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Artificial Intelligence for the Sustainability of Climate Change

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Abstract: The environmental challenge may be the most serious and urgent, given the significant pollution of air, water, and soil, which are the three main components of the ecosystem, with the increase in global warming and climate change that the world is witnessing, which threatens the very existence of man on this earth. AI has the potential to accelerate global efforts to protect the environment and conserve resources by monitoring air pollution and energy emissions, helping develop transportation networks, monitoring deforestation, and forecasting extreme weather. Hence the importance of using the latest technology to combat environmental pollution, leading to the environmental sustainability that countries seek to achieve. As such, the use of AI offers an opportunity to make meaningful change in this critical moment, whether through mitigation, adaptation, and resilience or by supporting the fundamentals of overall climate efforts. As for consumers, they will benefit from AI in the form of improving services, providing recommendations and quality more efficiently, as well as bringing about fundamental and tangible changes in industries such as health care, transportation, and pharmaceuticals in a safer manner. Of course, people's lives will change for the better from the presence of self-driving cars and the expansion of this technology to other means of transportation such as trains, ships, and planes. It is expected that companies will reduce a lot of expenses thanks to artificial intelligence and its applications, which are increasing day after day, as well as the accompanying innovations and new inventions that will strongly affect daily life.

Keywords: Artificial Intelligence, Climate Change, Emissions, Agriculture, Epidemics, Disasters

1. Introduction

The changing climate will have a major impact on environmental, social, and economic systems around the globe. We are already experiencing many of its environmental effects, from longer droughts to more destructive storms.

Mitigation is therefore critical, including efforts to achieve net-zero emissions by 2050. However, minimizing the harm will also require increasing our efforts at adaptation and resilience—from immediate crisis response to long-term planning. Further, these efforts will require support from activities such as research, finance, and education.

AI as a tool is uniquely positioned to help manage these complex issues. Due to its capacity to gather, complete, and interpret large, complex datasets on emissions, climate impact, and more, it can be used to support all stakeholders in taking a more informed and data-driven approach to combating carbon emissions and building a greener society. It can also be employed to reweight global climate efforts toward the most at-risk regions. Note that we employ the term "AI" to refer to artificial intelligence and advanced analytics, defined as the use of sophisticated data analysis techniques such as machine learning algorithms and data engineering.

Mitigation. AI can be employed to help measure emissions at both the macro and micro levels, reduce emissions and greenhouse gas (GHG) effects, and remove existing emissions from the atmosphere. In BCG's experience, for example, AI can be used to help reduce GHG emissions equal to 5% to 10% of an organization's carbon footprint, or a total 2.6 to 5.3 gigatons of CO_2e if scaled globally.

Adaptation and Resilience. AI can be applied to improve hazard forecasting for regionalized long-term events, such as sea-level rise, and for immediate, extreme events, such as hurricanes, among other possibilities. These applications include the management of vulnerability and exposure, such as by developing infrastructure that can minimize the impact

of climate hazards.

Fundamentals. AI can also be used to bolster efforts across climate research and modeling; climate finance; and education, nudging, and behavior change, such as by powering personalized tools to estimate an individual's carbon footprint or making recommendations for environmentally friendly purchases [1].

2. Artificial Intelligence Confrontation Environmental Challenges

Artificial intelligence has the ability to accelerate global efforts to protect the environment and conserve resources, as it has the great capabilities inherent in collecting and analyzing data to help combat climate change, as machine learning can be used to improve energy generation methods, and regulate the process of demand for it, with a focus on the use of renewable energy, In addition to deploying sensors and smart meters inside buildings to collect data, monitor and analyze and improve energy use inside buildings.

The use of artificial intelligence to preserve environmental diversity, where artificial intelligence connected to satellites can detect changes in land use, monitor vegetation cover, predict natural disasters, monitor, and analyze their effects, and can monitor alien (invasive) species of organisms that may threaten a specific environmental area such as Environmental reserves, identification, tracking, and elimination using machine learning [2].

In the field of air quality improvement, smart air purifiers that use artificial intelligence can record air quality and environmental data in real time, and work to increase the efficiency of air filters. AI-powered devices can also send warnings to people living in cities and urban areas about pollution levels in their areas. There are tools that exist today that can detect pollution sources quickly and accurately, as machine learning can analyze data collected from vehicles and aircraft, radars, and cameras, to reduce air pollution [3].

