

Research Article

THE LEGAL IMPLICATIONS OF THE AVIATION INDUSTRY'S ENTRANCE TO THE METAVERSE

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ABSTRACT

Background: Technological growth allows aviation companies to embrace practices and applications that improve their approaches. A concept that is fast gaining attention from firms in this area is the Metaverse. This technology, driven by Artificial Intelligence (AI), improves consumer services, particularly by allowing passengers to travel virtually. Various entities already use this feature, and organisational and scholarly reports suggest that such establishments record positive outcomes. The primary goal of this analysis is to describe why operators must watch out for possible legal implications of using this tool.

An important point is that they must prevent data security breaches that might violate consumers' privacy rights. A few enterprises in this sector have become victims of infringements that resulted in data loss. Subsequently, some of these issues may proceed to court, and organisations spend many resources handling such cases. Another vital message relating to the utilisation of this innovation is that it could cause unfair competition. Particular establishments, especially those yet to deploy this idea, may claim groups that use Metaverse for exposing vital personal data to cyber attackers. Besides, the sector witnesses legal proceedings whereby some airlines blame competitors for indulging in unfair competition.

While no specific Metaverse laws exist, a suitable remedy for operators is to follow legislations and policies that define AI use for commercial purposes. It is necessary to abide by regulations safeguarding consumers' data privacy. Another solution is that corporations can adhere to international provisions such as the General Data Protection Regulation (GDPR) that have a global effect. Moreover, non-compliance could cause devastating legal repercussions that harm business practices. This paper introduces these challenges and pays more attention to the practical and legal aspects.

Methods: This paper retrieves data from secondary sources, encompassing websites and journal articles. The approach entails reviewing what the authors of selected works present about the topic and taking relevant information for this project. The approach saves time and is cost-effective.

Results and conclusion: Various firms in the aviation sector already use Metaverse to enhance their consumer experience. Companies feel attracted because of the many merits associated with the technology. However, they must watch out for the potential limitations of using this concept. In addition, users should consider the legal aspects of the innovation.

1 INTRODUCTION

Operators in the aviation sector deploy various forms of Metaverse to appeal to buyers, appearing to be switching to modern forms, which most consumers look for today. Metaverse refers to a network of worlds formed via augmented and three-dimensional virtual reality based on social interactions.¹ The innovation allows people to experience life in different forms they cannot encounter. Hence, operators should settle on forms that suit their practices and available resources. Otherwise, not knowing what a firm wants may lead to postponements and delays that could derail an organisation's desire to become influential in its sector.

The evolution of the Metaverse and other digital innovations are causing significant changes in the aviation/tourism industry. Metaverse is a decentralised platform based on blockchain technology intended to build a virtual world of digital assets and identities. The Metaverse is 'a three-dimensional virtual space enabled by Internet 3.0 and focuses on social connections.'² However, besides enhancing social connections, the Metaverse's ability to create a sense of presence attracts significant attention from the aviation and hospitality industry. The Metaverse is bound to transform the travel industry in significantly new ways that can downgrade the current aviation industry since individuals can travel anywhere worldwide by simply being online from their workplaces and homes.³ The Metaverse and its associated virtual experiences have radically changed people's perspectives on the technology's future and its potential impact on the aviation and hospitality industry. Generally, businesses in the aviation industry are increasingly exploring ways to leverage or capitalise on the Metaverse and develop virtual travel and hospitality experiences as well as products and services.

The aviation industry is exploring the limitless potential of the Metaverse in different ways. Accordingly, consumers across the world are increasingly considering and opting for Metaverse-enabled travel and hospitality/tourism experiences, products, and services. Airlines are embracing the Metaverse in organising virtual meetings and conferences

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- 1 Jess Brownlow, 'How is the Metaverse Being Used in Aviation?' (*World Aviation Festival*, 27 September 2022) <<https://worldaviationfestival.com/blog/airlines/how-is-the-Metaverse-being-used-in-aviation>> accessed 5 November 2023.
 - 2 Dogan Gursoy, Suresh Malodia and Amandeep Dhir, 'The Metaverse in the Hospitality and Tourism Industry: An Overview of Current Trends and Future Research Directions' (2022) 31(5) *Journal of Hospitality Marketing & Management* 1, doi:10.1080/19368623.2022.2072504.
 - 3 Alden Fernandes and Sunetra Chatterjee, 'Possibilities of Metaverse: The Second Life' (2022) 12(4) *International Journal of Engineering and Management Research* 79, doi:10.31033/ijemr.12.4.12.

to expand the client base and actively engage customers. More importantly, many of these Metaverse applications are revolutionising the aviation and hospitality industry, transforming how consumers select accommodations and destinations, make bookings and attend concerts, meetings, and conferences. This paradigm shift unfolds through virtual destinations, hotels, and tours. Airlines are also using Metaverse to give customers personalised experiences by allowing them to personalise their travel and access relevant information. It is evident that the Metaverse is slowly becoming an integral part of the aviation industry, augmenting the overall travel and hospitality experiences in multiple ways.

However, as the Metaverse fundamentally changes the aviation industry, many stakeholders are concerned about the legal implications of this technology. In particular, since the technology is new, the legal consequences associated with the Metaverse are complicated and continually developing. Besides the content and technical challenges related to the Metaverse, the regulatory aspects must be addressed. Although the Metaverse is virtual and hence separate from the real world, the actions and activities in the virtual world can significantly affect the real world. At the same time, the Metaverse has an independent economic system to support the virtual world's rules.⁴ Nevertheless, legislative obstacles are imminent, particularly regarding who will establish regulations and create the code of conduct and whether the transfer of information, money laundering, and different types of fraud will be sufficiently monitored.

