Integration of Artificial Intelligence (AI) within SmartLynx Airlines to Increase Operational Efficiency

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Abstract: - This article investigates the current and potential future applications of AI in the SmartLynx airlines. The airline industry is a complex system that requires efficient and effective management of various operations, including revenue management, flight operations, customer service, and baggage handling. The use of Artificial Intelligence (AI) has now emerged as a promising solution to address the challenges faced by many other airlines. The aim of this research is to analyze SmartLynx Airlines' operational efficiency in flight operations segments of the Latvian aviation industry and to develop recommendations for improving the current operational strategy for the company through the integration of AI-supported tools with conventional flight operation tools. Research tasks are: (1) to conceptualize theoretical aspects of the use of AI in the aviation industry; (2) to perform empirical research regarding current operational issues and study the use of AI in SmartLynx Airlines to improve these issues; (3) to work out recommendations. The current research employs the quantitative approach – a survey of SmartLynx employees of various departments.

Key-Words: - artificial intelligence, crew fatigue prediction, flight operation optimization, impact factors of performance, personalization, predictive maintenance**,** SmartLynx Airlines.

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1 Introduction

The Latvian aviation sector is a dynamic and ever-evolving industry that involves the operation of aircraft to transport people, cargo, and mail. The aviation sector includes a variety of activities such as airline operations, aircraft manufacturing and maintenance, air traffic control, and airport management, [1]. Over the years, the Latvian aviation industry has experienced "significant growth and has become an essential component of the Baltic regional economy, connecting people and businesses from the Baltic to across the world", [2]. The sector plays a critical role in facilitating tourism, international trade, and cultural exchange. However, the aviation sector in the Baltic region faces several challenges, including increasing demand, rising fuel costs, and environmental concerns. As a result, "the industry has been continually adapting and adopting new technologies, such as artificial intelligence and machine learning, to improve efficiency and sustainability", [3].

The aviation industry has experienced significant growth factor from 1950 to 2022. Research on AI implementation in aviation is highly relevant as the aviation industry is a critical sector that relies on safety, efficiency, and effectiveness to ensure smooth operations, [1]. AI technology has the "potential to improve various aspects of aviation operations, including aircraft maintenance, air traffic control, and passenger experience", [4]. With the current increasing demand for air travel and the need to reduce operational costs while improving safety and efficiency, AI can provide valuable insights and automation capabilities that can enhance the decision-making process and reduce the likelihood of errors. AI-based predictive maintenance systems can also help airlines identify potential faults before they occur, reducing the risk of unscheduled maintenance and delays.

Furthermore, AI can assist air traffic controllers in managing air traffic more efficiently, enabling the optimization of flight paths and reducing congestion, which can lead to significant reductions in fuel consumption and carbon emissions, [1]. Overall it can be stated that AI implementation in aviation is highly relevant in addressing the current and future challenges faced by the aviation industry and a successful adoption of AI technologies can lead to improved safety, increased efficiency, and reduced costs, ultimately benefitting both the aviation industry and its customers.

The topicality of the research is that AI has been identified as a key technology that can revolutionize the SmartLynx Airlines industry, it can play a crucial role in achieving the needs for airlines to optimize their operations, reduce costs, and reach these goals. Introduction of AI-powered assisted solutions, airlines can improve their scheduling and resource allocation, enhance predictive maintenance, and streamline their overall operations. The main initiatives are aimed at further improving the current efficiency of SmartLynx airline operations.

Thus the aim of the current research is to analyze SmartLynx Airlines' operational efficiency in flight operations segments of the Latvian aviation industry and to develop recommendations for improving current operational strategy for the company through integration of AI-supported tools with conventional flight operation tools. The research question put forward is the following: "Would Integrating Artificial Intelligence (AI) supported tools integration with the current operational structure in Smartlynx Airlines improve the overall operational efficiency of SmartLynx Airlines?"

