SustAInability: doing good faster, better

What do AI and sustainability have in common? More than you might think! There's some real common ground: both rely on **technology and innovation to thrive**. What if we apply the potential of AI to the urgent issues we need to address in sustainability? We arrive at the **AI for good** concept.

AI can help accelerate sustainability and the energy transition, especially in sectors such as agriculture, energy, transport or water usage, where it can bring positive disruption. As an enabler of big data analytics, **AI could be a tool** for managing risk and identifying investment opportunities that drive financial returns while optimizing environmental and social impact.

Nevertheless, AI faces significant sustainability challenges. Current AI technology makes intensive use of **power** and other scarce resources such as **water**.

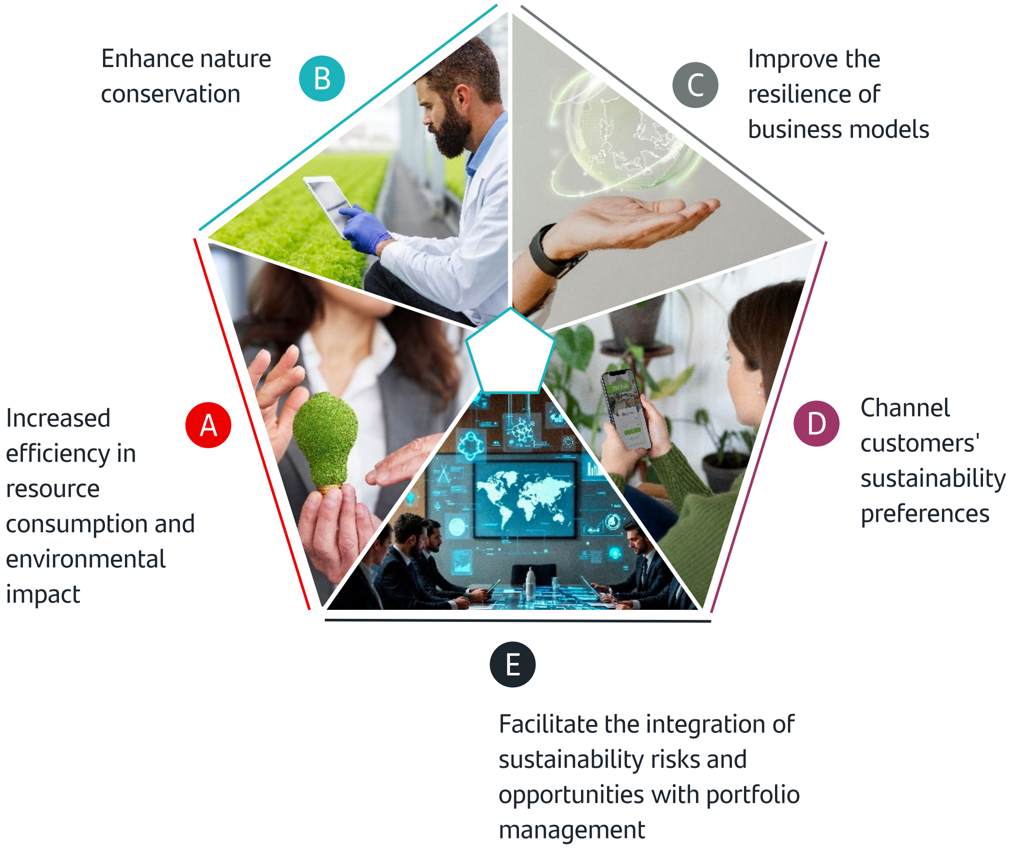
As the world enters the **Intelligent Age-** a term coined by the World Economic Forum for our era of rapid technological advancement- change and transformation can accelerate sustainable and social progress, but **how fast and at what cost?**

01

AI could be a disruptive force to address sustainability challenges

The potential of AI lies in its ability to make **use of data, optimize processes, foster** innovation **and build resilience**. AI-based models are particularly good at **capturing complex, non-linear relationships** that make a difficult fit with traditional ones.

1.2. Use cases of AI for environmental impact:



A Increased efficiency in resource consumption and environmental impact

AI can help companies identify and implement sustainability improvements within operations and along the supply chain. Modelling the functioning of physical assets, factories, buildings, roads or electric grids using **digital twins** will better inform decision making and reduce consumption of materials, energy, and water.

How AI is used for optimizing

AI and machine learning are able to enhance data processing and analysis to suggest the most efficient use of resources (e.g. via smart batteries & grids).