Most of the legal implications of the Metaverse in the aviation industry relate to privacy and security concerns. Despite the extensive studies on virtual world innovations, concerns about privacy and security in the Metaverse have been the subject of few studies. Consequently, security and privacy issues are of the utmost importance in the Metaverse, as they are in social media networks. For example, biometrics, such as facial expressions in real-time, pose grave privacy concerns, and malevolent users can covertly monitor and collect Metaverse users' behaviour data, including purchase actions and interactions. Since the Metaverse operates in a digital environment, cyber security and privacy concerns must be considered for the aviation industry to provide customers with expedient travel services efficiently and securely. Therefore, it is crucial that the aircraft industry's cyber security and privacy protection strategies offer a range of practical countermeasures and solutions to guarantee that its customers and systems are secure against a variety of threats and weaknesses.

4 Jie Huang, Pingjin Sun and Weijie Zhang, 'Analysis of the Future Prospects for the Metaverse' (Proceedings of the 2022 7th International Conference on Financial Innovation and Economic Development (ICFIED 2022), March 2022) 1899, doi:10.2991/aebmr.k.220307.312.

2 VIRTUAL STORES AND REALITY

Virtual stores and reality are some approaches corporations use to elevate their Metaverse experience. Virtual stores are online avenues that display merchandise to target consumers.⁵ The application's controller may offer live text chats through which buyers interact with an organisation's representative in real time. Virtual reality, on the other hand, entails using special headsets to experience computer-generated simulations of 3D images or environments. Further exploration of these approaches helps to understand how they allow aviation firms to improve their customers' experience.

2.1. Virtual Stores

Airlines and other operators in the aviation sector are developing virtual stores that increase their consumers' experience. An example of an entity that already deploys this approach is London Heathrow Airport (LHR), which collaborated with Chanel and their 'beauty spaceship' – a leading multinational luxury fashion company – to create an environment whereby customers could try their products and selections virtually.⁶ In particular, the Airport's management relied on Chanel's beauty spaceship, which gives passengers a unique experience of not having to be physically present in a purchasing store to buy certain goods. The London-based entity invests in this innovation, believing it will appeal to more travellers and strengthen its position globally.

2.2. Virtual Reality

One of the widely applicable technologies is Virtual Reality (VR), which positions corporations in the aviation sector as pioneers in Metaverse utilisation. According to Brownlow, VR refers to a simulated 3D setting that enables users to interact with and explore a virtual environment in a manner that imitates reality.⁷ The adoption of VR gains inspiration from the fact that globally, consumers are considering and choosing more travel, hospitality and tourism-related experiences, goods, and services that function according to the principles of the Metaverse.⁸ Similarly, operators use the Metaverse to foster air traffic control, permitting controllers to become competent in handling air traffic without jeopardising real-life flights – a sentiment supported by Gursoy et al., who affirm the growing popularity of using virtual reality as a Metaverse in the aviation/tourism industry is gaining popularity.⁹

According to the authors, it is conceivable to program virtual reality to simulate various scenarios and circumstances encountered by trainee personnel, facilitating learning by giving them a sensation of the real-world workplace. Notably, virtual reality's capacity to vividly recreate the airport's complex surroundings, particularly during ground operations

5 Aashish Pahwa, 'What is a Virtual Store? How Does It Work?' (*Feedough*, 12 February 2023) <<https://www.feedough.com/what-is-virtual-store>> accessed 5 November 2023.

6 Brownlow (n 1).

7 *ibid.*

8 Gursoy, Malodia and Dhir (n 2) 1-2.

9 *ibid.* 1.

and training, positions it as a crucial Metaverse tool in aviation. Firms also use VR to identify and mitigate possible threats of flying. For operations, maintenance, repairs and overhaul, the engineering department can apply the technology and gain awareness of how to address possible glitches or faults in the aircraft. Regarding safety, the concept can provide the aviation industry with cutting-edge detectors, 3D imaging – formation of a three-dimensional view or image of an object¹⁰ – and current data that staff members can utilise when examining an aircraft.

The preciseness achieved through this technology is of paramount importance. The innovation provides clear and detailed visuals of the vessel, allowing even slight damages to attract the engineering team's attention. Concisely, cutting-edge concepts like VR for training and other organisational-related practices can produce excellent outcomes with considerably fewer resources and time.

Furthermore, virtual tourism has immense potential for airlines that use VR as a Metaverse. Virtual tourism covers a wide area of digitally aided reality, encompassing VR, augmented, and mixed reality.¹¹ Gursoy et al. claim that the idea can significantly encourage buyers who may have mixed feelings about making reservations.¹² Buying, snapping pictures, and engaging in other fun activities while relaxing in the comfort of one's office or home and then sharing the experience on social networks is becoming increasingly tempting to many individuals. For example, the Japan-based business First Airlines currently provides its customers virtual trips from Tokyo. As a result, First Airlines registers a 100% reservation for its virtual journeys to various and numerous sites worldwide, notably New York City, the Italian city of Rome, the French capital Paris, and Hawaii, among others.

Moreover, airlines are utilising the Metaverse to host virtual conferences and gatherings to increase their clientele and actively involve their clients. More significantly, many of these Metaverse applications are altering the travel and hospitality sectors by changing how consumers select travel locations, hotels, and excursions, as well as how they book tickets for events like meetings, conventions, and performances.¹³ Innovators should develop new forms to allow operators to choose from a wide range of options while considering the increasing demand for this application.

Nonetheless, such developments require considerable research and investment, given the intricacy of the technology involved. Collaborative efforts are essential for developers to create similar productions, prioritising collaboration that would make it easier to share key concepts. While innovators may have varying views and desires, the area would significantly improve by changing information and working collaboratively. However, this calls for further assessment and research to increase awareness of how this field works. Persistent production will allow operators in the aviation sector to incorporate better and more advanced forms of Metaverse, ultimately revolutionising their operations.

