Improving climate forecasting to better prepare communities for extreme weather events and reduce exposure to climate risks as aimed in target 5 of SDG 1.

link

Use case 3

Providing access to overlooked communities to market solutions to provide them with a new revenue stream and higher financial resilience.

link

Sustainable Development Goal 2: No Hunger

End hunger, achieve food security and improved nutrition and promote sustainable agriculture

As of 2024, the progress of SDG 2 is unbalanced. While 1 goal out of 8 (2.b Agricultural export subsidies) is advancing, the remaining seven goals are either regressing or not being measured.[164] This lack of progress means an estimated 600 million people are projected to experience hunger by 2030, with one in three individuals currently facing moderate or severe food insecurity.[165] Globally, rising food prices, attributed to supply chain distribution and conflict, are exacerbating the challenge for communities to meet their nutritional requirements.[166]

AI and SDG 2

AI offers numerous use cases to advance SDG 2, such as precision farming to optimize the use of resources (fertilizer or pesticides),-[167]monitoring environmental conditions such as air, soil and water quality to enhance crop resilience,[168]and tracking animals for their well-being.[169] These use cases can improve farming practices, reducing environmental impact while maximizing productivity.
In 2022, 10.5 billion tons of food waste were generated.[170]AI can address food waste by helping individuals monitor consumption and repurpose leftovers, as well as optimize the supply chain to reduce waste and ensure food reaches those in need. [171] [172] [173]The significance of AI for SDG 2 is evident in the substantial number of relevant use cases across different UN repositories: 8 use cases out of 40 in AI for Good: Innovate for Impact,[174] and approximately 60 use cases out of 408 in the UN Activities on AI.[175]

However, the use of robots and other AI technology can be costly, potentially limiting access to a minority of farmers and exacerbating inequalities.[176] [177]This could place additional pressure on farmers with limited resources across various regions to compete against these new technologies. Additionally, more efficient crops do not necessarily guarantee environmental or social improvements.[178]Focusing only on improved crop quality might disregard the environmental impact of increased yields and production. The impact of this could be better assessed due to improved monitoring capabilities. Increased crop yields should not be at the expense of reduced nutritional value for the end consumers.[179]

Key Considerations for Stakeholders

- **Impact assessment:** The development of AI use cases and incentives should be aligned with OECD AI principles to maximize sustainable value creation.[180] The objective is to prioritize governmental tools for AI use cases related to the SDGs.
- **Ownership sharing**: To reduce the risk of monopoly on technologies, new business models should be considered,[181] where value is shared differently to minimize the increase in inequalities and reward all contributors.

Impact

According to a study on the impact of AI on SDG 2 could act as an (positive) enabler for 75% of the targets and act as an inhibitor (negative) for 25% of the targets. (Nature Communications, 2020)

Use case 1

Using AI to drive new farming practices, such as precision farming, to reduce the quantity of pesticides used and to drive food production.

link

Use case 2

Improving AI instruments to improve the efficiency of farming practices and increase the quantity of food produced.

link

Use case 3

Optimizing supply chain and food transport to minimize waste creation and maximize access to nutritional products for various regions.

link

Sustainable Development Goal 3: Well-being

Ensure healthy lives and promote well-being for all at all ages

SDG 3 is experiencing limited progress across all 13 targets, with only 1 target on track (3.9 Health Impact of Pollution).[182] The UN reports a global decline in life expectancy since COVID-19, dropping from 73.1 years in 2019 to 71.4 in 2021. Inequalities among regions significantly contribute to the lack of access to health services and rising death rates, posing challenges for lower- and middle-income countries in achieving their targets.[183]

AI and SDG 3

AI's impact on SDG 3 is well documented in various AI use cases repositories: 20 use cases out of 40 in the *AI for Good: Innovate for Impact,*[184] and approximately 85 use cases out of 408 in the *UN Activities on AI.*[185] For instance, AI can enhance diagnostics by efficiently reviewing patient data. As stated in a recent article of the National Library of Medecine, "With the recent AI revolution, medical diagnostics could be improved to revolutionize the field of medical diagnostics."[186] This extends to the development of new patient approaches, with practitioners increasingly seeking AI-driven tools to enhance patient health and quality of life.[187] For example, new treatments using AI to connect Amyotrophic lateral sclerosis (ALS) patients with their loved ones were presented at the AI for Good Summit 2024.[188] Similarly, robots are now providing comfort to patients and their families by taking over some care activities.[189] Additionally, AI can support and expedite the development of new drugs more efficiently, as demonstrated by the development of one of the vaccines during the Covid_19.[190] AI can also optimize the overall management of health-related processes, making them more cost-effective.[191] By enhancing patient diagnosis and drug development, AI has the potential to reduce the costs of medicine, making it more affordable.

One significant risk associated with AI and SDG 3 is that many of these use cases originate from developed countries, raising concerns about the affordability of these technologies for individuals in countries with fewer resources.[192] This could widen the gap in SDG 3 outcomes between countries. Additionally, mental health is increasingly negatively associated with AI, as practitioners are expected to keep up with new technologies, leading to additional stress and feelings of inadequacy.[193] Governments should account for this risk by putting the user at the center of AI development and supporting patient-centric processes. Furthermore, health data is highly sensitive,[195] and as AI relies on patient data, there is a significant risk of creating biases based on discriminatory dimensions (gender, ethnicity, etc.) or potential data breaches. These risks should be considered in the development of solution.[196]

Key Considerations for Stakeholders

- **WHO six AI principles**: AI solutionsshould be aligned with the six principles advocated by the WHO: 1) Protecting human autonomy, 2) Promoting human well-being and safety and the public interest, 3) Ensuring transparency, explainability and intelligibility, 4) Fostering responsibility and accountability, 5) Ensuring inclusiveness and equity, and 6) Promoting AI that is responsive and sustainable.[197]

Impact

According to a study on the impact of AI on SDG 3, AI could act as an (positive) enabler for 69% of the targets and act as an inhibitor (negative) for 8% of the targets. (Nature Communications, 2020)

Use case 1

Leveraging AI to improve and support patient diagnostics to help make the diagnostic process faster, more efficient and transparent.

link

Use case 2

Using AI instruments to improve the quality of life of patients and their families by generating new technology-driven solutions such as connected prosthetics.

link

Use case 3

Implementing AI solutions at scale to drive down the cost of medicine and related activities.

link

Sustainable Development Goal 4: Education

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Only 1 out of the 10 targets in SDG 4 (4.5 Equal Access to education) in on track, while the remaining targets are either not progressing sufficiently or regressing.[198] This places 300 million students at risk of lacking basic numeracy and literacy skills by 2030 and could result in approximately 84 million children being out of school by the same year.[199] These outcomes are concerning, given that SDG 4 serves as an enabler for various other goals, and a lack of progress in this area could impact the entire 2030 agenda.[200]

AI and SDG 4

AI's impact on SDG 4 is well documented in various AI use cases UN repositories: 7 use cases out of 40 in *AI for Good: Innovate for Impact*[201] and approximately 80 use cases out of 408 in the *UN Activities on AI*.[202] An example of the link between AI and SDG 4 is the use of robots to address the shortage of teachers and introduce innovative teaching methods.[203] Various instances of this use case were showcased in the AI for Good Summit, such as "Robots and AI in Schools" and "Supervised and reinforcement learning through fun robotics activities using ThymioAI educational robots," indicating a growing interest in this area. Additionally, AI can aid in monitoring learning activities and developing personalized and inclusive curricula tailored to each student's needs.[204] [205] Analytics-driven learning can create appropriate content to accommodate diverse learning and teaching situations, which is crucial as students increasingly experience school fatigue and burnout.[206] AI-driven learning solutions are beneficial not only for students but also for facilitating the upskilling and reskilling of workers to continuously acquire relevant skills. This is particularly pertinent as the transition to AI necessitates new skills from the workforce, underscoring the need for reskilling.

However, these practices can be costly and inaccessible for economically disadvantaged communities, widening the skills development gap.[207] [208] To enhance learning opportunities for underprivileged communities, remote content can expand access to educational materials. Digital or AI-generated content accessible globally can help bridge learning gaps.[209]Governments could collaborate with NGOs or international organizations to facilitate the creation of accessible content suitable for diverse communities. Another crucial consideration in the context of AI and education is the proliferation of fake online content.[210] The prevalence of unverified or false information makes it increasingly difficult to discern between accurate and misleading content, hindering education as certain topics are disputed and restricted due to mis/disinformation. Governments should advocate for greater transparency in information dissemination.

