The Role of ICAO's CORSIA in Shaping Sustainability Reporting in the Aviation Industry

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1. Introduction

The aviation industry is increasingly under the spotlight due to its environmental impact, particularly regarding greenhouse gas (GHG) emissions, which account for approximately 2-3% of global CO_2 emissions, with international flights alone accounting for 1.3% of the global share (ICAO, 2022; Lee et al., 2021). Transparency and rigorous environmental accountability have become crucial as demand for air travel grows faster than the industry's ability to implement technological advances or operational improvements that reduce emissions (Lee et al., 2021; Gössling & Humpe, 2020).

The International Civil Aviation Organisation (ICAO) has developed the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) to address the growing number of emissions from international aviation. Implemented in 2021, CORSIA requires airlines to offset emissions growth beyond established baselines, initially set at 85% of 2019 emissions levels (IATA, 2024). A key element of this regulatory framework is the requirement for robust monitoring, reporting and verification (MRV) to report their CO_2 emissions (ICAO, 2022).

Before CORSIA, sustainability reporting in aviation was mostly voluntary and inconsistent. While some airlines published environmental and social responsibility reports, the quality, detail and comparability of disclosures varied widely, reflecting different regional practices rather than global standards (Karaman et al., 2018; Kılıç et al., 2019). Stakeholders have often criticised this voluntary framework for its lack of transparency, accountability and verification.

CORSIA will be implemented in three phases: a pilot phase (2021–2023) and a first phase (2024–2026), both voluntary, followed by a second mandatory phase (2027–2035). Participation in the mandatory phase is based on aviation activity levels and socio-economic conditions, ensuring that emerging economies are not disproportionately affected (ICAO, 2022). ICAO Member States must establish an MRV system for CO_2 emissions from 1 January 2019, regardless of their participation in offsetting requirements.

This paper analyses how the introduction of CORSIA corresponds with changes in the structure, content, and language of environmental disclosures among selected international airlines, particularly with alignment with global sustainability standards. A longitudinal disclosure approach will be used to assess how sustainability reporting practices changed

between 2013 and 2023, with specific attention to the role of ICAO's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).

This paper is written for an academic audience in the field of accounting, with a specific focus on the evolving role of regulatory frameworks that shape corporate environmental disclosure. The study examined four research questions to assess how airlines have responded to the introduction of CORSIA. These include an assessment of whether CORSIA has affected the structure, language and transparency of disclosures; the degree of alignment with monitoring, reporting and verification (MRV) requirements; a comparison of the responses of flag carriers and regional carriers; and whether CORSIA has introduced new reporting obligations or simply codified existing practices. The findings contribute to compliance, standardisation and credibility of ESG reporting, with practical implications for regulators, standard setters and corporate stakeholders.

2. Literature Review

2.1 Sustainability Reporting in the Airline Industry (Pre-CORSIA period)

Sustainability reporting has constantly become an essential tool for airlines to communicate and promote their environmental, social and governance (ESG) commitments and impacts (Cowper-Smith & De Grosbois, 2011). Before the global framework of CORSIA, airlines operated in an environment where reporting initiatives were influenced by external stakeholder requirements, reputational considerations and voluntary industry practices.

The emergence of sustainability reporting in the aviation sector can be traced to the late 20th century, in parallel with the developments of corporate responsibility in other industries. Initially, the sector was criticised for limited transparency on its environmental impact, specifically on greenhouse gas (GHG) emissions and resource overconsumption (Kolk & Pinkse, 2004). Furthermore, early reporting efforts were sporadic and reactive, driven by public pressure and increased scrutiny from environmental NGOS and regulations. Researchers have found early sustainability in the aviation sector to be largely marketing-oriented, emphasising improving corporate image rather than significant transparency and accountability (Cowper-Smith & de Grosbois, 2011). Initial disclosures were dominated by narratives that underline a

broad commitment to sustainability without measurable performance indicators (Graham & Shaw, 2008).

2.2 Gradual Integration and Institutionalisation

The beginning of the millennium marked a shift towards structured reporting that was influenced by global frameworks such as the Global Reporting Initiative (GRI). Airlines started to move toward standardised reporting, adopting measurable indicators and structured ESG frameworks (Kolk, 2008). Research indicates that during this period, the airline industry's sustainability disclosures evolved, with increasing alignment towards recognised global standards (Morrell & Swan, 2006). However, Heeres et al. (2011) point out the substantial variation across geographic regions and airline types. European carriers were early adopters of more rigorous sustainability reporting frameworks, driven by EU regulations and market pressures compared to airlines in other regions. What is more, the spread of low-cost carriers (LCCs) has changed the environment as their sustainability disclosures have been relatively limited and reflected divergent strategic priorities and expectations of consumers.

Regulatory frameworks in Europe significantly shaped airline sustainability reporting in the pre-CORSIA period. The European Union Trading Scheme (EU-ETS), initiated in 2005, exerted pressure on airlines operating in the EU market, forcing them toward transparent disclosure practices (EU, 2010). Airlines consequently started to be more under control because of the requirements for integration of robust sustainability frameworks into corporate strategies.

Concerning Institutional Theory, DiMaggio & Powell (1983) pointed out that it creates mimetic and normative pressures, where companies emulate successful sustainability practices to maintain legitimacy in competitive markets. In addition to recent changes, a few studies further reinforce that sustainability reporting is often driven by adding an extra factor of response to external demands for legitimacy. For instance, Fan et al. (2024) found that normative pressures such as industry standards and professional expectations significantly influence the adoption of environmental disclosure practices in response to regulatory frameworks. Similarly, Higgins and Larrinaga (2014) point out that organisations align their reporting practices with

stakeholder expectations and industry standards, illustrating how following behaviour promotes standardisation of sustainability disclosures across industries. Furthermore, by early 2010, airline sustainability reporting shifted significantly toward proactive disclosure, transparency and stakeholder engagement (Cowper-Smith & de Grosbois, 2011).

Pre-CORSIA literature acknowledges that technological advancements are crucial in advancing sustainability reporting accuracy. The introduction of more sophisticated fuel management systems, carbon accounting software and monitoring technologies enabled airlines to report more precise and verifiable data on GHG emissions and resource consumption (Morrell & Swan, 2006). These advancements supported more credible and comparable sustainability reporting within the industry which further built the stakeholder's trust. However, despite the significant progress, sustainability reporting before the introduction of CORSIA faced significant limitations. According to Heeres et al. 2018, Mak et al., 2007, reported the absence of industry-wide standardisation across the industry, and difficulties in comparability and consistency of reporting metrics. Furthermore, many airlines have maintained discretion in their choice of disclosures, which resulted in differences in data quality and comprehensiveness (Cowper-Smith & de Grosbois, 2011). The absence of a unified international policy prevented comprehensive industry alignment, which led to partly sustainability efforts and potential money laundering practices (Kolk, 2008).

Before 2016, sustainability reporting by the airlines was mostly voluntary and characterised by significant inconsistency. Analyses of pre-CORSIA disclosure content reveal that while some European carriers began publishing annual environmental or CSR reports in the early 2000s, the rest of them were either minimal or not at all (Zieba & Johansson, 2022). Typically, early reports emphasised increases in fuel efficiency while skipping critical metrics such as total emissions of carbon intensity, limiting the comparability and reliability of reported data. What is more, researchers have described sustainability reporting practices as not ineffective, serving to improve corporate image rather than reflecting measurable improvements in sustainability performance (Cowper-Smith & de Grosbois, 2011; Graham & Shaw, 2008).

However, several assumptions in the pre-2016 literature no longer reflect current industry practice. The prevalence of reporting has increased significantly, and by 2019, around one-third of global airlines were publishing dedicated sustainability reports, with almost every international carrier represented in this group (Karaman et al., 2018). This transformation

reflects not only growing stakeholder expectations but also the introduction of new regulatory mechanisms. CORSIA that has been introduced in 2016, is the first global compliance mechanism specific to aviation emissions, while regional measures, such as the 2014 EU Non-Financial Reporting Directive, imposed new information obligations on airlines from 2017 onwards. (ICAO, 2022; Kim et al., 2020). While pre-2016 disclosures tended to focus almost exclusively on operational environmental concerns such as noise reduction and fuel efficiency, these changes mark a shift away from the previously voluntary sustainability reporting and emphasise the growing corporate governance, including employee practices and gender diversity (Rüger & Maertens, 2022).

2.3 CORSIA Implementation and Impact on Reporting Practices

The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), introduced by ICAO in 2016, marked a major shift toward global sustainability reporting in aviation. Previous research has presented that the adoption of CORSIA was a significant response to the previous partial approaches that did not comprehensively and transparently record the growth of aviation emissions (Scheelhaase et al., 2018). The implementation of CORSIA improved the transparency and data accuracy across the industry. From that moment, airlines are required to adopt standardised monitoring, reporting and verification (MRV) systems, which have significantly reduced differences in emissions reporting data and fostered more reliable sustainability disclosures (ICAO, 2022). According to Zhangd & Yang (2021), CORSIA has reduced discrepancies in reported data and provided a foundation for credible emission offsetting frameworks.