10 *ibid* 3.

11 *ibid* 3.

12 *ibid* 5.

13 *ibid* 1-2.

3 FIRMS ALREADY DEPLOYING METAVERSE

Various aviation industry firms (see examples in this article) have already been deploying Metaverse, proving how much entities are committed to embracing and using the emerging technology that many expect will revolutionise operations. Those firms that have already adopted the Metaverse and are enjoying the benefits of this technology should motivate others to move in the right direction to create a competitive environment. Otherwise, some companies, already using innovation, are revolutionising their operations, intending to make significant strides. In contrast, others need help with conventional approaches to appealing to buyers and stakeholders.

3.1. Emirates Airlines

Emirates Airlines is an example of a firm already venturing into this challenging area. With its headquarters in Dubai, the airline is now hiring additional cabin crew employees to meet the growing demand for travel.¹⁴ Thanks to the Metaverse, the corporation's in-person training bodies can handle this duty well. The company's Chief Operating Officer (COO), Adel Ahmed Al Redha, stated at an event held in Dubai that this breakthrough would allow crewmembers to receive the appropriate VR training and even participate in realistic-looking simulations of real-life tasks.¹⁵

Towards the end of 2023, the company expects to have trained at least 3900 additional employees in the Metaverse. The COO stated that the firm currently has thousands of cabin attendants in training, but by the second quarter of next year, it intends to increase this number. Al Redha, the COO, added that whether it is the cuisine the group serves or how it interacts with customers, the team aspires to improve onboard services continuously. With this technology, the COO repeated, the business could provide its workforce with the necessary instruction effectively and precisely. The company anticipates that the Metaverse lessons will enhance the practical training situations involving medical emergencies and rescue simulations.

The COO explained that the technology protects the company's relationship with younger customers and encourages the training processes. He emphasised the importance of cultivating a suitable environment for youthful travellers and recognising how consumers in their 30s engage with one another because, ultimately, they are the industry's future.¹⁶ As one of the leading operators throwing themselves into this emerging idea, the airline is exploring other applications for the technology, namely the removal of intermediaries ("middleman"). The COO claims the elimination will improve training procedures, business operations, sales, and the general shopping experience. We support the leader's argument because incorporating intermediaries often require additional financial

14 Jess Brownlow, 'How Emirates is Capitalising on the Metaverse' (*World Aviation Festival*, 19 October 2022) <<https://worldaviationfestival.com/blog/airlines/how-emirates-is-capitalising-on-the-metaverse>> accessed 5 November 2023.

15 *ibid.*

16 *ibid.*

resources and an in-depth assessment of the situation to ensure everything runs as expected. The company also intends to provide Non-fungible Tokens (NFTs) – unalterable digital proof of ownership and authenticity of a particular asset¹⁷ – and traveller-specific Metaverse experiences, including the ability to select terminals, sitting positions, resorts, and shops across the Metaverse. These endeavours suggest Emirates' significant investments in this area and its dedicated commitment to further exploring and advancing the technology to elevate its practices.

In addition to elevating the training procedures, Emirates hopes that venturing into this technology presents a suitable opportunity to extend its leading experiences for workers and buyers into the newly emerging digital spaces. The airline that enjoys the reputation of an influential operator announced in April 2022 plans to formulate signature brand encounters in the Metaverse and utility-based and collectable NFTs.¹⁸ The initial projects are ongoing, with a launch expected in the coming months. The company also informed that its Emirates Pavilion at the Expo 2020 station would change into a site for innovation, introducing talent from all over the world to bring to life the company's future initiatives, including those relating to Web3, which refers to a series of interlinked decentralised applications functioning based on the principles of blockchain computing, NFTs, and Metaverse. The firm's Chairman and Chief Executive, Sheikh Ahmed bin Saeed Al Maktoum, reported that Dubai and the UAE are leading the path in the digital economy, having a focused intention backed up by practical directives and regulatory structures in areas such as data protection, artificial intelligence, and virtual space.¹⁹ In addition, the Chairman reported that the company has always adopted enhanced technologies to elevate its business practices, improve consumer offerings, and elevate staff members' experiences and skills.

3.2. Qatar Airways

Another airline that has made significant strides towards incorporating Metaverse is Qatar Airways. The business introduced a fully immersive environment for customers to try out various services and goods before they go on a trip. The business is considering using virtual cabin staff to deliver a dynamic, digital customer experience.²⁰ With the aid of a 3D virtual production, which shows the distinctive elements in the cabins while sticking to a pre-designed code, passengers can virtually navigate the executive facilities and centres at the airport and traverse the cabin interior, as well as the high-end suits and economy-class seats in the plane. The enterprise first investigated its ambitions before creating the foundation for its interactive services. The firm subsequently implemented a value-driven

17 *ibid.*

18 'Emirates to Launch NFTs and Experiences in the Metaverse' (*Emirates*, 14 April 2023) <<https://www.emirates.com/media-centre/emirates-to-launch-nfts-and-experiences-in-the-metaverse/>> accessed 5 November 2023.

19 *ibid.*

20 'How Qatar Airways is Transforming Air Travel with the QVerse' (*Fast Company*, 6 July 2023) <<https://www.fastcompany.com/90905905/how-qatar-airways-is-transforming-air-travel-with-the-qverse>> accessed 5 November 2023.

and platform-neutral strategy, such as absorbing technologies that influential firms use.²¹ To attain precision, the formation procedure required that all elements be photographed and transformed into 3D. The agency also examined construction blueprints for lobbies and layouts of aircraft compartments to ensure high levels of realism for each component and atmosphere. The developments at Qatar Airways show how much Metaverse continues to receive support from multiple operators in the aviation and airline sectors.