Key Considerations for Stakeholders

- **Access:** AI content should be readily accessible to all, not only in terms of cost but also in the manner of information sharing, by adhering to the UNESCO and UNICEF Gateways to Public Digital Learning or the AI and education guidance from UNESCO.[211] [212]
- **Transparency:** To reduce the dissemination of false information, governments could concentrate on creating incentives aligned with established trustworthy AI principles.

Impact

According to a study on the impact of AI on SDG 4, AI could act as an (positive) enabler for 100% of the targets and act as an inhibitor (negative) for 70% of the targets. (Nature Communications, 2020)

Use case 1

Using AI-driven robots to provide new ways for students to learn and to practice content

link

Use case 2

Implementing AI solutions to help map the educational needs of students in a geographical space to better plan school locations.

link

Use case 3

Learning from AI technologies to enhance storytelling skills to drive communication, collaboration and knowledge-sharing.

link

Sustainable Development Goal 5: Gender Equality

Achieve gender equality and empower all women and girls

SDG 5 faces significant data availability challenges, making it difficult to accurately assess its status.[213] However, based on the available data, only 1 target (5.6 Technology for Women Empowerment) is on track. At the current pace, it is projected to take 300 years to end child marriage and 286 years to close the gender gaps in legal protection.[214]

AI and SDG 5

The connection between AI and SDG 5 is not extensively documented in various AI use case repositories from the UN: 3 use cases out of 40 in *AI for Good: Innovate for Impact,*[215] and approximately 90 use cases out of 408 in the *UN Activities on AI.*[216] However, there are a few AI use cases that can contribute to the progress of SDG 5. For example, AI can facilitate the monitoring of the goal at a country or company level, which is particularly relevant given the limited availability of data on gender equality globally.[217] Additionally, AI can support the development of platforms or chatbots for women to quickly seek help in cases of violence or abuse.[218] AI could also drive the use of connected devices in households, reducing the time required for chores. For instance, automated robot cleaners can alleviate some of the burden of household chores,[219] which disproportionately impact women.

While AI can advance certain targets of SDG 5, it is important to address the associated risks for gender equity. For instance, many AI solution developers are men, posing challenges for women to enter this field.[220] According to the World Economic Forum, women make up only 22% of AI professionals globally, only 14% of AI paper authors are women, only 18% of authors at the leading AI conferences are women and just 2% of venture capital was directed towards start-ups founded by women in 2019.[221] This underrepresentation can result in solutions that do not account for women's needs and limit work opportunities for women. Moreover, historical data used in many AI solutions may contain inherent biases. [222] For example, common GenAI tools have associated women's names with words such as "home", "family", or "children", while men's names were linked with "business", "salary", or "career".[223]In finance, AI use can lead to bias against women, limiting their access to loans or credits.[224]Across various sectors, AI-driven bias may restrict women's access to employment, financial services, health services, insurance, and more. Additionally, AI-driven content on social media can exacerbate gender-based roles,[225]leading to challenges with body-image and instanes of toxic masculinity, thereby compromising women's safety on the internet.

Key Considerations for Stakeholders

- **Women-centricity**: The development of AI solutions should be aligned with UNESCO's "Recommendation on the Ethics of Artificial Intelligence" to ensure that human dignity is maintained.[226]
- **Diversity in development:** Provide women and girls the appropriate financial and emotional support to join STEM careers, and work or connect them with NGOs that can provide the right technical skills and ecosystem to push those aspirations forward.[227]

Impact

According to a study on the impact of AI on SDG 5, AI could act as an (positive) enabler for 56% of the targets an act as an inhibitor (negative) for 33% of the targets. (Nature Communications, 2020)

Use case 1

Creating a tool to explore natural language processing (NLP) software to identify biases and stereotypes.

link

Use case 2

Developing of a tool to help measuring Gender Based Violence in Latin America.

link

Use case 3

Designing an AI-driven transit safety app for Manila to Ensure Women's Transport Safety

link

Caitlin Kraft Buchman from **Women at The Table** shares recommendations on ensuring gender equality in AI development and deployment (2024):

- Construct **large new unbiased datasets** with a focus not only on quantity but on quality for the public good. It is important to actively produce open, gender disaggregated datasets; which will better enable an understanding of the sources of bias in AI, and ultimately improve the performance of machine learning systems. We need to Invest in controls to oversee data collection processes and human-in-the-loop verification, so that data is not collected at the expense of women and other traditionally excluded groups. And of course, it is also vital to engage in more inclusive data collection processes that focus, again, not only on quantity but on quality of datasets.
- Pilot AI that allocates 21st century **social protection, subsidies, and scholarships** where women and girls have traditionally been left behind. Encourage public institutions to innovate and lead in this domain. We need to be creative with small, targeted, impactful pilots based on social science research that allocate social incentives, subsidies, or scholarships where women have traditionally been excluded in prior systems. This is a positive agenda to advance values of equality we have long embraced, to correct for the visibility, quality, and influence of women proportionate to the population. STEM education alone will not get us where we want to go.
- Enact **gender responsive public procurement guidelines** for organizations and all levels of government with hard targets and the outline of roles and responsibilities of those organizations required to apply these principles. This could jumpstart new industries and value creation, invented and owned by women and girls, expanding definitions of 'expertise' so that those with lived experience and communities affected by technologies can influence the design, deployment, and control of new technologies.
- Mandate **algorithmic impact assessments** with an integrated approach, and holistically include gender, human rights, and environmental impact. These assessments need to be done beforehand and continuously throughout the lifecycle of the system. We need rigorous testing across the lifecycle and this testing should account for the origins and use of training data, test data, models, Application Program Interface (APIs), and other components over the product lifecycle. AI should improve the quality of, not control, the human experience.
- Enshrine the **public's right to know** the systems that impact their lives if algorithmic decisions have been made that affect an individual and that this right includes continuous consent and ends with contestability of the systems.

Sustainable Development Goal 6: Clean Water

Ensure availability and sustainable management of water and sanitation for all

SDG 6 currently has no targets on track, making it one of the least progressing SDG goals.[228] This lack of progress means that safe drinking water remains out of reach for billions worldwide, with 2.2 billion lacking access to safely drinkable water and 3.5 billion lacking access to safe sanitation.[229] With droughts becoming more common, this situation is expected to worsen, endangering the lives of billions of people. In 2022, roughly half of the world's population experienced severe water scarcity for at least part of the year, while one-quarter faced 'extremely high' levels of water stress.[230]

AI and SDG 6

The connection between AI and SDG 6 is not extensively documented in various AI UN use case repositories: 3 use cases out of 40 in *AI for Good: Innovate for Impact,*[231] and approximately 50 use cases out of 408 in the *UN Activities on AI*.[232] Specific use cases for water improvement can include data monitoring for water management systems, which can optimize water flows to reduce energy and chemical usage while increasing water quantity.[233] This reduction is crucial, as water and wastewater management organizations are expected to invest around US$6.3 billion in AI solutions to enhance their services.[234] Additionally, by improving climate event predictions, AI can better help the system manage large water discharges, which may occur more frequently due to increased flooding from climate change.[235] AI solutions can also be used to locate new water sources for at-risk communities or to test the water quality of those sources.[236] Other use cases include AI-driven farming solutions that reduce the need for irrigation,[237] asset monitoring in water systems to ensure ongoing maintenance,[238] monitoring the quality of lakes and other bodies of water,[239] and the use of AI to drive desalination plant efforts.[240]

However, these solutions are often costly and may not be accessible to all countries or communities.[241] This is particularly critical as water access issues affect regions differently, and most countries affected by water issues are also the poorest,[242] making it even more challenging for them to use AI solutions because AI itself requires significant water usage to function. [243] From producing the supporting hardware to the cooling of data centers, substantial water quantities are needed, which could be polluted or inaccessible for individuals to meet their own needs. The numbers are quite significant, as it is stated that "the global AI demand may be accountable for between 4.2-6.6 billion cubic meters of water withdrawal in 2027, which is more than the total annual water withdrawal of Denmark or half of the United Kingdom".[244]

