



Addressing the economic challenges that hinder the application of artificial intelligence technologies in the environmental field

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Abstract:

The great technological development that has been witnessed in recent years in terms of artificial intelligence has led to an increase in the diversity of its uses to cover broad and vital areas of daily life, among the most important of these areas that countries seek to develop, is the environmental field of great importance, especially with challenges: such as climate fluctuations, global warming and water scarcity.

On this basis, countries try to harness AI technologies as much as possible, and employ them effectively to help develop this field, but the forms presented are to face the application of AI to several obstacles and special challenges at the economic level, and we will address various of these challenges in this intervention, with the latter focusing on how to face them in order to optimally and successfully apply AI in the environmental field.

Keywords: Artificial Intelligence, Environment, Economic challenges.

• Introduction

The world is witnessing continuous technological advancements, particularly in the widespread application of artificial intelligence (AI) across various fields of life. Our article today will focus on the environmental sector, given its crucial role in achieving sustainable development for nations. Since the economic challenges hindering the use of AI in this area are among the most significant obstacles preventing the full utilization of modern technologies, we will aim to explore solutions to address these challenges.

Artificial intelligence stands out as a promising technological pillar capable of transforming environmental governance mechanisms and ecosystem management. Through its advanced applications in climate modeling, energy efficiency enhancement, and biodiversity monitoring, these technologies can offer innovative solutions that surpass the capabilities of traditional systems. However, the path to widespread adoption of these solutions is fraught with structural obstacles, most notably those related to economic viability and the sustainability of funding.

The fundamental challenge lies in the fact that employing artificial intelligence (AI) technologies in the environmental field requires a massive computing infrastructure, intensive energy consumption, and specialized human resources. This imposes high economic costs that



environmental organizations and governments may struggle to bear given the limited budgets allocated to the environmental sector.

Furthermore, many AI-based environmental projects lack clear business models that guarantee viable returns on investment, limiting their ability to attract private funding and making them dependent on unstable international grants and government allocations. This situation creates a gap between the immense technological potential of these tools and the ability of societies to utilize them effectively and sustainably. Hence, the urgent need arises for an in-depth study of the economic challenges hindering the application of AI in the environmental sector, and for exploring mechanisms to overcome them.

This study aims to analyze the most prominent economic obstacles, ranging from high infrastructure and operational costs to the scarcity of long-term funding and the difficulty of building sustainable economic models. It also seeks to discuss possible strategies for addressing these challenges, such as developing innovative financing mechanisms, strengthening public-private partnerships, and building local capacity in the field of environmental artificial intelligence.

Our study stems from the following problem:

What are the economic challenges hindering the use of artificial intelligence in the environmental field, and how can they be overcome?

To answer this problem, we adopted a historical and descriptive approach within a methodological framework outlined as follows:

Section 1: Uses of artificial intelligence in the environmental field.

Section2: The most significant economic challenges hindering the use of artificial intelligence.

Section 3: Ways to overcome economic challenges for better use of artificial intelligence in the environmental field.