Thierry Antinori, the Chief Commercial Officer of Qatar Airways, underlined that the company employs Epic Games' Unreal Engine, which it regards as the most cutting-edge 3D creation apparatus obtainable for creating immersive VR experiences and optimising landscapes for the Internet. The Chief Commercial Officer (CCO) and the supporting team believe focusing on this area will bring experience to life. The company used a cloud-based innovation that procedures intricate smart creations, enabling the virtual helper's manufacturing.²² The organisation considers its consumer and cabin crew experience a vital component of its success, and through 'Sama', its virtual assistance, it anticipates demonstrating how its cabin crew helps buyers throughout their journey. Antinori reinstated that the company was inspired to form an all-around digital form that embodies the cabin crew's attitudes and values towards travellers. According to the administrator, the business plans for innovation will be fully AI-projected into the near future, capable of answering questions and providing help. Besides, the company aspires to achieve vertical value in addition to what it provides and permits consumers to have augmented and virtual experiences. According to a statement by the company's Chief Executive Officer (CEO), Qatar Airways acknowledges that forming VR content is problematic and that the real test lies in developing services and ideas that expand consumers' digital understanding and elevate sales via a highly inclusive VR illustration.²³ Nonetheless, it is committed to excelling in this area, hoping that focusing on it will have lucrative outcomes.

3.3. Etihad Airways

Etihad Airways, the national airline of the UAE and one of the nation's two leading airways together with Emirates, increasingly pay attention to enhancing its use of Metaverse to increase operations and consumer experience. The business, in particular, introduces VR to the actual airport, enabling terminal customers to communicate and amuse themselves with specially designed headgear prior to departure. In addition, Etihad introduced an NFT collection known as EY-ZERO01, which is the initial utility-powered NFT collection by a carrier featuring various intricate 3D aircraft models.²⁴ It includes NFTs of the Boeing 787 Dreamliner operated by Etihad Airways with intricate 3D aircraft designs. Each NFT bearer gets a momentary registration to the Etihad Guest stage, and only some of them may be eligible to win free trips. The membership guarantees early reach for the company's future Metaverse experiences and NFT collections. Etihad's CEO informed us that the company

21 *ibid.*

22 *ibid.*

23 *ibid.*

24 Valeria Goncharenko, 'Etihad Airways Issues NFTs' (*Metaverse Post*, 22 July 2022) <<https://mpost.io/etihad-airways-issues-nfts>> accessed 5 November 2023.

is enthusiastic about announcing its original NFTs, which make them available for consumers and other key stakeholders to experience the distinctive artistic creations and offer lifestyle reimbursements and trips with the company. The NFTs and other Metaverse innovations are changing the digital economy. Staff members are happy to be one of the initial airlines globally to explore its capacity to offer additional utility to consumers.²⁵ Etihad's commitment to improving its application of Metaverse confirms the innovation has a significant impact on their aviation sector and that it is set to become more applicable in the future.

3.4. Other Companies

Outside the UAE and the Gulf region, other aviation companies have made significant strides toward incorporating the idea. For instance, Boeing is actively working on creating digital imitations of aircraft to enhance tests and simulations.²⁶ This approach allows new crew members to familiarise themselves with an aircraft's amenities without the need to physically enter one. In addition, the company aspires to design planes in the Metaverse, aiming to alter its design and production processes by incorporating aspects of the Metaverse. The corporation is set to transform within the next two years, involving a fully integrated electronic data environment and more dependence on automation.²⁷ In the next ten years, the corporation plans to invest USD 15 billion in digital improvement.²⁸ Greg Hyslop, Boeing's Chief Engineer, believes the enacted approaches will improve communication and quality.²⁹ The employees and others behind the program are confident the change will elevate financial performance when the group starts doing things differently. Another company that has made substantial strides in this area is Singapore Airlines. The organisation collaborates with like-minded establishments, such as the Agency for Science, Technology and Research and the Civil Aviation Authority of Singapore (CAAS), to foster digital transformation.³⁰ The national carrier hopes that such cooperation, created under its 'Digital Innovation Blueprint', which is a component of the company's continuous transformation plan and a vital aspect that boosts its digital capabilities, will enable it to cope with the escalating industry rivalry, which subjects it to considerable financial losses. Some of the collaborations under this new framework encompass using the Internet of Things, which describes a series of physical components

25 *ibid.*

26 'Utilization of Metaverse in the Aviation Industry' (*Antier Solution*, 10 October 2022) <<https://www.antiersolutions.com/utilization-of-Metaverse-in-the-aviation-industry>> accessed 5 November 2023.

27 *ibid.*

28 'Boeing Wants to Build Its Next Airplane in the "Metaverse"' (*Civil Aviation Authority*, 27 December 2021) <<https://caa.gov.qa/en/news/boeing-wants-build-its-next-airplane-metaverse>> accessed 5 November 2023.

29 *ibid.*

30 Shawn Lim, 'Singapore Airlines Embarks on Digital Transformation Drive as it Seeks to Remain a Preferred Choice' (*The Drum*, 29 January 2018) <<https://www.thedrum.com/news/2018/01/29/singapore-airlines-embarks-digital-transformation-drive-it-seeks-remain-preferred>> accessed 5 November 2023.

with software, sensors, and other forms to link and exchange information with other apparatuses and systems over the Internet.³¹ Other applications include augmented reality, VR, and data analytics that assist Singapore Airlines in determining when essential parts of aircraft need fixing or replacement. Adopting the technology by such influential operators in the airline sector shows that the idea is quickly gaining prominence, and firms must turn their attention to this area if they wish to become influential in the industry and defend their positions.