Key Considerations for Stakeholders

- **Impact assessment:** The development of AI use cases and incentivesshould be aligned with OECD AI principles to maximise sustainable value creation.[245] The objective is to prioritise governmental tools for AI use cases related to the SDGs.
- **Technology improvement**: Reducing water consumption is imperative to support the development of SDG 6 hence technologies with less water use should be prioritized.[246]

Impact

According to a study on the impact of AI on SDG 6, AI could act as an (positive) enabler f,or 100% of the targets and act as an inhibitor (negative) for 63% of the targets. (Nature Communications, 2020)

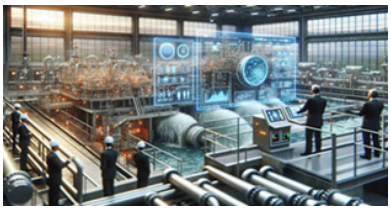
Use case 1

Implementing AI to monitor water consumption and to identify and address overconsumption.

link

Use case 2

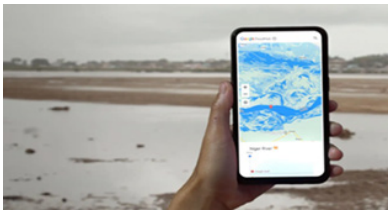
Using AI in wastewater management systems to improve forecasting of the system and reduce costs.



link

Use case 3

Establishing AI use cases that can improve flood and rain prediction to help the system account for water changes.



link

Sustainable Development Goal 7: Affordable and Clean Energy

Ensure access to affordable, reliable, sustainable and modern energy for all

SDG 7 is the only goal where no targets are regressing, and 2 out of 5 targets are currently on track.[247] However, despite this progress, most energy consumed globally is still derived from non-renewable sources, and hundreds of millions of people remain unconnected to the energy grid.[248] According to the UN, at the current rate, 660 million people will still lack electricity, and 1.8 billion will not have access to clean cooking fuels and technologies by 2030.[249]

AI and SDG 7

The relationship between SDG 7 and AI presents a paradox. While AI has the potential to contribute to the achievement of SDG 7, its substantial energy requirements pose a significant challenge to this Goal.[250] There are numerous AI UN use cases that align with SDG 7 objectives, in the various repositories: 4 use cases out of 40 in *AI for Good: Innovate for Impact,*[251] and approximately 50 use cases out of 408 in the *UN Activities on AI.*[252] AI use cases for energy include the development of a smart grid, where energy can be optimized to enhance system efficiency and reduce energy waste.[253] Additionally, AI can be used in data management processes to minimize the energy required for specific tasks or schedule them at times when less energy is needed.[254] This is critical as data storage is projected to contribute to 14% of the world's emissions by 2040.[255] AI can play a crucial role in exploring new energy solutions and materials, such as driving advancements in nuclear fusion[256] and identifying more efficient photovoltaic materials.[257] Furthermore, AI can optimize the production of renewable energy, addressing the unpredictability of sources like wind and solar power.[258]

The adoption of AI technology has led to a significant increase in energy consumption.. AI servers, if operating at full capacity, would consume at least 85.4 terawatt-hours of electricity per year, surpassing the annual energy usage of many small countries.[259]Using this large quantity of energy could make it a challenge to achieve the targets related to SDG 7. This substantial energy demand poses a challenge to achieving the targets of SDG 7, particularly impacting poorer communities' access to affordable energy[260]and their ability to prioritize renewable energy over fossil fuels.

Key Considerations for Stakeholders

- **Impact assessment:** Align AI use case development and incentives with OECD AI principles to maximize sustainable value creation.[261] The objective is to prioritize governmental tools for AI use cases related to the SDGs.
- **Technology improvement**: Prioritizing technologies with lower energy requirements is crucial to support the development of SDG 7 by reducing overall energy consumption.[262]

Impact

According to a study on the impact of AI on SDG 7. AI could act as an (positive) enabler for 100% of the targets and act as an inhibitor (negative) for 40% of the targets. (Nature Communications, 2020)

Use case 1

Using AI to optimize the supply and demand of the energy grid to improve efficiency and minimize waste.

link

Use case 2

Implementing AI solutions for data centers to reduce the overall energy impact of data processing or storing.

link

Use case 3

Focusing on AI solutions to develop more efficient materials for energy production, such as photovoltaic cells.

link

Sustainable Development Goal 8: Decent Work and Economic Growth

Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Half of the 12 targets of SDG 8 are regressing, with only 1 (8.10 Access to financial services) on track.[263] This means that approximately two billion workers remain in precarious informal jobs.[264] The UN highlights that progress towards SDG 8 is hindered by challenges stemming from the aftermath of COVID-19, trade tensions, increasing debts in developing nations, conflicts, and geopolitical conflicts, collectively posing threats to global economic growth. [265]

AI and SDG 8

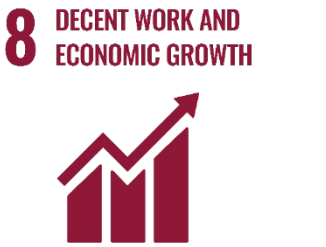
Various papers suggest that the automation of tasks with AI is expected to indirectly yield positive impacts on the SDG goals.[266] This includes the potential for growth and employment to generate social and environmental value, such as creating new income streams for communities (SDG 1 and SDG 10) and improving agricultural practices (SDG 2).[267] That being said, the synergy between AI and SDG 8 is well-documented within the UN system: 9 use cases out of 40 in *AI for Good: Innovate for Impact,*[268] and approximately 100 use cases out of 408 in the *UN Activities on AI.*[269]

While there are numerous use cases for SDG 8, the primary focus of the literature centers on the impact of AI on economic growth, a first target of SDG 8. One report suggests that the adoption of AI could potentially generate approximately US$15.7 trillion by 2030, or a 16 % higher cumulative GDP compared with today,[270] while others express more pessimism. Economist Daron Acemoglu, for instance, suggests a more modest GDP boost of approximately 0.93% to 1.16% over the next decade.[271] Various factors, including investment levels, adoption rates, and the extent of change, will influence these projections. Governments are therefore positioned to create the necessary framework to facilitate AI advancement within organizations. While the precise percentage improvement remains uncertain, all sources concur that AI will indeed impact economic growth. However, this pursuit of economic growth may give rise to additional environmental challenges, as the current economy is not detached from environmental degradation.[272]

Another consideration is the connection between AI and job transitions. While using AI will necessitate new skills and talent to facilitate the transition, automation could result in the displacement of numerous jobs.[273] Furthermore, AI has the potential to automate the most mundane tasks, allowing workers to concentrate on more interesting aspects of their roles.[274] Governments should therefore take steps to support job transitions and prevent the widening of talent gaps that could exacerbate inequalities.

Key Considerations for Stakeholders

- **Impact assessment:** Aligning AI use case development and incentives with OECD AI principles to maximize sustainable value creation.[275] The objective is to prioritize governmental tools for AI use cases related to the SDGs.
- **Job transition support**: Supporting the workforce access to new skills while considering diversity to minimize the increase in inequalities.



Impact

According to a study on the impact of AI on SDG 8, AI could act as an (positive) enabler for 92% of the targets and act as an inhibitor (negative) for 33% of the targets. (Nature Communications, 2020)

Use case 1

Using AI to drive the growth of countries and benefits in providing more products and services.

link

Use case 2

Implementing open-source AI solutions could help drive free access to educational content and information.

link

Use case 3

Applying tools for smaller companies processes can help them be more efficient and to compete on the market, while making them more sustainable.

link

Sustainable Development Goal 9: Industry, Innovation and Infrastructure

Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

SDG 9 is experiencing uneven progress, with only 2 out of 8 targets currently on track (9.5 Research and development and 9.c Access to ICT & Internet).[276] The UN reports that since 2022, the manufacturing sector has faced stagnation, attributed to geopolitical instability, inflation, logistical challenges, rising energy costs, and a broader global economic slowdown. Globally, the share of employment in manufacturing has declined, despite some progress in reducing CO_2 intensity in manufacturing, which still falls short of the 2030 target values. [277]

AI and SDG 9

Similar to SDG 8, the interplay between SDG 9 and AI is expected to yield indirect positive impacts for numerous other SDGs.[278] [279] AI-driven solutions will contribute to potential SDG impact through technological advancements, which is a key focus area of SDG 9. [280] This synergy is well-documented, with numerous UN use cases identified: 14 use cases out of 40 in *AI for Good: Innovate for Impact,*[281] and approximately 140 use cases out of 408 in the *UN Activities on AI*.[282]

Various specific AI use cases can indeed link AI to SDG 9. Firstly, AI can enhance research efficiency, as evidenced by ar ececent study, which indicated 8% of its recent articles mention AI, with around half of 1,600 surveyed scientists considering AI a crucial research tool.[283] AI's ability to process large volumes of data supports improved data-driven insights creation and enables innovators to focus on higher-value tasks while automating tedious ones.[284] Secondly, AI can provide access to previously unusable data or information, such as processing social media text, satellite images, or videos promptly, which was previously time-consuming.[285] Furthermore, AI can significantly contribute to industrialization and manufacturing capacity by optimizing manufacturing processes, product design, and enhancing risk control efficiency.[286]

Given the crucial role of AI in supporting the implementation of the SDGs, it is vital to ensure that these use cases are prioritized.[287] This is especially critical in the context of funding, as current research funds for AI applications often prioritize commercial interests, potentially leading to a risk of neglecting SDG-related development.[288] Consequently, AI use cases with positive environmental and social impacts may be overlooked in favor of economically lucrative ones.