↑20%

Use Case

Siemens

Siemens uses AI to optimize wind turbine performance and has found it can improve efficiency by 10% and increase profitability by 20%.

Source: Clarity

How AI is used for predicting

AI leverages pattern identification and iteractive learning to signal potential future-looking outcomes based on big data.

↓20%

Use Case

IBM's Green Horizon

IBM's Green Horizon project uses AI to predict air pollution levels. In pilot projects, cities using the platform have reported a 20% reduction in air pollution levels dure to better predicting and optimizing traffic flows and energy use.

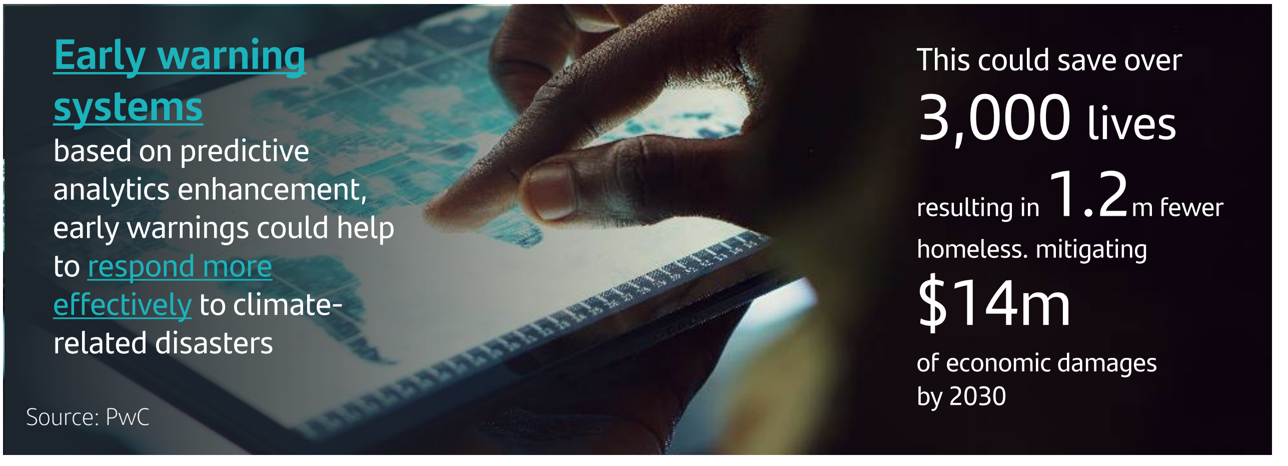
B Enhance nature **conservation**

AI-powered systems can monitor ecosystems, wildlife habitats and natural resources more efficiently than existing methods, enhancing conservation and preservation and sustainable resource management.

Fighting against wildfires, protecting natural ecosystems and preserving wildlife through bioacoustics (leveraging AI to process audio recordings of diverse species for wildlife population assessment) are other innovative opportunities.

C Improve the **resilience** of business models

AI-powered tools are valuable instruments for analyzing vast datasets to identify climate risks (exposure of assets to climate events) and developing mitigation and transition plans for the most endangered assets.



D Channel customers' **sustainability preferences**

AI can help customers make more informed purchasing decisions regarding the sustainability of products and services. For instance, an AI-driven recommendation engine that can match product suggestions with consumers´ sustainability preferences.

E Facilitate the integration of sustainability risks and opportunities with **portfolio management**

AI technologies enable in-depth analysis of large sets of unstructured data from many different sources, which helps in identifying parameters and hidden dynamics, trends, and patterns; gaps can be filled by sourcing alternative data. Moreover, AI can allow dynamic portfolio optimization for sustainability criteria and goals when connected to real time data.

MALENA MACHINE LEARNING ESG ANALYST | AN INNOVATION OF IFC International Finance Corporation WORLD BANK GROUP

Since 2019, the IFC has been using MALENA, an NLP-based AI system able to analyze vast amounts of data, to look at sustainability topics across 250k documents from over 10k companies in 26 different sectors from 185 countries, **shortening processes that took weeks to less than a day and reducing operational mistakes**.

The level of granularity that AI allows has helped to build both a financial and impact track record on asset classes such as microfinance and SME financing in emerging markets, improving the accuracy of risk assessments and facilitating the mobilization of capital from the private sector to create decent jobs and improve the living conditions of underserved or vulnerable populations in those countries.