3. The Impact of Artificial Intelligence on the Country's Economy

Artificial intelligence is defined as the science that makes machines simulate human behavior and thinking in everything, such as inference, learning and development, so that machines and computer programs work at the same human level in dealing with any orders they issue to complete any operation without human intervention.

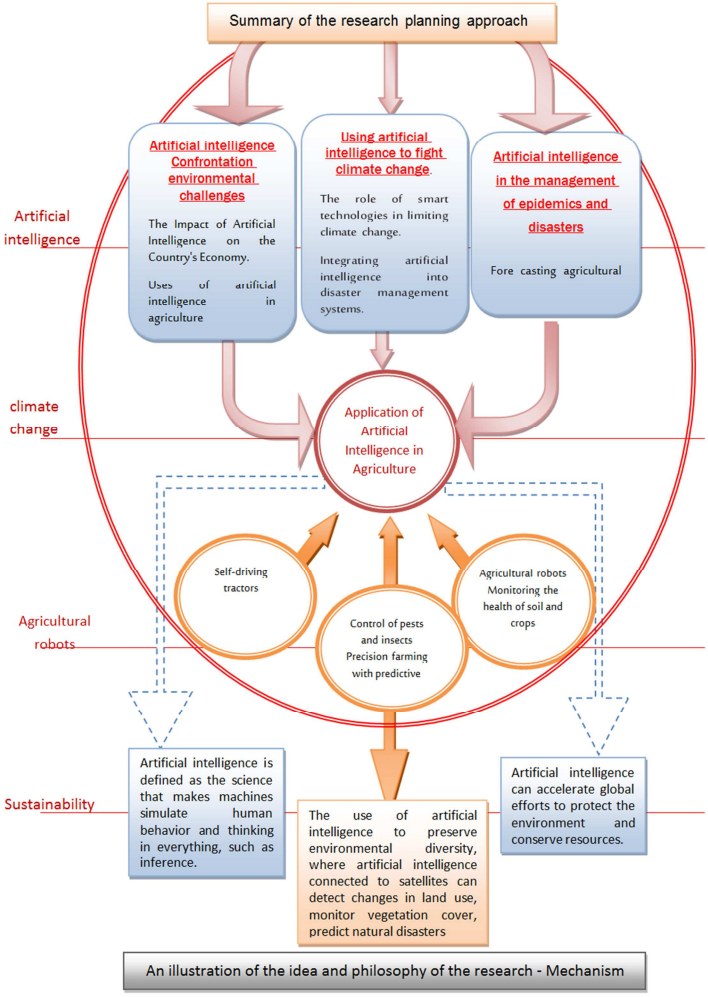


Figure 1. *Mechanism of Research Study.*

Therefore, developed and developing countries have accelerated to include the strategy and applications of artificial intelligence in their economic plans because of their added value to economic growth, technological progress, reducing costs, increasing productivity, reducing risks, and raising competitive benchmarks for global countries [4].

while there is a rapid race between humans and machines and artificial intelligence enables in The twenty-first century is the result of the invention of a constellation of technologies that have served humanity, such as smart systems in cities, robots, cars and self-driving planes, and addressing problems that have eluded scientists for decades.

There is a direct relationship of artificial intelligence to the country's economy, and that whenever a country relies on artificial intelligence, its economy will rise. On the other hand, artificial intelligence may affect the country due to its development and growth in some countries that depend on it, and since most countries are linked with each other in the commercial and other fields, it may effect on the economies of other countries [5].

And that the entry of artificial intelligence into several industries, such as the automobile industry, gives it a competitive advantage and thus its high prices will return a great profit for the manufacturing countries. The effect may also be through the quality of new products that rely on artificial intelligence or through the reduction of time. Thus, the product is of high quality and low time, which is the reason for the high percentage of profits and low costs. AI can spur growth by providing an endless supply of ideas production. In theory, AI is good for growth because it boosts productivity [6].