Key Considerations for Stakeholders

- **Financial incentives:** To support the development of SDG-related use cases, research funding should also be allocated to socially or environmentally beneficial use cases.
- **Impact assessment:** Aligning AI use case development and incentives with OECD AI principles to maximize sustainable value creation.[289] The objective is to prioritize governmental tools for AI use cases related to the SDGs.

Impact

According to a study on the impact of AI on SDG 9, AI could act as an (positive) enabler for 100% of the targets and act as an inhibitor (negative) for 50% of the targets. (Nature Communications, 2020)

Use case 1

Using new AI technologies to further develop the AI technical ecosystem and help it be more efficient and more suitable for generating innovation.

link

Use case 2

Implementing standardization of technology and processes to support AI growth, innovation, and collaboration.

link

Use case 3

Connecting AI start-ups to the SDGs gaps to drive new AI-driven use cases aligned with the SDGs.

link

Sustainable Development Goal 10: Reduced Inequalities

Reduce inequality within and among countries

SDG 10 currently has only 1 out of 10 targets (10.b resources flow for development) on track.[290] Before the pandemic, the forecasted inequality stood at -0.8% but has now risen to 4.4%, posing challenges for countries in achieving their SDG agenda.[291] Furthermore, discrimination based on age, gender, religion, race, or belief affects one in six people globally. In 2023, there was a record high of 35.8 million refugees, and over 8,000 migrant deaths were recorded worldwide.[292]

AI and SDG 10

The connection between AI and SDG 10 is extensively documented in various AI use case repositories from the UN: 14 use cases out of 40 in *AI for Good: Innovate for Impact,*[293] and approximately 110 use cases out of 408 in the *UN Activities on AI.*[294] These use cases encompass a range of topics, including the monitoring of weather events or conflicts for at-risk communities.[295] By consolidating information from diverse sources such as official reports and social media, AI can assist governments and NGOs in effectively tracking situations in different communities to identify risks and take appropriate action. Additionally, AI has the potential to aid refugee support by helping to identify welcoming communities, creating chatbots to assist, and optimizing refugee camps, among other applications.[296]

While these use cases are valuable in illustrating the synergy between AI and SDG 10, it is crucial not to overlook the associated risks for inequalities. Firstly, the majority of AI solution ownership is concentrated in a few countries (primarily in the Global North) or large companies, leading to the centralization of benefits in specific locations[297] and unequal distribution of ownership and value, potentially exacerbating inequalities.[298] For instance, the training of AI models using data from individuals or small and medium-sized enterprises (SMEs) often occurs without financial compensation for sharing their content and work.[299] Secondly, the development of AI solutions typically reflects the needs and values defined by the developer, potentially resulting in significant biases, particularly as much of the technology is concentrated in specific geographic locations.[300]

While this matter has been discussed from a gender perspective, it also applies to country diversity and underrepresented communities. Lastly, while AI can monitor at-risk populations for their benefit, it can also be misused by malicious organizations to achieve the opposite outcome, endangering these populations.[301] There is a legitimate concern that AI could be employed for surveillance of humanitarian efforts, perpetuating hate towards minorities, and providing tools to monitor populations and restrict freedom of movement when necessary.

Key Considerations for Stakeholders

- **Ownership sharing**: To reduce the risk of monopoly on technologies, new business models should be considered,[302] where value is shared differently to minimize the increase in inequalities and reward all contributors.
- **User-centric**: Align the development of AI solutions with the "Recommendation on the Ethics of Artificial Intelligence" from UNESCO to ensure that human dignity is maintained.[303]

Impact

According to a study on the impact of AI on SDG 10, AI could act as an (positive) enabler for 90% of the targets and act as an inhibitor (negative) for 70% of the targets. (Nature Communications, 2020)

Use case 1

Aggregating various data points from social media to assess critical situations for minorities and support in case of problems or risks.

link

Use case 2

Using an AI platform to help refugees find the best information in their time of need by leveraging chatbots.

link

Use case 3

Training AI to recognize biases in historical data to develop new solutions that are more inclusive.

link

Sustainable Development Goal 11: Sustainable Cities and Communities

Make cities and human settlements inclusive, safe, resilient and sustainable

Data availability for SDG 11 is notably low, with only 35% of data available, posing challenges in assessing progress on the targets.[304] Currently, only 1 out of the 10 targets (11.6 Urban air quality & waste management) is on track. This translates into 1.1 billion urban residentsliving in slums, with this number expected to rise to 2 billion in the next 30 years.[305] As cities continue to expand globally, the significance of SDG 11 is growing, with an estimated five billion people expected to reside in cities by 2050, compared to 3.3 billion in 2014.[306]

AI and SDG 11

The relationship between AI and SDG 11 is well-documented, with numerous AI use cases: 17 use cases out of 40 in *AI for Good: Innovate for Impact*,[307] and approximately 80 use cases out of 408 in the *UN Activities on AI*.[308] This demonstrates the breadth of AI applications available to advance smart cities and align with a forward-looking vision. Notably, several articles highlight the benefits of leveraging AI to develop smart cities.[309] AI has the potential to enhance cities by promoting environmental sustainability through energy efficiency and space optimization, [311] [312] as well as by improving the overall livability and organization of urban areas through enhanced transportation systems.[313] [314] Furthermore, the adoption of AI in smart cities has shown promise in reducing inequalities compared to traditional cities.[315] Additionally, AI can also be used to help in the design of cities and to drive urban planning.[316] [317] Additionally, AI can play a crucial role in city design and urban planning, providing urban planners with tools to expedite decision-making processes and prioritize citizen needs, ultimately leading to more inclusive and sustainable city development. Moreover, AI can contribute to enhancing city security by facilitating the monitoring of urban activities.[318]

One important aspect to consider is the need to build trust and transparency with citizens regarding the value of smart cities and the responsible use of data. [319] For instance, one attempt to establish a smart city in Toronto failed due to a lack of public trust, highlighting the critical importance of citizen involvement in the development of smart cities.[320] It is also important to mitigate the potential risks associated with AI, such as the risk of conducting surveillance on specific communities, as identified in SDG 10. [321] Additionally, within the context of SDG 11, the preservation of cultural and natural heritage (SDG 11.4) is paramount. There is a growing concern about the potential homogenization of the creative sector by AI, which could stifle creative diversity. [322] It is important to recognize the risk that a limited number of AI tools influencing areas such as arts and architecture may lead to a reduction in cultural diversity within the sector.

Key Considerations for Stakeholders

- **Data privacy:** Insufficient trust in data sharing has the potential to diminish the effectiveness of smart cities.[323] Governments need to establish robust privacy frameworks to prevent data over-sharing and mitigate associated concerns**.**
- **User-centric**: Align the development of AI solutions with the "Recommendation on the Ethics of Artificial Intelligence" from UNESCO to ensure that human dignity is maintained.[324]

Impact

According to a study on the impact of AI on SDG 11, AI could act as an (positive) enabler for 100% of the targets and act as an inhibitor (negative) for 20% of the targets. (Nature Communications, 2020)

Use case 1

Developing smart cities that are less environmentally impactful, and more enjoyable for the urban population using AI and technologies.

link

Use case 2

Using an AI platform to help increase the security of cities by monitoring and flagging any risks for the citizens.

link

Use case 3

Developing cities plan and urban solutions using AI to improve the development process and connect it to the needs of the citizens.

link

Sustainable Development Goal 12: Responsible Consumption and Production

Ensure sustainable consumption and production patterns

Data availability for SDG 12 is notably limited, with only 32% of data availability, posing challenges in tracking progress towards the targets.[325] Currently, only 4 out of the 11 targets are deemed to be on track, underscoring the critical nature of the situation.[326] This is critical since SDG 12 is a direct enabler of various other SDGs such as SDG 13 - Climate Action, and could thus make it more challenging to reach those goals.