1.2. SustAInability by sectors. Who can benefit the most?

The use of AI can contribute to the energy transition and support adaptation and resilience in the following sectors:

Utilities and renewables

Improve the prediction of weather conditions to manage supply and demand and optimize energy storage. For instance, hyperlocal weather modelling is used to monitor and adjust the positioning of solar panels and wind turbines to maximize power generation. In addition, AI tools can mitigate negative impacts from renewable infrastructure. In India, AI has been used to spot the most suitable areas to build solar energy developments to maximize energy efficiency while avoiding tradeoffs with agricultural land that might result in food price inflation. Regarding energy storage, predicting peak demand allows energy storage systems to optimize charging and discharging, ensuring energy is available when it's needed most.

Healthcare and Genetics

Personalized medicine and genomics enabling tailored treatments could produce better health outcomes at lower cost for more people. Faster research could boost drug discovery and design. Retinopathy, the primary cause for blindness globally, affects close to 22% of people with diabetes worldwide. AI has allowed early detection of this condition through images with the precision of a trained professional.

Transport and smart cities

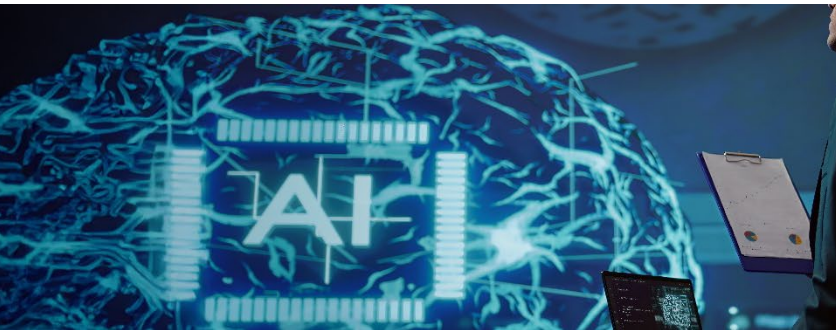
Along with autonomous transport including trucking, more accurate traffic prediction and smarter urban planning can lead to more sustainable living environments, reducing carbon footprints and improving quality of life

Agriculture

Precision agriculture can help ensure food security by optimizing crop yields through enhanced pest management, soil health monitoring, and water usage, boosting agricultural production.

02

The expected impact in numbers



Using AI for environmental applications could:

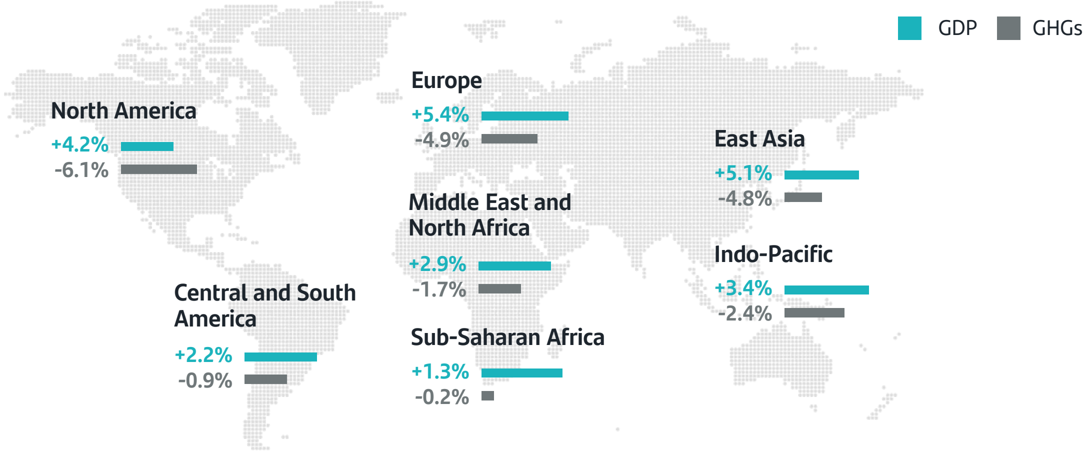
i. Reduce global greenhouse gas emissions (GHG) according to BCG, AI could help mitigate 5% to 10% of GHG emissions by 2030. According to PwC, AI applied to agriculture, water, energy and transport sectors could reduce GHG by 1.4% to 5% by 2030.

ii. Create jobs on a net basis
The WEF estimates that AI could generate 7% net growth in global jobs in 5 years, of which **18.4 – 38.2 million** could be related to sustainability (including wider complementary technology and infrastructure developments to AI).

iii. Boost global GDP by 3.1 – 4.4% (up to USD 5.2tr) mainly in Europe, East Asia and North America, as these regions have large skilled workforces that are able to utilize AI technologies, as well as strong technological capabilities. Thanks to enhanced efficiency, **output in sectors like agriculture, water, energy and transport could also see significant improvements** of up to 3.2 – 7.4%. Countries investing significantly in the development of AI technologies are also expected to reap the benefits. As an example, China is filing the highest number of generative artificial intelligence (GenAI) patents, far outpacing the next top five countries, including the US.

iv. Boosting the social economy, where AI could add between $182 - $308 billion in value annually to this sector, which represents 7% of global GDP.

