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Implementation of Artificial Intelligence (AI) in Global Electronic Pilot Licenses: The Purdue Case Study

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ABSTRACT

ICAO Annex 1 Chapter 5 specifies that Civil Aviation Authorities "shall use first quality paper or any other kind of appropriate material, including plastic cards, where all data stated in Section 5.1.1.2 of the Annex of reference shall be available." With the advancement of technology in the digital world, the shift to electronic personnel licensing has been at the forefront of the aviation industry. As of March 2023, ICAO has launched an electronic verification toolset for pilots, EPL (Electronic Pilot Licensing), to allow States to give the option of issuing electronic licenses through a standardized template (Uniting Aviation, 2023). The countries currently known that are participating in electronic pilot licensing are China, Brazil, and Australia. There are several challenges regarding e-licensing, such as license eligibility and verification, the ability to function online and offline, and license standardization worldwide (ICAO, 2021). The Purdue research team focused on an automated digital verification – Electronic Pilot License application offering aviation Subject Matter Experts (SME's) easily accessed verification job aids. However, these solutions are still under evaluation, as there continue to be barriers to streamlining the electronic verification process of pilot licenses, especially when international operations validity is considered. Hence, the presented research focuses on the challenge of tying the e-license to a mobile platform – an application that can be used for license verification and authentication that crew members can carry around portably and help manpower planning of airlines worldwide in their planning, selection and hiring process. A high standardization, security, and privacy level are vital to successful implementation. The Purdue School of Aviation and Transportation Technology (SATT) research team provides an AI solution following the EASA recommendations, a lean/ 6 Sigma approach in manpower planning.

Keywords: Immersive technologies, Artificial intelligence, Human systems integration, Competency based training and assessment (CBTA)

INTRODUCTION

Technological advancements significantly cause the digitalization of modern society, leading to new socio-economic opportunities and solutions that may not have existed previously (Ronzhina et al., 2021). Today, technology exists due to the exponential development of integrated software and hardware processed by advanced computers the size of a wristwatch. Cloud storage,

Internet of Things (IoT), Big Data, Digital Twins, and Artificial Intelligence are examples of the rapidly incoming wave of technologies to be integrated into today's digital space (Liu et al., 2021).

Digital innovation in the aviation industry is comparatively slower than other fields, despite the rampant leaps and bounds of the digital age, as there are several contributing factors that make the aviation distinct from other corporations (Silling, 2019). Aviation prioritizes and takes pride in committing to the highest levels of safety and security, and digital transformations in aviation face hurdles in harmonizing cyber security, regulations, and compliance (IATA, 2023). Hence, it is admittedly demanding for ICAO's vision for global adoption of an EPL system that is standardized worldwide.

Moreover, standardization in aviation ecosystem may be expedited through the implementation of ICAO pilot competencies. Competency is demonstrated and perceived by behaviors that effectively utilize the essential knowledge, abilities, and attitudes to execute activities or tasks within predetermined circumstances (Ziakkas et al., 2023).

METHODOLOGY

The Purdue research team follow the ICAO's recommended ADDIE instructional system design model (Analysis, Design, Development, Implementation, and Evaluation). The recommended model provides a structured framework for the design and development of the prototype and final product through a step-by-step process of identifying the needs of the market with multi-level factors (Branch, 2009).

The *analysis* section analyzes areas of strengths, weaknesses, opportunities, and threats of an electronic pilot recruitment tool. This is followed by the *design* phase, which contains the wireframing of the digital prototype to demonstrate the potential of the recruitment tool prior to development. The *development* stage includes the physical web and mobile development of the tool and includes the artificial intelligence image processing software. Next, we will assess the *implementation* of the recruitment tool through several methods for the market: a safety-risk assessment, benefit-cost analysis, and sustainability assessment. The last step, *evaluation,* will evaluate the projected impacts of the electronic pilot recruitment tool on the commercial market.

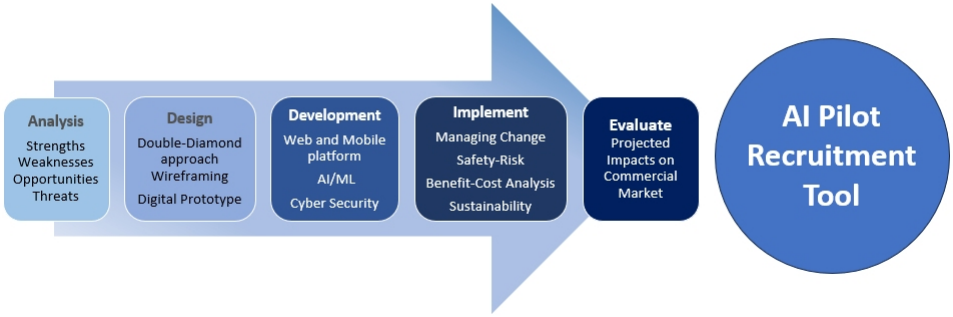

Figure 1: Adapted ADDIE approach (ICAO, 2023).