AI and SDG 12

AI plays a crucial role in supporting the green transition as shown by the list of various AI UN use cases for SDG 12: 8 use cases out of 40 in *AI for Good: Innovate for Impact*,[327] and approximately 50 use cases out of 408 in the *UN Activities on AI*.[328] AI can support SDG 12 in process optimization and driving circularity in organizations.[329] For example, AI can be used for environmental data monitoring and optimization related to energy use, waste generation, GHG emissions, logistics, and other environmental data.[330] This monitoring can help companies make data-driven decisions that incorporate environmental considerations, thereby reducing their overall environmental impact.[331] This also extends to individuals who now have access to improved data on the products they buy, and can nudge behaviors towards more sustainable options, forcing companies to adapt in turn.[332] In the fashion sector, for instance, AI can be used to provide personalized recommendations to avoid waste or use predictive analytics to help with forecasting.[333] Furthermore, the proliferation of data can enhance sustainability reporting, fostering collaboration with external stakeholders, attracting investors, and ensuring compliance with environmental regulations.[334] This streamlined approach to data reporting can help advance SDG 12.6 – Corporate Sustainable Practices.

In addition to these use cases, AI also poses some risks for SDG 12. Specifically, process improvement and optimizing may not necessarily align with positive environmental impact.[335] Increased efficiency could incentivize organizations to produce more thereby using more resources. Moreover, the use of AI in social media and marketing may further drive consumer consumption by making targetter marketing more efficient.[336] However, AI can play a positive role in identifying and mitigating greenwashing claims by raising the disclosure quality of ESG rating scores.[337] However, the substantial resources required for AI implementation can pose challenges in aligning with SDG 12, as shown with SDG 6 and SDG 7.

Key Considerations for Stakeholders

- **Impact assessment:** Aligning AI use case development and incentives with OECD AI principles to maximize sustainable value creation.[338] The objective is to prioritize governmental tools for AI use cases related to the SDGs.
- **Technology improvement**: Reducing energy consumption is imperative to support the development of SDG 12, hence technologies with less energy requirements should be prioritized.[339]

Impact

According to a study on the impact of AI on SDG 12, AI could act as an (positive) enabler for 82% of the targets and act as an inhibitor (negative) for 27% of the targets. (Nature Communications, 2020)

Use case 1

Providing access to environmental data to end-customers to nudge them into selecting the most sustainable option.

link

Use case 2

Monitoring environmental data with AI to drive sustainability reporting capacity for organizations.

link

Use case 3

Using AI to reduce forecasting risks within the supply chain and to minimize waste creation.

link

Sustainable Development Goal 13: Climate Action

Take urgent action to combat climate change and it's impacts

SDG 13 shows limited progress, with 2 out of 5 targets advancing moderately [340] This lack of progress could lead to 2.5°C degree warming by 2 100,[341] posing a direct threat to all other SDGs. For example, climate change cost the economy an average of US$803 billion between 2019 and 2020, impacting SDG 8, and increasing mortality rates in vulnerable regions, affecting progress towards SDG 3.[342]

AI and SDG 13

The relationship between AI and SDG 13 is well-documented, with numerous use cases highlighted in various UN repositories: 7 use cases out of 40 in *AI for Good: Innovate for Impact*,[343] and around 110 use cases out of 408 in the *UN Activities on AI*.[344] Similar, to other environmental SDGs, the synergy between AI and SDG 13 is a paradox. On one side, numerous use cases can enhance climate actions by using AI, while on the other side, the energy usage and increase in consumption behaviors from AI put the entire relationship at risk.[345] Interesting use cases from AI include the optimization of logistics such as freight roads to minimize CO_2 emissions, where the road used is for example the least carbon-intensive.[346] This is a valuable reduction, as transport accounts for around one-fifth of global CO_2 emissions.[347]Additionally, AI can be used to drive CO_2 measurement and can give additional visibility to the causes and effects of climate change to governments.[348]It can also help governments better monitor their climate impact and make informed decisions around it.[349] Moreover, AI can also be used to provide improved forecasting abilities on weather events, to help governments and organizations better prepare for adverse climate events, and also better prepare the regions to support such catastrophes.[350] Additional AI use cases for the climate include mapping melting behaviors of icebergs, helping communities at risk to better mitigate climate impact or supporting organizations in finding pathways to decarbonize.[351] AI can give the right tools to governments to better predict and plan the challenges that climate change will generate.

The rise of AI use cases, however, can also be problematic for SDG 13 as AI consumes important energy, which does not only originate from renewable energy, and lead to the creation of 0.01% of the GHG emissions currently.[352] The question arises with the socialization of AI to see if this number is going to rise, as the demand for AI by 30% - 40% annually. Developing new efficient models could be a pathway to minimize any growth impact of AI. Another problem could regard the rise of new use cases such as marketing-driven cases that push for consumerism, and thus for the purchase of new products and services that would generate GHG emissions to be produced and managed.[353]

Key Considerations for Stakeholders

- **Impact assessment:** Aligning AI use case development and incentives with OECD AI principles to maximize sustainable value creation.[354] The objective is to prioritize governmental tools for AI use cases related to the SDGs.
- **Technology improvement**: Reducing energy consumption is imperative to support the development of SDG 13, hence technologies with less energy requirements should be prioritized.[355]

13 CLIMATE ACTION

Impact

According to a study on the impact of AI on SDG 13, AI could act as an (positive) enabler for 80% of the targets and act as an inhibitor (negative) for 20% of the targets. (Nature Communications, 2020)

Use case 1

Using AI to optimize the CO2 emissions of organizations from transport, distribution and logistics.

link

Use case 2

Leveraging AI to assess the new frontiers of climate science and provide a better understanding of our climate and climate change.

link

Use case 3

Implementing AI forecasting solutions for weather events to better prepare communities for adverse weather events and the risks associated.

link

Sustainable Development Goal 14: Life Below Water

Conserve and sustainably use the oceans, seas and marine resources for sustainable development

SDG 14 faces significant challenges, with 4 out of 19 targets regressing and only one on track.[356] The ocean is at risk due to ocean warming, acidification, plastic pollution, over-fishing, and coastal eutrophication, endangering the livelihoods of three billion people who rely on the ocean for sustenance and income.[357] [358]

AI and SDG 14

The synergy between AI and SDG 14 is underrepresented, with a limited number of documented UN use cases: 1 use case out of 40 in *AI for Good: Innovate for Impact*,[359] and approximately 40 use cases out of 408 in the *UN Activities on AI*.[360] AI can be used to monitor and track the biodiversity underwater,[361] giving scientists and governments a better understanding of the risks marine life is facing to protect it. Additionally, AI can be used to develop new transporting solutions on water inspired by the mobility of life underwater.[362] AI can be used to improve the monitoring of ships, which is beneficial given that approximately 80% of goods are transported by ships and could therefore benefit from new transportation approaches.[363] Using AI to optimize routes while considering the environment, could provide important benefits for the waterways.[364] Similar to SDG 13, AI can be used to provide the government with new climate forecasting tools that could better plan for extreme weather events and help communities living in coastal areas to better prepare. [365] AI can also help robots clean the plastic from the ocean[366] or support the discovery of oil spills.[367]

Although there are numerous compelling use cases for SDG 14, it's important to acknowledge the potential negative impacts of AI on this goal. AI's significant water use, as shown in SDG 6,[368] and its potential to increase the fishing industry's productivity, can exacerbate overfishing, are key concerns.[369] However, AI can also be employed to monitor and limit overfishing, provided there is international collaboration to prevent actors from benefiting.

