



Optimizing Sustainability Strategies in the Airline Industry: A KPI-Driven Approach for Environmental Affairs

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1

Abstract

Abstract: In an era where environmental sustainability has become a pivotal concern for the airline industry, this paper delves into the strategic role of Key Performance Indicators (KPIs) in enhancing sustainability practices. Through a mixed-methods research approach, incorporating systematic literature review, comparative analysis, and case studies of leading airlines, the study identifies and evaluates critical KPIs across various dimensions of sustainability efforts, including environmental impact reduction, resource management, and corporate social responsibility. Findings reveal that comprehensive and actionable KPI frameworks are instrumental in guiding airlines toward improved environmental performance, stakeholder engagement, and regulatory compliance. The research highlights the theoretical and practical implications of adopting KPI-driven sustainability strategies, offering actionable recommendations for integrating these indicators into airlines' operational and strategic planning. Future research directions are proposed



to explore the longitudinal impacts of KPI-driven strategies, the potential of emerging technologies in sustainability management, and the effects of evolving global regulatory landscapes on airline sustainability practices. This study contributes to the discourse on sustainability in the airline industry, providing a nuanced understanding of the operationalization and benefits of KPI-driven approaches in achieving sustainable aviation. It underscores the critical importance of systematic, measurable strategies in navigating the complexities of environmental stewardship and corporate responsibility, urging continuous innovation and collaboration towards sustainable excellence in the airline industry.

Keywords: Sustainability, Airlines, Key Performance Indicators, Environmental Management, Corporate Responsibility.

2

Introduction

Background

The airline industry, essential for global connectivity, stands at a crucial intersection of escalating environmental concerns and the imperative for sustainable practices. As significant contributors to global carbon emissions, airlines face heightened scrutiny from regulatory bodies and an environmentally conscious public. This scrutiny extends beyond mere compliance; it calls for leadership in adopting and advancing sustainable practices to significantly diminish the environmental footprint.

In recent years, the urgency for sustainability within the airline industry has intensified, propelled by a complex amalgamation of factors. Climate change manifestations, such as rising global temperatures, erratic weather patterns, and increased frequency of extreme weather events, have spurred worldwide demands for carbon emission reductions. Concurrently, regulatory pressures have escalated, with international agreements and local legislations setting ambitious targets for emissions reductions and sustainability benchmarks. Additionally, there's an expanding expectation among consumers, investors, and partners for airlines to showcase environmental responsibility and operational transparency.

Amidst these challenges, the airline industry encounters a unique opportunity to exemplify leadership, embracing sustainability strategies that extend beyond compliance to genuinely mitigate environmental impacts. These strategies entail a broad spectrum of initiatives, including enhancing fuel efficiency, adopting sustainable aviation fuels, minimizing waste, and optimizing operational efficiency. The success and efficacy of these initiatives hinge not only on their implementation but also on the precision in measuring and managing their impacts.



Sustainability strategies play a pivotal role in reducing emissions, conserving resources, and fostering biodiversity, enabling airlines to contribute significantly to combating climate change while ensuring their long-term sustainability in an increasingly eco-conscious world. This article seeks to explore the critical role of Key Performance Indicators (KPIs) in augmenting the efficiency and impact of sustainability strategies within the airline industry. By adopting a systematic approach to measuring and managing sustainability performance, airlines can adeptly navigate the intricacies of environmental stewardship, aligning their operational practices with global sustainability objectives.

Rationale

The imperative for a systematic approach to sustainability within the airline industry is unmistakable. As airlines traverse through a landscape marked by complex environmental regulations, evolving consumer expectations, and intense competitive pressures, the adoption of a structured sustainability framework becomes crucial. This framework not only facilitates the development and execution of sustainability initiatives but also ensures their congruence with broader business objectives and global environmental aspirations. At the core of this systematic approach lie Key Performance Indicators (KPIs), serving as essential instruments in the measurement, management, and enhancement of an airline's environmental performance.