1. Uses of artificial intelligence in the environmental field.

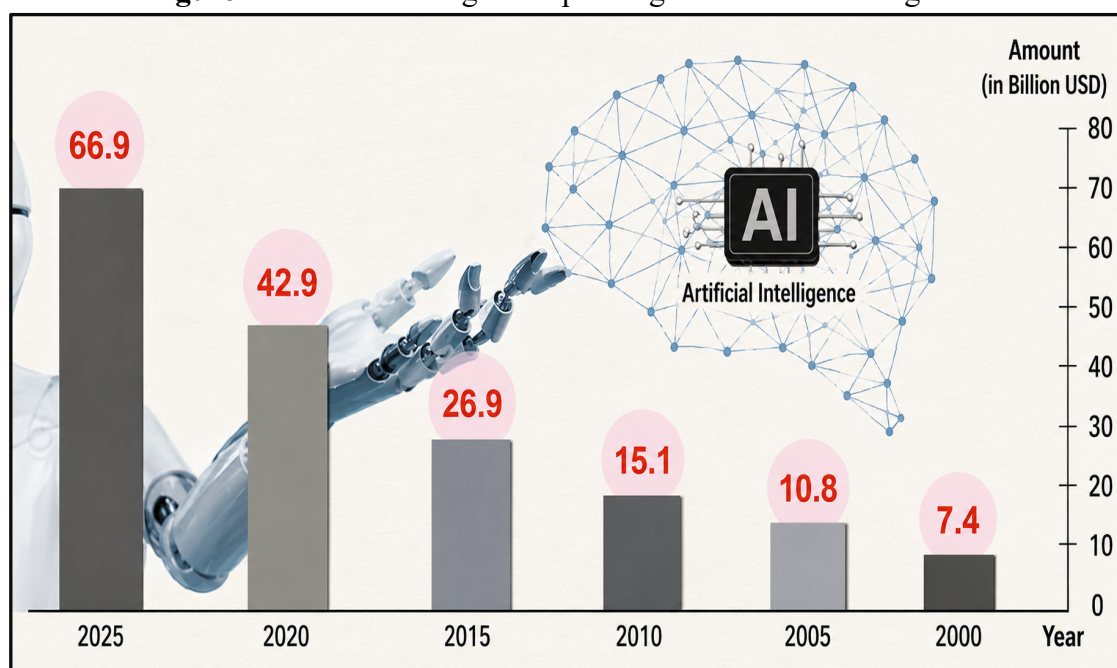
Artificial intelligence technology has a wide range of uses, involving many fields in the environmental field, so that it becomes indispensable.

1.1 Different environmental uses of artificial intelligence:

The countries of the world have realized the need to leverage high technology embodied in artificial intelligence algorithms. Back when spending on research for developing this technology was considered significant but barely matched the military spending that takes a large share of each country's budget, the situation changed once many major countries, led by the United States, started excelling. Technology has now become a vital field of competition. The figure in front of us represents the size of global spending on AI, and its development to become better every time, covering various vital areas of life.



Figure 1 – Evolution of global spending on artificial intelligence



Source: The New Arab website, <https://www.alaraby.co.uk/> , Publication date: 30/06/2020, A date of visit: 01/01/2026.

Figure 1, shows the increase in global spending on AI: from \$7.4 billion in 2000, it reached \$66.9 billion in 2025. Most of this increase in spending aims to enhance sustainability in these countries. What matters to us in this study is the environmental aspect, and in the following points, we will address the various uses of artificial intelligence, which we list as follows:

1. Artificial intelligence (AI) technology performs continuous and periodic analysis of information, following close monitoring of climate fluctuations, particularly those resulting from environmental challenges such as global warming.
2. AI works to understand the causes of climate change by analyzing massive amounts of big data.
3. It helps in identifying desertification in areas worldwide to combat drought.
4. It monitors ice melt, which causes changes in river water levels, thus facilitating the implementation of necessary measures.
5. It helps in identifying sources of air pollution more quickly, especially in cases of toxic emissions.
6. It helps in predicting sudden climate fluctuations using modern technologies that enable the forecasting of environmental disasters and facilitate proactive preventative measures.¹
7. It collects and monitors satellite imagery and sensor data for the early detection of natural disasters worldwide, such as hurricanes, floods, and earthquakes.

¹ Dahmani Mohamed, The uses of artificial intelligence in the environmental field, **Review of Law and Environmental Sciences**, Vol 2, Issue 3, 2023, p 486.



8. It monitors the aftermath of natural disasters to improve the efficiency of emergency response and develop strategies, thereby accelerating recovery and reconstruction.
9. Protecting biodiversity using advanced smart monitoring technologies, such as drones equipped with thermal imaging cameras, to monitor and protect endangered species in nature.
10. Developing smart irrigation systems in the agricultural sector that determine soil moisture levels and actual water needs, thus helping to conserve water.
11. Utilizing robots in rugged environments characterized by harsh climates and terrain, where their role includes monitoring pollution, carbon emissions, and managing natural resources and renewable energy.²

1.2 Artificial intelligence tools used in the field of environment:

First – TensorFlow: an open-source system developed by Google for building artificial intelligence models. Its function is to train and run models on a wide range of different devices. It features a flexible ecosystem and multiple operating systems.