Key Considerations for Stakeholders

- **International collaboration:** Alignment of good practices around AI is important to make sure that all actors can collaborate.[370]
- **Technology improvement**: Reducing energy consumption is imperative to support the development of SDG 14, hence technologies with less energy requirements should be prioritized.[371]

Impact

According to a study on the impact of AI on SDG 14, AI could act as an (positive) enabler for 90% of the targets and act as an inhibitor (negative) for 30% of the targets. (Nature Communications, 2020)

Use case 1

Monitoring biodiversity underwater using AI to give governments and organizations a tool to better protect it.

link

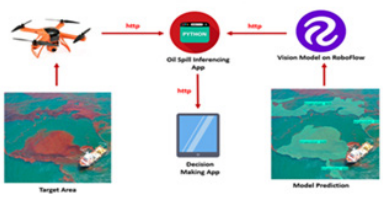
Use case 2

Leveraging AI to develop a new transporting approach inspired by underwater biodiversity.

link

Use case 3

Using AI to identify oil spills or leakages early, to minimize the risks of a damaging oil spill.



link

Sustainable Development Goal 15: Life on Land

Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Like other environmental SDGs, SDG 15 encounters significant challenges, with only 2 out of 12 targets currently on track. [372] This lack of progress poses a threat to biodiversity, with the world experiencing its largest species extinction since the Cretaceous Period (dinosaur age), ongoing forest loss, and land degradation.[373] Additionally, the lack of progress jeopardizes other SDGs, as many communities rely on land safety and biodiversity for survival, directly linking to climate change.[374]

AI and SDG 15

The connection between AI and SDG 15 is well-documented, with numerous UN use cases: 7 out of 40 in *AI for Good: Innovate for Impact*,[375] and approximately 45 use cases out of 408 in the *UN Activities on AI*.[376] Particularly, there are several AI applications related to SDG 15 that include monitoring land-use change.[377] Land use change refers to the change of typology of a specific land, such as deforestation or desertification,[378] which is also often used as a proxy for biodiversity impact.[379] Using satellite images, AI can show what is happening on the ground, thereby helping organizations limit the deforestation of their activities, but also help governments protect those areas. These solutions can also help with planning land management and reforestation.[380] Additionally, AI can be used to help count and monitor biodiversity.[381] For instance, AI can analyze recorded forest noises or videos to identify the species present, providing insights into the local ecosystem and animal behaviors. This aids scientists in devising effective conservation strategies. Additionally, AI assists the government in anti-poaching efforts by enabling rangers to optimize patrol routes using randomization and historical data for enhanced efficiency and poacher deterrence.[382]

These use cases demonstrate the potential of AI to advance SDG 15, but it's crucial to establish guardrails to ensure mutual support between AI and SDG 15. AI's potential for biodiversity preservation must be balanced against the risk of exploitation by poachers or other malicious actors.[383] Moreover, the development of AI hardware solutions requires specific resources, which could impact land use and contribute to pollution.[384] Similarly, the production and marketing of goods using AI can drive land usage change and biodiversity loss, highlighting the need for careful consideration of AI's environmental impact.[385]

Key Considerations for Stakeholders

- **International collaboration:** Alignment on good practices around AI are important to make sure that all actors can collaborate on those matters.
- **Technology improvement**: To reduce the quantity of energy consumed would be imperative to support the development of SDG 15, hence technologies with less energy requirements should be prioritized.[386]

Impact

According to a study on the impact of AI on SDG 15, AI could act as an (positive) enabler for 100% of the targets and act as an inhibitor (negative) for 33% of the targets. (Nature Communications, 2020)

Use case 1

Monitoring biodiversity status using AI to provide governments with improved information on pathways to protect it.

link

Use case 2

Using AI to review deforestation to assure to have precise information and make informed decisions.

link

Use case 3

Implementing AI solutions to help the government prevent poaching.

link

Sustainable Development Goal 16: Peace, Justice and Strong Institutions

Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

SDG 16 encounters significant challenges, with no targets currently on track.[387] This lack of progress is evident in the 50% surge in civilian deaths in 2022, the global displacement of 104.8 million individuals by the end of 2022, and the identification of nearly 200,000 trafficking victims between 2017 and 2020.[388]

AI and SDG 16

AI's connection with SDG 16 is well-documented, with numerous use cases in AI repositories: 5 out of 40 in the *AI for Good: Innovate for Impact*,[389] and approximately 135 use cases out of 408 in the *UN Activities on AI*.[390] This highlights the significance of AI for SDG 16 and underscores the critical role of strong and inclusive institutions in AI development. Specifically, AI applications include driving efficient and equitable justice,[391] improving government record-keeping and identification processes,[392] enhancing national security through crime prediction, and detecting money laundering activities.[393]

AI presents both opportunities and challenges in achieving SDG 16. On one hand, AI can provide governments with tools to enhance public safety and justice. On the other hand, it could also be exploited for governmental abuse.[394] A key area where AI intersects with governance is through its use in social media, which can influence citizen behavior by polarizing opinions.[395] Recommendation algorithms often reinforce users' interests by repeatedly exposing them to the same content (creating echo chambers) and limiting access to diverse viewpoints (filter bubbles). This restricts citizens' exposure to new ideas and credible information, potentially deepening extreme beliefs.[396] The spread of misinformation through AI-generated content, such as deepfakes or biased data, complicates the process of discerning truth.[397]

This not only undermines social cohesion but also impacts individuals and the legal system. Detecting deepfakes, for instance, requires specialized tools, making it difficult for people to verify the authenticity of information.[398] Lastly, the centralization of AI ownership by a few entities can restrict participation, both among countries and individuals.[399] This consolidation of power may lead to limitations in social systems, as those who control AI could influence who benefits and who is excluded from its advancements.

Key Considerations for Stakeholders

- **Data privacy:** Lack of trust in data sharing could reduce the potential of smart cities.[400] Governments should make sure to create an appropriate privacy framework to avoid any problems with the over-sharing of data.
- **User-centric**: Align the development of AI solutions with UNESCO's Recommendation on the Ethics of Artificial Intelligence' that human dignity is maintained.[401]

Impact

According to a study on the impact of AI on SDG 16, AI could act as an (positive) enabler for 58% of the targets and act as an inhibitor (negative) for 25% of the targets. (Nature Communications, 2020)

Use case 1

Using AI powered technologies to drive safer cities

link

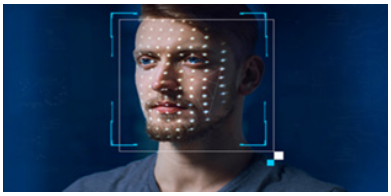
Use case 2

Developing AI-technologies to give access and discuss them in forums to legal support and legal system to anyone who might need it.

link

Use case 3

Leveraging AI to assess whether some content accessed is deep fake or real information.



link

Sustainable Development Goal 17: Partnerships for the Goals

Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

SDG 17 faces significant challenges, with only 5 out of 19 targets currently on track.[402] This lack of progress poses a threat to the entire SDG 2030 agenda, as SDG 17 is pivotal in creating the necessary environment to drive progress across all other SDGs. The UN has highlighted a substantial US$4 trillion annual investment gap for developing countries to achieve the SDGs, along with persistent challenges such as high external debt levels and limited online connectivity in low-income countries.