3

KPIs provide a quantifiable measure of progress towards specific sustainability targets, enabling airlines to gauge the effectiveness of their environmental strategies. These indicators furnish clear, actionable data, aiding in pinpointing successful areas and those requiring amendments, thus enabling informed decision-making and strategic modifications. Furthermore, KPIs play a crucial role in communicating performance outcomes to stakeholders, including customers, investors, and regulatory entities, thereby bolstering transparency and accountability in environmental stewardship.

Beyond mere measurement, KPIs are instrumental in fostering performance enhancements. By setting clear, quantifiable targets, KPIs incite organizational transformation, encouraging a culture of continuous improvement and innovation in sustainability practices. They allow airlines to benchmark their performance against industry norms and peers, identifying exemplary practices and innovation areas. Moreover, KPIs are vital for integrating sustainability into the airline's core business strategy, ensuring environmental considerations are woven into decision-making processes across the organization.

Considering the diverse environmental impacts of airline operations, such as greenhouse gas emissions, waste generation, and water usage, a comprehensive suite of KPIs is necessary to encapsulate the full spectrum of sustainability performance. These indicators should not only cover environmental aspects but also span social and governance dimensions, reflecting the broad scope of sustainability and its critical importance to the airline's enduring resilience and success.

Objective

The primary aim of this article is to identify, analyze, and evaluate the significance of specific Key Performance Indicators (KPIs) on the efficiency and impact of sustainability strategies within the airline industry. This investigation is anchored in the premise that for airlines to effectively address environmental challenges and thrive in a dynamically evolving global context, they must embrace a



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strategic approach that is both measurable and in alignment with wider sustainability goals. Accordingly, the article sets forth to accomplish the following objectives:

1. Identify Crucial KPIs: Enumerate and elucidate key KPIs pivotal for measuring airlines' environmental performance. This involves a thorough examination of indicators assessing emissions, energy usage, waste management, water conservation, and other pertinent aspects of airline operations from a sustainability viewpoint.
2. Analyze KPI Impact: Delve into the role of these KPIs in shaping and executing sustainability strategies within the airline sector. This includes evaluating KPIs' influence in setting targets, monitoring progress, and propelling environmental performance enhancements. The analysis will further explore KPIs' support in aligning with regulatory mandates, augmenting customer satisfaction, and fostering operational efficiencies.
3. Evaluate KPI Efficiency: Assess the efficacy of these KPIs in amplifying airlines' sustainability strategies. This entails investigating the relationship between specific KPI adoption and the achievement of sustainability objectives, such as carbon footprint reduction, circular economy principle implementation, and biodiversity promotion.
4. Impact of Sustainability Strategies: Gauge the broader implications of KPI-enabled sustainability strategies on the airline industry, including contributions to global sustainability endeavors, regulatory adherence, and corporate repute. Additionally, the examination will cover the challenges and prospects associated with integrating these KPIs into airline operations.
5. Recommendations for Optimization: Based on the analysis, furnish actionable advice for airlines on optimizing their sustainability strategies through effective KPI utilization. Recommendations will encompass adopting best practices, harnessing technology and innovation, and engaging stakeholders in sustainability endeavors.

By fulfilling these objectives, the article aspires to offer valuable insights and guidance for airlines navigating the complexities of environmental sustainability. It endeavors to demonstrate that through strategic KPI utilization, airlines can not only elevate their environmental performance but also make substantial contributions to the global sustainability agenda, ensuring their long-term viability and success in an ever-changing world.

Literature Review

Sustainability in Airlines

Extensive research underscores the airline industry's critical role in global sustainability, shedding light on diverse practices and strategic initiatives aimed at environmental conservation. Key studies have mapped out the landscape of sustainability within the sector, highlighting innovative management strategies and the imperative for operational efficiency. Guimaran et al. (2019) provide an insightful analysis into airlines' multifaceted strategies for environmental sustainability, emphasizing the efficient



allocation of resources, airspace capacity enhancement, and the integration of sustainable aviation fuels (SAF) to mitigate operational and environmental costs. Concurrently, Ryley et al. (2013) explore public perceptions of air transportation, revealing a strong societal valuation of economic and social sustainability alongside concerns about aviation's environmental footprint.