2.4 Stakeholder Influence in ICAO CORSIA Policy Formation

The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) was developed through a multi-stakeholder process led by the International Civil Aviation Organisation (ICAO), following the adoption of Resolution A39-3 at the 39th ICAO Assembly in 2016 (ICAO, 2022). The process of development involved extensive consultation and

negotiation between ICAO Member States, regional aviation authorities, industry associations, environmental groups and independent technical experts (ICAO, 2023). The Committee on Aviation Environmental Protection (CAEP), ICAO's technical body responsible for environmental policy, played a crucial role in conducting technical and economic impact assessments to shape the CORSIA project (ICAO, 2022). Other key organisations involved included the International Air Transport Association (IATA), the International Airports Council (ACI) and the International Coordinating Council of Aerospace Industries Associations (ICCAIA), all of which provided industry perspectives in ensuring that the policy was economically viable (ICAO, 2023).

Their engagement has supported the credibility and transparency of reporting standards, particularly in the measurement, reporting and verification of emissions (MRV). Although NGOs did not directly influence policymaking, their influence was evident in the push for accountability mechanisms. The wider network of stakeholders also included air navigation service providers (ANSPs), civil aviation authorities, aircraft manufacturers, ground service providers and even passengers. ANSPs were responsible for modifying air traffic routes to improve fuel efficiency, while manufacturers drive technological innovation in aircraft and engine design to meet changing environmental standards. Civil aviation authorities combine the implementation of national policies with the global ICAO framework, often offsetting environmental objectives with industry growth. Furthermore, Airport operators manage local engagement and address environmental issues such as noise and air quality that further influence public acceptance and regulatory support (ICAO, 2017).

The policy's formulation was subject to extensive negotiations to balance the interests of major aviation economies, environmental organisations, and developing nations. Governments such as the United States, the European Union (EU), China, India, and Brazil played significant roles in shaping the final framework. The EU initially pushed for a stricter carbon pricing mechanism aligned with its EU Emissions Trading System (EU ETS), while developing economies sought greater flexibility to prevent economic disadvantages for emerging aviation markets. The Air Navigation Commission (ANC), ICAO's primary technical advisory body, reviewed CAEP's recommendations and submitted them to the ICAO Council, a 36-member body responsible for final policy decisions (ICAO, 2023). The policy was adopted after extensive state consultations, with four months for objections which were formally raised, allowing the regulation to take effect. Major airlines, including Lufthansa, Singapore Airlines,

and Ryanair, participated in discussions through IATA, ensuring that the policy was practical for airline operations. Lufthansa has since supported CORSIA as a necessary global framework, aiming to prevent the fragmentation of carbon regulations across jurisdictions (Lufthansa Group, 2023). Singapore Airlines has aligned its sustainability strategy with CORSIA, focusing on carbon offsetting and emissions monitoring, while Ryanair has introduced offsetting programs and operational efficiencies to comply with regulatory requirements (IATA, 2023).

CORSIA has been structured in three phases to mitigate administrative and technical challenges, enabling airlines to gradually adapt its monitoring, reporting and offsetting obligations. The pilot phase (2021-2023) was voluntary, allowing States and Airlines to gain experience in monitoring and reporting emissions (ICAO, 2023). Furthermore, the first phase (2024-2026) remains voluntary but encourages broader participation, with 115 countries already signed up as of 2023. The second phase (2027-2035) will be mandatory for countries meeting certain thresholds of aviation activity, ensuring that aviation markets contribute to emissions reductions (ICAO, 2022).

2.5. Theoretical Perspectives on Sustainability Reporting & Regulation

The theory of legitimacy, introduced by Suchman (1995), provides a fundamental framework for understanding why organisations engage in sustainability reporting. The theory posits that organisations seek to ensure that their actions are appropriate within the norms, values and beliefs of broader society. In sectors such as aviation, sustainability disclosure functions as a tool to demonstrate compliance with societal expectations. In this context, CORSIA, introduced by the International Civil Aviation Organisation (ICAO) in 2016, serves not only as a regulatory obligation but also as a platform for airlines to increase organisational legitimacy through environmental communication.

Bansal and Clelland (2004) suggest that firms facing high reputational risk are more likely to engage in proactive environmental disclosure to avoid legitimacy gaps. This is particularly relevant for national carriers and high-profile international airlines, which face greater scrutiny from governments, consumers, and environmental groups. For instance, L'Abate et al. (2023)

found that airports with complex stakeholder networks disclose more detailed sustainability information, often referencing frameworks like the Global Reporting Initiative (GRI) or the Sustainable Development Goals (SDGs), to maintain stakeholder trust and legitimacy. In the case of airlines, similar behaviour is observed in reports that emphasise emissions monitoring, offsetting strategies, and compliance with CORSIA benchmarks (ICAO, 2022).

What is more, Johansson (2021) examined how airlines strategically construct sustainability narratives to manage perceptions. He indicated that many use optimistic or forward-looking language to divert attention from current environmental challenges. This is consistent with the findings of Tilling and Tilt (2010), who argued that sustainability reports often serve a symbolic purpose, enabling organisations to be seen as responsible without having to change their core operations

Moreover, the strategy of sustainability disclosures reflects a growing trend towards institutionalised legitimacy practices. Delmas and Toffel (2004) argue that third-party verification and alignment with global standards enhance organisational credibility, which explains why many airlines emphasise CORSIA compliance and certification in their reports.

2.6 Key Debates in Accounting on Sustainability Reporting

Recent accounting discussions have highlighted the growing significance of sustainability reporting standards and the shift from voluntary to mandatory disclosure frameworks. Christensen et al. (2021) claim that the introduction of reporting frameworks such as the Global Reporting Initiative (GRI), the Sustainability Accounting Standards Board (SASB) and the Task Force on Climate-related Financial Disclosures (TCFD) has created inconsistencies leading to reduced comparability and reliability of sustainability disclosures. In response, accounting standard setters such as the International Sustainability Standards Board (ISSB) have emerged to provide global standards through the IFRS Sustainability Disclosure Standards (IFRS S1 and IFRS S2). These standards aim to enhance comparability by standardising the metrics and narrative disclosures that companies must provide, primarily for information that is material to investors (Adams & Abhayawansa, 2022).

Meanwhile, regulatory approaches have diverged on the concept of materiality. The European Union's Corporate Sustainability Reporting Directive (CSRD), effective from 2024, introduces mandatory disclosure based on dual materiality, requiring companies to report not only how ESG factors affect their financial position but also how their activities affect society and the environment (Baumüller & Sopp, 2022). This contrasts with the ISSB's emphasis on financial materiality or single materiality, highlighting the differences between investor-focused disclosure and broader stakeholder accountability (Abel & Markarian, 2024). In addition, Jørgensen et al., (2022) argue that single materiality narrows corporate accountability and may omit disclosures that are key to social stakeholders.

What is more, Dempere et al., (2024) point out that voluntary sustainability disclosures, historically devoid of external verification, have led to selective and potentially misleading reporting, a practice increasingly referred to as ‘greenwashing’. Simnett et al., (2009) suggest that mandatory verification can significantly improve the credibility of ESG disclosures by aligning sustainability reporting with financial audit practices. The EU CSRD has mandated external verification of sustainability disclosures, initially at a level of limited assurance and potentially moving to reasonable assurance. This development creates a significant shift towards higher quality sustainability disclosures at the audit level, making it a major focus of contemporary accounting research (Bebbington et al., 2023).

Furthermore, the effectiveness of sustainability reporting has intensified regarding whether these disclosures lead to improved ESG performance or remain mainly symbolic exercises in legitimacy management. Michelon & Parbonetti (2022) highlight a common risk in which companies present idealised images of corporate responsibility while maintaining business as usual. Empirical studies examining investor reactions to sustainability disclosures show diverse results. Disclosures perceived as authentic and relevant tend to positively influence investor behaviour, while templated and symbolic reports have no impact on the market and may even raise investor scepticism (Amel-Zadeh & Serafeim, 2022).

2.7 Research Gap

In the past decade, academic research has increasingly focused on sustainability in the aviation sector, particularly in regulatory measures such as the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) (Wozny et al., 2022; Strouhal, 2020). While scholars have explored carbon offsetting practices (Scheelhaase et al., 2018; Zhang and Yang, 2021), carbon market dynamics (Kim et al., 2020) and the operational implications of emissions trading schemes (Gössling and Humpe, 2020), there has been limited attention to how these regulatory mechanisms have changed sustainability disclosure practices in the aviation industry. The literature remains unexplored of airline reporting structures, language and transparency, which have evolved in response to international policy updates.

Furthermore, Larsson et al. (2019) highlight that existing studies take either a policy-based perspective focusing on ICAO-level decision-making (ICAO, 2022) or a macroeconomic assessment of emissions performance regimes, but rarely link to sustainability practices at the company level. In addition, there is also a lack of longitudinal disclosure research assessing how major carriers have aligned their reporting practices with regulatory expectations before and after the introduction of CORSIA. This provides an important gap in understanding how the standardised environmental monitoring framework, in particular the Monitoring, Reporting and Verification (MRV) system required by CORSIA, has changed airlines' levels of transparency, strategic frameworks and stakeholder communications over time.