Second – GODAN: a network of over 1,000 innovators from around the world, whose mission is to support the sharing of open global data on agriculture and food.

Third – Taranis, an AI-powered agricultural platform that provides farmers with analysis, imaging, reporting, and field comparison services. It contains the most comprehensive database of crop threats (Agro Brain), which facilitates problem identification and problem-solving.³

1.3 Main artificial intelligence platforms in the environmental field:

1) NASA's Earth Observatory platform:

This NASA platform uses artificial intelligence to analyze satellite imagery and monitor environmental changes such as desertification, ice melt, and carbon dioxide concentrations. It is used to monitor vegetation cover in the Arab region and track dust storms.⁴

2) The Copernicus platform:

This European Union Earth observation program provides real-time maps and weather and marine forecasts supported by artificial intelligence models.⁵

² Chakalil Imane; Baghdadi Billel, Modern irrigation technology to improve water consumption efficiency in agriculture and enhance rural development - "Experience of applying modern irrigation technologies on a typical farm", *Ibn Khaldûn Journal of Innovation and Development*, Vol 6, Issue 6, 2024, page 69.

³ Dahmani Mohamed, *ibid*, p 487.

⁴ Arab Educational, Cultural and Scientific Organization (ALEXO), **The use of space technology in monitoring environmental changes in the Arab homeland**, Tunisia: Department of Science and Scientific Research, 2022.

⁵ Center for Environment and Development for the Arab Region and Europe (CEDARE), **Remote Sensing Applications in Arab Environmental Management**, Cairo: CEDARE Publications, 2023.



3) Google Earth Engine:

This is a cloud computing platform for analyzing geospatial data that relies on machine learning techniques to analyze satellite imagery. For example, it is used to monitor deforestation (such as the cedar forests in Lebanon and Morocco) and track urban expansion at the expense of agricultural land.⁶

4) Global Forest Watch:

This is an interactive platform that uses artificial intelligence and machine learning to analyze satellite imagery in real time to monitor deforestation.⁷

Other platforms that rely on artificial intelligence for environmental protection, which we will mention briefly, include:

- a) **Climate AI:** This is a platform for analyzing climate data and predicting future environmental changes using artificial intelligence techniques.
- b) **Terramonitor:** This platform uses artificial intelligence and machine learning to monitor environmental and natural changes around the world, including changes in vegetation cover, pollution, and water levels.
- c) **EarthAI:** This platform uses artificial intelligence and machine learning to analyze aerial imagery. Predicting pollution levels, vegetation cover, and other environmental factors.
- d) **Climate TRACE:** A platform that uses artificial intelligence and machine learning techniques to track carbon emissions and other greenhouse gas emissions.
- e) **Blue River Technology:** Uses artificial intelligence techniques to improve farming processes and crop productivity, helping to reduce greenhouse gas emissions.⁸
- f) **ClimateClever:** A platform that uses artificial intelligence to improve energy efficiency in homes, institutions, and communities.
- g) **Global Forest Watch:** A platform that uses artificial intelligence and aerial imagery analysis to determine the size of forests worldwide and monitor changes in them.
- h) **Ecometrica:** A platform that uses artificial intelligence and machine learning techniques to analyze environmental data, monitor emissions, and manage environmental risks.
- i) **NatureServe:** A platform that uses artificial intelligence and data analysis to assess the state of wildlife and identify endangered species.

⁶ King Abdulaziz University Journal: **Computer Science and Information Technology**, "Using the Google Earth Engine Platform to Estimate Changes in Vegetation Cover in the Makkah Region." Kingdom of Saudi Arabia, Volume 10, Issue 2, 2021.

⁷ United Nations Environment Programme - Regional Office for West Asia, **Assessment of natural resources in the Arab region**, Beirut: UNEP, 2022.