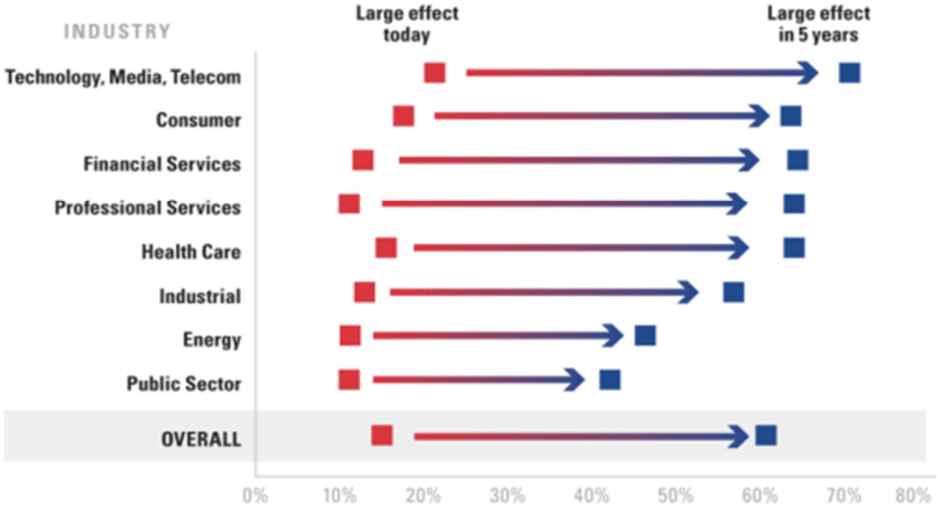


Figure 2. *AI and Economic growth.*

On comparing different industry-sectors we see from the figure above:

In high-tech industries like Telecom and media has already adopted AI relatively rapidly and looking for transformations in all possible avenues. They are then followed by Consumer, Financial Services and Professional Services.

Healthcare and Industrial Sector are adopting AI slowly.

Energy and Public Sector are the slowest adaptors to this transition [7].

4. Using Artificial Intelligence to Fight Climate Change

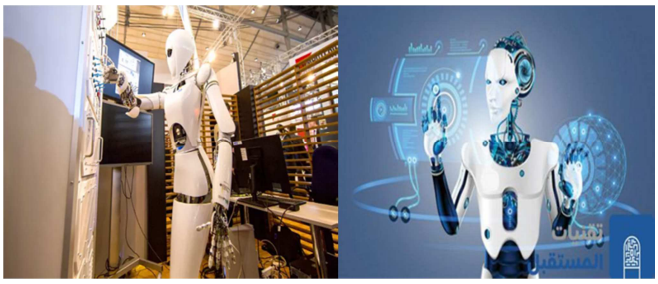
Therefore, we must use the innovative technologies that resulted from the great progress in the field of artificial intelligence to combat climate change, and it is certainly possible to resort to artificial intelligence to measure and mitigate emissions, as each company measures baselines, then sets goals, and then acts, but most companies comment when the first step [8].

Therefore, artificial intelligence programs can be used to help companies complete all steps, such as the (BCG'S CO_2 AI) program, which helps reduce 30% of emissions, and another example of this is Google's partnership with (electricity Map), which aims to reduce carbon dioxide emissions resulting from the process Electricity consumption.

AI can also enable innovative corporate models to help address climate change, as smart AI algorithms in the field of agriculture can identify the best land and soil, in addition to the ability of AI to measure carbon in the soil at a low cost.

AI can also be used to take satellite images to ensure farmers comply with changes in seeding processes related to investors and the subsequent sale of CO_2 certificates. Moreover, AI can improve the resilience of societies to climate risks. For example, Google's Hydro net program can identify the most serious vulnerabilities related to river floods with unprecedented accuracy. AI can also help with proactive planning to mitigate crises and deploy help when needed, just as the BCG GAMMA team used AI to put out fires in Australia's forests [9].

Artificial intelligence Combat climate change



source: Data collected by a researcher

Figure 3. *Artificial intelligence Combat climate change.*

Then there are the remarkable successes of the robot in the field of combating pollution in all its forms. Where the robot is now clearly identifying the sources and causes of pollution in all its forms, which helps to reduce it; He was even able to accurately predict the weather and some natural disasters; Which contributes to the speed of preparedness, confrontation and reducing losses, and now the robot seeks to determine when, how much and how climate changes to prepare to deal with them and adapt, and there are modern programs to determine the places and characteristics of air pollution and how to reduce and deal with them, in addition to renewable energy projects such as wind and solar energy, in addition to the successes Great for knoll in overall energy consumption reduction; For example, in Germany, the use of the robot succeeded in purifying the air with a quality of up to 90%, and close to that for water [10].

5. The Role of Smart Technologies in Limiting Climate Change

One of the most important features of smart technologies is that they contribute to preserving the environment, simply because they depend on clean energy sources, primarily electricity. For example, there is no computer or mobile phone powered by coal or petroleum.