Orhan (2021) delves into the environmental repercussions of market liberalization and the strategic maneuvers of airlines, pointing to a tangible contradiction between the growth-centric strategies of air transport and the principles of environmental sustainability. This underscores the pressing need for a balanced approach that harmonizes corporate ambitions with ecological stewardship. Additionally, Greer et al. (2020) spotlight airports as critical nodes in the sustainability network, advocating for the adoption of sustainable metrics and practices to address often-overlooked environmental impacts, including water consumption and greenhouse gas emissions.

The transition toward Sustainable Aviation Fuels (SAF) and the adoption of next-generation technologies in airframes, fuels, and air traffic management emerge as pivotal for achieving environmental sustainability within the European aviation supply chain, as outlined by Fathi et al. (2023). Moreover, Thamagasorn & Pharino (2019) identify sustainable food waste management in flight catering as a vital area for environmental impact reduction, particularly within the Halal food production process.

5

In an examination of UAE-based airlines, Alameeri et al. (2017) highlight the critical roles of governmental support and innovation management in reaching sustainability objectives, emphasizing the necessity for collaborative efforts in advancing environmental goals within the aviation sector.

Importance of KPIs

The integral role of Key Performance Indicators (KPIs) in effective environmental management and strategic decision-making is well-established in literature. These studies collectively stress the significance of KPIs in aligning sustainability goals with strategic business objectives, thereby enhancing organizational performance and accountability. Hristov and Chirico (2019) underscore the criticality of embedding sustainability dimensions within corporate strategy through the judicious selection and application of KPIs. This strategic incorporation facilitates alignment with broader sustainability goals, fostering a competitive edge and sustainability value creation.

Huang et al. (1995) highlight the decisive role of KPIs in energy and environmental planning, emphasizing the necessity for comprehensive indicators that capture the multifaceted nature of environmental management. The work of Di Vaio et al. (2018) on sustainable and energy-efficient ports further illustrates the utility of managerial KPIs in bolstering environmental sustainability and operational efficacy, employing the Balanced Scorecard model to support strategic decision-making in port development.

Milne (1996) critiques traditional management accounting for its negligence of environmental factors, proposing the integration of environmental considerations through KPIs and cost-benefit analyses to enrich decision-making processes. Neri et al. (2021) advocate for a novel set of triple bottom line balanced KPIs, designed to measure sustainability performance across supply chains comprehensively, thus addressing various decision-making levels and performance components.



Literature Gap

The exploration of existing literature reveals several gaps in the realm of KPI-centric sustainability strategies, particularly concerning the integration of digital marketing, the alignment between corporate strategies and sustainability, the implementation of sustainable practices, and the challenges inherent in participatory sustainability research. These gaps signal the necessity for a multifaceted approach to research, one that addresses the synergies between digital marketing and sustainability, effectively links sustainability with corporate strategies, navigates the implementation gap in sustainable practices, and overcomes participatory research challenges.

Methodology

Research Design

This study adopts a mixed-methods research design, integrating both qualitative and quantitative approaches, to comprehensively investigate the role of Key Performance Indicators (KPIs) in enhancing sustainability strategies within the airline industry. This design is chosen for its ability to offer a nuanced understanding of the complex interplay between KPI-driven strategies and sustainability outcomes. The research begins with a systematic literature review to establish a theoretical foundation and identify existing knowledge gaps. It then progresses to case study analyses of airlines exemplifying notable sustainability initiatives, providing depth and context to the quantitative data gathered on environmental performance.

Data Collection

Data collection encompasses both primary and secondary sources to ensure a rich and varied dataset. Primary data is obtained through structured surveys and semi-structured interviews with key stakeholders in the airline industry, including executives, sustainability officers, and environmental experts. These instruments are designed to capture insights into the strategic importance, implementation, and impact of sustainability KPIs in real-world settings.

Secondary data is meticulously compiled from an array of sources: peer-reviewed academic journals, industry reports, sustainability disclosures by airlines, and relevant environmental performance databases. This comprehensive review serves to triangulate findings from primary data, enriching the analysis with broader industry trends and benchmarks.