⁸ Shehata Elsayed, **10 tools that use artificial intelligence to investigate environmental and climate issues**, published on: 15/01/2020, <https://short-url.cc/1tGcH>, date of visit: 25/05/2026, 11:05.



- j) **CoralNet:** A platform that uses artificial intelligence and aerial imagery analysis to monitor the health and recovery of coral reefs and marine life in different regions.⁹

2. The economic challenges hindering the use of artificial intelligence

Among the main challenges that hinder the utilization of artificial intelligence and high-tech technologies are economic challenges. The latter is considered an obstacle that can delay the growth process through benefiting from and utilizing the multiple applications of artificial intelligence, especially in our topic related to the environmental field. Without financial investments to fund the adoption of this advanced type of smart technology, the matter remains merely hopes for development and achieving sustainability, among the most important economic challenges, we mention the following:

First - High Financial Costs:

Financing such advanced technological systems and technologies requires significant investments in infrastructure, specifically the construction of sophisticated data centers to handle massive amounts of information (Big Data). This places a heavy burden on national budgets and economies, especially for those new to these technologies.

Second - Limited Technical Capabilities:

This stems from weak technological infrastructure, hindering the application and utilization of artificial intelligence technologies in data analysis.¹⁰ It is crucial for countries to keep pace with global technological advancements to benefit from artificial intelligence technologies.

Third - The Need for Large Electricity Supply for AI Systems and Data Centers:

Countries aiming to increase their investments in artificial intelligence focus on developing their electricity grid systems to ensure reliable and sustainable power supplies for data centers and enhance their capabilities and efficiency.¹¹ However, many countries often obtain their energy from other sources. From unclear sources (such as fossil fuels), which pollutes the air and exacerbates the problem of global warming.¹²

Fourth - The high cost of extracting rare earth minerals:

Advanced technology relies on certain types of rare earth minerals and minerals, such as lithium and cobalt, which are essential in the manufacture of electronic chips, the main component in high-tech microdevices. This increases pressure on environmental resources and leads to higher operating costs.¹³

⁹ Shehata Elsayed, *ibid*.

¹⁰ Heba Mohamed Imam, **Artificial intelligence strikes a balance between economic growth and resource conservation**, published on: 28/01/2024, <https://short-url.cc/1tGcg>, date of visit: 18/04/2026, 20:16.

¹¹ Emirates Center for Strategic Studies and Research, **Determinants of Investment in Artificial Intelligence: The Importance of Energy and National Strategies**, published on: 01/01/2015, <https://short-url.cc/1tHwJ>, date of visit: 11/05/2026, 22:06.

¹² **The Disadvantages of Artificial Intelligence... Is it Threatening the Environment on the Planet Earth?** published on: 19/01/2025, <https://short-url.cc/1tHDb>, date of visit: 13/05/2026, 15:27.