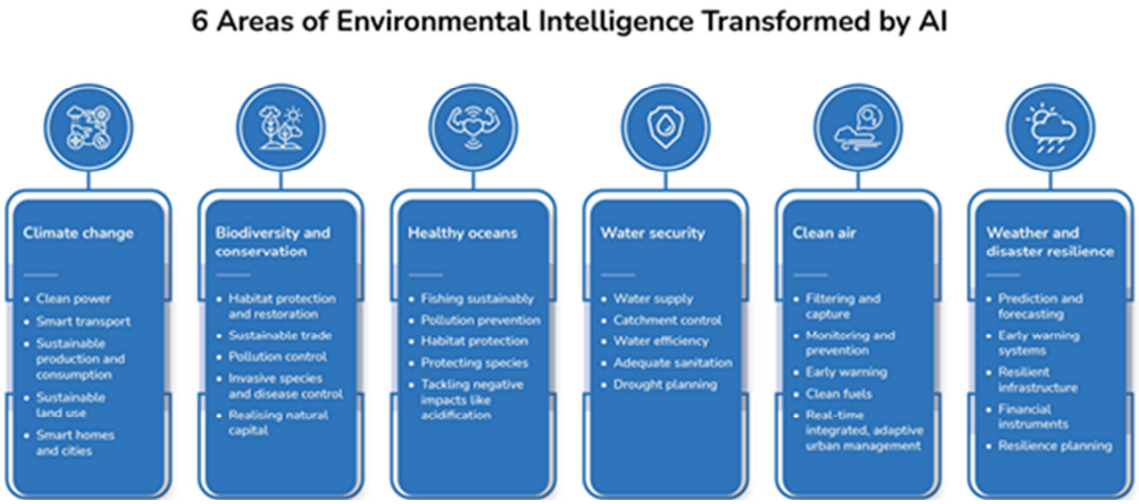
However, it is not only the fact that smart technologies do not pollute the environment that makes them a reason to limit climate change; Rather, it helps to improve the quality of human life in general, and reduce the waste of natural resources, through the use of artificial intelligence systems capable of predicting fires and natural disasters, and Internet of Things systems that are used to improve resource management and reduce energy waste, and to adopt smart city models that are capable To create more sustainable and environmentally friendly societies. This is evident in the following points:

5.1. Reducing Harmful Emissions

One of the major challenges facing cities in general, resulting in a significant rise in temperatures and an exacerbation of global warming, is the problem of harmful emissions that result from problems such as traffic congestion. It is a complex and intertwined problem, containing a wide range of sub-problems, such as environmental pollution, chest, and lung diseases, and wasting time, effort, and fuel in long waiting hours, which exposes individuals to cases of frustration and depression in many cases [11].

Smart technologies contribute to a large extent in overcoming this problem, by taking advantage of the technological solutions they provide, such as providing accurate and real-time information on traffic congestion points and its cause, by collecting Big Data from sensor systems, the Internet of Things and CCTV cameras on the roads, which contributes to the speed of identifying the problem and working to solve it.

The use of smart traffic lights also helps to prevent such problems in advance, using smart signals that automatically measure indicators of traffic densities and exchange them with each other and give priority to streets with a high density at the expense of the least dense. For example, if the number of cars in a street increase compared to another, it gives a greater opportunity of time to the crowded street automatically at the expense of the least crowded [12].



source: Data collected by a researcher

Figure 4. *Areas of Environmental intelligence by AI.*

On the other hand, electric vehicles, whether they are powered by a driver or intelligently without the need for a human presence, contribute to reducing harmful emissions, improving the weather in the streets, and helping to reduce accidents and reduce deaths.

The main advantage of this is that cities do not need to inject giant investments, they are cameras and sensors that can be installed in streets and roads with control rooms and central management, without the need to restructure the city's infrastructure, and of course it will be easier and more effective when planning to build new cities. These smart technologies will help facilitate the work of self-driving cars within the city, by providing them with accurate and real-time information about the condition of the roads and the cars around them.

There is a real and accelerating revolution in the transport sector around the world thanks to technology, which contributes to reducing environmental pollution problems, whether vehicles traveling over or under the ground or in the air. These technologies start with electric scooters, through smart bicycles and self-driving cars, to hyperloop trains, flying taxis, small planes, and other smart technologies [13].