Summary of regional GDP an GHG impacts relative to the baseline by 2030 in the "expansion" scenario



Source: PwC

03 Challenges

3.1. Resource intensity

It's hard to predict how much power usage AI technology will require, or the volume of emissions it will generate. As technology evolves, we expect an increase **in the efficiency of processes and components. This will reduce AI power intensity**, as happened with the rise of power demand from expansion of data centers earlier in the century, which was later offset by the use of cloud services. Additionally, some data centres are reusing the waste heat on **innovative solutions** ranging from greenhouses to aquaculture.

The same goes for water demand forecasts. Training models in state-of-the-art U.S. data centers can directly evaporate 700,000 liters of clean fresh water, but that figure can drop significantly for less power-intensive technologies. We think making electricity and water demand forecasts from the use of AI is a futile exercise until technologies reach a more mature stage. For instance, **ChatGPT requires around c.8-10x the energy of a Google search**. Recent technologies such as DeepSeek **are yet to prove if they can be more energy efficient.**

3.2. Data availability

The main hurdle to train AI models to drive sustainability outcomes is data.

Public data, open for analysis by anyone, requires cleaning and anonymization to remove confidential information

Data quality, which involves meeting industry or government regulations, is also fundamental for analysis

Data and model validation via Sandbox for experimental setups is also needed, particularly for catastrophic events, for which data is unavailable or at best very rare

3.3. Ensure a "fair AI for all"

By analogy to the Just transition in sustainability, AI should ensure fair adoption, leaving no one behind. This would require upskilling and reskilling of workers, particularly in low-income countries and vulnerable populations.

Additionally, **AI may face bias risks, as poorly trained models** could drive discriminatory decisions in critical areas due to gender or racial stereotypes.

3.4. Regulation and collaboration

AI needs to be supported by the necessary regulatory insight and oversight to avoid significant gaps in transparency, safety, and ethical standards.

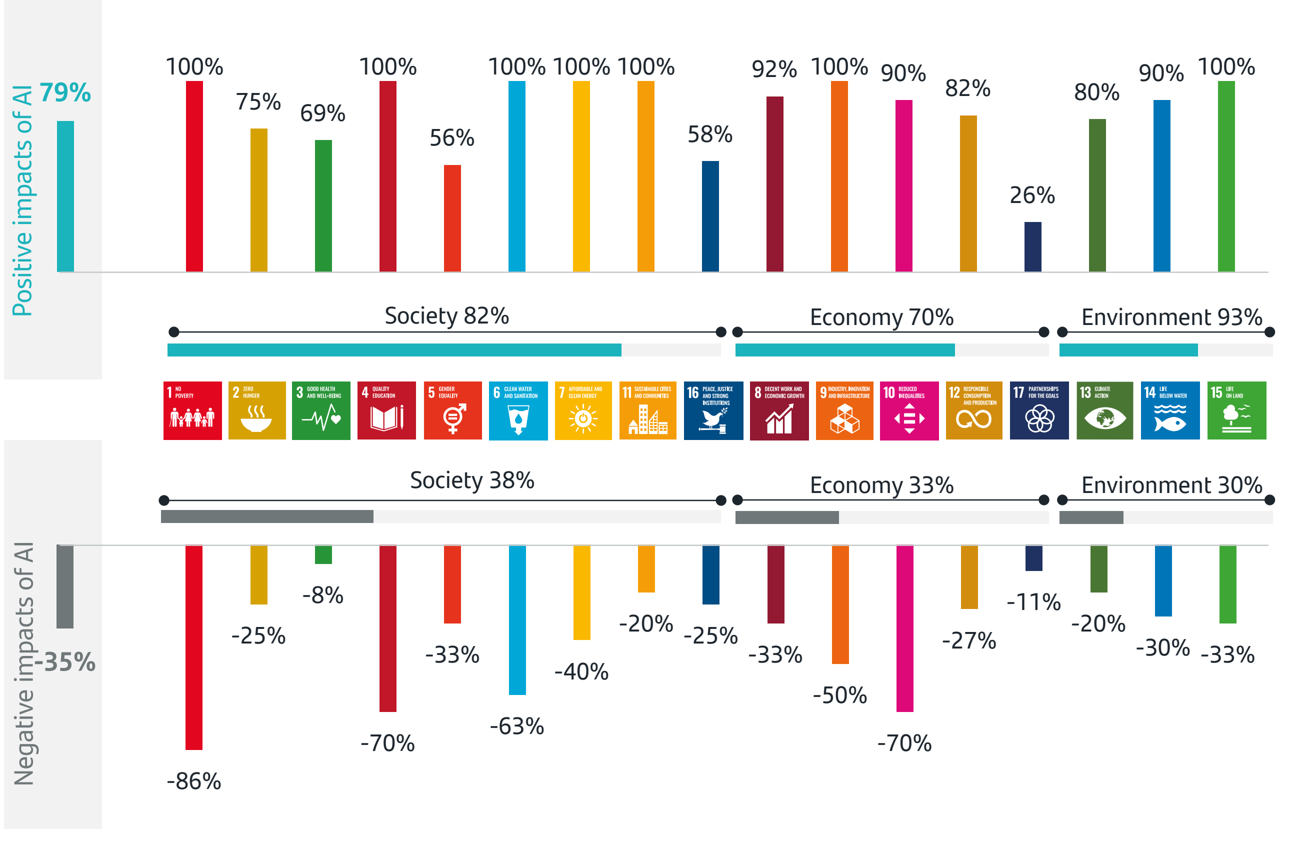
Ideally, governments should take an agile approach to targeted regulation and policy support for data access, R&D, digital infrastructure and skills investment.