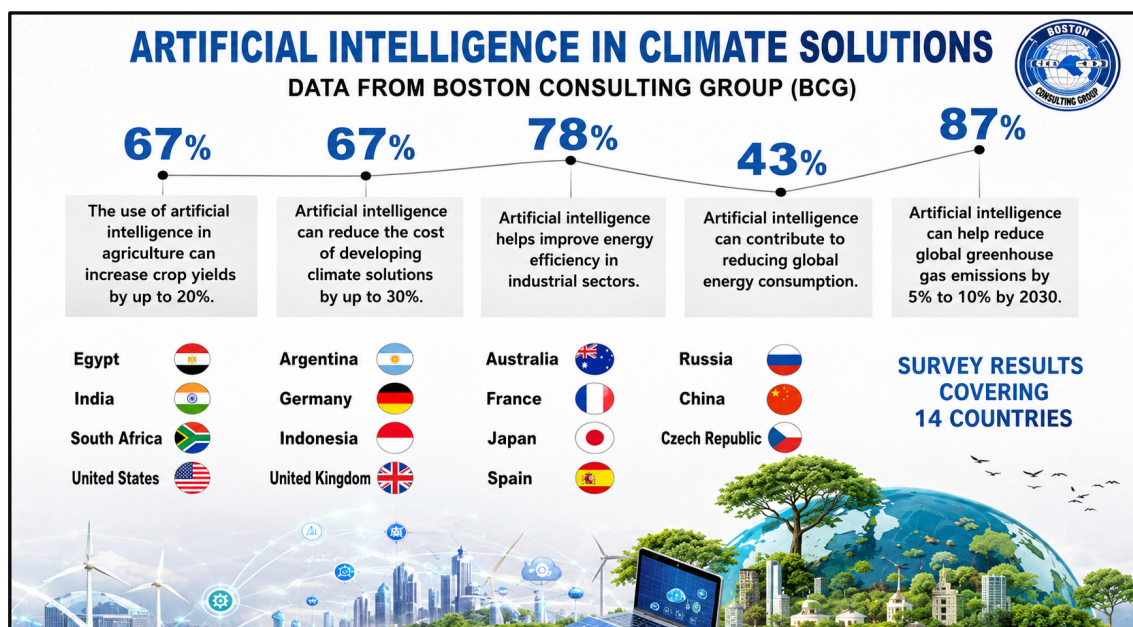
¹³ Al Jazeera News Agency, **Artificial Intelligence High Cost to the Environment**, published on: 10/03/2025, <https://short-url.cc/1zfyt>, date of visit: 29/06/2026, 14:22.



Fifth - The lack of development of artificial intelligence models that support economic and environmental sustainability:

Therefore, there is a need to develop technology to keep pace with modern technologies. This is fundamental in the technological field because achieving economic sustainability requires development mechanisms, especially when it comes to artificial intelligence, which is experiencing very rapid development globally. Stagnation in the development of these smart technologies does not help in benefiting from the uses of artificial intelligence in the environmental field.

Figure 2 – Results of a survey of 14 countries on the contribution of artificial intelligence to climate solutions



KUNA, Kuwait News Agency, **Results of a survey of 14 countries on the contribution of artificial intelligence to climate solutions**, published on: 17/02/2024, <https://short-url.cc/1zjva>, date of visit: 10/04/2026.

Despite these significant economic challenges that hinder the use of artificial intelligence, research is still ongoing in an attempt to address this and determine whether the use of artificial intelligence will actually be beneficial to the environment or not, and on this basis, the Boston Consulting Group conducted a comprehensive survey that included 14 countries on the contribution of artificial intelligence to climate solutions, and **Figure 2** shows the results it reached.¹⁴

¹⁴ Heba Mohamed Imam, **Artificial intelligence to reduce the carbon footprint: Environmental and economic challenges**, published on: 01/06/2025, <https://short-url.cc/1ze3K>, date of visit: 14/03/2026, 10:56.



3. Ways to address economic challenges for better use of artificial intelligence in the environmental field:

1- Focus on Human Capital Development:

Artificial intelligence cannot replace human expertise, so investing in specialized education and training is essential to enhance technical skills in data science, AI, and environmental management. This approach helps alleviate operational costs to some extent.¹⁵

2- Increase Government Funding and Encourage Private Investment:

As previously discussed in economic challenges, funding serves as the primary driver for supporting AI technologies. Given the high costs of advanced technologies, which pose the greatest barrier to adoption or continued advancement, governments must increase support for AI-driven environmental protection projects. Additionally, they can offer incentives and facilitations to institutions and companies willing to invest in this field, ultimately reducing financial burdens on the state while fostering innovation¹⁶, but environmental projects often suffer from being "unprofitable" in the traditional sense, making it difficult to attract private investment¹⁷, but not impossible, so it is necessary to:

- Establishing blended finance funds: Combining government capital (from environment ministries), international grants (from the United Nations Environment Programme or the World Bank), and private investment. This aims to reduce risk for private investors and attract larger funding¹⁸ without undue apprehension or risk.
- Issuing smart "green bonds": Issuing financial bonds to finance environmental projects that rely on artificial intelligence (such as smart irrigation networks), with the bond's return linked to the effectiveness of AI in achieving financial savings or reducing emissions.
- Public-private partnerships (PPPs): Designing partnership models where the government provides environmental data (such as satellite imagery) and the private sector develops AI applications, with both parties sharing the revenues generated from the subsequent marketing of these services.¹⁹