5.2. Energy Saving and Good Management of Natural Resources

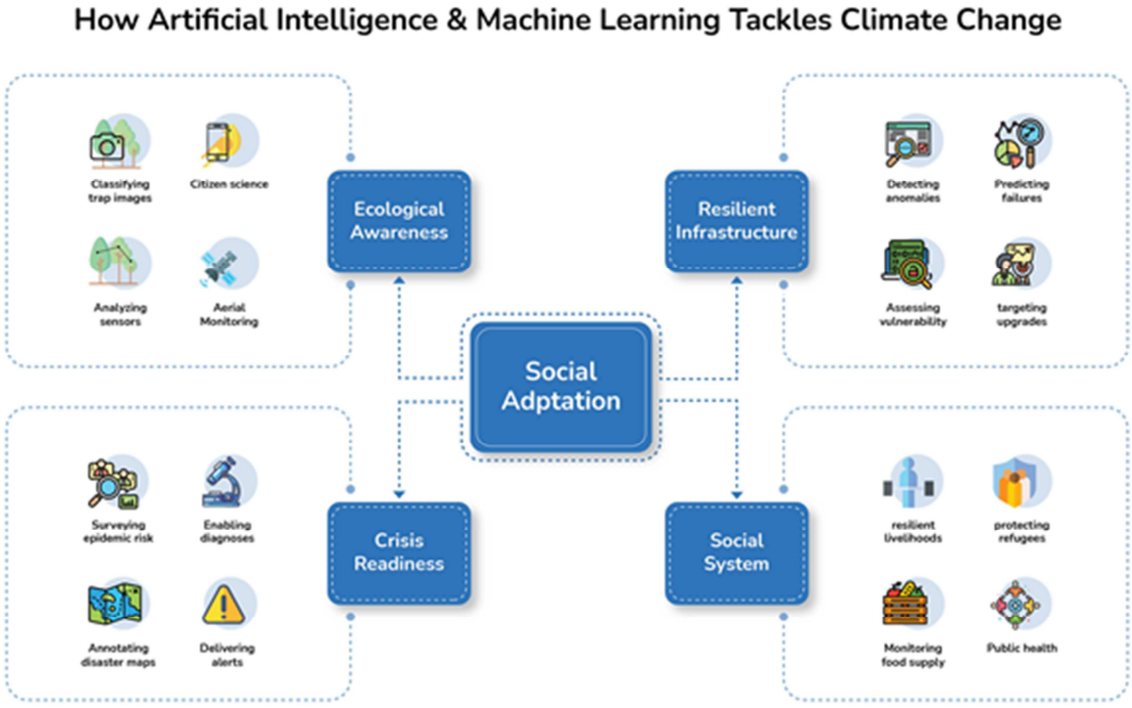
Environmental pollution is one of the main problems that cause ecosystem disruption, and overcoming it requires action at multiple levels. Here, the use of smart technologies contributes to reducing carbon emissions and pollution, by creating smart and environmentally friendly buildings that are sustainable and save in energy and water consumption.

Efficiency in resource management can be achieved using sensors and IoT devices that configure energy, electronic devices, air-conditioning, lighting, and water based on people's home situation. For example, it reduces the intensity of the lighting and disconnects the air-conditioners in the absence of individuals inside the house. It also monitors indicators of high temperatures, monitors cases of water leakage, and sends an alarm to the members of the house or to the concerned authorities [14].

The same applies to streets, squares, and cities as well. Smart sensors and meters deployed inside the city work to conserve resources and reduce energy waste, such as smart lighting systems, which operate only when needed, according to traffic density in the streets, and monitor air pollution levels. and water in real time, and measuring temperatures, atmospheric pressure, and the degree of chemical and carbon emissions in the air and their places of flow. The technology also enables the management of waste and its transformation into clean energy and fuel, and the treatment of waste and rainwater and agriculture for reuse, which ultimately contributes to overcoming the problem of pollution and managing environmental waste [14].

5.3. Improving the Weather

The role of smart technology does not stop at preserving the environment from pollution only, but rather it goes beyond that to intervene in nature to improve the weather on several levels. For example, the human factors that lead to higher temperatures can be influenced by utilizing big data analysis.



source: Data collected by a researcher

Figure 5. *Artificial Intelligence to Combat Climate Change.*

This is done by analyzing the huge data that can be obtained from the various temperature monitoring places in the city, linking it to the process of crowd management and human accumulations, as well as linking it with the areas of industries that result in high temperatures, and linking all these data with weather and humidity data in Atmosphere. With the overlap and analysis of this data with its counterpart received from satellite images on desertification, drought, floods, fire outbreaks and natural disasters, this contributes to anticipating the problems of climate change in the future and providing a realistic picture of the factors that can be controlled to improve the weather.

