

Digitalization, AI in Aviation and the Human Factor

Introduction

Prior to the recent downturn in the aviation business, global air traffic, which reached 8.8 billion passengers in 2018, was, according to IATA, expected to double by 2037. The challenge for aviation was viewed as managing this growth, while containing costs. The key was making better use of resources through efficiencies, while at the same time increasing sustainability, improving passenger experience, and maintaining safety and security. The digital transformation of the industry was seen as a key to achieving these goals. With the downturn in the industry, digitalization has become even more important, as reducing costs and achieving efficiencies is critical to industry participants as they seek to remain financially viable.

Today's technologies allow airlines, airports and other industry participants to operate in ways that were not possible up to just a few years ago, including the delivery of personalized and individualized services to millions of users. This can be accomplished because of the enormous amount of data that are available; data that are generated by aircraft systems, air traffic control, airport operating systems and stakeholders. These data, combined with algorithms that convert the data into usable information, represent enormous opportunities to the industry. Digitalization allows industry participants to improve the customer experience, while at the same time, increasing efficiencies and generating revenues. However, there are considerable challenges to realizing the benefits from digitalization.

Definition of AI and Digitalization

IATA defines digital transformation as *value creation through deconstruction of legacy processes and the reconstruction of these processes leveraging digital assets*. The goal of digitalization is to simplify tasks, improve efficiency and develop new services. A distinction is sometimes made between digitalization and digital transformation. Digitization implies the conversion of an analogue or manual process into an equivalent digital process, whereas digital transformation involves both the implementation of new technologies and the transformation of business operations. Whereas digitalization, by itself, may preserve existing forms and procedures, digital transformation can completely change the way business is conducted.

One way to achieve digital transformation is through artificial intelligence (AI). AI is the collection of technologies that allow machines to detect, understand, act and learn either on their own or by augmenting human learning. AI involves the development of algorithms that can be used to solve problems that have traditionally been dealt with by humans. AI integrates input devices (vision systems, audio, text inputting and other sensing systems) with algorithms to allow a machine to take 'intelligent' actions.

Uses of AI and Digitalization

The industry trade associations that contributed their briefs to Hermes outlined many uses for AI and digital technologies. Some of the most important uses of digitalization and AI in aviation are outlined below:

- **Maintenance, Repair and Overhaul (MRO).** AI technology can be used in the maintenance field to predict possible failure of parts. Moreover, digital technology can be used to guarantee the traceability and validity of a part (called “credentialing”); often in conjunction with blockchain systems.
- **Training.** Digital technologies can change the way training is delivered; for example, through the development of virtual reality (VR) devices that allow for realistic-based collaborative learning.
- **Cargo Movement with Autonomous vehicles.** AI can be used to improve the functioning of autonomous vehicles, such as ground handling equipment and drones, improving their operations while maintaining safety.
- **Air Traffic Management.** AI can be used to better control aircraft movements to increase efficiency and improve safety. For example, AI can be applied in speech recognition to detect read-back errors, the synchronization of aircraft ground movements, and in predicting optimal runway configurations to maximize operating capacity. The use of AI can lead to a substantial increase in airspace capacity without significantly increasing the demands on air traffic controllers and their respective cognitive capabilities.
- **Flight Safety.** Using the data generated by aircraft and their systems, smart algorithms exist that can detect trends in normal operations, as well as potential hazardous behaviors.
- **Aviation Operations.** Digitalization can help the industry make smarter use of assets, optimize efficiency of all processes and develop a better understanding of the businesses, routes, costs and opportunities for improvement. Applications include on-line or mobile check-in, identification of passengers with the use of biometrics, assistance to passengers to resolve travel problems and the real-time provision of information on flight updates, changes, delays and baggage management.
- **Revenue Management.** AI can help airlines achieve greater profitability, by allowing enhanced inventory availability and price optimization, based on intelligent demand analysis. AI can assist in the analysis of product configuration decisions (seat or cargo payload) at specific points in time, thereby providing highly competitive, customized (product) pricing for all customers. Airlines can thus attain higher flight/aircraft/fleet utilization, creating operating efficiencies and producing additional revenues that can be directed to customer service enhancement.
- **Enhance the Customer Experience.** Digitalization can help the aviation industry better understand traveler needs and to improve the passenger experience. AI can be used to meet the needs of individual passengers; for example, in terms of inflight-entertainment options and meal requests. AI can also assist in resolving customer breakdowns; such as helping passengers to arrive at their destination after missed connections.

