Chapter 16
Sustainability and AI

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ABSTRACT

The chapter "Sustainability and AI" examines how artificial intelligence (AI) is revolutionizing sustainable business practices across industries. AI's transformative potential is explored through its applications in optimizing energy management, supply chains, product lifecycle management, and waste reduction. The chapter discusses AI's contributions to the UN's Sustainable Development Goals (SDGs), promoting resource efficiency, climate resilience, and environmental conservation. Case studies illustrate how AI enhances circular economy models, advancing recycling and waste minimization. Additionally, the chapter addresses the social and economic benefits, ethical challenges, and governance issues of AI-driven sustainability. Concluding with future prospects, it presents AI as a key enabler for long-term sustainability, emphasizing responsible adoption for lasting impact.

1. INTRODUCTION

1.1 Overview of Sustainability and Its Significance in Modern Business

Modern business strategy has sustainable development as its essential component because it tackles the severe requirement of merging economic development with ecological protection and socially responsible practices. Sustainability as a concept originates from the Brundtland Report (1987) that describes sustainable development through this definition: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 1987). Various regulatory forces and consumer and investor demands now push organizations to use sustainable practices for minimizing their emissions and waste generation along with fair labor implementation (Bansal & DesJardine, 2014).

The business world recognizes sustainability as something that transcends corporate social responsibility (CSR) by emerging as a core element for winning over competitors. When businesses embed sustainability within their operations, they gain three financial benefits which include energy costs reduction and superior reputation and enhanced investor confidence (Elkington, 2018). Sustainable business models help decrease business risks through reduced exposure to nature-based and regulatory

DOI: 10.4018/979-8-3373-0608-7.ch016

challenges. Organizations operating in the corporate world must actively promote sustainable operations because climate change and resource exhaustion alongside biodiversity loss create survival-level threats.

1.2 Role of Digital Technologies in Advancing Sustainability

The fast development of digital technology gives companies new instruments to reach environmental targets. Organizations now monitor, control, and maximize their environmental and social effect using technologies such the Internet of Things (IoT), blockchain, big data analytics, and artificial intelligence (AI) (George et al., 2020).

By providing predictive insights, automating resource management, and reducing energy use, AI especially has become a potent facilitator of sustainability (Sustainable AI Lab, 2022). Real-time monitoring of carbon emissions, waste creation, and supply chain inefficiencies made possible by IoT sensors in concert with artificial intelligence analytics by means of immutable records of transactions and certificates, blockchain technology improves openness in sustainable sourcing (Saberi et al., 2019). Big data analytics lets companies make data-driven choices on environmental impact reduction, resource allocation, and energy efficiency while others (Azoury et al., 2024).

Digital platforms facilitate collaboration among businesses, governments, and civil society in addressing sustainability challenges. Open-source AI tools, digital sustainability dashboards, and virtual supply chain platforms enable organizations to share data, benchmark sustainability performance, and implement best practices (Boons et al., 2020). Through these digital innovations, businesses can transition from traditional, linear economic models to circular and regenerative systems that reduce waste and promote long-term sustainability.

1.3 The Intersection of AI and Sustainability

Artificial intelligence (AI) is quickly becoming a game-changer in the fight against climate change and for ethical human resource management, among other areas. Machine learning algorithms let businesses shift through massive information in search of trends, patterns, and other insights that might inform the development of long-term, proactive plans. Artificial intelligence (AI) connects the dots between social and economic sustainability, as well as environmental sustainability, three critical areas that contribute significantly to sustainability advances.

Environmental Sustainability: Artificial intelligence (AI) aids environmental preservation efforts by conserving energy, making better use of resources, and reducing emissions of greenhouse gases. By adjusting power distribution based on demand patterns, smart grids driven by AI may significantly reduce energy waste (Subrahmanyam et al., 2024). Machine learning algorithms analyze weather patterns, crop health, and soil conditions to optimize fertilizer and water consumption while minimizing environmental impact in precision agriculture (Van Es & Woodard, 2017).

Social Sustainability: AI contributes to social sustainability by promoting fair labor practices, improving workplace safety, and enhancing accessibility for marginalized communities. AI-powered analytics help businesses detect exploitative labor conditions within global supply chains, ensuring compliance with ethical sourcing standards (Pereira et al., 2022). AI-driven assistive technologies empower people with disabilities by providing speech recognition, language translation, and smart accessibility features in digital environments (Nishant et al., 2020).