

Use of artificial intelligence in cleaner production proposals

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Abstract. - This paper aims to present a critical essay on the importance of artificial intelligence for companies' future, its objective of leaving a positive ecological footprint, and rewarding the use of natural resources spent by industries. Humanity has made life easier for everyone with technological advances; for this reason, with the proper research of accurate data, a prediction can be given of the savings and other economic and social benefits companies will obtain with artificial intelligence for cleaner production.

Keywords: Cleaner production, industry 4.0, harnessing, big data, artificial intelligence.

Uso de la inteligencia artificial en propuestas de producción más limpia

Resumen: El propósito de este trabajo es presentar un ensayo crítico sobre la importancia de la inteligencia artificial para el futuro de las empresas y su objetivo de dejar una huella ecológica positiva, premiando el uso de los recursos naturales que han sido gastados por las industrias. La humanidad ha hecho la vida más fácil para todos con los avances tecnológicos; por esta razón, con la investigación adecuada de datos reales consultados, se puede dar una predicción de los ahorros y otros beneficios económicos y sociales que las empresas obtendrán con la inteligencia artificial para una producción más limpia.

Palabras clave: Producción más limpia, industria 4.0, aprovechamiento, big data, inteligencia artificial.



I. INTRODUCTION

The environment is precious, and its care and protection must be constantly encouraged using all possible tools. All the objects found on the planet come from nature, so taking care of them is essential. For this reason, the implementation of artificial intelligence as a cleaner production proposal is applied in different sectors to improve them, the environment one of them, due to the high technology implemented to protect the other natural resources necessary for life.

Currently, natural resources are being depleted, but as time passes, tools have also been developed that are based on artificial intelligence and that, as far as possible, delay the depletion of these resources and the effects they entail. Moreover, while the development of technologies has inevitable negative consequences for the planet, the advancement of these technologies has also brought benefits.

An example of the impact that artificial intelligence has had on the environment has been smart agriculture. The implementation of automated data collection has made it possible to detect problems in crops (in early stages) and know the optimal time of planting, irrigation, and fertilization, allowing greater efficiency in controlling resources such as water, pesticides, and fertilizers. On the other hand, the use of artificial intelligence has been put into practice in respective problems to reduce air pollution with the creation of eco-driving algorithms, route optimization, and decrease urban transport traffic, as well as the establishment of intelligent traffic lights, capable of reducing the driving time by adjusting traffic flow.

Thus, it can be determined that using artificial intelligence in cleaner production proposals provides new and more innovative solutions that allow us to fight many threats, such as climate change, pollution, and the health of the planet's waters.

II. Elements that prevent the creation of proposals for cleaner production in industry 4.0.

The environmental impact generated throughout history by the industrial sector is already quite studied and known, so implementing preventive or corrective actions is increasingly practiced by different companies that accept or encourage a positive environmental culture. This brings us to industry 4.0, which radically changes how some industries operate, making them more efficient and, directly or indirectly, reducing the environmental impact.

Industry 4.0 can be seen as the combination of advanced production techniques and intelligent technologies implemented in all organizations. The processes that are part of the value creation chain are connected through a digital network. [1]. And in a certain way, some factors limit the use or implementation of industry 4.0 and are similar to those that restrict the creation of more ecological proposals within this industry.

Economy

The economic factor is a significant gap in implementing new technologies, which limits a little more to industry 4.0. Although investments can be made in technological systems, increasing investment in proposals considering the ecological impact generated has yet to be considered.

Culture

Although industry 4.0 brings benefits in terms of reducing the environmental impact of certain activities, we must also take into account the effect it has, such as the production of materials that are the physical inputs of the systems and the high energy expenditure generated by some hardware in different industries, but that is not something as visible as the emission of CO₂. It is often left aside, and there is no concern about the environmental impact of this industry.

It should also be borne in mind that despite its advantages, energy consumption will always be necessary and that traditional electricity will be dependent until some alternative is found, and this may be increasingly significant since the European Commission estimates that the energy footprint caused by technology is between 5% and 9% of world consumption [2].

B. Methods that prevent better use and use of cleaner production

Bottled products

According to Eco envases (2020), it is useless to consume bottled products. However, millions consume plastic bottles produced yearly for product packaging, and not all are recycled worldwide to create new materials. On the other hand, most of these containers end up in landfill, which significantly impedes the use and use of cleaner production. In addition, the unnecessary use of oil to produce plastic containers affects the environment and the beings that inhabit it.

Pesticides

Although the damage caused to the environment and animals is known, millions of people use pesticides to cultivate gardens and eliminate insects. Today, numerous natural remedies allow to keep insects away and keep the garden or plantations cared for naturally, without harming the environment or affecting living beings. That is, they encourage the use of cleaner production.

