**TOWARDS SUSTAINABLE CONSUMPTION AND PRODUCTION: ADVANCING AEROSPACE INNOVATION FOR SDG12**

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**ABSTRACT**

The aerospace industry stands as a cornerstone of technological progress, national security, and economic prosperity. It plays a crucial role in advancing Sustainable Development Goal 12 (SDG 12) by prioritizing energy efficiency, waste reduction, circular economy principles, and environmental stewardship. Despite its pivotal role, our research suggests a lack of significant correlation between attitudes toward eco-friendly measures and the adoption of energy-efficient technologies in aerospace manufacturing. This highlights the need for further investigation to validate these findings and identify potential barriers to sustainable practices. To better align with SDG 12, the aerospace sector must enhance research efforts, promote awareness about the benefits of sustainable technologies, and advocate for policies that support sustainability in manufacturing processes. Collaboration among industry stakeholders, research institutions, and policymakers is essential for developing comprehensive strategies. By addressing these challenges, the aerospace industry can amplify its contribution to sustainable development, driving innovation and fostering a more sustainable future.

***KEYWORDS:*** *Aerospace industry, Sustainable Development Goal 12 (SDG 12), Energy efficiency.*

**INTRODUCTION**

The aerospace sector epitomizes technological progress, driving human exploration beyond Earth's boundaries. It encompasses aircraft, spacecraft, and satellite design, manufacturing, and operation, serving sectors such as commercial aviation, defense, and space exploration. Commercial aviation facilitates global connectivity, fostering trade and tourism while spurring innovations in aircraft design and fuel efficiency. Aerospace technologies are crucial for national security, supporting surveillance, reconnaissance, and strategic deterrence. Space exploration initiatives, led by organizations like NASA and SpaceX, fuel innovation, create high-skilled jobs, and contribute to economic growth through research and development and technology transfer.

**AREOSPACE SECTOR**

The aerospace sector involves designing, making, and operating aircraft, spacecraft, and satellites. It serves commercial aviation, defense, and space exploration. This sector drives innovation, creates jobs, and contributes to economic growth through research and development.

**WHO AEROSPACE INDUSTRY PLAYS A IMPORTANT ROLE IN PROMOTING SDG-12**

* **Energy Efficiency:** Aerospace companies invest in developing and implementing energy-efficient technologies for aircraft and spacecraft, reducing fuel consumption and emissions during operations.
* **Waste Reduction:** The industry focuses on minimizing waste generation through improved manufacturing processes, recycling initiatives, and the development of reusable spacecraft components, aligning with SDG 12's target of reducing waste generation.
* **Circular Economy:** Aerospace companies promote circular economy principles by refurbishing and repurposing spacecraft components, reducing the need for raw materials and minimizing waste generation.
* **Environmental Impact Reduction:** By developing cleaner propulsion systems and adhering to strict environmental regulations, the aerospace industry aims to minimize its environmental footprint, contributing to SDG 12's goal of reducing environmental impact.
* **Innovation and Collaboration:** Aerospace companies collaborate with research institutions, governments, and other industries to develop innovative solutions for sustainable consumption and production, fostering technological advancements that benefit society as a whole.

**OBJECTIVES**

* Implement eco-friendly measures in aerospace manufacturing to enhance energy efficiency and minimize waste, in accordance with SDG 12.
* Introduce energy-efficient technologies in aerospace manufacturing to reduce carbon emissions and resource usage.
* Implement waste reduction programs in aerospace through recycling and reuse to promote circular economy and minimize environmental impact.
* Partner with waste management firms to improve recycling in aerospace manufacturing.

**REVIEW OF LITERATURE**

**Sánchez Roncero, A. (2022). “Study on the contribution of Aerospace Engineering to achieve the United Nations Millennium Goals by Artificial Intelligence.”,** The 2030 Agenda of the United Nations (UN) revolves around the Sustainable Development Goals (SDGs). A critical step towards that objective is identifying whether scientific production aligns with the SDGs' achievement. To assess this, funders and research managers need to manually estimate the impact of their funding agenda on the SDGs, focusing on accuracy, scalability, and objectiveness. With this objective in mind, in this work, we develop ASDG, an easy-to-use Artificial-Intelligence-based model for automatically identifying the potential impact of scientific papers on the UN SDGs.

**Ashutosh Tiwari. (2024). “Advancement of Materials to Sustainable & Green World.”**The International Association for Advanced Materials is optimistic that the United Nations' Sustainable Development Goals (SDGs) can be achieved through scientific consideration of circular materials and embracing new green technological advances, as well as by keeping global commitments to reduce climate change, adapt to it, and come up with new ways to deal with it. The present green transition projects rely heavily on the accessibility of biodiversity, climate, and net-zero technologies leading to a sustainable future.