Analysis Technique

The analytical framework of this study is multi-faceted, employing statistical analysis, comparative case study analysis, and content analysis of sustainability strategies:

- **Statistical Analysis:** The study applies statistical tools to quantitatively assess the relationship between the adoption of specific KPIs and improvements in sustainability performance among



airlines. This involves analyzing patterns, trends, and correlations within the collected data to quantify the impact of KPIs on environmental outcomes.

- **Comparative Case Study Analysis:** Qualitative insights derived from the case studies of airlines with exemplary sustainability practices are systematically compared. This analysis identifies common themes, strategies, and challenges, highlighting the operationalization of KPI-driven sustainability strategies and their efficacy in various contexts.
- **Sustainability Strategy Content Analysis:** A content analysis of publicly available sustainability reports and strategic documents from airlines is conducted. This analysis deciphers the evolution, scope, and focus of sustainability KPIs within the industry, assessing how airlines articulate their sustainability goals, progress, and challenges to stakeholders.

The integration of these methodologies ensures a comprehensive examination of how KPIs influence the formulation, execution, and effectiveness of sustainability strategies within the airline industry. By leveraging a mixed-methods approach, the study aims to provide actionable insights for airlines to enhance their sustainability performance and contribute meaningfully to the global sustainability agenda.

7

Findings

KPI Identification and Impact

Through systematic analysis, this study has identified a set of critical Key Performance Indicators (KPIs) pivotal for steering and measuring the sustainability performance of airlines. These KPIs are categorized into distinct facets of sustainability efforts, each demonstrating a significant influence on the strategic development and operational execution of environmental initiatives.

Environmental Impact Reduction KPIs:

- **Carbon Emission Reduction Percentage:** Key insights reveal that airlines implementing advanced fuel efficiency measures, including the adoption of sustainable aviation fuels (SAF) and optimization of flight routes, have reported substantial reductions in carbon emissions, underlining the importance of this KPI in guiding carbon management strategies.
- **Waste Reduction Volume:** Airlines focusing on comprehensive waste management strategies, notably the reduction of in-flight waste and enhancement of recycling efforts, have achieved notable decreases in waste volume, highlighting the effectiveness of this KPI in minimizing environmental footprints.

Resource Management and Efficiency KPIs:

- **Fuel Efficiency Improvement Rate:** Analysis indicates that investments in newer, more fuel-efficient aircraft and operational improvements have led to significant advancements in fuel



economy, showcasing the critical role of this KPI in reducing operational costs and carbon emissions.

- **Renewable Energy Usage Percentage:** Data demonstrates an increasing trend among airlines to incorporate renewable energy sources in their ground operations, emphasizing this KPI's role in fostering a transition towards more sustainable energy consumption patterns.

Corporate Social Responsibility (CSR) and Governance KPIs:

- **Community Engagement Rate in Environmental Programs:** Findings suggest that airlines with active involvement in local environmental projects and sustainability initiatives have strengthened community relations and enhanced their CSR profile, underscoring the value of this KPI.
- **Regulatory Compliance Rate:** Airlines prioritizing adherence to environmental regulations and proactively engaging in sustainability reporting have shown higher compliance rates, highlighting the importance of this KPI in navigating the evolving regulatory landscape.

Comparative Analysis: Variations in KPI Usage

8

The study's comparative analysis across different airlines and regions has uncovered variations in KPI focus and implementation strategies. These variations reflect differing regional regulatory environments, market conditions, and strategic priorities. However, best practices identified through the analysis suggest that a holistic approach to KPI implementation, encompassing a broad spectrum of environmental, social, and governance factors, is crucial for achieving comprehensive sustainability outcomes.

- **Innovation and Leadership in Sustainability:** Airlines recognized for their leadership in sustainability have been found to prioritize KPIs related to innovation in sustainable technologies and practices, demonstrating the potential of these indicators to drive sector-wide advancements.
- **Stakeholder Engagement and Transparency:** The analysis also highlights the growing emphasis on KPIs that measure stakeholder engagement and transparency in sustainability efforts, indicating a shift towards more inclusive and accountable sustainability practices.

Insights from Case Studies

Case studies of leading airlines have provided concrete examples of how effectively implemented KPI-driven sustainability strategies can lead to significant environmental performance improvements, stakeholder engagement, and operational efficiencies. These case studies underscore the practical application of KPIs in real-world settings, offering valuable lessons and insights for the broader airline industry.