3- Relying on recycling and adopting a circular economy:

Waste is one of the most intractable challenges facing the environment. Therefore, to address it, it is essential to integrate artificial intelligence (AI) technologies into waste management and recycling processes. AI also enhances the success of the circular economy by designing, developing, and maintaining circular products that are environmentally friendly and easily

¹⁵ **The role of artificial intelligence in environmental management**, published on: 08/03/2025, <https://short-url.cc/1zfCO>, date of visit: 10/05/2026, 03:05.

¹⁶ **The role of artificial intelligence in environmental management**, <https://short-url.cc/1zfCO>, ibid.

¹⁷ Mariana Mazzucato, **The value of everything: Making and taking in the global economy**, PublicAffairs, 2018.

¹⁸ Organisation for Economic Co-operation and Development (OECD), **Blended Finance in the Least Developed Countries 2021**, OECD Publishing, 2021.

¹⁹ Graeme Hodge, Carsten Greve, On public-private partnership performance: A contemporary review. **Public Works Management & Policy**, Vol 22; Issue 1, 2017, p 61.



recycled. Furthermore, AI helps in designing new materials to replace unsustainable materials that harm the environment.²⁰

4- Encouraging social and participatory innovation:

As previously discussed, it is crucial to encourage the use of various AI platforms to promote and increase community and stakeholder engagement in environmental issues. This fosters awareness and increases cooperation in adopting better environmental practices without incurring high costs.²¹

5- Strengthening Partnerships and Cooperation Between Countries:

One of the appropriate solutions to address the economic challenges hindering the use of artificial intelligence in the environmental field is cooperation and intensified efforts between research institutions, as well as large companies that can alleviate some of the financial pressure, and share resources and technologies. Furthermore, unifying efforts and collective cooperation in research processes can encourage innovation in the fields of sustainable artificial intelligence.²²

• Conclusion

The economic challenges hindering the use of artificial intelligence (AI) in the environmental field are among the main obstacles that sometimes lead to failure in achieving environmental sustainability. Because the use of AI is crucial in our daily lives for achieving sustainable development, it is essential to first seriously acknowledge these challenges and obstacles in order to find appropriate solutions.

As previously mentioned, the most significant economic challenge lies in the lack of funding for AI, particularly in developing countries. This is due to the substantial financial burden that adopting such high-tech applications places on these countries' budgets. Therefore, appropriate solutions lie in raising awareness of the importance of expanding the uses of AI to include environmental protection and achieving environmental sustainability. However, raising awareness alone is insufficient to fund these smart projects.

Governments must also increase their funding for AI-based projects that serve and protect the environment, while encouraging institutions, businesses, and individuals to support these development projects that serve the public good and maintain a safe and clean environment. This study concluded with the following recommendations, which, although mentioned earlier in the third section, we will summarize in the following points:

²⁰ Takwasht Imad, The role of artificial intelligence in accelerating the transition to a circular economy, **EI - Acil Journal for Economic and Administrative Research**, Vol 7, Issue 2, 2023, p 470.

²¹ **The role of artificial intelligence in environmental management**, <https://short-url.cc/1zfCO>, ibid.

²² Tamer Farouk Houcine Ahmed, The role of using artificial intelligence in monitoring and predicting climate change to support the green economy, **The Scientific Journal of Business Research** (Menoufia University), Volume 61, Issue 2, 2026, p 517.



- Work on developing human capital and investing wisely in making it more efficient.
- Increase government funding and encourage private investment, allocating a substantial portion of the budget to this purpose.
- Emphasize recycling and adopt a circular economy.
- Promote social and collaborative innovation, and raise awareness among all members of society to foster cooperation.
- Strengthen partnerships and cooperation between countries, leverage leading expertise in artificial intelligence, and utilize it to protect the environment.

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