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Resilient Supply Chains in the Post-Pandemic Era: A Comparative Review of Global Disruption Management Frameworks in Aviation Industry

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Abstract *— The COVID-19 pandemic demonstrated the critical frailty of the global supply chains, which necessitated the change in mindset towards resilience-oriented, rather than efficiency-oriented, supply chain. The article is a qualitative comparative literature review of disruption management models in the world to understand that technological integration, teamwork, and policy fit has enabled the strength of supply chains regardless of the pandemic. According to the research that has been indexed in Scopus, case studies within the industry, and policy reports, the study mentions that the adoption of Artificial Intelligence (AI), Internet of Things (IoT), Blockchain, and Digital Twin technologies have led to the levels of incredible visibility, traceability, and responsiveness in industries. The case studies that feature the Unilever AI-based demand forecasting, the IoT-based cargo tracking offered by Maersk, and the blockchain-based food traceability by Walmart demonstrate how the digital technologies may be transformative. The comparisons in the region indicate that certain strategies are chosen: North America, as oriented on automation and predictive analytics, Europe, as oriented on the circle supply chains, and Asia-Pacific, as oriented on the flexible localization. In addition, these are the following types of collaboration models that became the most important facilitators of resilience: the public-private partnerships and global data-sharing consortia that allow a sense of shared responsibility and fast recovery in case of crisis. The findings show that the future of supply chain resilience is the proactive digital transformation, inclusive cooperation, and strategic integration of sustainability and flexibility.*

Keywords *— **Supply Chain Resilience, Post-Pandemic Transformation, Digital Technologies, Artificial Intelligence, IoT, Blockchain, Collaboration, Disruption Management, Global Supply Networks, Sustainability***

I. INTRODUCTION

The COVID-19 outbreak revealed inherent structural weaknesses in the global aviation supply chains, making aircraft manufacturing, airport management, and airline logistics to come to a stop like never before (Melo, 2021). The shutting of fleets on the ground, shutting down of airports, shortages of aviation-related fuel, and extreme interruptions in the supply chain of aircraft-parts compelled aviation stakeholders, including airline, MROs, OEMs, and regulators, to re-evaluate procurement, maintenance planning, and aircraft-parts-network design (Merlo, 2024). Such upheavals hastened a transition between classic cost-effective and lean aviation designs to more agile, redundant, and end-to-end-visibility-based

designs, and with the aid of digitalization, collaboration, and sustainability demands.

During the restructuring phase after the pandemic, some innovative technologies, e.g., AI-based demand forecasting, aircraft and cargo monitoring through IoT, fleet maintenance using digital-twin simulation, and blockchain-based traceability shifted to the category of mainstream operational tools in the aviation ecosystem (Gulati, 2023). An example is that Airbus and Boeing widened the digital-twin to level production timetables and more accurate predictive upkeep (Gupta et al., 2024), whereas SITA and Amadeus broadened their IoT and cloud-communication airport frameworks to assist real-time baggage, person, and cargo tracking (Vikas, 2011). On the same note, IATA launched operational resilience principles, which prompted airlines and airports to combine digital documentation, automated decision-making and data sharing across borders in order to recover following a shock (Abeyratne, 2020).

These developments were accompanied by the shift of organizational and regional strategies. The airlines transformed conventional Just-In-Time models through multi-supplier contracts on essential parts and MRO vendors took on collaborative digital services to liaise with OEMs and suppliers on lead times, maintenance windows and inventory buffering (Ho et al., 2021). Digital-twin tools and smart-sensor infrastructure became the methods by which airports and air-cargo operators dealt with the sudden variations in the quantity of cargo, runways, and the usage of equipment. Such industry adaptations indicate that resilience in the aviation industry is not a feature of a single tool but a product of combined digital capabilities, multi-tier supply integration, and process redesign due to sector-specific constraints (Moenck et al., 2024).

This paper aims to make a comparative review of post-pandemic disruption-management models in aviation through the review of Scopus-indexed literature, aviation case studies worldwide, and policy reports. This goal is to determine trends, best practices, and practices that are transferable to support long-term operational resilience by airlines, airports, and MRO organizations and regulators. The research would unify technological, collaborative, and policy-level innovations in different regions to present actionable suggestions to aviation leaders and policymakers interested in future-proofing aviation supply chains when systemic disruptions occur.

Objectives of Study

1. To compare global disruption-management frameworks used in the aviation industry to enhance supply chain resilience in the post-pandemic era.
2. To assess the role of aviation-focused digital technologies and collaborative models—such as AI, IoT, digital twins, blockchain, and regulator–industry partnerships—in strengthening adaptability, continuity, and sustainability across airline, airport, MRO, and air-cargo supply chains.