4 APPLYING THE DIFFUSION OF INNOVATIONS THEORY

Many questions are raised about these new activities and challenges. First, how these different companies apply Metaverse to elevate their operations illustrates how the diffusion of innovations theory works. The concept outlines how new ideas spread among groups of people and cultures.³² The way innovations move to various sectors of society and the subjective views relating to these developments facilitate the speed with which the dissemination happens. The model applies when firms create a new marketing plan for increasing market share and developing new services and products. The leading players in this framework are innovators, first adopters, early and late majorities, and those who come much later, typically known as laggards. Hence, for Metaverse, individuals and firms responsible for its production embody the innovators, while those who have already deployed this application are categorised as adopters. Laggards, on the other hand, comprise organisations yet to use this technology to elevate their operations and provide customers with a distinctive experience.³³ Often, firms or other users will embrace a particular innovation when it is apparent its use will have positive implications.

Companies, including those already using Metaverse and those yet to embrace this idea, will likely use it and record satisfying results by understanding the key provisions of the diffusion of innovations theory.

5 STRENGTHS AND LIMITATIONS OF APPLICATION

The concept is an exciting and promising innovation, but it has its hitches like any other emerging technology. While the Metaverse can change how people engage with digital technology, it is still in the early phases of development. Operators must get through a number of ethical, societal, and technological obstacles before it becomes possible. Knowing the strengths and weaknesses of using Metaverse would allow users in the aviation sector to take decisive measures when considering implementing its components.

31 *ibid.*

32 Michael Frank, MJ Jadick, Cynthia Minnick and Roger Williams, 'Diffusion of Innovation Theory' (*The University of Oklahoma*, nd) <<https://www.ou.edu/deptcomm/dodjcc/groups/99A2/theories.htm>> accessed 5 November 2023.

33 *ibid.*

5.1. Strengths

Using Metaverse to elevate practices in the aviation sector has several strengths that are most beneficial to users. These strengths are the main reason why operators in the aviation sector are fast embracing the idea. However, implementers may find new benefits when they continue using the innovation.

5.1.1. New Idea

One notable strength of this technology is that it can change the Internet by providing a more interactive online experience beyond conventional browsing and travelling. Monaco and Sacchi refer to the Metaverse as a new form of engaging with reality, whether real, mixed, virtual, or augmented.³⁴ Consequently, people can indulge in various digital encounters such as gaming, social interactions, aviation, and non-aviation-related commerce.

5.1.2. Upkeep and Repairs

Using virtual visualisations and simulations by engineers to solve and identify problems streamlines the process of performing aircraft upkeep and repairs. Machine learning-based systems are slowly eradicating manual labour, which allows for better and more efficient maintenance practices.³⁵ Additionally, the technology enables real-time surveillance of planes, staff, and belongings. This improves airline and airport services. The approach improves the entire client experience by reducing downtime and increasing efficiency. Therefore, the strength should compel more operators to embrace the idea.

5.1.3. Advertising and Promotions

Airlines may reach out to international consumers appealingly and creatively thanks to the Metaverse, an innovative vehicle for advertising and promotion. To reach new customers, the strategy comprises cooperating with other Metaverse businesses to create virtual experiences.³⁶ The Metaverse may open up new avenues for airlines to make money through endorsements, virtual advertisements, and the selling of online goods and services. More airlines think this merit offers corporations a better chance to strengthen their global market position.

34 Salvatore Monaco and Giovanna Sacchi, 'Travelling the Metaverse: Potential Benefits and the Main Challenges for Tourism Sectors and Research Applications' (2023) 15(4) *Sustainability* 3348, doi:10.3390/su15043348.

35 Yirui Jiang, Trung Hieu Tran and Leon Williams, 'Machine Learning and Mixed Reality for Smart Aviation: Applications and Challenges' (2023) 111 *Journal of Air Transport Management* doi:10.1016/j.jairtraman.2023.102437.

36 Monaco and Sacchi (n 34).

5.1.4. Traveller Experience

Airlines use the Metaverse to improve the travelling experience for customers by letting them virtually tour the airport, their aircraft, final places of interest, and forthcoming trips. The concept offers travellers a chance to go beyond physical environments without moving physically.³⁷ Technology in aviation can also help airlines stand out from the competition and improve client happiness. The continued application will permit aviation firms to develop more practices that strengthen passenger experience. The more firms take measures to improve the traveller experience, they increase their chances of being appealing, which directly influences revenue production and competitiveness. Nonetheless, finding out from passengers how and what they would want the company to introduce or do to provide a customised experience will enrich the process. While the initiative requires users to know how virtual and augmented reality work, the ultimate effect will enhance organisational design and, prototyping and virtual training practices.³⁸ Such plans might only excel through proper planning and dedication. Thus, the management should assess the situation before embarking on the initiative to avoid unwanted implications.

5.1.5. Internet-Based Training

VR for pilots and, similarly, air traffic control officers (ATCO) training is one potential Metaverse use for aviation. These simulators can provide cockpit crew (pilots) an affordable and secure opportunity to practice crucial abilities, including emergency (such as evacuation) procedures.³⁹ Similarly, the technology presents a chance to improve air traffic control, permitting supervisors to advance their skills in handling air traffic without flying a real aircraft.⁴⁰ The intervention could increase efficiency and safety by acquainting pilots with new airports and aircraft architectures.

5.1.6. Online Meetings

Aviation firms can save valuable time and lessen the need for physical travel by enabling online communications between flight attendants and ground staff via the Metaverse. The aviation sector can use innovation through online discussions and trade demonstrations, allowing professionals to link and share concepts and abilities without travelling. The method can expand accessibility to events for individuals unable to travel and lessen the environmental damage (carbon footprint) caused by flying.⁴¹ Carriers should welcome technology if they want to host online meetings.

37 *ibid.*

38 'Metaverse Aviation: How Aviation Industry Can Use the Potential of Metaverse?' (*Shamla Tech Solution*, 20 February 2023) <<https://shamlatech.com/Metaverse-aviation>> accessed 5 November 2023.