Another gap from the current research is the lack of comparative assessments between state or national flag carriers and private or regional operators in terms of their sustainability reporting behaviour. Studies such as Karaman et al. (2018) and Kılıç et al. (2019) confirmed high heterogeneity in reporting quality but did not specifically analyse how institutional position or geographical origin may condition responses to CORSIA. Many of the flag carriers such as Lufthansa and Singapore Airlines are not only operational entities but also national symbols. Their reporting may reflect broader diplomatic or political incentives for compliance, such as alignment with ICAO policy to enhance international legitimacy.

Lastly, there has been limited research into how airlines use CORSIA as a tool for corporate legitimacy, rather than just compliance. Scholars such as Johansson (2024) and Tilling & Tilt (2010) emphasise the symbolic function of reporting, but few studies assess whether references

to CORSIA serve strategic narrative purposes such as justifying growth, designing green leadership or neutralising criticism.

2.8 Research questions

Three research questions have been chosen because they explore the effectiveness and tangible impact of CORSIA on sustainability practices and reporting standards in the aviation industry. By analysing changes in reporting structure of wording and language, the first question assesses whether CORSIA has significantly changed corporate sustainability communications or whether its impact has been largely superficial. The second question is crucial in determining the extent to which airlines are integrating the regulatory framework into their internal reporting mechanisms, reflecting compliance or only token compliance. Furthermore, comparing flag carriers and regional carriers provides valuable insight into how different market positions, quality of services provided, regulatory pressures, and stakeholder expectations influence airline responses. Flagship airlines tend to be more visible and controlled, potentially leading to more robust sustainability practices compared to regional carriers (Kotze, 2017).

- How has the implementation of CORSIA affected the structure of wording and language of sustainability reporting in the international airline industry between 2013 and 2023?
- To what extent do airlines align their sustainability disclosures with CORSIA's monitoring, reporting, and verification (MRV) requirements?
- How do national or flagship airlines differ from regional carriers in their response to CORSIA within sustainability reports?
- Did CORSIA introduce new reporting requirements or did codify existing airline practices?

3. Methodology

3.1 Research approach and strategy

This study applies a qualitative, longitudinal analysis of the content of sustainability disclosures by global airlines, focusing on how references to CORSIA (Carbon Offsetting and Reduction

Scheme for International Aviation) developed from 2013 to 2023. As noted by Bryman et al. (2019), a qualitative approach is suitable for interpretive questions to understand evolving organisational narratives in the context of new institutional pressures such as international regulations.

In addition, this research paper adopts a constructivist ontology, recognising that airline disclosures are socially constructed responses to changing stakeholder expectations and regulatory schemes (Guba and Lincoln, 1994). Positivist epistemology has been adopted to understand how airlines present environmental responsibility narratives through language, tone and strategic frameworks (Silverman, 2013). This is consistent with similar qualitative content analyses in the CSR reporting literature (Hahn & Kühnen, 2013; Cho et al., 2015), which support interpretive document analysis in sustainability research.

3.2 Data Collection

The dataset includes 66 sustainability or ESG reports from six major international airlines: Lufthansa, Emirates, Singapore Airlines, American Airlines, Qatar Airways and Ryanair. These airlines were selected based on their market leadership, global influence and recognition for service and innovation excellence, as evidenced by their consistent high rankings in the Skytrax World Airline Awards. Lufthansa, Emirates, Singapore Airlines, American Airlines and Qatar Airways are consistently rated among the world's best airlines, reflecting their influence in shaping industry standards and practices. Ryanair is included as the largest low-cost carrier in Europe, known for its cost-effective business model, providing a comparative benchmark. The selection of six airlines also ensures geographical diversity (Europe, Asia, Middle East, North America), a range of business models (legacy and low-cost), and different service quality tiers. These carriers also operate large fleets and cover significant portions of global air traffic, amplifying their influence on market-wide sustainability trends. What is more, all selected airlines provided consistent and accessible reporting across the 2012–2024 period. The reports cover the pre-implementation (2012–2016), transition (2017–2020), and post-implementation (2021–2024) phases of CORSIA.

Reports were mainly sourced from airline investor relations websites and sustainability databases, including the Global Reporting Initiative (GRI) Sustainability Disclosure Database. Inclusion criteria required disclosure of environmental information related to emissions, fuel efficiency, carbon offsetting or CORSIA compliance. In addition, the ICAO CORSIA Guidelines (ICAO, 2022; 2023) were revised to contextualise the regulatory changes.

The content analysis focused on the presence and frequency of CORSIA-related keywords, which were divided into five categories: CORSIA & Regulation, Carbon & Climate, Sustainable Aviation Fuel (SAF) and Governance & Reporting. The data was coded annually for each airline and keyword mentions were standardised by report length (keywords per page) to account for differences in formatting and volume of disclosures. This indicator enabled a fair comparison between airlines and allowed the visualisation of disclosure intensity trends. This method mirrors longitudinal studies in the sustainability domain, combining narrative interpretation with structured empirical tracking to enhance validity and analytical depth (Michelon et al., 2015; Liesen et al., 2017),

4. Findings

4.1 Carriers – Keyword mentions by category

4.1.1 Lufthansa

During the 2013–2020 period, Lufthansa maintained high volumes of disclosure, with a strong emphasis on Carbon and Climate, which peaked at 308 mentions in 2019. CORSIA and Regulation terms increased constantly from 34 in 2013 to 141 in 2019. SAF mentions also rose from 19 to 96 during this period, while Governance and Reporting remained consistently high, reaching 88 mentions in 2018 before a drop in 2020.

From 2021 onward, a sharp decline in total keyword frequency is evident across all categories. CORSIA and Regulation mentions dropped to 24 by 2021 and remained static. Carbon and Climate terms decreased from their 2019 peak to 176 by 2023. SAF mentions fell before modestly recovering to 50, while Governance and Reporting was reduced to only two annual

mentions. This decline coincides with a redesign in the report format adopted by Lufthansa from 2020 onward, which appears to affect the volume and structure of keyword disclosures.

4.1.2 Singapore Airlines

In 2013–2020, Singapore Airlines showed consistent growth in all keyword categories. Carbon and Climate mentions increased from 57 in 2013 to 399 in 2020. SAF terms more than doubled, from 144 in 2013 to 420 in 2020. CORSIA and Regulation references rose from 40 to 126, and Governance and Reporting peaked at 244 in 2020.

From 2021 to 2023, there was a marked shift in keyword patterns. While SAF and CORSIA keywords continued to rise, reaching 374 and 205, respectively in 2023 Carbon and Climate mentions declined slightly to 311. Governance and Reporting terms dropped significantly from their peak of 244 in 2020 to just 21 in 2022, before recovering slightly to 40 in 2023. Despite these fluctuations, the volume of reporting across all categories remained high.

4.1.3 Emirates

Emirates' reporting between 2013 and 2020 revealed moderate fluctuations across categories. CORSIA and Regulation terms began at a level of a total of 88 in 2013 and rose up to 98 in 2019 before dropping to 20 in 2020. Carbon and Climate mentions remained low throughout this period, gradually increasing from 0 in 2013 to 47 in 2020. SAF references grew from 19 to 70 over this timeframe, while Governance and Reporting remained minimal, reaching only 7 in 2020.

From 2021 onward, there was a marked intensification across all categories. CORSIA and Regulation mentions surged to 136 in 2022 before slightly decreasing to 127 in 2023. Carbon and Climate terms tripled from their 2020 value to 104 in 2023. SAF references rose sharply to 152, and Governance and Reporting also saw a clear increase, peaking at 37 in 2023. The data points to a clear post-2020 acceleration in reporting activity across all categories.

4.1.4 Qatar Airways

From 2013 to 2020, Qatar Airways' sustainability-related disclosures exhibited more volatility. Carbon and Climate keywords fluctuated, ranging from 18 in 2013 to 37 in 2020. Mentions of CORSIA and Regulation declined from 13 in 2013 to a low of 3 in 2016, before gradually recovering to 14 in 2020. SAF terms showed moderate growth from 4 in 2014 (first available data point) to 13 in 2020. Governance and Reporting keywords rose gradually from 4 to 20 during the same period.

Post-2020, the data suggests a more stable reporting approach. Carbon and Climate mentions remained high, reaching 42 in 2022 before a slight decline to 40 in 2023. CORSIA and Regulation terms increased to 19 in 2022 and stabilised at 18 in 2023. SAF mentions climbed steadily to 22, and Governance and Reporting terms reached 21 in 2023. This suggests a clearer integration of structured sustainability communication following the formalisation of the reporting format from 2015 onwards.

4.1.5 American

Between 2013 and 2020, American Airlines demonstrated a steady and incremental increase in keyword mentions across all four disclosure categories. Carbon and Climate keywords were consistently the most prominent, rising from 15 in 2013 to 35 in 2020. Mentions related to CORSIA and Regulation grew from 8 to 20 in the same period, showing gradual integration of regulatory language into the airline's disclosures. Sustainable Aviation Fuel (SAF) references remained modest but rose from 2 to 11 by 2020, while Governance and Reporting terms grew from 5 to 16.