II. REVIEW OF LITERATURE

This conceptual paper presents a cohesive framework that connects resilience enablers, post-pandemic operational tactics, and sustainability objectives. The research conducted by **Setyadi et al., 2025** advances theoretical understanding by redefining sustainable operations amid complex global upheavals and provides a prescriptive framework for future academic inquiry and practical application.

Taneja's 2021 book elucidates the distinctions of this extraordinary pandemic from previous disruptions faced by the aviation sector over the last 50 years, and outlines strategies for airlines and associated enterprises to adjust to the significantly altered marketplace. This book is essential reading for all senior practitioners in the airline industry and adjacent sectors, as well as global aviation policymakers.

This study seeks to thoroughly analyze the existing literature on corporate risk management published post-COVID-19 by bibliometric analysis. The study by **Çopur & Yılmaz (2025)** analyzes academic publications from 2020 to 2025, identifying significant themes and publication trends for the post-pandemic era, with the intention of directing future research in enterprise risk management.

This study examined the risk management methods of Hainan Airlines Group and Aegean Airlines, among other representative cases, to investigate how airlines might enhance risk management during the post-pandemic recovery phase **(Cao et al., 2024).** This

study seeks to offer a valuable reference for airlines' risk management in the post-epidemic era, facilitating stability and sustainable development in a complex and dynamic market environment through methodical analysis and research.

III. RESEARCH METHODOLOGY

The current article will use the qualitative research design to compare and analyze the global disruption-management models applied in the aviation sector in the post-pandemic period. Since the topic is exploratory, this design will allow conducting a comprehensive study of the strategies implemented by airlines, airports, MRO providers, OEMs, and air-cargo operators to make aviation supply chains more resilient. The research seeks to mould the findings in the literature and the industry to determine trends, best practices and some of the major issues that have some bearing on procurement, maintenance logistics, aircraft-parts movements and general stability in the operations of the aviation supply chains.

All the data that will be used in this study is based on secondary sources that include such material as peer-reviewed journals that are placed in the Scopus database, reports in the industry of aviation, white papers, case studies, and official documents of international aviation organizations such as IATA, ICAO, ACI, and general organizations like the World Economic Forum (WEF) or the World Bank. The most important publications in 2020 and further were selected to reflect post-pandemic events. These sources were carefully examined to track down recurring motifs connected to digital transformation, regulatory cooperation, sourcing of parts to aircraft, airports reshaping logistics and technology-based resilience solutions incorporated in the aviation industry.

The analysis of data collected was conducted using a thematic literature review method. The most significant themes were revealed through qualitative coding and synthesis and comprised the integration of digital technologies (AI, IoT, digital twins, blockchain), risk mitigation in airline and MRO activities, the multi-stakeholder collaboration in the airports and regulators, and resilience based on sustainability. They were then compared to reveal the similarities and differences between the regional aviation response based on differences in maturity of infrastructure, regulatory condition and technological preparedness.

The study is based on comparative synthesis and triangulation to guarantee the methodological soundness of the research, which confirms the findings based on a number of data sources. This methodological frame underpins a thorough insight into the manner in which various aviation stakeholders are enhancing operational resilience, fleet preparedness and supply chain resilience in the face of uncertainty in the global environment. The study results of this qualitative, secondary-data research work should provide both theoretical and practical insights to the aviation policymakers, airline management, and airport administrators and supply chain executives aiming to develop aviation networks that could withstand future disruptions.

IV. RESULTS

The findings from the comparative review indicate that aviation supply chains have undergone significant restructuring in the post-pandemic era, driven by accelerated technology integration, strengthened collaboration, and adaptive resilience models. Airlines, airports, MRO providers, and OEMs that adopted AI-driven analytics, IoT-based aircraft and cargo monitoring, digital-twin simulations, and blockchain-enabled traceability demonstrated stronger agility, higher operational responsiveness, and more robust disruption recovery compared to aviation networks reliant on traditional and fragmented systems.

Technological Integration and Resilience Results

Table 1. Impact of Digital Technologies on Supply Chain Resilience.

Technology	Key Function in Aviation	Observed Benefit	Aviation Example	Sources
Artificial Intelligence (AI)	Predictive maintenance, demand forecasting for	Reduced AOG (Aircraft on Ground) time;	Airbus Sky wise AI predictive maintenance platform	Merlo, 2024

	aircraft parts, route optimization	improved maintenance planning		
Internet of Things (IoT)	Real-time aircraft health monitoring, cargo/environment tracking, airport equipment visibility	Enhanced operational visibility; early detection of component failures	SITA IoT-enabled baggage & cargo tracking systems	Gulati, 2023
Blockchain	Secure documentation, parts traceability, MRO record auditability	Increased trust in aircraft-parts movement; minimized counterfeit risks	Honeywell's blockchain-based aircraft parts marketplace	Ho et al., 2021
Digital Twins	Simulation of fleet operations, predictive MRO scheduling, airport flow optimization	Improved risk preparedness; reduced maintenance delays; optimized airport operations	Boeing and Airbus digital twin environments for production and MRO	Moenck et al., 2024

