

Chapter 16

The Role of IoT and AI in Bioeconomy

Justino Lourenço

Polytechnic Institute of Gaya, Portugal

ABSTRACT

The new era brings a panoply of new challenges in terms of proactive procedures in order to achieve a better Europe's ecosystem. A set of new trend technologies such as artificial intelligence (AI) and internet of things (IoT) can and will bring a new approach to deal with our problem. The AI can contribute to sustainability in various ways, such as optimizing energy consumption, reducing waste, improving supply chain efficiency, and enabling precision agriculture. AI can help advance scientific research and innovation for sustainable development, such as developing new materials and technologies for clean energy production and storage. On the other hand, IoT can help in terms of sustainability by enabling real-time monitoring and control of energy and resource usage in buildings, transportation systems, and industrial processes. This chapter plans to start the discussion of the expected positive impacts in the short term from the adoption of AI and IoT for a more sustainable planet.

INTRODUCTION

The bioeconomy refers to the sustainable use of biological resources, such as plants, animals, and microorganisms, to produce food, energy, and materials. It is a crucial component of efforts to achieve a more sustainable future, as it provides a way to meet our growing needs while reducing our impact on the environment. So, the bioeconomy faces a number of significant challenges that must be addressed in order to ensure its success. These challenges include issues related to resource availability, sustainability, economic viability, and regulatory frameworks. In this context, it is important to explore the key challenges facing the bioeconomy and identify potential solutions to help unlock its full potential. This will require collaboration between governments, businesses, and other stakeholders, as well as a willingness to embrace innovative solutions and new technologies.

The bioeconomy is a rapidly growing sector that is playing an increasingly important role in addressing the global challenges of food security, energy security, and environmental sustainability. One of the

DOI: 10.4018/978-1-6684-8879-9.ch016

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key drivers of this growth is the increasing use of digital technologies, such as artificial intelligence (AI) and the internet of things (IoT), which are enabling innovative approaches to the production, processing, and distribution of biological resources.

The AI has the potential to revolutionize the bioeconomy by providing new tools for data analysis, modeling, and prediction. For example, AI can be used to optimize crop yields by analyzing soil and weather data to predict the best time for planting and harvesting. It can also be used to develop new materials and chemicals by simulating the properties of biological molecules and predicting their behavior under different environmental conditions. As a last remark, AI can optimize waste usage and improve efficiency in the bioeconomy by optimizing supply chain logistics and reducing energy consumption.

The IoT is another key technology that is driving the growth of the bioeconomy. IoT devices can be used to collect data on everything from soil moisture levels to animal behavior, providing valuable insights into the biological processes that underpin the bioeconomy. This data can be used to optimize production processes, improve quality control, and reduce waste.

The blending of AI with IoT provides a powerful lever for the bioeconomy, enabling us to develop more sustainable and efficient approaches to food, energy, and material production. However, there are also challenges that must be addressed in order to fully realize the potential of these technologies. These include issues related to data privacy and security, regulatory frameworks, and the ethical implications of using AI and IoT in the bioeconomy.

As a last argument, the combination of AI and IoT is creating new opportunities for innovation and growth in the bioeconomy. By embracing these technologies and working together to address the challenges they present, we can unlock the full potential of the bioeconomy and help to build a more sustainable future.

BACKGROUND

The purpose of this chapter is to present the state-of-the-art and discuss the future positive impact in bioeconomy from the lever provided by AI and IoT. In this section, the AI and IoT current and past interventions in bioeconomy are presented.

The AI and IoT are relatively new technologies, but they have already had a significant impact on the bioeconomy. Over the past few decades, researchers and innovators have used these technologies to develop new approaches to food, energy, and material production, and to address some of the key challenges facing the bioeconomy.

One of the earliest applications of AI in the bioeconomy was in the field of genetics. In the 1980s, researchers began using AI to analyze genetic data and identify patterns that could be used to predict the properties of new biological materials (Schaffer, J. D. 1984). This led to the development of new crops and materials with improved properties, such as increased yield, disease resistance, and durability.

Similarly, IoT has been used in agriculture, with sensors and other devices used to monitor soil moisture, temperature, and other factors that can affect crop growth. By collecting and analyzing this data, farmers and other stakeholders can optimize their production processes and reduce waste, improving both efficiency and sustainability.

In recent years, AI and IoT have also been used to develop new approaches to bioenergy production. For example, AI has been used to develop algorithms that can optimize the production of biofuels from

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