From 2021 onward, American Airlines continued this upward trajectory. Carbon and Climate mentions increased further to 45 in 2023, while CORSIA and Regulation reached 29. SAF mentions doubled from 11 in 2020 to 20 by 2023. Notably, Governance and Reporting terms also showed a moderate increase, reaching 22 in 2023.

4.1.6 Ryanair

Between 2014 and 2020, Ryanair's environmental disclosure was incorporated within annual financial reports, reflected in relatively stable but modest keyword volumes. Carbon and Climate terms rose from 48 in 2014 to 97 in 2017 and remained steady through 2020. CORSIA and Regulation mentions stayed relatively constant around 80–85, and SAF references increased gradually from 74 to 101. Governance and Reporting keywords were minimal, averaging six mentions annually.

Following the introduction of a standalone sustainability report in 2021, a clear shift in reporting emphasis is observable onwards. Carbon and Climate mentions grew rapidly to 168 in 2023. SAF also increased to 102, and Governance and Reporting expanded from 9 mentions in 2020 to 61 by 2023. In contrast, CORSIA and Regulation dropped markedly to only 6 mentions in 2021, recovering slightly to 31 in 2023. These patterns suggest a transition to more comprehensive thematic coverage from 2021 onward.

4.2 Total & Keywords Per page

4.2.1 Lufthansa

Between 2013 and 2019, Lufthansa's sustainability reporting was characterised by stable document structures and steadily increasing keyword counts, with keywords per page rising gradually from 2.51 to 2.71. In 2020, a marked shift occurred due to a redesign of the reporting format. Despite a significant drop in document length, keyword density surged to 12.29 keywords per page. From 2021 to 2023, while total mentions remained stable around 250–270, the keywords-per-page ratio remained above 11, indicating a sustained emphasis on content density under the new reporting structure.

4.2.2 Singapore Airlines

Singapore Airlines displayed a progressive intensification of sustainability reporting throughout the 2013–2023 period. From 2013 to 2020, total keyword mentions rose from under 300 to more than 1000, while the keywords-per-page ratio increased from 2.2 to 8.37. The highest values were recorded in 2021, with total mentions surpassing 1250 and the per-page ratio reaching 9.43. Although 2022 saw a moderate decline in both indicators, 2023 experienced a partial increase, with values stabilising above pre-2019 levels. The pattern demonstrates a long-term, linear enhancement in both report content and density updates in the format and structural changes.

4.2.3 Emirates

Emirates maintained a relatively consistent pattern of sustainability disclosure from 2013 to 2020. During this period, the total keyword mentions was between 90 and 130, while the keywords-per-page ratio fluctuated within a band of 0.74 to 1.89. A pronounced increase is visible from 2021 onwards. The total keyword mentions more than tripled by 2023, peaking above 430, while the keywords-per-page ratio rose sharply to 5.95. This suggests a significant shift in reporting density beginning in 2022, with a marked intensification of sustainability language.

4.2.4 American Airlines

Between 2013 and 2020, American Airlines exhibited a consistent and gradual increase in the number of sustainability-related keyword mentions within its reports. Total mentions rose from below 30 in 2013 to over 80 by 2020, while the keywords-per-page ratio expanded from 0.36 to 0.86 over the same period. This upward trajectory continued post-2020, with both metrics reaching their highest values in 2023 approximately 115 total mentions and 1.16 keywords per page. This trend indicates a steady integration of environmental themes across the reporting

period, with no abrupt structural shifts in reporting style or intensity observed before or after 2020.

4.2.5 Qatar

Qatar Airways introduced a formal sustainability report in 2015. From 2015 to 2020, keyword mentions and keywords per page grew steadily, with total mentions increasing from approximately 50 to 85 and keywords-per-page from 2.4 to 3.82. This growth trend was followed by post-2020, with both indicators reaching their peak in 2023 with over 100 mentions and a ratio of 4.21. The consistency in upward momentum following 2015 demonstrates a gradually expanding focus on sustainability, particularly from 2019 onwards.

4.2.6 Ryanair

Before 2021, Ryanair's sustainability disclosures were part of annual reports. During this period (2014–2020), both total keyword mentions and keywords-per-page ratios exhibited only minor annual variations, with density figures ranging from 1.3 to 2.1. Following the introduction of a dedicated sustainability report in 2021, a sharp increase in both metrics was observed. The keywords-per-page ratio rose to 4.12 in 2021 and reached 6.24 by 2023, while total mentions exceeded 360. This post-2020 development marks a clear inflection point in Ryanair's approach to sustainability communication.

4.3 Total Keyword mentions by airline comparison

Between 2013 and 2020, the data indicate a steady, incremental expansion in sustainability disclosures for most airlines. Singapore Airlines, Lufthansa, and Ryanair reported the highest absolute counts during this phase, with Singapore Airlines notably surpassing 600 mentions by 2020. Lufthansa maintained a high level of reporting through 2019, reaching a peak above 500 mentions, before undergoing a sharp decline in 2020 associated with a restructuring of its

reporting format. In contrast, American Airlines and Emirates demonstrated a more gradual growth in this earlier period, with mentions rising from below 200 in 2013 to over 200 by 2020. Qatar Airways, which began formal sustainability reporting in 2015, recorded modest increases, reaching approximately 180 mentions by 2020.

The post-2020 period reflects a second, more accelerated phase of reporting expansion. Ryanair, which introduced a dedicated sustainability report in 2021, exhibited a significant rise in mentions, growing from just under 300 in 2020 to nearly 470 by 2023. A similar pattern emerged for Emirates, where a sharp increase occurred after 2021 gathering over 320 mentions by 2023. Singapore Airlines sustained the highest levels throughout the dataset, recovering from a brief decline in 2022 and peaking again in 2023 at over 740 mentions. In contrast, Lufthansa's total keyword mentions remained relatively stable post-2020 with around 250 mentions, reflecting a shift towards denser but shorter reports. American Airlines showed consistent growth across the entire decade, with no marked deviation in 2020, while Qatar Airways continued a steady upward trend, though at a more modest scale.

5. Discussion

This study set out to examine how the implementation of CORSIA has shaped the sustainability reporting practices of six major international airlines between 2013 and 2023. The results noted several trends in the literature while introducing new findings regarding the similarities between airline type and regulatory engagement. Each research question is now addressed considering these findings.

5.1 Research Question 1

How has the implementation of CORSIA affected the structure, language, and transparency of sustainability reporting in the international airline industry between 2013 and 2023?

The findings suggest that CORSIA significantly influenced the structure and content of sustainability reporting across all sample airlines, although the degree of change varies. From 2020 onwards, which coincides with the pilot phase of CORSIA, all carriers presented increased use of regulatory language and keywords such as “CORSIA, “MRV”, “compliance”,

and “offset” appearing more frequently. For instance, Emirates’ mentions of “CORSIA and Regulation” rose from 20 in 2020 to 127 by 2023, and Singapore Airlines reached 205 mentions by 2023, more than doubling its 2020 level. What is more, these patterns reflect findings of normative pressures described by DiMaggio and Powell (1983), whereby organisations adopt similar language in response to institutional expectations. While the increase in keyword density suggests an increasing alignment with the CORSIA framework, the trend also varied structurally. For instance, Lufthansa's post-2020 reporting format included fewer keywords overall but a much higher keyword per page ratio, suggesting a strategic shift in presentation rather than content volume. Thus, it supports earlier findings by Scheelhaase et al. (2018) and Zhang & Yang (2021) who highlighted that the implementation of CORSIA improved industry-wide transparency and accuracy in sustainability disclosures by mandating standardised MRV systems, thus reducing inconsistencies in emissions reporting.

Singapore Airlines and American Airlines provide an example of the path of institutional convergence that was covered in the existing literature. Their reporting has remained consistent while progressively adopting regulatory terminology, reflecting Hahn and Kühnen's (2013) argument that organisations introduce external disclosure frameworks to enhance transparency and comparability. However, Ryanair, in comparison to other airlines, demonstrated a reactive structural transformation that embedded environmental mentions in annual reports to publishing standalone sustainability documents in 2021 with a higher density of keywords. In comparison to the gradual progression observed among legacy carriers, Ryanair’s shift appeared abrupt and externally influenced. This suggests that the change may have been driven more by concerns about maintaining legitimacy than by internal developments in sustainability practices. The findings align with Dempere et al. (2024), who argue that in response to mandatory regulatory frameworks and external scrutiny, companies often engage in more detailed sustainability disclosures as a defensive strategy against accusations of greenwashing. Ryanair shift presents an attempt to address evolving stakeholder demand for credible, verifiable sustainability reporting rather than reflecting a profound internal integration of environmental priorities.

These differences support the argument that, while CORSIA created a common framework, airlines differed significantly in how they embedded it in their reporting structure and communication. Therefore, this study supports and extends the literature by showing that regulation can promote language convergence while generating divergence in structure.

5.2 Research Question 2

To what extent do airlines align their sustainability disclosures with CORSIA's monitoring, reporting, and verification (MRV) requirements?

