

Chapter 11


Economic, Environmental, and Social Benefits of Sustainable Automation With Energy Optimization

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ABSTRACT

Sustainable automation incorporates emerging techniques such as AI, robotics or Internet of Things (IoT) into industrial and societal systems and at the same time address environmental sustainability. Automation also contributes to global sustainability objectives such as improved productivity, lowering of carbon emissions and the promotion of a circular economy. AI powered systems promote energy efficiency, waste management, and resource conservation which lead to economic flexibility. Moreover, automation promotes social equity by boosting workplace safety, wider access to healthcare, and greater inclusivity in employment. Thus, high

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initial costs, ethical issues and workforce displacement must be clearly addressed and investment in new meaningful government and education policy landscape must be in place. Overcoming these obstacles is key for fair uptake and the durability of the system. Looking at the case studies, measurable impacts and forward path, the research highlights how automation can be a foundational element for a resilient, inclusive future.

INTRODUCTION

Sustainable automation incorporates emerging technologies—robotisation, AI, IoT, and machine learning—into industrial, agricultural and societal systems based on economic efficiency along with environmental soundness and social justice. By integrating automation into sustainable strategies as their cornerstones, sectors can optimize resources allocation, minimize ecological influence, and call their workers to promote inclusivity. Sustainable automation looks beyond the conventional automation drivers, which are essentially productivity and cost reduction; it is in line with the global sustainability agenda such as the United Nations’ Sustainable Development Goals (SDGs) to solve issues like climate change, resource depletion, and social disparity. The chapter offers and highlights for all these benefits including economic, environmental and social aspects from sustainable automation inferred with empirical analysis, theories, case examples, tables, figures. It is updated with new 2025 studies to represent the newest progress and the evolving landscape and comes as a complete analysis of how sustainable automation can lead us to a more resilient and fair future. The inclusion of a tables and figures serve to better illustrate the important related impacts and dynamics, such as comparative energy efficiency gains, industrial waste reductions, and employment growths. When sustainability is merged with automation, long-term value can be achieved in industries and societies, inspiring and enabling innovation while delivering ethical and environmentally-responsible practices.

ECONOMIC BENEFITS OF SUSTAINABLE AUTOMATION

Resilient automation offers significant economic benefits, including productivity gains, lower operational costs, innovation and job creation. They hold many benefits for businesses that need to address the pressures exerted by global competition, economic uncertainty, and customer change.

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