Comparative Regional Insights

Global aviation regions adopted different resilience strategies in response to post-pandemic disruptions, shaped by their infrastructure maturity, regulatory environments, and technological readiness. Developed aviation markets such as North America and Europe prioritized digital automation, predictive analytics, and sustainability-focused supply chain reforms, while Asia-Pacific leveraged localization, multi-tier supplier models, and flexible sourcing to stabilize aircraft-parts availability. Emerging regions such as Africa concentrated on digital enablement, air-cargo capacity expansion, and aviation workforce upskilling to address long-standing infrastructural gaps. These regional patterns demonstrate that resilience strategies are context-specific and reflect each region's operational capabilities and aviation ecosystem maturity.

Table 2. Comparative Summary of Regional Aviation Supply Chain Resilience Frameworks.

Region	Primary Focus	Key Practices in Aviation	Illustrative Aviation Example	Sources
North America	Automation and Predictive Analytics	AI-based aircraft maintenance forecasting; integrated airline–airport digital platforms	Delta Air Lines' AI-powered predictive maintenance & FAA-backed digital modernization programs	MoghadasNian, 2025
Europe	Sustainability and Circular Aviation Supply Chains	Blockchain-enabled parts traceability; green procurement; SAF-driven logistics	Lufthansa Technik's circular MRO initiatives & Airbus's sustainable supply chain programs	Wirths, 2019; Melo, 2021
Asia-Pacific	Localization and Flexible Sourcing Models	Multi-tier aircraft-parts sourcing; regional MRO collaboration; near-shoring for critical components	Japan's hybrid JIT–resilience model in aviation supply networks; Singapore's regional MRO hub expansion	Abdulraheem, 2018; Sullivan, 2023
Africa	Digital Adoption and Aviation Capacity Building	Mobile-based air-cargo platforms; digitized airport logistics; aviation workforce upskilling	Kenya Airways & Ethiopian Airlines' digital cargo modernisation through pan-African platforms	Belay, 2024

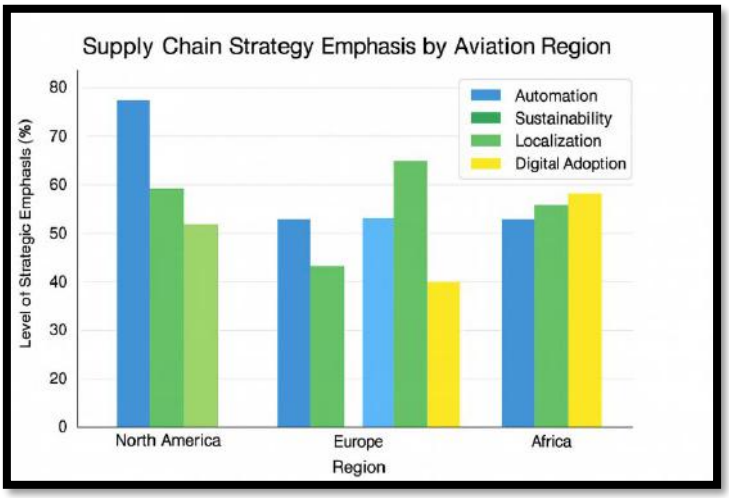

Fig.1. Regional Distribution of Dominant Aviation Supply Chain Resilience Strategies.

It is revealed that there are regional differences in resilience strategies (comparative analysis). The developed countries stressed on automation and digital change, whereas the developing ones focused on flexibility and local sourcing.

Frameworks of Collaboration and Policy

Table 3. Global Collaborative Resilience Models.

Framework	Stakeholders Involved	Outcome in Aviation	Region	Sources
Public–Private Aviation Resilience Partnerships	Civil aviation authorities, airlines, airport operators, logistics firms	Streamlined crisis coordination, standardized health & travel protocols, rapid reopening of aviation corridors	European Union (EASA–airline partnerships)	Zhou, 2024
Integrated Aviation Supplier Ecosystems	OEMs (Boeing/Airbus), tier-1/2/3 suppliers, MRO providers	Reduced dependency on single-source components; shared digital dashboards for parts tracking	Japan (aviation manufacturing clusters)	Wendt, 2016
Aviation Data-Sharing Consortiums	Tech providers (SITA, Amadeus), airlines, regulators (FAA, ICAO)	Improved real-time visibility; harmonised reporting for passenger, baggage & cargo movement	North America	Dias, 2024
Digital Enablement for Emerging Aviation Markets	Development agencies, aviation banks, small airport operators, regional carriers	Increased digital adoption in air-cargo, airport operations & safety systems	South Asia & Africa	Abeyratne, 2020

The emergence of collaboration between government, industry and technology partners is also one of the key resilience enablers. Multi-stakeholder networks also supported quicker recovery and risk-sharing processes in the global disruption. The general synthesis is that the digital innovation, collaborative governance, and strategic flexibility are integrated in resilient supply chains. The organizations that achieved a balance between automation and human skills and sustainability-related needs proved more

adaptive and competitive after the crisis. The comparative analysis ends with the conclusion that resilience is shifting towards the notion of a reacting concept, becoming a proactive capability to determine the future of global supply networks.