The results suggest a clear increase in the use of MRV-related language "monitoring", "reporting", and "verification" across most airlines after 2017, especially post-2020. This trend supports the view by Hahn and Kühnen (2013) and Michelon et al. (2015) that regulatory frameworks lead to greater disclosure alignment. For instance, Singapore Airlines' mentions of CORSIA and Regulation rose from 40 in 2013 to 126 in 2020, and further to 205 by 2023. Lufthansa similarly increased MRV mentions from 34 in 2013 to a peak of 141 in 2019, before stabilising around 24 post-2020 due to a change in reporting format. These trends suggest that larger, internationally visible firms with more mature reporting infrastructure tend to integrate regulatory terminology earlier and more consistently.

However, the findings also highlight inconsistencies that previous studies have not fully captured. Ryanair, despite introducing a sustainability report in 2021, showed a decline in MRV-specific terms that year, a significant decline from the 80–85 mentions it maintained in earlier financial reports between 2014 and 2020. This suggests selective reporting in which companies adopt a sustainability approach without integrating its technical foundations, confirming the observation by Liesen et al. (2017) that there are gaps between actual and reported performance in sustainability reports.

In addition, Qatar Airways similarly increased its total environmental keyword usage while underreporting MRV terminology, particularly before 2019. While this may reflect regional regulatory differences, it also supports the literature's emphasis on how institutions relate to strategic priorities. These examples illustrate that the adoption of MRV is not only influenced by external political pressures, but also by an airline's internal strategic communication goals. This extends existing research by highlighting that airlines engage in MRV not only at an operational level but also through discursive practices that shape how their commitment is presented to stakeholders.

5.3 Research Question 3

How do national or flagship airlines differ from regional carriers in their response to CORSIA within sustainability reports?

The findings reinforce the proposition by Brammer and Pavelin (2006) that larger and more visible firms report more intensively and proactively. This supports the research question, as comparing national or flagship airlines with regional carriers allows for the identification of how institutional visibility, stakeholder scrutiny influence the depth of sustainability reporting in response to CORSIA. Flagship airlines such as Lufthansa, Singapore Airlines, and American Airlines consistently exhibited the highest number of keyword mentions across all reporting years. Their disclosures were also more likely to align closely with CORSIA language and to reference broader policy agendas such as ICAO and IATA, suggesting a deeper integration of sustainability into strategic identity.

In contrast, Ryanair and Qatar Airways presented delayed and partial responses to the change. Ryanair's sharp increase in reporting after 2020 aligns with legitimacy theories that disclosure can result from reputational pressure rather than policy compliance. This contrasts with legacy carriers and highlights the difference between proactive and reactive reporting strategies. Similarly, Qatar Airways began formal reporting in 2015 but showed significant growth only after 2019, indicating a gradual institutionalisation of CORSIA discourse rather than immediate regulatory conformity.

The findings suggest that airline type, business model, and regional context influence the pace and depth of CORSIA engagement. The study contributes to the existing literature by providing empirical evidence that low-cost and hybrid models are less consistent in aligning with international frameworks, even when these frameworks are sector-specific and widely approved.

5.4 Research Question 4

Did CORSIA introduce new reporting requirements or codify existing airline practices?

The findings suggest a split between airlines for whom CORSIA was largely confirmatory and those for whom it was transformative. For Lufthansa, Singapore Airlines, and American

Airlines, many of the technical elements formalised by CORSIA, such as carbon offsetting, emissions tracking, and ICAO references, were already present before 2020. This aligns with Christensen et al. (2021) findings, who suggest that regulatory frameworks often formalise and standardise pre-existing voluntary disclosures, enhancing their credibility and comparability in global markets.

In contrast, Ryanair and Qatar Airways have experienced a more significant transformation in response to CORSIA. Ryanair introduced a standalone sustainability report in 2021, marking a turning point in its disclosure strategy. The total number of keywords mentions increased from less than 300 in 2020 to almost 470 in 2023, while the keyword per page ratio increased from 1.3-2.1 before 2021 to 6.24 in 2023 Qatar Airways similarly increased the number of keywords mentions from around 85 in 2020 to more than 100 by 2023, with an increase in keywords per page from 3.82 to 4.21. These changes suggest that external regulatory pressures may have played a role in driving more structured and comprehensive disclosures, particularly among airlines that previously showed limited or inconsistent reporting.

This development is in line with the findings of Dempere et al. (2024) and Simnett et al. (2009), who highlight how mandatory frameworks and verification pressures can significantly change corporate reporting behaviour, particularly for companies with minimal past involvement. Thus, rather than acting solely as a codifier, CORSIA may have acted as a regulatory catalyst that encouraged more formalised and standardised reporting at Ryanair and Qatar Airways. This also reflects institutional theory, which posits that regulation can have both a constraining and enabling effect, prompting organisations to adopt practices that they may have previously resisted or not prioritised.

5.5 Limitations

While this study offers valuable insight into the evolution of airline sustainability disclosures in response to CORSIA, several methodological and contextual limitations must be considered. The sample includes major carriers from many regions of the world, and it does not cover the full diversity of the aviation sector. The exclusion of smaller regional airlines and low-cost carriers limits the results, as these organisations may take different approaches to reporting or demonstrate lower levels of regulatory engagement. What is more, the analysis is limited to

English language disclosures, which may overlook cultural differences in terminology found in reports published in other languages. This limitation may lead to under-representation of regional interpretations of environmental responsibility and compliance.

A further limitation arises from the qualitative content analysis, which despite a structured coding framework and the application of inter-coder reliability checks, remains interpretive. The possibility of researcher bias, particularly in the selection, classification and contextual reading of keywords, cannot be fully excluded (Silverman, 2013; Schreier, 2012).

6. Conclusion

This study explored how ICAO's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) influenced the structure, transparency and language of sustainability reporting at six international airlines between 2013 and 2023. By using a longitudinal, comparative disclosure analysis and content interpretation with keyword tracking, the research responded to existing gaps in the literature on the role of international regulations in shaping corporate environmental communication in the aviation industry.

The results suggest that CORSIA had a dual function in shaping airlines' sustainability disclosures. For legacy carriers such as Lufthansa, Singapore Airlines and American Airlines, CORSIA acted primarily as a codifier, formalising reporting practices that were already in place before 2020, including consistent references to carbon offsets, ICAO standards and emissions tracking. In contrast, for airlines such as Ryanair and Qatar Airways, which had previously failed to disclose detailed or structured environmental information, CORSIA appears to be acting as a catalyst. Following its implementation, these carriers have introduced stand-alone sustainability reports and significantly increased their use of the regulatory vocabulary, indicating a move towards a more standardised and external reporting framework

The introduction of CORSIA's MRV requirements contributed to a measurable increase in reporting standardisation and the use of regulatory language in airlines' sustainability reporting. Post-2020, the majority of airlines in the sample consistently included terminology related to 'monitoring', 'reporting', 'verification' and 'compliance' in their disclosures - language that was either absent or inconsistently used before CORSIA. This was evident in the more recent sustainability reports, which began to refer more systematically to CORSIA-

related processes, suggesting compliance with the technical expectations of the framework, even if structural formats continued to vary from airline to airline.

However, despite growing convergence in language, the visual and structural differences in reports such as Lufthansa's 2020 shift toward fact-sheet-based formats highlight persistent variation in disclosure approaches. These differences demonstrate that while regulatory alignment may grow, strategic narrative construction and stakeholder targeting continue to shape how disclosures are framed and prioritised. Another important finding is that the response to CORSIA was not constant across all carriers. While some airlines used the framework to affirm existing strategies, others adapted their reports significantly, marking a shift from symbolic disclosure to more tangible engagement with sustainability goals.

This dissertation contributes to sustainability reporting scholarship by offering a comparative and longitudinal account of how a single regulatory update has shaped disclosure patterns across distinct governance models and geographic contexts. It also underlines that sustainability communication is both a tool for accountability and a means of asserting legitimacy. CORSIA serves as a regulatory anchor around which narratives of environmental responsibility are increasingly constructed.

Future research could extend this work by including additional carriers, exploring stakeholder reactions to disclosure narratives or integrating interviews with airline representatives and ICAO stakeholders to deepen understanding of internal decision-making processes. As the airline industry continues to face increasing pressure to decarbonise, the strategic role of sustainability reporting will only intensify, making further academic engagement in this area both timely and necessary.

Lastly, my experience in the Accounting, Organisations and Institutions (AOI programme has been reflected in my approach to this dissertation. Through AOI, I explored accounting as a calculative and social practice, recognising how budgeting, forecasting, and reporting measure and shape organisations' approach. Studying institutions revealed their powerful role in setting norms and influencing organisational behaviour, which is evident in sustainability reporting and compliance mechanisms, as shown in my CORSIA research. My dissertation integrates these insights by analysing how regulatory frameworks like CORSIA institutionalise transparency and accountability in airline sustainability disclosures. The AOI framework helped me critically assess whether new regulations merely codify existing practices or

transform corporate reporting. Furthermore, through institutional theories like legitimacy and stakeholders, I examined why airlines align their disclosures with evolving global standards. The programme not only shaped my dissertation topic but also deepened my understanding of accounting's broader societal implications, preparing me for future professional practice and research.