Plastic waste

Plastic waste has become part of everyday life, the same that can be easily found on roads, on the beach, in the forest, in parks, and in water resources. This waste, over time, has created plastic islands in the oceans and seas, causing the poisoning of marine animals.

Detergents and soaps

The Environmental Working Group in the United States has developed a blacklist of cleaning products used in homes that pose the most significant risks to health and the environment. Both detergents and soaps are not recommended because they have an antibacterial chemical compound that can destroy water and have catastrophic consequences for the marine environment and human health.

Glass bottles and cans

The most common waste on planet Earth is glass jars and cans. For one, glass jars can become small animal traps, and sharp parts (such as broken glass bottles, aluminum cans, and steel cans) can cause injury to wild animals. In addition, unfortunately, there is much waste of this type that is exposed to the air, and that takes decades to decompose.

Cosmetics

Many countries struggle to eliminate microcontaminants in cosmetic products, such as toothpaste and body scrubs. These tiny particles are not biodegradable, as they are made of polyethylene or polypropylene and, through sewers, reach seas, rivers, and lakes. Because of this, the danger has increased for fish and aquatic animals that ingest the micro granules, thinking they are food.

C. Big Data is a way to generate new proposals for cleaner production

To know the viability of a project, it is essential to know the organization's current situation, which is why data plays a vital role in understanding the benefits and waste reduction.

Data is at the heart of digital transformation, and the revolution is in being able to capitalize on it, take advantage of the value it brings to understand better what is happening, and, above all, be able to predict what will happen and prescribe what should be done. This will allow the optimization and generation of business opportunities and new sources of income.

There are several ways to collect data. However, they only sometimes treat this data correctly because of the large volumes, variety of sources, and the speed with which it is generated, known as Big Data. That is why several computational solutions have been developed that allow the treatment of Big Data, such as the following techniques to work with Big Data[3].

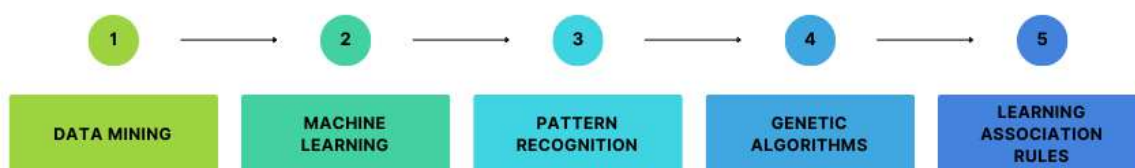


Fig. 1. Generation of new proposals through the application of Big Data

By applying these techniques, we obtain information that, when interpreted correctly, allows correct decision-making. Within a cleaner production project, costs can be reduced because the information is obtained from the workstations, which produce more waste and allows alternatives, such as the reuse of materials that allows the best use of the raw material used in the industry. [4] An example is observed in the aeronautical sector through optimizing aircraft routes. In 2019, IATA estimated 188,000 million dollars in fuel consumption in the global airline industry. Through the use of Big Data, it was possible to obtain data on the aircraft's speed and the influence of wind direction, with which they could establish the best routes with a saving of around 30 to 50 million dollars. [5] It is essential to highlight that this achievement also has an environmental impact by reducing the emission of CO₂ into the environment. The application of Big Data allows us to identify the material that hurts the environment due to the use of chemicals or the amount of energy needed to transform it, opening the opportunity to look for new ways to offer a similar product to the market, optimizes the resources used in the process of adding value, which will allow the company to be more attractive to another niche market.[6]

II. Artificial intelligence and new proposals for cleaner production.

Environmental care, all the actions taken to reduce the deterioration of nature, has been affected mainly by the various companies that exist worldwide. For this reason, with the growth of technology, industries have found multiple ways to prevent pollution. One is artificial intelligence, the algorithms proposed to create machines that can perform human actions [2]. Artificial intelligence indicates an era of enterprise digital transformation. Although the investment ranges from \$ 20,000 to 1,000,000 dollars, the benefits generated by this implementation are the reduction of operating costs, improved efficiency, and customer experience, which as a result, will obtain greater profitability [3]. It is estimated that by 2030, production will increase by 16% using this intelligence [4]. That is to say that in the future, companies will be obliged to make use of machinery with this type of technology and thus maintain a solid competitive level.

Companies are prone to various accidents, for example, fires. It is estimated that electrical fires cause 19% of business fires, that is, due to a lack of maintenance of cables, machinery, or electricity services. With artificial intelligence, the "B2FireDetection" tool has been created to calculate any fire risk that is about to occur with a minimum margin of error. In addition, it contains algorithms to monitor the status and behavior of infrastructures in extreme weather conditions [5]. In this way, this intelligence contributes to reducing the carbon footprint and protecting assets. In Latin America, it is estimated that as of 2018, fires in companies have increased by 8%. With AI, fires can be reduced to 90% due to their level of accuracy [6].