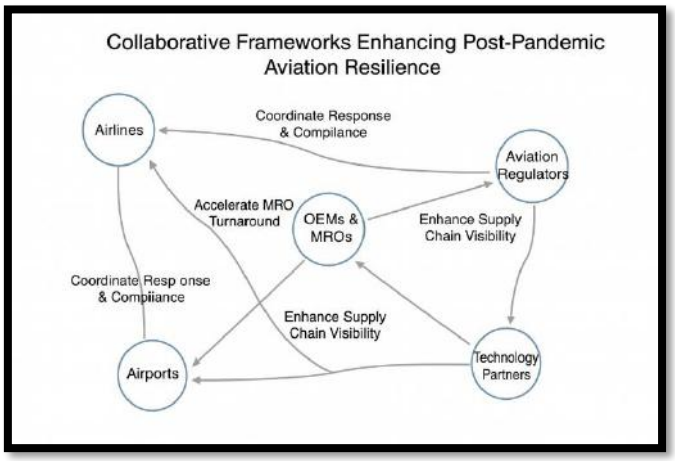

Fig.2. Collaborative Frameworks Enhancing Post-Pandemic Resilience.

V. DISCUSSION

As demonstrated in the comparative review, the post-pandemic aviation supply chain redesign has become centered on the digitalisation and collaborative governance. Stakeholders in aviation who embraced AI-based predictions, aircraft and cargo tracking using IoT, parts track ability using blockchain, and digital-twin simulations outperformed networks that were manually managed or disjointed. The cases in the industries, including AI-based planning in large airline companies, IoT-enhanced tracking in international air-cargo companies, and blockchain-based component verifiability systems used in large OEMs, show that the transparency, reliability, and speed of response are greater.

This is further influenced by regional differences in strategies. North America is focused on automation, predictive analytics and combined digital platforms. The sustainability-based models and the cyclical material loop in airplane production and MRO are leaders in Europe. The Asia-Pacific zone enhances localisation, multi-tier sourcing, and adaptable supplier ecosystems in the aim of minimising long-distance dependency. Digital enablement, capacity building and inexpensive mobile based visibility tools are the main priorities of emerging economies especially Africa and South Asia in order to mitigate infrastructural and skills based vulnerability.

Cooperation systems also developed as the supporting blocks of aviation resilience. In the EU, public-private partnership enhanced the coordination of the crisis and standardised travel measures. The integrated supplier ecosystems granted by Japan mitigated the risk of part-dependency with the help of the common dashboards. The North American data-sharing consortiums increased real-time baggage, cargo and compliance reporting. According to such models, the future-ready aviation supply chains are determined by the collaboration of three components: the high degree of digital technologies, multi-stakeholder's governance, and operation systems based on sustainability. All in all, resilience is no longer reactive in the form of a response to a disruption, but it has evolved into a proactive, intelligence-driven capability that is based on prediction, prevention, and a fast recovery.

VI. CONCLUSION

Researchers conclude that the global supply chains in aviation, especially the post-pandemic restructuring, have moved the industry away from the lean and cost-minimising supply chain models to resilience, agility, and digital intelligence. The disruption was more anticipated, continuity was ensured, and recovery was faster in organisations that integrated technologies in the form of AI, IoT, blockchain, and digital twins. Such tools enhanced transparency, accuracy of forecasting, facilitated MRO optimisation and enhanced trust among multi-level supplier networks.

The contextual factors in evidence in regions are that advanced economies are using automation and predictive systems to build resilience, whereas emerging regions are considering digital inclusion, flexible sourcing, and building capability to make the economy less susceptible. The collaborative mechanisms, such as public-private coordination frameworks, global data-sharing consortiums and integrated supplier ecosystems, have been influential in stabilising the aviation operations during and after the crisis.

In general, sustainability of the supply chain has transformed into a strategic and advance competency, but not a reaction. To achieve the future of aviation logistics and procurement, three forces that need to be harmonised include digital transformation, cross-industry collaboration, and sustainability integration. Organisations that find this balance will be in a good position not only to survive the future shocks but also to use the disruptions as an opportunity to innovate and remain competitive.

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