AI and SDG 17

The synergy between AI and SDG 17 is well documented as seen by the quantity of AI UN use cases in the various repositories: 10 use cases out of 40 in *AI for Good: Innovate for Impact*,[403] and approximately 135 use cases out of 408 in the *UN Activities on AI*.[404] This underscores the potential for AI to propel SDG 17 forward by providing essential tools to accelerate global partnerships for sustainable development.[405] For instance, AI can support brainstorming activities by creating virtual environments to enhance collaboration between different actors[406] and analyze real-time data to keep teams informed[407] and provide real-time feedback for faster international action.[408] Moreover, AI's role in driving GDP growth (SDG 8) can enable governments to explore new sources of tax revenue (17.1), although it is crucial to ensure fair and efficient taxation of AI.[409] Additionally, AI can assist organizations in improving tax compliance, thereby bolstering financial support for sustainable development initiatives.[410]

An important consideration is the pivotal role of AI and data ownership in shaping the dynamics between countries.[411] The development of more use cases from the Global North could exacerbate the imbalance in collaboration, potentially marginalizing the Global South in the international AI landscape.[412] Recognizing the potential of AI to impact the 2030 Agenda, governments and international organizations have initiated the development of new international organizations or agreements to promote collaboration and international support, such as the "European Group on Ethics in Science and New Technologies: Statement on Artificial Intelligence, Robotics and 'Autonomous' Systems", and "OECD: OECD Principles on AI".[413]

Key Considerations for Stakeholders

- **Collaboration**: Align the development of AI solutions with international recommendations or agreements such as UNESCO's 'Recommendation on the Ethics of Artificial Intelligence' and the OECD Principles of AI to further support the development of international collaboration.[414]

17 PARTNERSHIPS FOR THE GOALS

Impact

According to a study on the impact of AI on SDG 17, AI could act as an (positive) enabler for 26% of the targets and act as an inhibitor (negative) for 11% of the targets. (Nature Communications, 2020)

Use case 1

Aligning AI development locally in line with external requirements such as the OECD Principles of AI.

link

Use case 2

Using AI to drive brainstorming activities and real-time feedback to make collaboration more efficient.

link

Use case 3

Leveraging AI solutions to support tax monitoring.

link

Conclusion

AI holds immense potential to drive positive change, but like any tool, its impact depends on how it is used. Governments, businesses, and society must work together to steer AI toward advancing social good rather than causing harm. While AI can be used to decarbonize economies, reduce inequalities, and improve health outcomes, it can also be misused, monopolize industries and increase inequality. Ensuring AI aligns with the SDGs is critical to maximizing the benefits to society.

To achieve this, governments must take proactive steps. First, aligning AI development with sustainable goals and following best practices will ensure that new use cases contribute to social and environmental progress. This means creating policies that incentivize AI projects that focus on long-term societal benefits over short-term profits.

Governments also need to provide funding for AI initiatives that might not be commercially profitable initially but address critical social or environmental matters, such as climate change or health care access in underserved regions.

Transparency is another key aspect. AI systems must be open about how they work and which datasets they use to avoid biases or abuses in decision-making. Clear regulations should be in place to ensure ethical AI deployment, and users should be informed about how their data is being used and be offered a right of reply.

In addition, ensuring that marginalized groups—such as women and minorities—have access to skills development program is vital. By promoting diversity in the tech workforce and closing the digital skills gap, governments can help ensure that AI benefits everyone equally and reduces job displacement and transition impacts.

Furthermore, innovative financial models are necessary to ensure AI's benefits are shared equitably across society. This includes creating systems that prevent wealth concentration among a few tech giants and ensure fair compensation and transition pathways for workers in AI-affected industries.

Finally, access to AI technology should be broad to ensure that the benefits of AI are shared globally, not just concentrated in wealthier countries or large corporations. At the same time, ongoing technological improvements are needed to minimize AI's environmental footprint, ensuring its use does not contribute to long-term ecological damage.

This list of focus areas and key considerations can help support governments and policymakers to successfully channel AI in support of the UN SDGs, ensuring that AI initiatives are ethical, inclusive, and effective.

1) AI Policy, Governance and Ethical Standards

Developing a cohesive framework that integrates AI policies, governance, and ethical standards is essential. Clear and effective policies guide the ethical and equitable deployment of AI technologies, ensuring they align with national goals and the UN SDGs. Strong governance and regulatory guardrails ensure AI systems are used responsibly, minimizing risks related to privacy, security, and fairness. Establishing ethical standards guarantees that AI respects human rights and societal values, fostering trust and accountability in its development and application.

Key considerations:

- Adopt and tailor international frameworks: Base national AI policies on established frameworks adapting them to local needs and priorities.
- Develop a comprehensive national AI strategy: Create a strategy that integrates ethical principles, governance, and national challenges.
- Implement and enforce ethical standards: Ensure fairness, transparency, and accountability by developing and enforcing ethical guidelines.
- Foster stakeholder engagement: Involve diverse stakeholders in shaping and monitoring AI policies to ensure broad representation and accountability.

2) Capacity Building and Education

Building AI skills and knowledge through capacity building and education is vital for bridging the AI digital divide. Enhancing institutional and individual capabilities ensures that both present and future generations are equipped to leverage AI's benefits. Robust educational programs provide professionals with the essential knowledge for successful AI integration, while capacity building strengthens institutions to support and sustain AI-driven advancements, creating a more inclusive and equitable technological future.

Key considerations:

- Integrate AI into curricula: Incorporate AI and data science education across all levels, from early education to higher education, to build foundational skills and prepare future generations for an AI-driven world.
- Develop training programs: Establish targeted training and certification programs for AI professionals and policymakers to ensure they have the necessary skills and expertise for AI development and governance.
- Support research and development: Invest in R&D to drive AI innovation, advance knowledge, and develop cutting-edge applications that benefit national development.
- Establish scholarships for underrepresented groups: Implement targeted scholarship programs to support individuals from diverse backgrounds in AI education and training.

3) Promote Responsible AI Investment

Investment is crucial for advancing technological capabilities, driving innovation, and ensuring effective implementation of AI applications across sectors. It can help boost economic growth, enhance competitiveness and facilitate international collaboration.

Key considerations:

- Incentivize responsible AI research and development: Provide grants, tax incentives, or subsidies for projects that prioritize ethical considerations, sustainability, and social impact in AI research and development.
- Promote public-private partnerships: Foster collaboration between government, academia, and industry to develop and implement best practices for responsible AI and facilitate knowledge sharing and innovation.
- AI responsible innovation fund: Allocate funds to support startups and scale-ups developing AI technologies that advance the UN SDGs or other AI projects that aim to solve social and environmental matters. This fund could offer financial support, mentorship, and resources to AI-driven ventures that contribute to sustainable development and enhance social impact.

4) Inclusive Innovation and Representative Data

Promoting inclusive innovation ensures that AI technologies benefit all segments of society and address diverse requirements and perspectives. Representative data sets that reflect national identities, languages, and cultures are essential for developing AI systems that are inclusive and effective across diverse contexts.

Key considerations:

- Collect diverse data: Ensure that data collection reflects national diversity in language, culture, and socio-economic factors to develop AI systems that are inclusive and representative.
- Address data bias: Implement measures to identify and mitigate biases in data, ensuring AI technologies are fair and equitable across all demographic groups.
- Promote open data initiatives: Support initiatives that provide access to diverse and representative data sets, fostering transparency and broadening the scope of AI research and development.
- Encourage diverse teams: Foster diversity in AI research and development teams to incorporate a wide range of perspectives and expertise, enhancing innovation and inclusivity in AI solutions.
- Support inclusive research: Fund research and projects that focus on underserved communities and address diverse needs, ensuring that AI technologies serve all segments of society effectively.

5) Stakeholder collaboration

Collaboration between governments, the private sector, and civil society will be essential for the successful implementation of AI. By working together, these sectors can ensure that AI technologies address broad societal needs, adhere to ethical standards, drive innovation and deliver trustworthy outcomes. Cross-sector partnerships can provide the resources and expertise needed to develop AI solutions that meet diverse needs and are socially responsible. Such partnerships can foster a more comprehensive approach to AI, enhancing transparency, accountability, and the overall impact of AI initiatives.

Key considerations:

- Establish collaborative platforms: Create formal platforms or forums where representatives from government, industry, and civil society can regularly meet to discuss AI developments, share insights, and coordinate efforts.
- Develop joint initiatives: Launch joint projects and initiatives that bring together resources and expertise from all sectors to tackle specific AI challenges and opportunities, ensuring that diverse perspectives are integrated.
- Promote transparent communication: Foster open and transparent communication channels among stakeholders to build trust, address concerns, and ensure that all voices are heard in AI policy and development discussions.
- Support multi-sector research: Encourage research collaborations that involve academics, industry professionals, and policymakers to explore innovative AI solutions and address complex societal issues from multiple angles.
- Create shared standards and guidelines: Develop and agree upon common standards and guidelines for AI development and implementation, ensuring consistency and alignment across sectors while respecting diverse interests.

6) AI Safety, Security and Human Rights

Ensuring AI safety and security helps prevent misuse, protects sensitive data, and safeguards systems against vulnerabilities. Upholding human rights within AI frameworks is vital for building public trust and protecting individual freedoms, ensuring that AI technologies are used ethically and responsibly.

