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Agility in aviation management: Evaluations from a supply chain perspective

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Abstract

This paper examines the concept of agility within aviation management, emphasizing its role from a supply chain perspective. Drawing from a comprehensive literature review, the study identifies how agility is defined, applied, and analyzed in the aviation sector. Key themes encompass the significance of agile supply chains in achieving operational adaptability, the incorporation of digital tools, and the strategies employed to address disruptions, exemplified by the COVID-19 pandemic. The paper identifies research gaps, including limited attention to sustainability and challenges in stakeholder collaboration. By synthesizing insights from previous studies, this paper provides a framework for understanding the strategic importance of agility in aviation management and offers directions for future research to build resilient and adaptive supply chains.

Keywords: Aviation Management; Agility; Supply Chain; COVID-19

1. Introduction

Over the last century, the air transportation industry has experienced significant growth, evolving into a vital sector of the global economy [1]. Air transport plays a critical role in supporting global supply chains by providing highly integrated, fast, safe, reliable, convenient, and efficient delivery services. While it accounts for just 1% of total cargo volume, the goods it transports represent 30-40% of global trade value. Thus, the aviation industry, as a key sector that generates employment and supports economic growth, significantly contributes to the expansion of the global economy [2].

The expansion of new services and rising consumer expectations for quality and safety in aviation necessitate innovative and practical mechanisms for managing diverse supply chains, along with the adoption of international operational and procedural standards. The aviation industry is undergoing structural transformations grounded in logistical principles, fostering the development of relationships among aircraft manufacturers, independent suppliers of aircraft parts, maintenance and repair providers, aircraft operators, and air carriers, all integrated into supply chain networks [2,3].

The objective of aviation management is to coordinate the activities of various actors involved on an aircraft carrier, including aircraft, vehicles, and personnel, by implementing procedures such as catapult launches, landings, refueling, and other operational processes [4]. The aviation supply chain encompasses a wide range of activities, including aircraft manufacturing, maintenance, fuel supply, and logistics for both passengers and cargo. The smooth operation of this network is essential for ensuring reliability and customer satisfaction. In an industry marked by constant change and unforeseen challenges, this operational complexity emphasizes the importance of agility as a strategic necessity. Therefore, agility is recognized as essential elements in shaping organizational strategy within the aviation industry [5].

Agility in aviation management has emerged as a key enabler of resilience and adaptability in addressing industry challenges. Agile practices allow stakeholders to respond swiftly to disruptions, optimize resources, and maintain

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continuity in operations. In supply chains, agility involves leveraging technology, fostering collaboration, and implementing flexible processes to navigate uncertainties effectively [6]. These principles have been particularly critical during global crises, such as the COVID-19 pandemic, which exposed vulnerabilities and emphasized the importance of rapid adaptability within aviation systems [7].

This paper aims to explore how the concept of agility is applied and evaluated in aviation management from a supply chain perspective between the years 2021-2025. By conducting a comprehensive literature review, the study seeks to identify key themes, trends, and gaps in existing research. It further aims to highlight the strategic importance of agility for enhancing the aviation sector's responsiveness and sustainability. The findings provide valuable insights for academics and practitioners, offering a roadmap for future studies and practical applications to build resilient and adaptive supply chain systems.

2. Literature Review

2.1. The Role of Agility in Aviation Industry during COVID-19

Agility is defined as the ability to rapidly adapt to changing circumstances while maintaining operational efficiency, is particularly crucial when viewed through a supply chain perspective [8]. Scholars have shown growing interest in exploring supply chain agility within manufacturing and service operations, particularly in response to emerging situations. The impact of the COVID-19 outbreak on airline supply chains and aviation management has necessitated both short-term and long-term response strategies [7]. Therefore, it is vital for aviation managers affected by environmental shocks to think strategically during such times and to prepare for future shocks by developing more resilient and adaptive organizations. Literature between the years 2021-2025 shows us various solutions and recommendations for situations such as COVID-19 pandemic. Linden [9] proposes that aviation managers create a unified strategic language, incorporate uncertainty as a standard element in long-term planning, and proactively manage uncertainty. They should also develop long-term plans by engaging in dialogue with various stakeholders in an agile manner, being mindful of the strategy tools in use, transforming the board into a co-creating team, and implementing a three-step process involving sensing, seizing, and adapting the organization accordingly.