The technology can also be used in the processes of generating rain or what is called "rain seeding", using laser beams directed at the clouds or through penetrating small clouds planes and launching dozens of torches loaded with very small particles of potassium chloride and sodium chloride to pollinate the clouds, with the aim of increasing Amounts of water inside and stimulated to increase rain.

5.4. Overcoming Technological Waste

Despite the multiple advantages provided by smart technologies, which contribute to reducing harmful emissions, improving the weather, and preserving the environment; One of the main problems negatively affecting the environment is technological waste and waste, as well as energy-intensive technologies such as cryptocurrencies.

Tech companies and governments of some countries have taken aggressive measures towards reducing technological waste. For example, Apple is working on making all its products free of plastic by 2025 and has also used 100% reused aluminum in all its devices and is developing a plan to make the manufacturing process of its products carbon-free by 2030.

Also, HP has cut its carbon emissions by a third, and is reusing 30% of the plastic in its printers. And for Microsoft, by 2023 70% of its data centers will be using clean energy, to be a completely carbon-neutral company by 2030.

In the end, it can be said that one of the most important advantages offered by smart technologies is the good management of available resources, especially scarce resources, including land, energy, water, and natural resources. For example, using smart technologies, it is possible to provide solutions for the optimal use of spaces by considering the design of buildings to be energy-saving, building smart car parks to accommodate as many vehicles as possible, and designing roads to consider the achievement of traffic liquidity, which may lead to maintaining environment and climate change mitigation [14].

6. Integrating Artificial Intelligence into Disaster Management Systems

AI helps protect us from disasters. Disasters caused by natural hazards are increasing in frequency and intensity, reflecting the immediate reality of climate change, and leading to a growing succession of humanitarian crises. AI can help response teams understand natural hazards and monitor events in real time. Anticipating specific risks in the face of imminent or ongoing disasters.

"The more prepared we are in early warning, the less human tragedy," and while satellites and other existing meteorological infrastructures provide valuable weather forecasting information, artificial intelligence can take the process even further. Impact system modeling can, for example, indicate the potential consequences of natural hazards on populations and ecosystems.

Several case studies show the value of AI during the different phases of disaster management: first, forecasting and forecasting; Next, to help communicate what happened; In monitoring and early detection of potential new risks.

7. Uses of Artificial Intelligence in Agriculture

With the multiplicity of effects that artificial intelligence is playing in various sectors from health care to cars, manufacturing and others, the impact of this technology has reached the most vital sectors in the world: the agricultural sector, which is the basis of the global economy, with the increasing population, the world needs to produce 50% more food by 2050.

AI technologies can help farmers get quality crops and use resources more sustainably. As for how to use this technology in the agricultural sector, we will learn about it through:

7.1. Self-driving Tractors

With the huge investment in the development of autonomous vehicles to meet different needs, the agricultural sector is also benefiting from the advantages of these vehicles specifically through self-driving agricultural tractors. This technology combines GPS and automation systems, and this allows the tractor to be driven accurately and measured in centimeters, and to avoid excessive soil pressure, and provides favorable conditions for the growth of planting and harvesting, and helps in saving time, by drawing appropriate paths for the movement of the harvest [15].

source: Data collected by a researcher

Figure 6. *Smart tractor.*

These tractors are also programmed to independently detect where to plow in fields, set speed, and avoid obstacles

such as irrigation equipment, and humans and animals while performing tasks. With more high-quality training data for farming, the widespread use of these independent tractors will revolutionize farming.

7.2. Control of Pests and Insects

According to the Food and Agriculture Organization of the World, between 20 and 40% of the world's cereal crop is currently wasted due to pests and insects, which are among the most common threats to crops worldwide before they are harvested and stored for human consumption.