Food waste is a big problem for companies because it negatively impacts nature and generates significant economic losses in stores selling food and household products. For this reason, artificial intelligence has been developed that analyzes any food to determine the exact period in which the food is no longer consumable [7]. This system can be effective in the food and beverage industries because production would achieve a balance in terms of waste, increasing food availability and reducing the wear and tear of natural resources. Globally, 1300 million tons of food are wasted. However, by implementing artificial intelligence, it can be reduced by up to 80% due to its level of accuracy [8].

As we know, electricity generation is a polluting factor, and using this energy produces high amounts of greenhouse gases that cause climate change when expelled into the atmosphere. That is why one of the preventions for environmental care is to turn off devices that are not being used, which is not a habit among families. Consequently, artificial intelligence also helps us with this problem. Machines with algorithms have been created that can diagnose sleep stages by breathing users for automatic shutdown [9]. For companies, this type of machine will be advantageous since it would help reduce electricity costs and, at the same time, generate a tremendous ecological impact. This intelligence would help detect when the operator is not in place, so the machinery would not be used. By using these machines, it would be possible to reduce at least 5% of the current consumption [10]. We take the example that an Ecuadorian industrial SME has a consumption of \$ 250 per month. Therefore, by reducing the abovementioned percentage, the SME would save \$ 125.

Finally, the use of artificial intelligence has a significant impact on companies and their way of carrying out new business strategies that allow implementation of this machinery throughout the infrastructure so that, in this way, optimal results are achieved, and the investment is reflected in greater profitability and even provide differentiation with customers. The savings proposals of the machinery that have algorithms will save 80% in electricity, economy, and waste savings. For this reason, companies have to adapt to the new realities of being part of this new era.

III. RESULTS

For this point, it will be considered a food company that makes natural juices, so it has a farm with plantations of the fruits it needs for its production, and on the other hand, it has its factory in which the fruits are processed. Finally, the finished product, the bottled natural juice, comes out. For this cleaner production plan, everything from plantation control to processing will be considered. Then, in the first place, big data will be used to collect information from each fruit. That is, specific sensors will be implemented for each plantation to collect relevant data, such as the ripening time of the fruit and the amount of water it needs. With this information, we can use artificial intelligence to program a system in which the data collected is taken into account and automate the frequency of irrigation of the plantations. On the side of sustainability, this will minimize water consumption, allowing only the necessary amount to be used. On the side of business profit, the raw material will be in optimal condition.

Then we will consider the logistics, for this essential data will be used to predict the demand for raw materials: the number of fruits needed for production. With this, it will be possible to program and plan the planting of fruits with artificial intelligence, but it will also be possible to determine which fruits are already ready to be sent. By this, we mean that the fruits are already ripe, and the amount established by using big data is already available; With this information, you can schedule the transports and their frequency of them and minimize unnecessary transfers. On the sustainability side, there will be fewer transfers, which means less environmental pollution, and the company will have fewer logistics costs.

Finally, once the raw material is in the factory, big data will be used to recognize quality problems of the final product and within the process, and the availability of the machines will also be recognized. In this way, the use of these will be optimized. Furthermore, with artificial intelligence, the use of the devices will be programmed, so if one of them will not be used, it will remain off until its use is required. This reduces the company's energy consumption and expenditure. In conclusion, these measures will reduce the energy and water consumption of the company's productive activity by optimizing processes using big data and artificial intelligence.

CONCLUSIONS

-Although the development of technologies related to big data entails inevitable negative consequences, it cannot be denied that it has allowed the creation of new and very good solutions for the implementation of cleaner production proposals in the environment.

-Data within organizations plays an important role because it allows to know the current situation of the processes, however, if the data are not treated appropriately, the information does not contribute to decision making. For which it is recommended that organizations look for software that uses techniques, which adapt to their process and providing the visualization of management indicators that allow the continuous improvement of the organization by identifying losses in the production process.

-The industrial future is also going towards automation and digitalization, which includes industry 4.0, in which many proposals can be made guided towards environmental care, so that both companies and governments will need to encourage proposals for cleaner production within the industry

-The industry must necessarily be supported by sustainable development, that is, it must try to maintain a balance with the components that surround it, as well as humans, as well as the environment in which it develops its activities, and although technology has been a trigger for this balance to be affected, at present, Technology can also allow industries to improve their processes with an emphasis on caring for the environment. This care is achieved through cleaner production techniques that are backed by technological tools which allow a serene coexistence between economic activity and the environment that surrounds them.

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