Belhadi et al. [7] provides insights into the effect of the COVID-19 outbreak on the automobile and airline supply chain. Their findings show that:

- The automobile industry identified that the most effective strategies for mitigating COVID-19-related risks were to establish localized supply sources and adopt advanced Industry 4.0 (I4.0) technologies.
- In contrast, the airline industry recognized the immediate priority as preparing for the business continuity challenges posed by COVID-19, by defining their operations both at airports and on flights.
- Both sectors emphasized the importance of Big Data Analytics (BDA) in providing real-time information on various supply chain activities, which helped address the challenges brought by COVID-19.
- Collaboration among supply chain stakeholders was seen as essential to overcoming the pandemic's challenges and accelerating the adoption of digital technologies.

Another critical factor in the development of airline supply chain operations is addressing the challenges of airline catering services. Rajaratnam and Sunmola [10] conducted research to develop a set of performance metrics for airline catering organizations and to explore the application of SCOR-based metrics during the COVID-19 pandemic. They adopted a case study approach for their research, working with focus group participants. The findings indicate that airline catering organizations can monitor their catering logistics performance and utilize specific techniques to prioritize performance measures in situations such as the COVID-19 pandemic. Moreover, supply chain agility—the ability to respond effectively to changes in catering service requirements within the airline business environment—is identified as a crucial factor for proper adaptation.

Additionally, air cargo, often considered a secondary focus for combination carriers, was largely overlooked in the aviation supply chain until the COVID-19 pandemic and the subsequent surge in e-commerce brought it to the forefront. Air cargo firms realized the importance of studying on new business models and critical supply chain integrations. However, success in this dynamic sector will increasingly require strong interpersonal skills, data literacy, and agility. Additionally, sustainability concerns, disruptions to global supply chains—both physical and digital—and the advent of drone technology are transforming the landscape [11].

Agility is crucial not only for air transport but also for supply chains in the tourism industry. Napoli [12] explored the importance of redesigning the customer journey and prioritizing communication to rebuild travelers' confidence while ensuring staff safety. During the pandemic, airports were required to act reactively and with agility, anticipating and implementing evolving protective measures to manage the crisis. They focused on safeguarding the health and safety of passengers and staff while maintaining operational facilities to ensure a smooth restart.

2.2. Agility as a Competitive Advantage in Aviation Industry

Agility has emerged as a vital tool for the aviation industry, enabling companies to survive, enhance competitiveness, and achieve excellence in an ever-changing and volatile labor market, ultimately securing a competitive advantage [13]. Scholars have emphasized the importance of integrating digital tools into aviation management to deliver more agile and competitive services. Ku [14] investigated how external IT linkage, IT proactive stance, and analytical capabilities of IOS affected business process agility of airlines and travel agencies. According to that study, airlines and travel agencies can quickly and flexibly create new processes to respond to the dynamic market challenge through IT initiatives.

The aviation industry operates as a highly interconnected system, where issues in one area can have ripple effects across other countries or parts of the air transport system. Agility, similar to resilience, refers to the capacity to manage dynamics and complexity flexibly by adjusting and adapting organizational performance and workflows to meet changing demands. Woltjer et al. [15] conducted a study to support air transport system organizations in enhancing their agility to better address crises and challenges. The results suggest that organizations can develop more agile and resilient strategies to respond to the unprecedented and recurring disruptions that have become a hallmark of the past decade and are likely to persist.

Rızk Soliman et al. [16] encouraged the adoption of artificial intelligence (AI) applications, which increased across various companies and industries, including aviation, due to the significant positive effects AI has on enhancing performance and competitive capabilities. Among the AI applications, forecasting was found to have the strongest impact on strategic agility, followed by chatbots and, lastly, robots.