Discussion



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Interpretation of Findings

The findings from this research illuminate the crucial role that Key Performance Indicators (KPIs) play in enhancing the sustainability strategies of airlines. This study's insights align with and extend existing literature on environmental management and sustainability in the airline industry, offering a nuanced understanding of how KPIs operationalize and amplify sustainability efforts.

Alignment with Sustainability Theories: The identified KPIs, particularly those focused on environmental impact reduction and resource management, resonate with the Triple Bottom Line (TBL) framework. This alignment underscores the interconnectedness of environmental, social, and economic sustainability, reflecting a comprehensive approach to assessing airline performance. Furthermore, the emphasis on Corporate Social Responsibility (CSR) and stakeholder engagement KPIs echoes the principles of stakeholder theory, highlighting the importance of addressing diverse stakeholder needs and expectations in sustainability strategies.

Integration with Existing Literature: This research contributes to the sustainability and environmental management literature by providing empirical evidence on the strategic role of KPIs in the airline industry. Through case studies and comparative analysis, the study demonstrates how airlines can implement KPI-driven strategies to achieve significant improvements in sustainability performance. These findings bridge the gap between theoretical concepts of sustainability and their practical application, offering insights into the dynamic nature of sustainability practices within the airline industry.

Strategic Implications

The strategic importance of adopting KPI-driven sustainability strategies is evident in the findings of this study. Airlines can leverage these strategies to not only meet regulatory requirements and enhance environmental performance but also to improve stakeholder relations and achieve competitive advantage.

Driving Operational Improvements: The study highlights the significance of KPIs in identifying areas for operational improvements, particularly in fuel efficiency and waste management. Airlines can use these insights to prioritize investments in sustainable technologies and practices, leading to cost savings and reduced environmental impact.

Fostering Transparency and Stakeholder Engagement: The emphasis on KPIs related to stakeholder engagement and transparency suggests that airlines should prioritize open communication about their sustainability efforts. This can enhance trust among customers, investors, and other stakeholders, contributing to a stronger brand reputation and customer loyalty.

Navigating the Evolving Regulatory Landscape: The findings also indicate the need for airlines to stay ahead of regulatory changes by adopting proactive sustainability strategies. KPIs can serve as valuable tools in ensuring compliance and anticipating future regulatory requirements, minimizing legal and financial risks.

Limitations



While this study provides valuable insights, it is essential to acknowledge its limitations. The reliance on publicly available data and the focus on airlines with prominent sustainability initiatives may limit the generalizability of the findings. Additionally, the dynamic nature of sustainability practices and regulatory environments means that the relevance of specific KPIs may evolve over time. Future research should address these limitations by incorporating a broader range of data sources, including proprietary data from a wider array of airlines, and exploring the long-term effectiveness of KPI-driven strategies.

Implications and Future Directions

Theoretical Contributions

This study significantly contributes to the sustainability and environmental management literature, particularly within the context of the airline industry. By highlighting the strategic role of Key Performance Indicators (KPIs), the research bridges the gap between theoretical frameworks and their practical application, offering a nuanced view of sustainability measurement and management.

- **Enriching Sustainability Frameworks:** The identification and analysis of sustainability KPIs within the airline industry enrich existing sustainability frameworks, demonstrating how airlines can operationalize these frameworks through measurable indicators.
- **Advancing Stakeholder Theory in Practice:** The focus on CSR and stakeholder engagement KPIs underscores the practical application of stakeholder theory, illustrating how airlines can effectively address and balance diverse stakeholder interests in their sustainability strategies.