39 *ibid.*, 2 virtual training.

40 Monaco and Sacchi (n 34).

41 Metaverse Aviation (n 38) 3 virtual conferences.

5.1.7. Design and Prototyping

By creating 3D models for their designs and simulating different situations, aircraft designers can test the performance and structure of their creations. The idea may offer an opportunity to spot possible drawbacks at the beginning of the design process, leading to more economically and productively produced goods.⁴² It allows architects and engineers worldwide to collaborate and communicate in real time while working together virtually. The technique can speed up the design procedure and reduce the desire to travel, thus saving time and funds. Additionally, it inspires many incidents related to the manufacture of aircraft, providing personnel with an immersive and engaging learning environment. Further, this could advance their knowledge and abilities, leading to effective production processes.

5.2. Limitations

While the Metaverse use has its strengths, operators must watch out for limitations that could influence its effects on an organisation. The primary concern is the need for more structures to encourage its use. Therefore, users must be familiar with the following challenges to formulate practical working guidelines.

5.2.1. Absence of Standards

Nonetheless, the idea has several limitations that require considerable attention from users and other stakeholders. A considerable challenge is the absence of standards, which Monaco and Sacchi consider a barrier for the Metaverse sector. There are yet to become universal principles for creating and operating virtual worlds within the concept. The gap implies that diverse platforms and creators may use different procedures, tools, and technologies to form virtual experiences.⁴³ Consequently, it can be hard for users to develop immersive experiences that function across diverse avenues and for organisations to navigate between them flawlessly. This absence of standardisation also generates constraints for collaboration and interoperability within the Metaverse. Virtual platforms and environments might be able to connect and communicate with one another successfully with the use of a shared set of procedures and terminology. The possibility of creating common experiences and generating a unified Metaverse ecosystem may fail to perform well due to susceptibility. To address the lack of laws, industry parties like standards bodies, aircraft companies, and designers must coordinate and collaborate. It will be necessary to develop and implement standardised guidelines for building and managing virtual worlds within the Metaverse to realise the full potential of this emerging sector. Currently, some territories have regulations that define how companies safeguard personal data. For instance, in Australia, the Privacy Act (1998) and the Privacy Act Review (2020)

42 Monaco and Sacchi (n 34).

43 Khushboo Goyal, 'Challenges Businesses and Users Face in Adopting the Metavers' (*Coforge*, 25 April 2023) <<https://www.coforge.com/blog/challenges-businesses-and-users-face-in-adopting-the-Metaverse>> accessed 5 November 2023.

regulate firms' handling of personal information. The Privacy Act (1988) particularly pushes for stiffer penalties for those who violate the law.⁴⁴ Such limits show that businesses are making significant progress in limiting the breach of individual rights. However, none of these legal frameworks makes direct reference to the Metaverse.

Developing standards that guide operations in this field would require developers to consider specific essential components during the process. In particular, it is a good idea to consider how the law might mitigate tort-related lawsuits by users against other users and groups encompassing users against Augmented Reality (AR) and Virtual Reality (VR) environment handlers and outsiders against users.⁴⁵ Moreover, the developers of such standards should consider how the regulations would treat or perceive changes in other users' avatars or the development of their avatars that imitate another entity or person's likeness or name. Furthermore, the creators of such directives should consider how such creations might handle the likely pervasive storage and handling of all the sensory data that AR and VR components provide to their users. Considering such vital factors would allow room for creating applicable legal components.

5.2.2. Cost and Technical Hurdles

Businesses that embrace the Metaverse often run into financial and technological barriers. It can be costly and complex to produce immersive virtual interactions. Operators and stakeholders in the aviation sector may need to take advantage of vital machinery to form virtual environments that can sustain considerable numbers of users and give surety on a high measure of engagement.⁴⁶ Businesses, especially developing companies with limited resources, may face difficulties due to the technical expertise needed to create and manage virtual environments within the Metaverse. Developing expertise in game development, coding, and 3D modelling may be necessary, which can be difficult and expensive. The need to stay up-to-date with new trends and technology is another factor that contributes to the elevated expenses and technical obstacles. Companies wishing to remain viable in this industry might have to invest in ongoing research and development, which can be expensive and lengthy. To overcome these obstacles, organisations may consider collaborating with technology vendors, designers, and other key players in the Metaverse context. Such ways of working together make it possible to reach needed assets, structure, and proficient personnel that may not be easy for operators in the aviation sector to obtain when functioning without engaging others.⁴⁷ Additionally, as opposed to creating their online encounters from the start, airlines and other aviation industry operators might think about utilising the channels and resources that already exist. The technique can reduce expenses and technical obstacles while enabling executioners to use the Metaverse's benefits.

44 'Review of the Privacy Act 1988' (Australian Government, 16 February 2023) <<https://www.ag.gov.au/integrity/consultations/review-privacy-act-1988>> accessed 5 November 2023.

45 Mark A Lemley and Eugene Volokh, 'Law, Virtual Reality, and Augmented Reality' (2018) 166 (5) University of Pennsylvania Law Review 1052.

46 Metaverse Aviation (n 38).

47 *ibid.*

5.2.3. Limited Use Cases

Many players in the aviation sector may be unaware of what Metaverse can do and how it influences business and consumer experiences. Considering the concept is still new, there are not many real-world applications that businesses may use to understand the innovation's capabilities. In particular, some companies lack the mechanisms to incorporate Metaverse in their operations due to a lack of resources and skill, illustrating how the technology is yet to become rampant. The impediment can make it hard for air carriers to determine how the idea can enrich their operations or sector.⁴⁸ Operators and aviation stakeholders must take the time to learn about the technology and understand its potential to deal with this obstacle. The approach may entail working with experts in Metaverse formation, participating in industry events, and learning from case studies from corporations that may have already adopted the technology and made significant strides in implementation. In addition, Metaverse may not be appropriate for all sectors, making it difficult for aviation operators to gain information and skills from other fields. A suitable way to mitigate this challenge is to carefully evaluate a firm's operations and find how the technology can benefit their sector or relevant use cases. Finding testimonials from companies in connected industries, working with Metaverse development professionals, and conducting market research are all possible components.