The development of an AI-supported inspection mechanism for detecting anomalies in aircraft components during maintenance should be developed [5] to detect similar incidents involving aircraft that resulted in engine loss as a result of damage to turbofan jet blades that were not detected as fatigued during visual inspection during the previous maintenance [6]. In terms of flight safety, they mentioned the significance of AI-assisted inspection for detecting structural damage and material fatigue that cannot be detected by human control. Risk management is a control function that focuses on keeping a process operating safely. The risk is defined as "the probability of a particular event and the scale of the consequences of this event", [5]. AI risk management therefore monitors and controls the defenses against particular accident processes. Therefore, it becomes basic to comprehend what variables make a mishap and how to relieve gambles, which includes a few levels of a socio-specialized framework. Every one of them is impacted by a speedy innovative change, serious climate, and public strain an approach to complex organizational work design that considers the interaction between people, human behavior, society's intricate infrastructure, and technology is known as sociotechnical systems, [7]. Accident models must incorporate social systems, technology, and underlying science from complex systems in order to effectively prevent accidents, [8]. There have also been mentions that, as a result of the development of avionics technologies in the aviation industry, vast amounts of data about the health of the aircraft and its components are generated and shared by means of sensors. They call attention to the article that by deciphering this information through profound learning, extraordinary advances can be made in the field of prescient support thus abnormalities can be anticipated before, [6].

The aviation industry is heavily regulated by various international and national bodies, including the International Civil Aviation Organization, the main regulations are Federal Aviation Administration (FAA), and the European Aviation Safety Agency (EASA). These regulatory bodies oversee various aspects of air travel, including safety, security, and environmental protection. Airlines must comply with these regulations to operate in different regions and countries, which can create significant compliance costs and operational challenges. The aviation industry is highly competitive, with airlines competing for market share based on price, route network, and service quality, [9]. LCCs have disrupted the traditional airline industry by offering lower fares and simplified travel experiences.

In response, traditional airlines have developed their own low-cost subsidiaries or adopted a "hybrid" model that combines some of the features of LCCs with traditional full-service airlines. "Technology is a key driver of innovation and growth in the aviation industry. New technologies such as artificial intelligence, blockchain, and big data analytics are expected to transform various aspects of the aviation industry, including operations, safety, and customer experience", [10].

Flight delays, cancellations, maintenance, safety, security, cost management, and crew operations are major obstacles for the aviation industry. Passenger satisfaction, airline costs, and the overall efficiency of aviation operations are all affected by these difficulties. By dissecting weather conditions, air gridlock, authentic information, and constant sensor information, simulated intelligence can anticipate flight postponements and upkeep prerequisites, enhance courses and timetables, and further develop group tasks. Moreover, artificial intelligence can be utilized for security screening and well-being examination to recognize possible dangers and dangers and make a remedial move before mishaps happen.

There are significant obstacles to overcome when implementing AI in aviation. One significant test is guaranteeing the exactness and culmination of information, which is essential for simulated intelligence frameworks to actually work. It can be

difficult to guarantee the quality of aviation data due to its complexity and variety. The "integration of AI with existing systems, which may not be compatible, is yet another obstacle", [11].

The aviation industry's strict regulations make it difficult to implement AI systems. These frameworks should follow existing guidelines, which require a thorough comprehension of the administrative structure and the improvement of man-made intelligence frameworks that meet administrative necessities, [12]. The joining of computer-based intelligence frameworks likewise requires a huge change in the abilities expected by the labor force, which might confront protection from change and upskilling challenges. Security is a basic worry in the flying business, and any innovation should be thoroughly tried with a guarantee it doesn't think twice about. The use of AI systems necessitates the collection and analysis of a large amount of data, which raises concerns regarding cybersecurity and data privacy. Last but not least, the high cost of implementing AI systems may be a significant obstacle to their adoption, [13]. This led to the conclusion that AI has the potential to revolutionize the aviation sector by addressing major issues pertaining to crew operations, cost management, flight delays, cancellations, maintenance, safety, and security, as well as maintenance. Data quality, legacy system integration, regulatory compliance, workforce upskilling, safety concerns, and cost management are just some of the significant obstacles that must be overcome when implementing AI systems, [14]. Tending to these difficulties will require a joint effort between industry partners, policymakers, and artificial intelligence specialists to guarantee the protected and viable reconciliation of man-made intelligence in flying.