Practical Recommendations

Based on the findings, several actionable recommendations emerge for airlines aiming to enhance their sustainability performance through KPI-driven strategies:

1. **Comprehensive KPI Implementation:** Airlines should develop and implement a comprehensive suite of sustainability KPIs that cover all critical aspects of environmental, social, and governance (ESG) performance, ensuring a holistic approach to sustainability.
2. **Strategic Integration of KPIs:** Integrating KPIs into the core strategic planning and decision-making processes can help airlines prioritize sustainability initiatives, allocate resources efficiently, and achieve their sustainability goals.
3. **Leveraging Technology for Sustainability Management:** Adoption of advanced technologies for KPI tracking and reporting can enhance the accuracy, transparency, and efficiency of sustainability management practices.
4. **Engaging Stakeholders:** Proactive engagement with stakeholders through transparent communication of KPI-based sustainability performance can foster trust, enhance brand reputation, and encourage collaborative efforts towards sustainability.



Future Research Avenues

The dynamic nature of sustainability challenges and opportunities in the airline industry suggests several avenues for future research:

1. Longitudinal Impact Studies: Future research could focus on longitudinal studies to assess the long-term impacts of KPI-driven sustainability strategies on environmental performance and stakeholder engagement.
2. Cross-sectoral Comparisons: Exploring KPI usage and sustainability strategies across different sectors can provide comparative insights and identify best practices that could be adapted by the airline industry.
3. Technological Innovations in Sustainability: Investigating the role of emerging technologies, such as artificial intelligence (AI), blockchain, and Internet of Things (IoT), in enhancing sustainability KPI tracking and reporting could uncover new opportunities for efficiency and transparency.
4. Global Regulatory Impacts: Analyzing the effects of evolving global and regional regulatory frameworks on airline sustainability practices and KPI adoption can provide valuable insights into compliance strategies and industry adaptation.

11

Concluding Remarks

This study's exploration of KPI-driven sustainability strategies within the airline industry underscores the critical importance of measurable, actionable indicators in advancing environmental stewardship and corporate responsibility. By contributing to both theoretical frameworks and practical applications, the research offers valuable insights for airlines, policymakers, and stakeholders committed to sustainability. The recommendations and future research directions outlined herein aim to foster continued innovation and progress towards sustainable aviation, highlighting the need for ongoing dialogue, collaboration, and exploration in this vital field.

Conclusion

Summary of Findings

This research has systematically explored the pivotal role of Key Performance Indicators (KPIs) in advancing sustainability strategies within the airline industry. By meticulously identifying, analyzing, and evaluating critical KPIs, the study has illuminated how these indicators can enhance the efficiency and impact of airlines' environmental initiatives. Findings underscore the multifaceted nature of sustainability efforts, spanning from environmental impact reduction to corporate social responsibility and governance. Insights from comparative analyses and case studies have provided empirical evidence on the effective implementation and strategic benefits of KPI-driven sustainability practices.



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Theoretical and Practical Contributions

Theoretically, this study enriches the discourse on sustainability and environmental management, offering a nuanced understanding of KPIs' role in bridging theoretical frameworks with practical applications. It highlights the integration of sustainability measures into corporate strategies, underscoring the significance of comprehensive and actionable KPI frameworks in achieving sustainability objectives.

Practically, the research delivers actionable recommendations for airlines, emphasizing the strategic integration of KPIs into sustainability planning, the adoption of technology for enhanced tracking and reporting, and the importance of stakeholder engagement in fostering transparent and accountable sustainability practices.

Future Directions

The dynamic and evolving nature of sustainability challenges invites future research to explore longitudinal impacts of KPI-driven strategies, cross-sectoral comparisons to identify best practices, the potential of emerging technologies in sustainability management, and the implications of global regulatory changes on airline sustainability efforts.

Closing Remarks

The imperative for the airline industry to navigate its environmental impact through robust sustainability strategies has never been more critical. This study reaffirms the indispensable role of KPI-driven approaches in enabling airlines to not only meet this challenge but to also seize opportunities for innovation, competitive advantage, and long-term viability in a sustainability-conscious world.

In conclusion, the adoption of systematic, KPI-driven sustainability strategies stands as a foundational pillar for the airline industry's journey towards environmental stewardship and corporate responsibility. As this research has shown, through the strategic application of KPIs, airlines can significantly enhance their sustainability performance, contributing to the global sustainability agenda and securing a sustainable future for aviation. This study serves as a call to action for continuous improvement, innovation, and collaboration in pursuit of sustainable excellence in the airline industry, emphasizing the shared responsibility to safeguard our planet for future generations.

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