Key considerations:

- Implement security protocols: Develop and enforce robust security protocols to protect AI systems from cyber threats and unauthorized access, ensuring system integrity and data protection.
- Conduct risk assessments: Regularly perform risk assessments to identify and address potential safety and security problems in AI systems, mitigating risks before they impact users.
- Align AI policies with human rights standards: Ensure AI policies and practices are in line with international human rights standards, safeguarding individual freedoms and promoting ethical use.
- Monitor human rights impacts: Continuously assess the impact of AI technologies on human rights and take corrective actions to address any adverse effects, maintaining a focus on ethical implications.
- Promote secure and ethical development practices: Encourage secure coding practices, robust testing, and integration of human rights considerations into AI development and education to foster safe and ethical AI technologies.

7) Public Awareness and Engagement

Building trust, ensuring transparency, and promoting responsible use of AI technologies are crucial. By educating citizens and involving them in discussions, it fosters a more informed and supportive public. Engaging diverse perspectives improves AI systems' inclusivity and effectiveness, while also guiding policy development to align with societal values and expectations.

Key considerations:

- Launch public education campaigns: Develop comprehensive educational campaigns to inform the public about AI technologies, their benefits, potential risks, and how they can impact daily life. Use various media channels to reach a broad audience and improve understanding.
- Launch pilot programs: Educate citizens about the benefits of AI in public services by launching pilot programs that showcase real-world applications of AI in areas like healthcare, transportation, and social services. By directly exposing the public to the tangible benefits of AI and involving them in its implementation, you can foster greater acceptance, trust, and engagement with AI technologies.
- Host public forums and workshops: Organize forums, workshops, and town hall meetings to engage citizens in discussions about AI strategy. These events allow the public to voice concerns, ask questions, and provide feedback on AI policies and initiatives.
- Collaborate with community organizations: Partner with local community organizations and advocacy groups to disseminate information and engage with diverse populations. These organizations can help tailor communication strategies to different communities and ensure broader outreach.

- Promote AI literacy programs: Integrate AI literacy into educational curricula and offer community-based learning opportunities to enhance understanding of AI. Equip individuals with the knowledge to interact responsibly with AI technologies and participate in informed discussions.

8) Sustainable AI Development

Ensuring that technological advancements are achieved without compromising environmental health or future resource availability is critical. By integrating sustainability into AI practices, it's possible to reduce the carbon footprint of AI systems at the outset, promote energy efficiency, and ensure that AI technologies are developed in an environmentally responsible manner.

Key considerations:

- Promote energy-efficient AI technologies: Encourage the development and adoption of AI systems that use energy-efficient algorithms and hardware. Support research into low-energy AI solutions and set standards for energy consumption in AI technologies.
- Implement green data centers: Invest in and promote the use of data centers powered by renewable energy sources. Ensure that AI infrastructure is designed to minimize environmental impact by using sustainable practices and materials.
- Encourage sustainable AI research: Fund research projects focused on reducing the environmental impact of AI development and deployment. Support innovation in areas like efficient data processing and recycling of electronic waste.

Glossary

Algorithm: A set of instructions or rules that serve as the foundation of programming and software development, as they dictate how a particular problem should be approached and solved. Algorithms are used to process data, perform calculations, automate reasoning, or carry out other computational tasks.

Artificial intelligence (AI): The branch of computer science focused on creating systems capable of performing tasks that typically require human intelligence, such as reasoning, learning, problem-solving, and understanding natural language.

Artificial neural networks (ANNs): Computational models inspired by the human brain's structure and function. They consist of interconnected layers of nodes (neurons) that process and learn from data by adjusting the connections' weights through training, enabling tasks like pattern recognition, classification, and prediction.

Autonomous systems: Systems capable of performing tasks without human intervention, often relying on AI to make decisions in dynamic and uncertain environments. Examples include self-driving cars and drones.

Bias: Systematic errors in a model that lead to unfair or incorrect predictions, often due to imbalanced training data or flawed algorithms.

Big data: Large and complex data sets that are difficult to process using traditional data processing techniques. AI and machine learning are often employed to analyze and extract meaningful insights from big data.

Deep learning: A subset of machine learning that uses neural networks with many layers (often called deep neural networks) to model complex patterns in data. It is particularly effective for tasks such as image and speech recognition.

Explainability: The extent to which the internal mechanics of an AI or machine learning system can be explained in human terms.

Foundation models: Large, pre-trained models, typically based on deep learning architectures, that can be fine-tuned for a wide range of downstream tasks. These models are trained on vast datasets and provide a general-purpose understanding that can be adapted for specific applications, such as language processing or image recognition.

Generative artificial intelligence (GenAI): A class of artificial intelligence models that can create new content, such as text, images, music, or code, by learning patterns from existing data. Unlike traditional AI models, which primarily focus on recognizing patterns or making predictions based on input data, generative AI is designed to produce novel outputs that resemble the training data.

Generative pre-trained transformer (GPT): A type of large language model pre-trained on vast amounts of text data and can generate coherent, contextually relevant text, making them useful for tasks like text completion, translation, and conversation.

Hallucination: An occurrence where the AI model generates information or content that is factually incorrect, nonsensical, or not based on the data it was trained, presenting them as though they were true.

Interoperability: The ability of different systems, software applications, or devices to communicate, work together and exchange information seamlessly, without compatibility issues, even if they were developed by different organizations or for different purposes.

Large language models (LLMs): A type of AI trained on a large amount of text data designed to understand and generate human-like text.

Machine learning (ML): A subset of AI that involves the development of algorithms and statistical models that enable computers to learn from and make predictions or decisions based on data without being explicitly programmed.

Natural language processing (NLP): A branch of AI that focuses on the interaction between computers and human language. It involves enabling machines to understand, interpret, and generate human language in a meaningful way.

Neural network: A computational model inspired by the human brain, consisting of layers of interconnected nodes (neurons) that process input data to produce an output. Neural networks are the foundation of deep learning.

Symbolic AI: An approach to artificial intelligence that uses symbols or concepts, rather than numerical data to represent knowledge and logical rules to manipulate these symbols for reasoning and problem-solving.

Training Data: The dataset used to train an AI or machine learning model. The quality and quantity of training data significantly impact the model's performance.

Transfer learning: A machine learning technique where a model trained on one task is reused or adapted for a different but related task. It's particularly useful when there is limited data available for the new task.

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This AI for Good Impact Report was written in collaboration with the International Telecommunication Union (ITU) and The Deloitte AI Institute™.

About the report

The AI for Good Impact Report provides an overview of AI's role in achieving the SDGs, including trends, indicators, and Deloitte's latest research. Emphasising trustworthy, responsible, and equitable AI, the annual report explores governance frameworks and sustainable AI transformation, highlighting positive impacts on the SDGs while managing associated risks. With a focus on AI trends, including trust, talent, gaps, governance, responsibility, and ethics, the report offers valuable insights and guidance for the evolving AI landscape.

About ITU

The International Telecommunication Union (ITU) is the United Nations specialized agency for information and communication technologies (ICTs), driving innovation in ICTs together with 193 Member States and a membership of over 1,000 companies, universities, and international and regional organizations. Established in 1865, it is the intergovernmental body responsible for coordinating the shared global use of the radio spectrum, promoting international cooperation in assigning satellite orbits, improving communication infrastructure in the developing world, and establishing the worldwide standards that foster seamless interconnection of a vast range of communications systems. From broadband networks to cutting-edge wireless technologies, aeronautical and maritime navigation, radio astronomy, oceanographic and satellite-based earth monitoring as well as converging fixed-mobile phone, Internet and broadcasting technologies, ITU is committed to connecting the world. Learn more: www.itu.int

About The Deloitte AI Institute

The Deloitte AI Institute™ helps organizations connect all the different dimensions of the robust, highly dynamic and rapidly evolving AI ecosystem. The AI Institute leads conversations on applied AI innovation across industries, using cutting-edge insights to promote human-machine collaboration in the Age of With™. The Deloitte AI Institute aims to promote dialogue about and development of artificial intelligence, stimulate innovation, and examine challenges to AI implementation and ways to address them. The AI Institute collaborates with an ecosystem composed of academic research groups, startups, entrepreneurs, innovators, mature AI product leaders and AI visionaries to explore key areas of artificial intelligence including risks, policies, ethics, future of work and talent, and applied AI use cases. Combined with Deloitte's deep knowledge and experience in artificial intelligence applications, the institute helps make sense of this complex ecosystem and, as a result, delivers impactful perspectives to help organizations succeed by making informed AI decisions.

Endnotes

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