From an environmental perspective, Nazeer and Saleem [17] explore how agility, adaptability, and alignment influence green supply chain practices in Pakistan's aviation sector. Data were collected from a sample of 163 participants across various divisions of the aviation industry and analyzed using SmartPLS. The findings revealed significant relationships between agility, adaptability, alignment, and green supply chain management practices, with adaptability emerging as a key driver.

From an economical perspective, Alzoubi [18] evaluated the cost of quality through lean and agile operations strategies, providing empirical evidence from the aviation industry in the UAE. The results revealed a significant relationship between lean and agile operations strategies and the cost of quality. Additionally, Seker [19] developed a framework or implementing agile attributes to attain a sustainable competitive advantage in the airline industry. Also, a roadmap for airline managers to navigate crises and challenging situations while enhancing customer satisfaction and increasing competitiveness is provided with this study.

From performance view, Caesari [20] examined and analyzed the impact of strategic agility, market-capitalizing agility, and operational agility on the aviation firm performance. A quantitative research approach, utilizing PLS-SEM, was employed. The findings reveal that both strategic agility and market-capitalizing agility significantly influence firm performance. Additionally, variations in business operations, supported by the dynamics of the business environment, were found to play a key role in shaping company performance.

Hong [21] studied the agility of air cargo hub airports, specifically focusing on Incheon International Airport (ICN), using a structural equation model. The research evaluates 27 variables to assess the agility of the air cargo business at a hub airport. The findings reveal that digital transformation, flight services, information sharing, and accessibility are key factors that enhance the agility of air cargo hub airports. Survey results indicate that air cargo experts view ICN as having satisfactory agile response capabilities. Agility is vital for resilience, which in turn provides a competitive advantage and supports the long-term success of the air cargo sector.

3. Conclusion and Recommendations

This study has examined the concept of agility in aviation management from a supply chain perspective, clarifying its critical role in developing operational flexibility, resilience, and competitiveness within the aviation industry. Agility is crucial for navigating the complex and dynamic challenges faced by the aviation sector, particularly as a result of disruptions such as the COVID-19 pandemic. As the industry continues to recover from the pandemic's impacts, the ability to quickly adapt to changing circumstances has emerged as a main factor in sustaining long-term success.

The research explores current trends in literature, including the importance of digital transformation, cross-stakeholder collaboration, and the integration of innovative technologies such as artificial intelligence in driving agility. In particular, the adoption of agile practices within supply chains has proven instrumental in allowing aviation organizations to maintain service continuity, optimize resources, and respond effectively to crises. However, the study also identified significant gaps in existing research, particularly in the areas of sustainability and the challenges associated with collaboration among diverse stakeholders within the aviation supply chain.

First of all, aviation organizations should prioritize the adoption of digital tools and technologies, including AI applications, data analytics, and real-time information systems. These technologies enhance the agility of operations by enabling faster decision-making and more effective management of disruptions. In the case of EgyptAir, it was found that artificial intelligence positively affected the strategic agility. Thus, other aviation industry companies can benchmark these applications properly.

Second, increased collaboration between stakeholders across the aviation supply chain, including airlines, airports, and service providers, is essential for improving resilience and agility. Collaborative platforms that allow for real-time information sharing and joint problem-solving should be further explored. Given the complexity of the aviation industry, future studies should explore the challenges and benefits of fostering agility across different stakeholders within the supply chain. This could lead to a deeper understanding of how agility can be managed at both the organizational and sectoral levels.

Third, future research should address the integration of sustainability practices within agile supply chains in aviation. As environmental concerns continue to gain prominence, aligning agility with sustainability objectives will be crucial for the long-term competitiveness and social responsibility of the aviation industry. Also, organizations should develop and implement frameworks that guide the adoption of agile practices in their operations. These frameworks should include strategies for adapting to both short-term disruptions and long-term shifts in the market and regulatory environment.

In conclusion, agility is not just a reactive capability but a proactive strategy that can drive competitive advantage in an increasingly volatile and uncertain environment. The aviation industry must evolve, leveraging agility to enhance resilience, optimize performance, and sustain long-term success.

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