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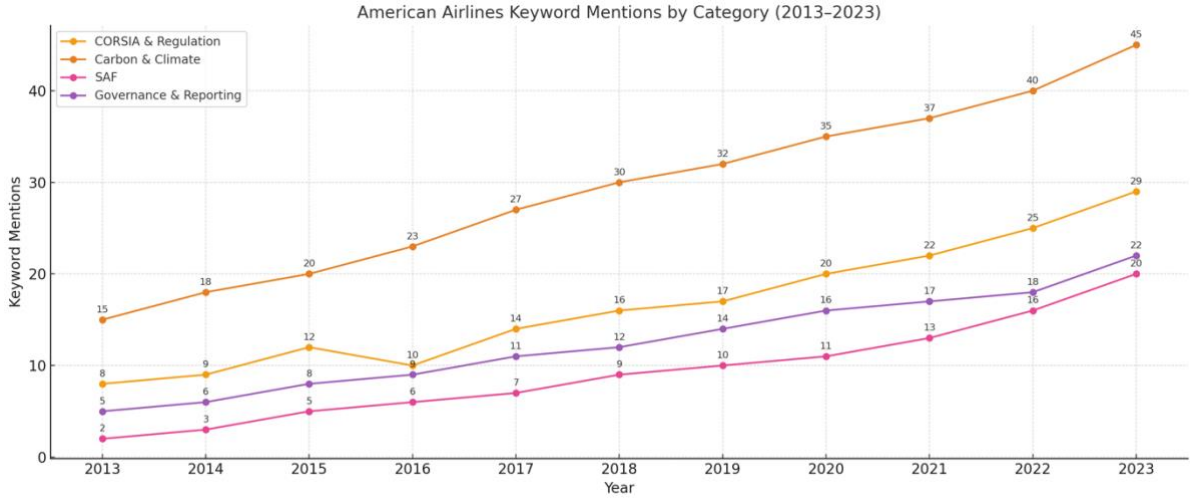
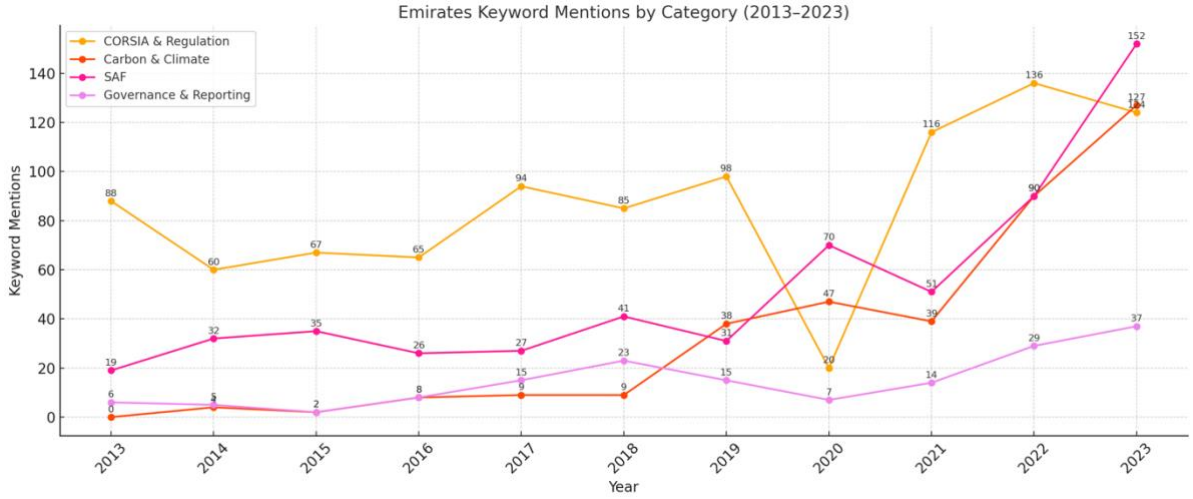
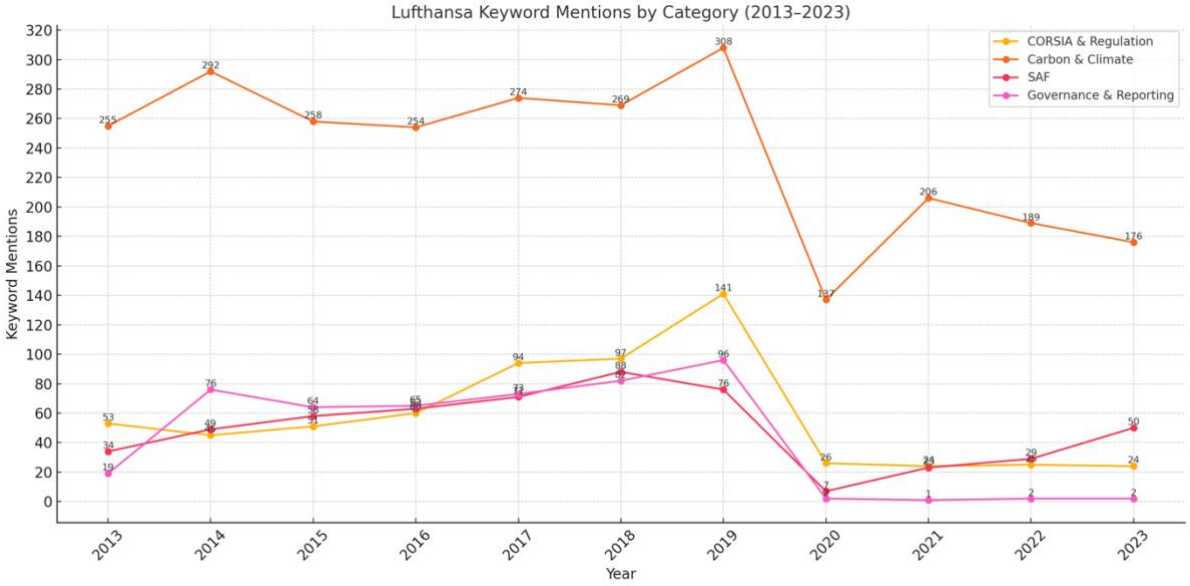
Appendix 1 – American Airlines Keywords