Artificial intelligence companies such as Farm Wise are helping to send alerts to farmers via their smartphones about insects such as locusts likely to land on a particular farm. These companies also use algorithms to analyze new satellite imagery and compare it to previous image data, allowing farmers to act to mitigate damage and remove costly pests in a timely manner.

source: Data collected by a researcher

Figure 7. *Smart farming.*

7.3. Agricultural Robots

Artificial intelligence companies are developing robots that can perform multiple tasks in the field of agriculture. These robots are trained to control weeds, harvest crops much faster than humans, help check crop quality and detect unwanted plants or weeds, among other things. Companies such as “Blue River Technology” and “Harvest CROO Robotics” manufacture this type of robot, which can harvest approximately 30,000 square meters of land in one day, which saves time and effort and allows for a reduction in the number of human workers.

source: Data collected by a researcher

Figure 8. *Agriculture robot.*

7.4. Monitoring the Health of Soil and Crops

Soil and crop quality is a major challenge for food-producing countries. Faced with this challenge, the German-based startup Peat has developed an application based on deep learning technology called Plantix that can identify potential defects and nutrient deficiencies in soil including pests and diseases. Image recognition A smartphone can be used to take a picture of the plant and detect defects in it. The application also provides advice and other solutions in the form of detailed videos depending on the situation facing the farmers [16].

source: Data collected by a researcher

Figure 9. *Smartphone robot.*

7.5. Monitoring the Health of Soil and Crops

Similarly, Trace Genomics relies on machine learning to provide soil analysis services to farmers. These applications help to monitor healthy soil and crop conditions and produce a healthy crop with a higher level of productivity. Vine View also brought in aerial photography solutions that rely on drones to monitor crop health. The drones are used to conduct a round of data capture from agricultural fields and then all the data is transferred via a USB drive from the drone to a computer and analyzed by experts. The company uses algorithms to analyze the captured images and provides a detailed report that contains the health status of the plants, and the condition of the leaves, as the plants are highly susceptible to diseases such as mold and bacteria, which helps farmers to control the health and protection of the plants in a timely manner.

source: Data collected by a researcher

Figure 10. *Smart fertilization.*

7.6. Precision Farming with Predictive Analytics

source: Data collected by a researcher

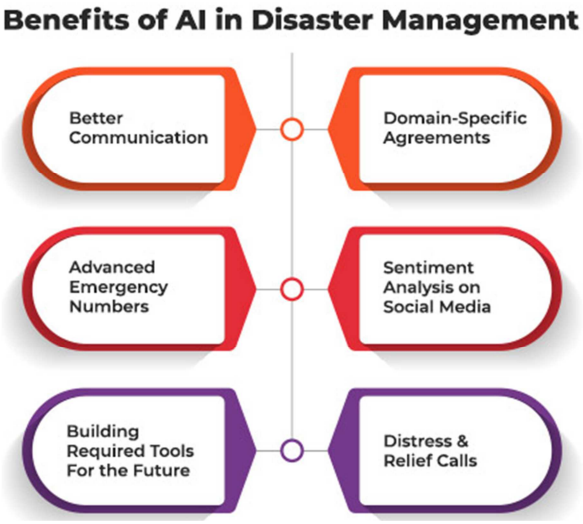
Figure 11. *Smart water management.*

The applications of AI in agriculture have expanded to become accurate and controlled by providing proper guidance to farmers on optimal planting, water management, timely harvesting, etc.… While using machine learning algorithms for satellite and drone images, AI techniques predict with weather conditions, it analyzes crop sustainability, assesses plant nutrition and the presence of diseases or pests with data such as temperature, precipitation, wind speed and solar radiation. AI not only helps farmers automate their farming, but also turns it into precision farming to get a better-quality crop while using fewer resources.

In the future, it is expected that agricultural companies whose services are based on artificial intelligence and machine learning will gain leadership and technological progress, as they will provide the most useful applications to help the world deal with the issues and challenges of food production for the exponential population growth every year.