5.2.4. Limited Access

Access to technology can substantially hinder adopting and implementing a Metaverse in aviation operations. The concept needs high-end software, hardware, and networking skills, encompassing fast-functioning computers, reliable Internet connections, and superior virtual reality machinery.⁴⁹ Corporations that cannot access this concept may need help incorporating the idea into their activities. For instance, commercial airlines operating in less developed or interior places may have constrained access to reliable Internet, making it problematic to get and use the Metaverse. Similarly, enterprises with fewer assets could need to invest additional funds in the systems required to employ the technology. Airlines and other aviation sector operators can successfully lower the barrier by allocating adequate cash for infrastructure and technology improvements or by developing partnerships with service and technology vendors to assist them in acquiring the needed resources. Promoting innovation access and developing the skills required to support the commercialisation of new ideas are both tasks that the government and other organisations may help with. Therefore, operators in the aviation industry wishing to use the technology to elevate their practices and consumer experience must identify possible barriers to access and develop effective remedies.

48 *ibid.*

49 *ibid.*

6 LEGAL ASPECTS

While different organisations in the aviation industry are increasingly embracing virtual reality applications to improve activities and obtain an edge over their competitors, there needs to be more regulatory standards to guide the use of this invention. Since companies gather identifiable information from customers while employing Metaverse, it is critical to follow laws requiring groups to respect confidentiality when dealing with sensitive information. Executioners must recognise and be acquainted with the relevant laws in the countries where they operate. They must also conform to all requirements to prevent legal ramifications that might damage or interfere with company procedures.

Additional proof indicates that the virtual reality world, including the Metaverse, is rapidly evolving. However, adequate laws regulating the privacy of data and cyber security still need revision. The difficulties with maintaining privacy and stored data in the Metaverse relate to the volatility of figuring out the precise spot of an avatar during the transfer of data and analysis based on the physical vicinity of the person managing the Metaverse structure or devices, such as the digital personality or its location.⁵⁰ As an outcome, establishing the jurisdiction for various Metaverse uses can be time-consuming, posing significant legal problems. Such issues frustrate the aviation industry's worldwide endeavours to regulate this innovation. Therefore, supervision is necessary to handle the Metaverse, guarantee security throughout the virtual world, and establish suitable legal structures.

Businesses could profit more if there were thorough legal regulations regulating virtual reality technological advances. No established regulations currently limit how firms can use this breakthrough technology. Corporations may exploit the weakness to set restrictions and regulate their application. The present regulations only define how businesses should protect their customers' information when utilising discoveries requiring the acquisition of personal data. The General Data Protection Regulation (GDPR),⁵¹ in particular, acts as an essential component of security and privacy law, expressing People's fundamental freedoms in today's world of technology while also establishing the accountability of those accountable for confidential information analysis.⁵² Furthermore, the rule outlines how to attain conformity and penalises both businesses and people who violate regulations.

Other jurisdictions' laws demand companies to handle data gathering effectively to meet present requirements. The California Consumer Protection Act (CCPA)⁵³ protects customers' rights to privacy and allows all residents to understand how businesses employ

50 Goyal (n 43).

51 Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) [2016] OJ L 119.

52 What is GDPR, the EU's New Data Protection Law? (*GDPR.EU*, 2023) <<https://gdpr.eu/what-is-gdpr/>> accessed 5 November 2023.

53 California Consumer Privacy Act of 2018 (CCPA) [1798.100 - 1798.199.100] (Title 1.81.5 added by Stats 2018, ch 55, sec 3) <<https://oag.ca.gov/privacy/ccpa>> accessed 5 November 2023.

their data.⁵⁴ The Personal Information Protection Law (PIPL)⁵⁵ of the People's Republic of China seeks to regulate how businesses keep and use information about individuals, such as classification and international data transfer. The Personal Data Protection Law (PDPL) was implemented in Saudi Arabia (2021) and was later modified in March 2023 to comply more with international data protection standards, such as the European Union's GDPR.⁵⁶ In the European Union legislation, the Brussels I Regulation⁵⁷ safeguards e-commerce consumers – at a very high level – regarding recognition and enforcement of foreign judgement in conflict of laws and protects them against misappropriation of personal data.⁵⁸ Many stakeholders feel the newly enacted EU AI Act⁵⁹ will protect businesses from unintended consequences when using Metaverse. The directive provides guidelines for using applications that utilise AI but does not mention the Metaverse. Whereas the framework could serve as a comprehensive direction, it is still under thorough analysis to see if it will become fully applicable. Businesses must still be aware of the rules that regulate their interactions with artificial intelligence-driven platforms such as Metaverse. Consequently, more effort is required to avoid unwanted outcomes because a lack of specific requirements leads to data security concerns such as phishing and ransomware attacks.