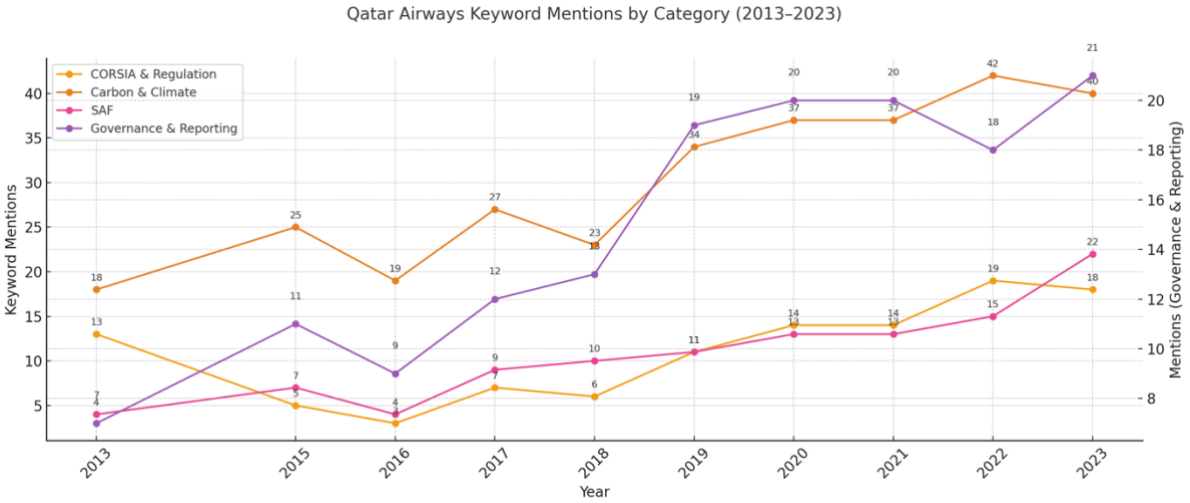
Appendix 2 – Emirates Keywords



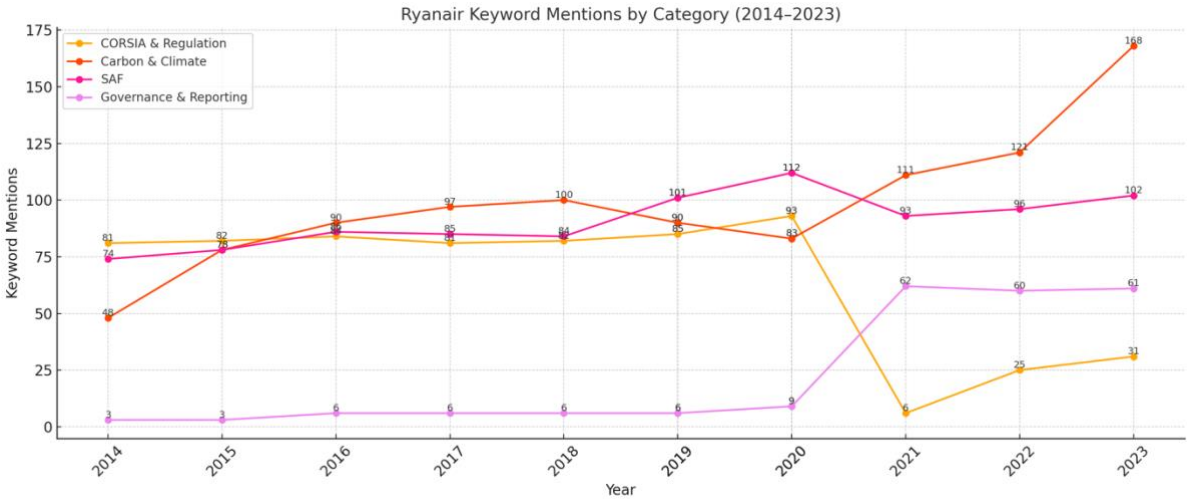
Appendix 3 – Lufthansa Keywords



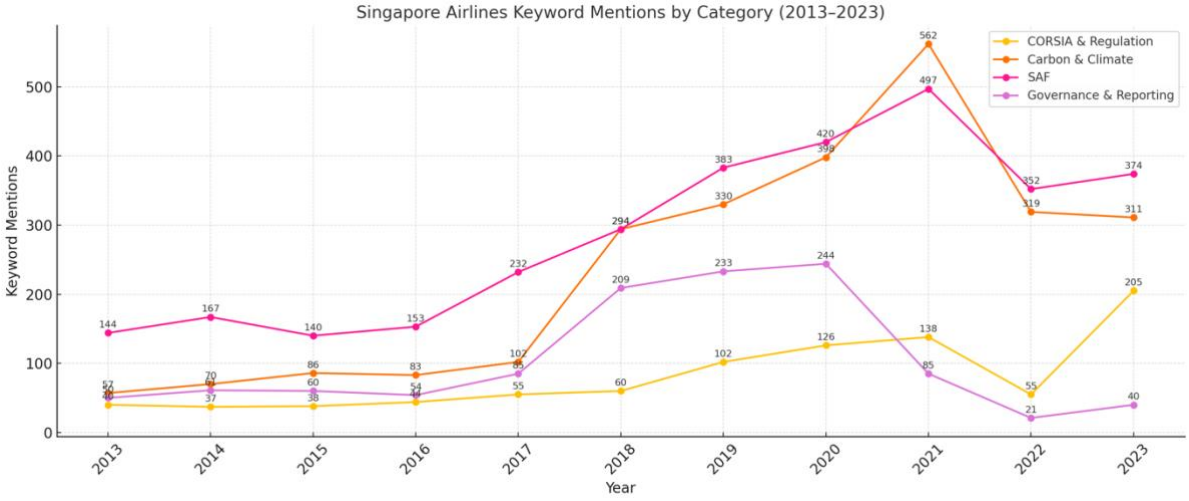
Appendix 4 – Qatar Airways Keywords



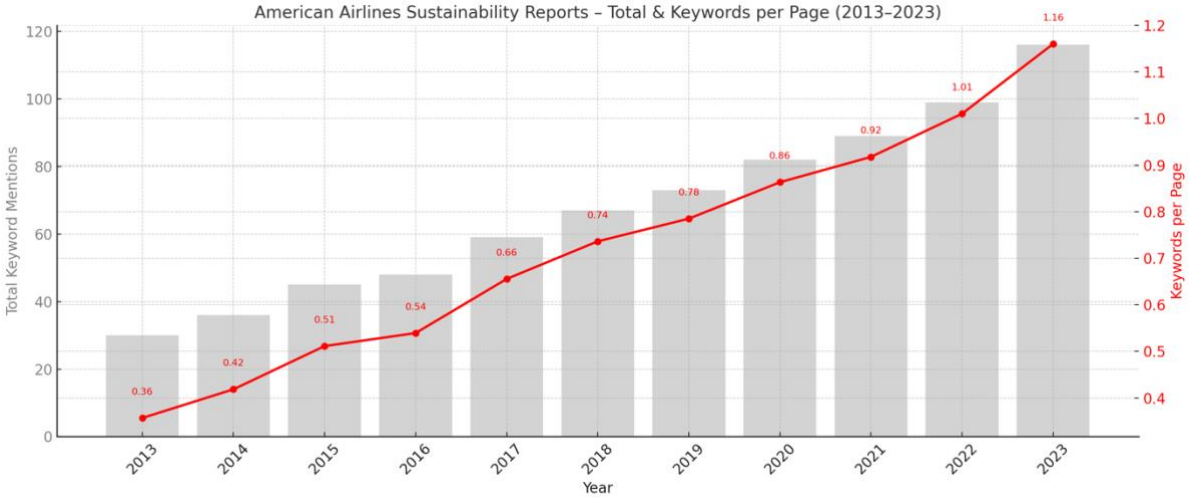
Appendix 5 – Ryanair Keywords



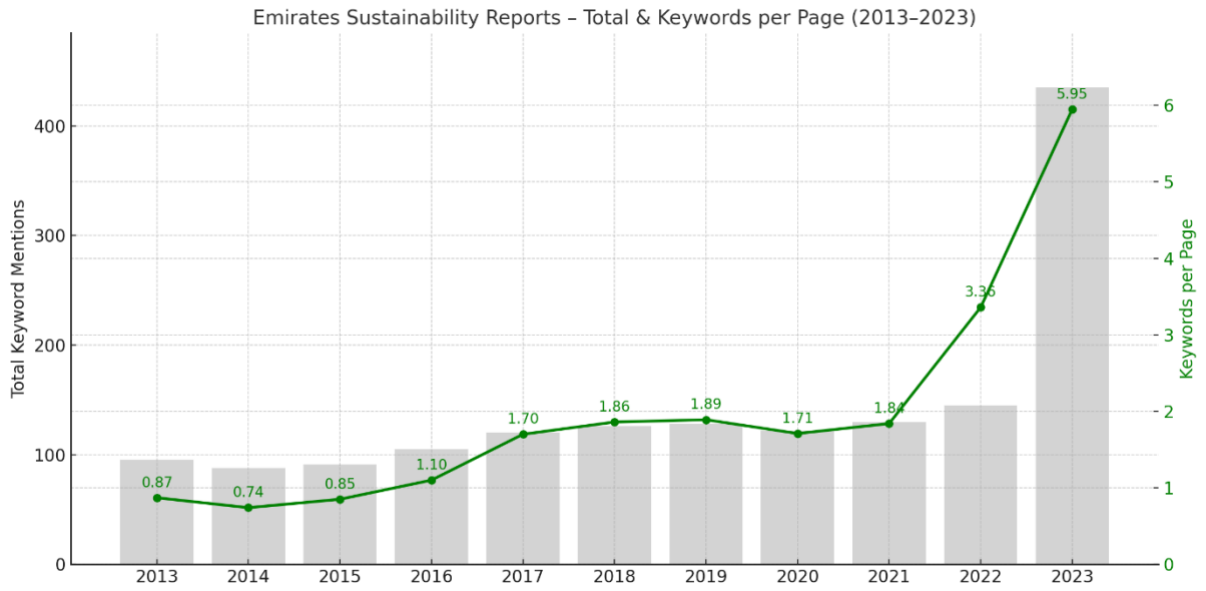
Appendix 6 – Singapore Airlines Keywords