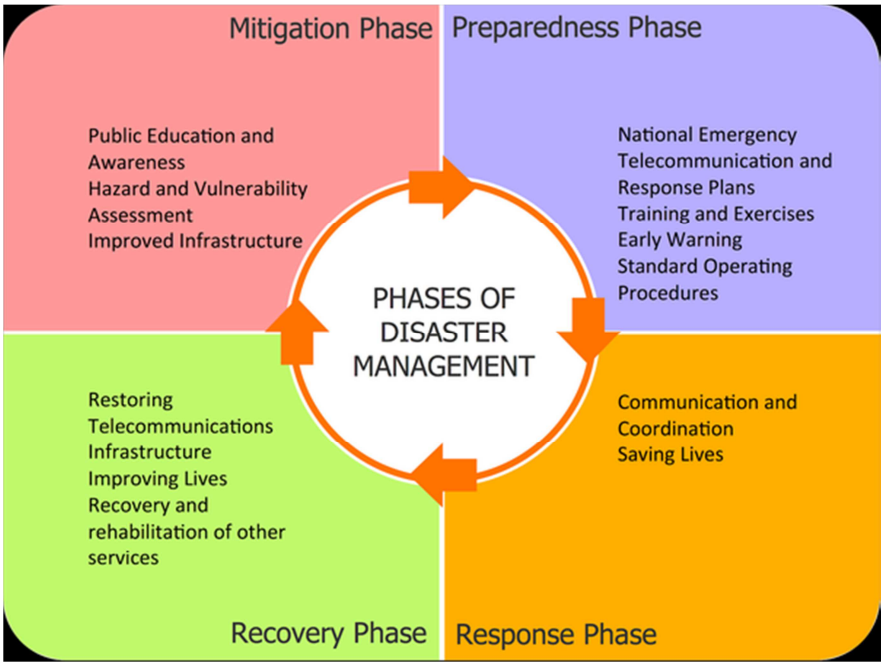
8. Artificial Intelligence in the Management of Epidemics and Disasters

The integration of artificial intelligence technology, with remote sensing tools and space sciences, provides a comprehensive integration of the information technology system for space monitoring, information acquisition, processing, analysis, and application on the ground, to study and support the sustainable development of society and the environment, and decision-making that serves economic development [17].



source: Data collected by a researcher

Figure 12. *AI in Disaster Management - Benefits and Use Cases | Analytics Steps.*



Data Collected by a Researcher

Figure 13. *Importance of disaster management.*

8.1. AI in Disaster Management - Benefits and Use Cases | Analytics Steps

As the impact of climate change has been documented around the world, an increase in the frequency and severity of natural hazards, including the recent health pandemic (Covid-19), has been observed, posing a serious threat to people's lives, property, and infrastructure.

In contrast, artificial intelligence and remote sensing have unique capabilities in surveying, monitoring, and measuring the effects of natural hazards, and providing conceptual advantages in extracting disaster information.

8.2. Importance of Disaster Management

These technologies have become an "important and essential support" for modern methods of disaster prevention and mitigation, with the acceleration of data processing operations, in the era of big data, to move towards a resilient, sustainable society, ready to face the consequences of climate change and natural and health hazards.

8.3. Forecasting Agricultural Yields

Remote sensing, through satellite imaging, has become an integral part of ongoing projects and applications in the fields of oil and mineral exploration, identification of pollution areas, meteorology, commercial fishing, field monitoring, forecasting of agricultural crops, and studies related to management and development. Urban area [18].

8.4. Application of Artificial Intelligence in Agriculture

Data Collected by a Researcher

Figure 14. *Application of Artificial Intelligence in Agriculture.*

As Microsoft launched the Artificial Intelligence for Planet Earth program, which aims to protect the Earth from pollution. The program lasts for five years and works in four basic sectors: water, agriculture, climate change, biodiversity, and dealing with natural disasters through anticipation, preparedness, and rapid intervention to reduce their repercussions, for example. Regarding rationalization and water conservation, there are great developments in the use of robots in agricultural irrigation, rationalizing water uses in agriculture, maintaining water quality and protecting it from pollution, as well as in rationalizing water uses within homes, work, and human activities in general.

9. Conclusion

Among the positive changes that accompany artificial intelligence are the rapid increase in human productivity and achievements by strengthening existing skills, providing better customer service, and improving the pace of recruitment and selection of labor.

New types of jobs will appear, and robots and other machines will carry out daily routine tasks in a professional manner, saving time and effort for employees to waste on simple things.

As for consumers, they will benefit from AI in the form of improving services, providing recommendations and quality more efficiently, as well as bringing about fundamental and tangible changes in industries such as health care, transportation, and pharmaceuticals in a safer manner.

Of course, people's lives will change for the better from the presence of self-driving cars and the expansion of this technology to other means of transportation such as trains, ships, and planes. It is expected that companies will reduce a lot of expenses thanks to artificial intelligence and its applications, which are increasing day after day, as well as the accompanying innovations and new inventions that will strongly affect daily life.

Controversy about artificial intelligence is raised from time to time, like any emerging technology that appears to the light. There are many industries that have sparked widespread controversy when they appear, such as cars and aircraft.

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