# **Abdul Hai Alami, Abdul Ghani Olabi, Adnan Alashkar, Shamma Alasad, Haya Aljaghoub. (2023). “Additive manufacturing in the aerospace and automotive industries: Recent trends and role in achieving sustainable development goals.”**[Additive Manufacturing](https://www.sciencedirect.com/topics/engineering/additive-manufacturing) (AM) is the fastest growing industrial technique, harboring innovative, cost effective and environmentally friendly solutions. Over the years, [AM technologies](https://www.sciencedirect.com/topics/engineering/additive-manufacturing-technology) have been utilized in the aerospace and automotive industries mainly for prototyping purposes. However, [3Dprinting](https://www.sciencedirect.com/topics/engineering/3d-printing) of aircraft and automobile components and parts has recently proven its efficiency. In this paper, a comprehensive review on the utilization of AM technologies in the aerospace and automotive industries is presented.

**Ray, Subrata. (2019). "Sustainable Aviation: A Visionary Perspective."** This publication explores the future trajectory of sustainable aviation, examining the role of emerging technologies such as electric propulsion, hydrogen fuel cells, and advanced materials in reducing the environmental impact of air transportation. Ray discusses the potential for sustainable aviation to align with SDG12 by improving resource efficiency, reducing emissions, and fostering innovation in the aerospace industry.

**Smith, John A. (2020). "Circular Economy in Aerospace: Opportunities and Challenges."** Smith's work delves into the concept of circular economy within the aerospace sector, investigating how principles of waste reduction, resource recovery, and product lifecycle extension can be applied to aircraft manufacturing, operation, and end-of-life management. The publication highlights opportunities for cost savings, environmental benefits, and regulatory compliance while addressing challenges related to technology adoption, supply chain integration, and stakeholder engagement.

**RESEARCH METHODOLOGY**

This research uses an exploratory design to examine the topics of interest. Convenience sampling is utilized to select participants who are readily accessible. Primary data is gathered through questionnaires, offering direct insights from respondents. Secondary data is obtained from various sources, including websites, journals, books, company websites, and other related records, providing additional context and background information to support the analysis.

**DATE ANALYSIS & INTERPRETATION**

**TABLE**

EXPLORING THE RELATIONSHIP BETWEEN ATTITUDES TOWARDS ECO-FRIENDLY MEASURES AND ENERGY-EFFICIENT TECHNOLOGIES IN AEROSPACE MANUFACTURING

**H0 (Null Hypothesis):** There is no meaningful correlation between and attitudes towards introducing energy-efficient technologies in aerospace manufacturing.

**H1 (Alternative Hypothesis):** There is a significant correlation between attitudes towards implementing eco-friendly measures and attitudes towards introducing energy-efficient technologies in aerospace manufacturing.

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| |  |  |  |  | | --- | --- | --- | --- | | **Correlations** | | | | |  | | Attitudes towards implementing eco-friendly measures | Attitudes towards introducing energy-efficient technologies in aerospace manufacturing. | | Attitudes towards implementing eco-friendly measures | Pearson Correlation | 1 | .236 | | Sig. (2-tailed) |  | .099 | | N | 50 | 50 | | Attitudes towards introducing energy-efficient technologies in aerospace manufacturing | Pearson Correlation | .236 | 1 | | Sig. (2-tailed) | .099 |  | | N | 50 | 50 | |

**INFERENCE**

The correlation coefficient between attitudes towards implementing eco-friendly measures and attitudes towards introducing energy-efficient technologies in aerospace manufacturing is 0.236, with a p-value of 0.099. With a p-value greater than 0.05, we fail to reject the null hypothesis, suggesting no significant correlation between the two variables.

**FINDINGS AND SUGGESTIONS**

**FINDINGS**

* The Pearson correlation coefficient between attitudes towards implementing eco-friendly measures and energy-efficient technologies is 0.236, with a p-value of 0.099.
* Since the p-value is greater than 0.05, we fail to reject the null hypothesis, indicating no significant correlation between the two variables.

**SUGGESTIONS**

* Conduct studies with larger samples to verify these findings and launch educational initiatives to highlight the advantages of eco-friendly and energy-efficient technologies.
* Promote policies and incentives for sustainability in aerospace manufacturing, and collaborate with stakeholders for comprehensive insights and solutions.

**CONCLUSION**

The aerospace sector is crucial in advancing technology, enhancing national security, and stimulating economic growth. It significantly contributes to Sustainable Development Goal 12 (SDG 12) by improving energy efficiency, reducing waste, adopting circular economy principles, and lessening environmental impacts. Our research, however, indicates no significant correlation between attitudes towards eco-friendly measures and energy-efficient technologies in aerospace manufacturing, suggesting a need for more extensive studies with larger sample sizes to verify these findings and identify obstacles to sustainable practices. To better align with SDG 12, it is vital to expand research efforts, initiate educational programs to highlight the benefits of sustainable technologies, and promote policies and incentives that support sustainability in aerospace manufacturing. Additionally, fostering collaboration among stakeholders is essential for developing comprehensive solutions. Addressing these areas will enable the aerospace industry to contribute more effectively to sustainable development through innovation and responsible practices.

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