Challenges to Meet

For digitalization and AI to achieve the greatest benefits for the aviation industry, key challenges must be overcome. As outlined by industry trade associations in their briefs to Hermes, key challenges include the following:

- **Developing and Implementing Standard Practices.** Regulatory frameworks will have a strong influence on digital transformation and the speed of digitalization. However, regulations can face major complications for cross-border integration, as they may have different interpretations across countries. For digitalization and AI technologies to become operational, collaboration among ICAO, States and industry is required. Both States and industry must agree to frameworks for training, certification, qualification, operations and data sharing. New industry procedures may be accomplished through amendments to ICAO Standards and Recommended Practices (SARPS). However, the development of new SARPS is a lengthy process, requiring comprehensive consultation. Then, even after there is agreement to the new SARPS, implementation, perhaps through trade associations, could take considerable time and effort.
- **Data Privacy.** Modern aircraft and airport systems are dependent on the reliable functioning of critical computer systems infrastructures. Consequently, the aviation industry's vulnerability to cyber-attacks is considerable. Sharing data among stakeholders in a trusted environment is a requirement for the successful implementation of digital technology. Regulations and standards defining how the data are processed, by whom, and how data security is ensured need to be set by governing bodies. Data drives digitalization and AI, and the trust of the consumer to provide their data is a critical element in any system.
- **Cost of Implementation.** The aviation industry, especially in developing areas such as Africa, is often characterized by very low profit margins. Airlines and other industry participants do not have the resources to heavily invest in digital transformation, so developing regions could lag wealthier regions. Unless funding is made available to the industry, it is likely that the implementation of digital technologies will be slow and uneven.

Specific Human Factor Challenges

In addition to general challenges faced by the aviation industry in the implementation of digital technologies and AI, there are specific challenges related to human factors. While digitalization and AI will certainly disrupt the work environment, with the right strategies in place, these new technologies can provide opportunities for upskilling employees and preparing them for new roles and challenges.

Digital transformation demands a new set of skills compared to the skills needed for legacy systems. Automated technologies will partly or entirely replace some repetitive jobs. Digital transformation will lead to a reduction in process driven, low-skilled physical and administrative jobs (for example check-in staff). On the other hand, new types of jobs will emerge empowered by technology to perform more complex tasks. However, such technologies will not replace critical positions involving immediate decision making that requires human logic, experience, and common sense.

Human actions currently contribute to the lion's share of aviation accidents and incidents. Therefore, ensuring that aviation workers are well-trained can be a cornerstone to the pursuit of aviation safety. For example, with the implementation of AI and the dynamic push toward digitalization, a disruptive environment has emerged that will push the industry towards the refinement of Aviation Management Systems. As the history of safety systems development in aviation has shown, it is important to be proactive in the training of personnel in the operation of the new systems.

In order to implement the new technologies, organizations must bring together teams of employees and all other involved stakeholders to explore synergies and jointly address areas of concern. Soft skills will be critical to guiding implementation. Team management, creativity and emotional intelligence will be desired qualities for team members. Hiring and developing personnel with these qualities will be essential to the successful implementation of AI and digitalization.

Outsourcing some tasks will also be possible. Airlines are served by many providers, some of which are very advanced in their digitalization strategies. This makes for a compelling case for airlines to enter strategic relationships with service providers to help transform the industry. Again, teamwork and other soft skills, such as negotiations, will be necessary to work successfully with suppliers in a team environment.

Recommendations

As noted in the brief from ICAO, the promise of intelligent automation for aviation can only be realized through a globally coordinated approach. Moreover, the implementation of digital technology and AI requires a clear set of standard operating practices. Both industry and State buy-in to the regulations is essential, so that a common set of standards emerge. In addition, regulations must both allow for the sharing of digital information and the protection of individuals' privacy. Finally, given the recent severe downturn in the industry as a result of the COVID-19 crisis, there must be funding available to industry participants to implement the new technologies and (re-)train staff accordingly. With this in mind, we propose the following:

- ICAO needs to take the lead in providing clear definitions and objectives and potentially a roadmap for the implementation of AI and digital technologies in the industry. Standards must be universal. They also must be accepted by States. As a worldwide intergovernmental organization, ICAO is the only forum for these standards to be developed and implemented.
- The development of standards, however, is not sufficient. States must enact regulations that allow industry participants to implement the technology. Unless enabling regulations are enacted, the risks and costs to industry participants in enacting new procedures could be deemed too high.
- The implementation of industry standards can be best accomplished through industry associations, such as IATA. However, given the lead times required for developing and implementing new operating procedures, these industry associations should proceed concurrently with ICAO standards development. Concurrent development will help ensure that the standards are workable and will allow industry to better participate in the development of the standards.

- Funding sources for technology implementation must be identified. Unless funding is available for industry participants around the world, implementation will be slow and uneven.
- Training and development focusing on digital skills and practices should be implemented immediately. The recent downturn of the industry has idled thousands of industry employees. Now is an ideal time to engage in training and re-training for the future needs of the industry.

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