The implementation of a new system or tool necessitates a period of adjustment for recruiters or users to familiarize themselves with and adapt to new policies, procedures, and practices in accordance with the operator's policies (4Ps), (Barshi et al., 2017).

FINDINGS

The Purdue research team focused on how the AI recruitment tool positively impacts the aviation ecosystem training and operations. Hiring/ recruitment teams will be able to assess the individual from competency-based visual indicators rather than numerical or textual basis per applicant. These visual indicators will reduce cognitive workload/errors and support hiring teams in decision-making with a scored assessment of an individual's submitted application based on the company's requirements and preferences. Additionally, recruitment is heavily influenced by factors such as training and operational costs (amongst others). There is a significant advantage of a recruitment system integrating data and information from other departments in a visually presentable format for recruiters and recruitment managers to optimize their hiring targets.

For instance, the human resources/recruitment department is allocated a fixed budget to hire and train prospective employees while tasked to meet manpower demands to ensure efficient and sustainable operations within specific time constraints. The manpower planning team, equipped with data and figures from training and flight operations, can plan manpower utilization and hiring needs based on forecasted manpower demands.

An expanding organization with an effective and efficient recruitment process will be advantageous in manpower planning, especially if there is a keen interest in aircraft fleet development and fleet transition. Inadequate manpower planning for growing corporations can lead to an insufficient surplus of manpower to perform the fleet transition and resist the capacity for change to accommodate different fleets (narrowbody-widebody-different aircraft manufacturers/variants, etc.). The crucial bottleneck in fleet transitions and expansion is training – pilots, flight attendants, engineers/technicians, dispatchers, etc. A recruitment process incorporating lean principles mitigates unforeseen manpower issues in this transition through proper planning. Training and preparation to receive new aircraft fleets take months, and any undue delays are an opportunity cost for the company. Furthermore, pilots will be restricted to flying specific aircraft types with minimal career progression, resulting in the possible threat of leaving the company.

Training employees will take time to familiarize themselves with a new system and is necessary for any organization in their management of change. This adjustment period will cost time and effort for the manpower planning department to evaluate its implementation feasibility and, if so, will need to trial the system. Hence, a small group of employees will need to test the system and provide valuable feedback based on the product's potential. There may be increased workload during this period as there is a fraction of employees using the traditional recruitment system and some employees testing the

upgraded version. Thus, it is advisable for the organization to transition to the AI recruitment tool during low hiring periods.

In addition, new policies, procedures, and practices may need to be cultivated in the department with the introduction of a new system. Restrictions and access to information levels or features may need to be considered for varying employee levels/privileges. A noble point of consideration is adapting the AI recruitment system to the existing hiring infrastructure (which varies from company to company), while retaining and optimizing the data inputs from the old system. In essence, the primary intangible cost for the organization is managing the change to the new system and convincing employees that it positively helps their work.

CONCLUSION

This research project addresses the prospect of implementing a potential pilot recruitment EPL system on digital platforms using visual and graphic design tools with UI/UX considerations for airlines, companies, and aviation organizations answering the following research questions:

1. Do ICAO's requirements for pilot licensing affect manpower planning?
2. How do the differences between ICAO requirements and other civil aviation authorities (i.e., FAA, EASA, DGCA, CAAS, etc.) affect manpower planning process?

Areas	Impacts	Effect on the Organization's Sustainability
Social	Reduces workload and cognitive strain on recruiting team	+
	Encourages familiarity with increasingly advanced technologies for the recruitment team	+
	Applicants have a good image of the organization's continuous development	+
	Reduces communication barriers and information processing	+
	Streamlined process for applicants	+
Economic	Reduces operational/labor costs	+
	Economy of Scale (early adapters lead industry to new paths of innovation)	+
	More efficient hiring process resulting in higher recruitment rate	+
	Cost savings from efficient decision-making based on applicant KPIs	+
	Needs initial investment for development, trial, testing, and training	-
Environmental	Reduced workforce required for recruitment hiring	+
	Minimal material use and waste for product development	+
	Encourages shift to digitalization	+
	Travel increases CO2 emissions for product testing, organizational integration, and employee training	-

Figure 2: Presentation of ELP research in aviation ecosystem.

3. What are the current challenges and plausible solutions to implementing the EPL? (Analysis).
4. What are the features of the application(s) that users can access and interact with? (Design).

To conclude, the ELP framework overcome problems and limitations inherent in human-provided manpower planning (Ziakkas et al., 2023). ELP is a valuable tool in aviation training and operations, particularly for the manpower planning team using Artificial Intelligence, in several aspects including social, economic and environmental factors.

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