Failure to comply with existing directives is a serious crime, and organisations that fail to pay particular attention to this matter will probably face legal consequences. Multiple businesses have had to go through lengthy legal procedures for failing to follow ordinances that establish how they ought to handle customer details when dealing with large amounts of data. Such organisations typically pay a fine and have their reputations harmed. In one instance, British Airways paid approximately USD 230 million following a directive by regulators in England for infringing on private data.⁶⁰ The largest fine ever levied on an organisation for violating privacy rights shows the level of importance with which privacy

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- 54 Stuart L Pardau, 'The California Consumer Privacy Act: Towards a European-style Privacy Regime in the United States?' (2018) 23(1) *Journal of Technology Law & Policy* 68.
- 55 Law of the People's Republic of China 'Personal Information Protection (PIPL)' of 20 August 2021 <www.personalinformationprotectionlaw.com> accessed 5 November 2023. The official text of the Law is only available in Chinese.
- 56 Personal Data Protection Law (PDPL) <<https://www.dataguidance.com/jurisdiction/saudi-arabia>> accessed 5 November 2023. Saudi Arabia's Law implemented by Royal Decree M/19 of 9/2/1443H (16 September 2021) approving Resolution No. 98 dated 7/2/1443H (14 September 2021).
- 57 Regulation (EU) No 1215/2012 of the European Parliament and of the Council of 12 December 2012 on jurisdiction and the recognition and enforcement of judgments in civil and commercial matters (recast) [2012] *OJ L 351*.
- 58 See, the Articles 17-19 (jurisdictions) and Article 45 (1) (e). Zlatan Meskic, Mohamad Albakjaji, Enis Omerovic and Hussein Alhusein, 'Transnational Consumer Protection in E-Commerce: Lessons Learned From the European Union and the United States' (2022) 13(1) *International Journal of Service Science Management Engineering and Technology* 4, doi:10.4018/IJSSMET.299972.
- 59 'EU AI Act: First Regulation on Artificial Intelligence' (*European Parliament News*, 14 June 2023) <<https://www.europarl.europa.eu/news/en/headlines/society/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence>> accessed 5 November 2023.
- 60 Adam Satariano, 'After a Data Breach, British Airways Faces a Record Fine' *The New York Times* (New York, 8 July 2019) <<https://www.nytimes.com/2019/07/08/business/british-airways-data-breach-fine.html>> accessed 5 November 2023.

entitlements deserve protection. The firm gained notoriety after permitting unauthorised individuals to misappropriate passengers' data to limit flow to the airline's official website. The fraudulent transaction exposed important details such as airline reservations, information about credit cards, usernames, and passwords.⁶¹ While the incident does not resemble Metaverse, it serves as an appropriate cautionary incident of the dangers of not safeguarding the data used to create online experiences. Thus, users must create protections that safeguard private data from getting into the hands of unapproved individuals to avert legal ramifications.

A suitable way to enhance processes in this field is for lawmakers and professionals to collaborate and create rules that establish how technological innovation operates to streamline organisational undertakings and customer service. Identifying organisations that have made major advances in this area and finding techniques to exchange needed concepts is a suitable strategy. Furthermore, involving specialists in this domain will yield helpful ideas that will change how players in the aviation sector employ Metaverse to improve the customer experience. Investing significantly in this particular area will close the legal gap in Metaverse usage. Nonetheless, not succeeding in focusing on this facet could end up in some service providers using Metaverse in a way that violates the right to privacy, potentially leading to legal repercussions.

7 CONCLUSION

Various factors make this new area worth exploring. A considerable aspect is that it familiarises aviation industry actors with a technology that can revolutionise the sector. Today, for example, Monaco and Sacchi argue that being able to deploy cutting-edge technology determines how a business remains competitive.⁶² Therefore, elaborating on how the Metaverse functions and highlighting its strong and weak elements allows establishments to make wise decisions. Another significance of this topic is how it creates an impression of how innovations change rapidly, requiring flexible entities. Being able to adjust so fast depicts an enterprise as being committed to meeting consumers' changing needs and having the capability to triumph over industry rivals. Therefore, more researchers should conduct additional studies on this topic and develop ideas to elevate aviation firms' experience deploying this technology.

Undoubtedly, the carriers and aviation stakeholders should improve the consumer experience through Metaverse. Assessing their capacity to install the feature into their operations is the initial step, as overlooking this aspect may lead to unpredicted effects that could harm implementation. Hence, in addition to acquiring needed resources to facilitate implementation, it is imperative to seek information from different sources on how this idea works and the easiest ways to record positive outcomes. Moreover, looking into the strong and weak aspects of this technology enables firms to determine whether to proceed

61 Metaverse Aviation (n 38).

62 Monaco and Sacchi (n 34).

with execution or not. More fundamentally, it is recommended that organisations have a distinct body to oversee the implementation and assessment of Metaverse and give suggestions on what must happen to improve. However, disregarding these vital considerations could derail how an establishment installs, manages, and benefits from this technology.

In summary, the Metaverse transforms the operational landscape of aviation companies, emphasising the need for users to understand its strengths and weaknesses. The technology's capacity to provide virtual experiences to customers compels firms to incorporate various applications such as virtual stores and virtual reality, with leading airlines such as Emirates Airlines, Qatar Airways, and Etihad Airways in the Gulf region and establishments encompassing Boeing and Singapore Airlines in other regions already making significant strides. Implementing this concept by leading airlines is adequate proof that the Metaverse is fast gaining eminence, and operators must focus on this development if they desire to defend their position. Increased use of this idea illustrates the main idea behind the diffusion of innovations theory, which explains how new technology becomes widely applicable. More enterprises will adopt this innovation when considering its benefits, such as its novelty, enhanced aircraft upkeep and repairs, increased marketing capability, better traveller experience, improved online experiences, and developed designing and prototyping capabilities.

However, potential threats, including a lack of regulatory guidelines, high operational costs, and limited installations and access, should not deter further exploration of the Metaverse. Corporations are encouraged to continuously learn about the technology, implement appropriate mechanisms for successful deployment, enact proper mechanisms to achieve successful implementation and consider potential legal ramifications for not adhering to existing frameworks. Policymakers play a crucial role in formulating specific guidelines to regulate the implementation of the Metaverse in the aviation industry.

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