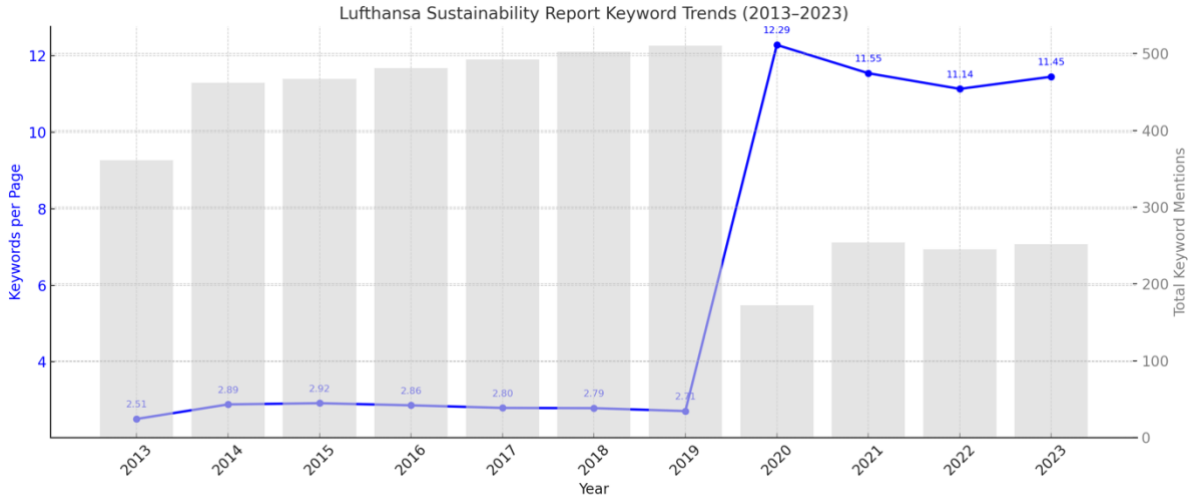
Appendix 7 - American Airlines Trends



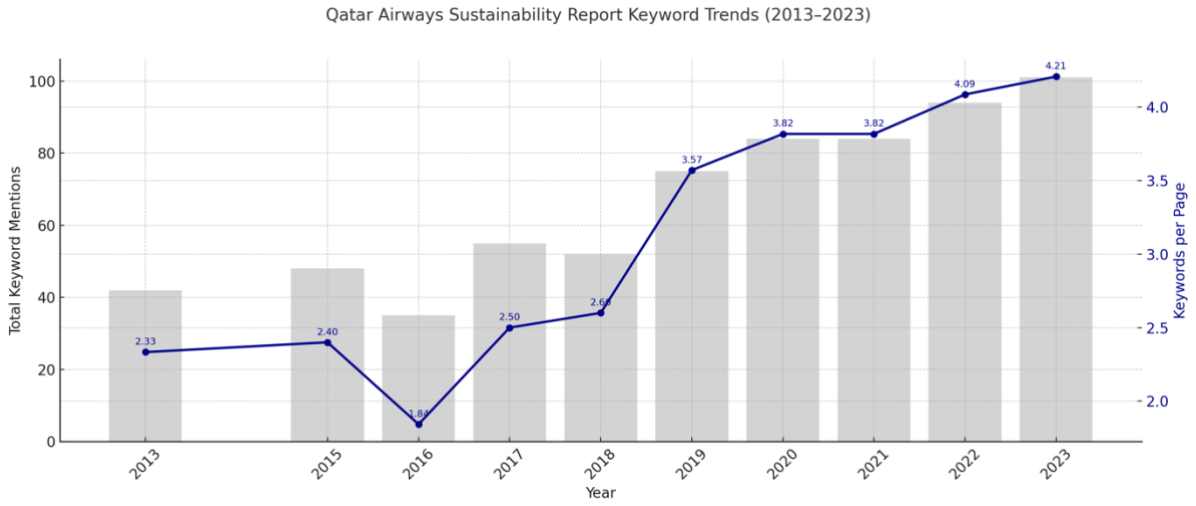
Appendix 8 - Emirates Trends



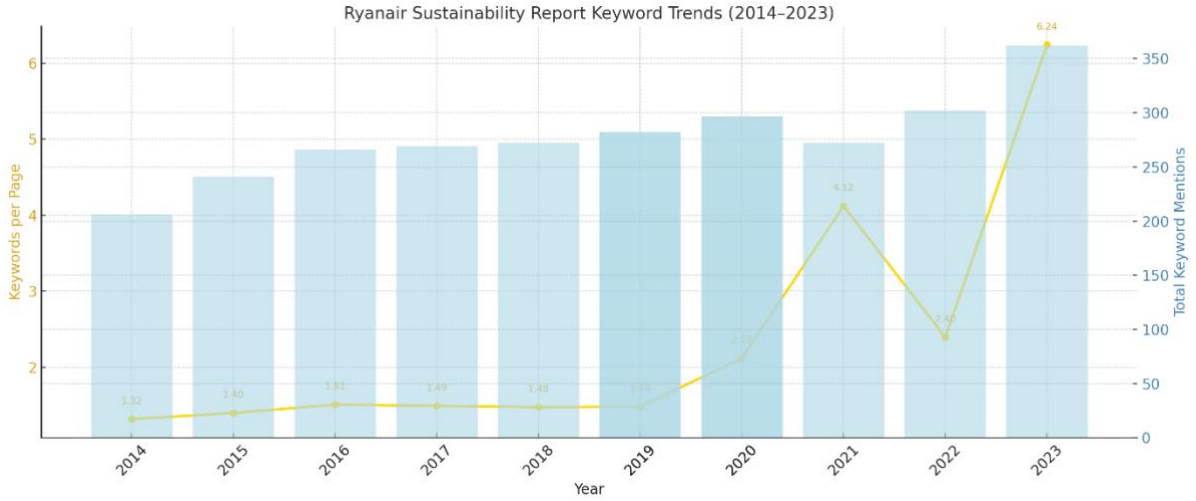
Appendix 9 - Lufthansa Trends



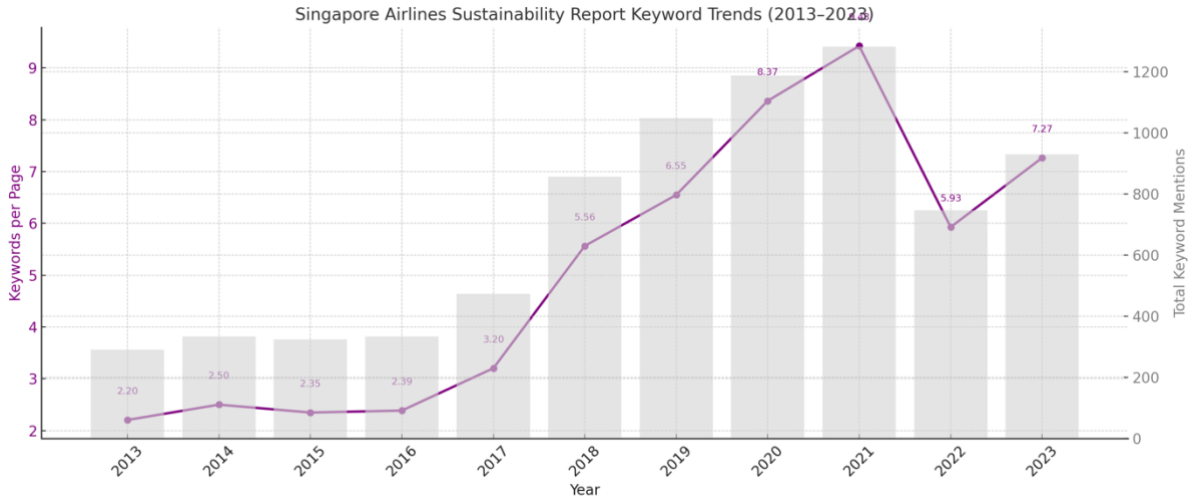
Appendix 10 - Qatar Airways Trends



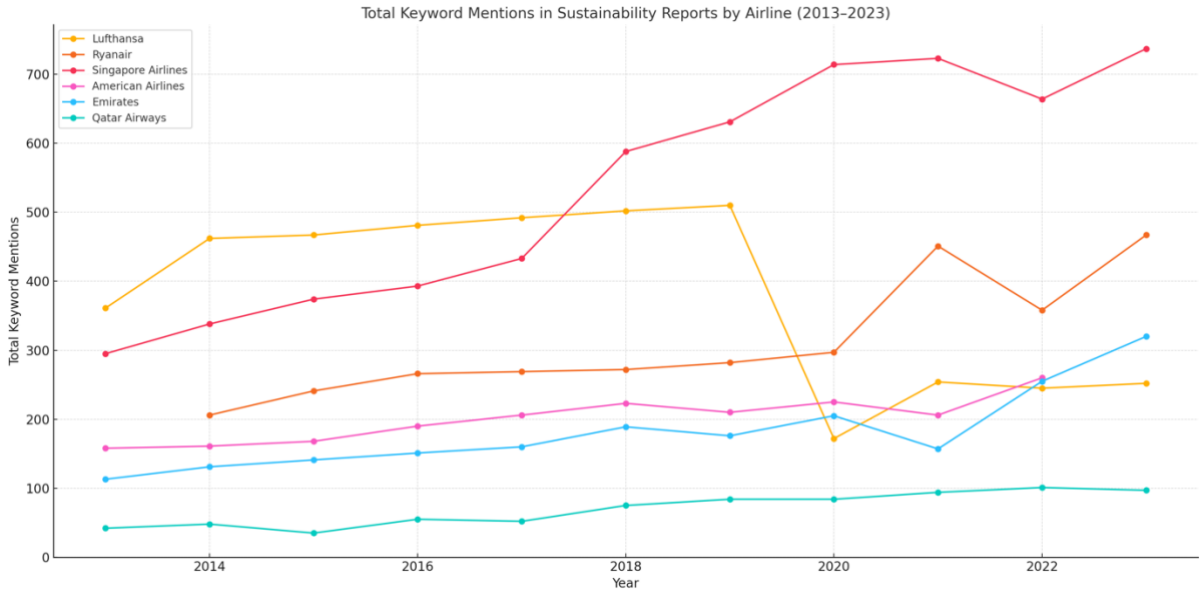
Appendix 11 - Ryanair Trends



Appendix 12 - Singapore Airlines Trends



Appendix 13 - Airlines Total Keyword Mentions



Appendix 14 - Keyword Categories

Keyword Categories in Sustainability Report 2013

Category	Keywords
CORSIA & Regulation	CORSIA, CORSIA offset, CORSIA compliance, ICAO, MRV, monitoring, reporting, verification
Carbon & Climate	carbon offset, carbon-neutral, carbon neutrality, net zero, climate strategy, climate action, emission reduction, emissions, greenhouse gas, GHG, CO2, carbon dioxide, fuel consumption, kerosene
Sustainable Aviation Fuel (SAF)	sustainable aviation fuel, SAF
Governance & Reporting	IATA, transparency, sustainability report