Collaborative efforts among private sector actors, academia and government can help speed up the development of these tools.

On a net basis, according to Nature, AI can contribute to meeting 134 targets (79%) derived from the 17 UN sustainable development goals.

Impacts of AI on the SDGs

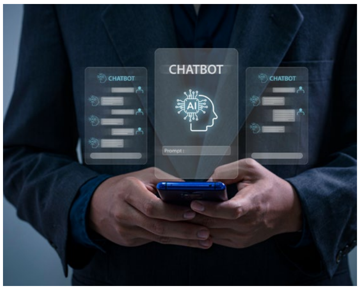
Source: Nature



04 And what about social areas?

Education Technology (EdTech)

AI-driven solutions can personalize learning experiences, making education more accessible and effective.



Mental Health and Wellbeing

AI applications such as chatbots for therapy or platforms that analyze user data for better mental health management can help address the growing mental health crisis.

Disability Inclusion

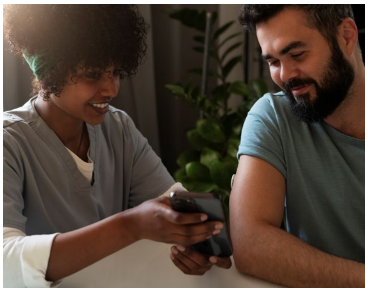
AI tools that enhance accessibility can create more inclusive environments.

Access to clean water / sanitation / healthcare

AI can play a critical role in disease prevention, health monitoring, and crisis management, particularly in low-income regions.

Social Entrepreneurship

the use of AI to tackle social issues, such as poverty alleviation, gender equality, and community development, can have a lasting impact.



Support for refugees and migrants and humanitarian aid

AI-driven platforms can help refugees and migrants access resources, information, and services more effectively.

05

Conclusions

AI has the potential to become a net creator of jobs and an economic booster. It may also contribute to tackle challenges related to climate change and nature-based risks, helping to reduce GHG emissions and propelling solutions for social challenges that otherwise could take decades to solve.

AI can offer many possibilities for governments and companies and highly beneficial applications for sustainability and social projects where it can be disruptive, unfolding attractive investing opportunities. Companies using AI to analyze data from drones, remote sensing for habitat protection, advance AI modelling for climate risks or applying efficiency improvement from digital twins analysis may just be some of the examples. Moreover, sectors such as infrastructure, water management or agritech could be some of the themes that may be less exposed to policy changes towards sustainability.

At present, AI still faces significant challenges, such as resource consumption, data requirements, biases and the need for regulation, which could have negative environmental and social effects. However, at this stage it is too early to make any predictions about negative effects, as the technology is still evolving towards improved efficiency.

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