SmartLynx Airlines is a Latvian airline that specializes in providing wet-lease services to other airlines. The airline was founded in Latvia in 1992 and has since grown to become one of the leading wet-lease providers in Europe. The overview of SmartLynx Airlines, including its history, fleet, destinations, and services. SmartLynx Airlines was founded in 1992 by the Estonian aviation company, Avion Express, with the aim of providing charter flights to Scandinavian destinations, [15]. In 2008 it was bought by the Lithuanian company FlyLA Charters and renamed as SmartLynx Airlines Lithuania. In 2012 the company gained a new owner - the Dutch aviation company, Avia Solutions Group. In the year 2023, the company fleet consists of 23 planes that fly to various destinations. The main service the airline provides is the one of wet-lease services, that is, leasing out short-term its aircrafts and providing maintenance of the planes. Among the airlines that have used the offered services, we can mention the ones of Thomas Cook Airlines, TUI Airways, and EasyJet. Over the years SmartLynx Airlines has received awards, such as the "Best Charter Airline award," the "Best Wet Lease Provider award" and the "Economics Aviation Award", [16].

2 Methodology

The authors carried out a survey. The survey participants were the employees of "SmartLynx Airlines," who were currently working on different positions mostly involving operations. Moreover, to collect the data, the author has used the non-probability sampling method. In which non-random selection concerning the research of the study is taken into consideration. The survey was carried out electronically with the help of a social media and communication mobile application, sharing the data in an open format with all respondents on social media platforms. Additionally, a company-side email database was used to invite the participants to answer the questionnaire. The main goal was to investigate and categorize the major challenges SmartLynx Airlines was facing as operational performance challenges. The challenges once identified will be classified and ranked according to their impact factor on the performance monitoring. The response data were then collected through Google Forms and backend database with a Microsoft Excel connection. The respondents were mostly from SmartLynx Airlines and comprised of different departments and professionals of their own fields. The respondent's departments has been listed below according to their participation in the survey and the ratio of respondents (n=100): operations team – 40%; crew control team – 20%; marketing team – 17%; commercial team – 13%; and flight operation management – 10%. The 5-point Likert scale questionnaire consisted of 20 statements that had to be evaluated from 1 (strongly disagree) to 5 (strongly agree). The statements concerned such topics as predicting flight demand, operational delays due to the weather conditions, issues of non-predicted potential aircraft component failures, flight craft availability for scheduling, problems with scheduled maintenance, problems with overbooked flights, fuel supply errors, flight crew fatigue, predicting passenger no-shows, lack of communication among crew members, maintenance schedule, in-flight services, and others.

3 Results and Discussion

According to the survey results for how frequently each department had faced issues with predicting flight demand accurately, the maximum response was from operations control staff (50%). They have been always dealing with a major challenge of flight demand prediction during the next 72hrs and 96hrs. The marketing team (13%) also responded as they usually face the challenge of marketing the aircraft on a short notice. The Flight operations manager (23%) also reported that they are facing huge challenges with predictions of flight demands.

On the results of the survey regarding how frequently each department faced issues with prediction of flight crew availability for scheduling, the crew control department (41%) responded that they face the maximum issue. This has also impacted the smooth functioning of flight operations department (28%). The flight operations manager (21%) was responsible for ensuring the crew coverage at all times (Figure 1).

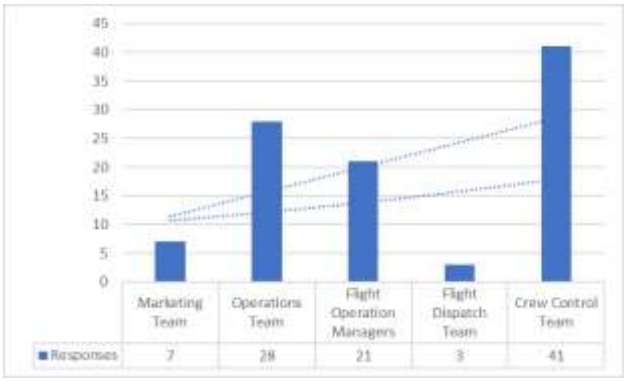

Fig. 1: Issues with the prediction of flight crew availability
Source: Authors'

Furthermore, when asked how frequently they experience operational delays due to unpredictable weather conditions, there has been a noticeable response from the flight operations staff (40%) and the flight operations manager (37%). The flight dispatchers (13%) also responded as they are facing the challenges with last-minute sudden weather changes. The flight operations manager has also expressed his concerns with predictions of the weather as it has caused a lot of operations disruptions and delays in the operation performance. However, when the frequency of instances when departments face issues with predicting flight crew availability for emergency situations, it was noted that crew control reported (47%) and flight operations manager reported (35%). During an emergency situation, these are the main two departments that are concerned and related (Figure 2).

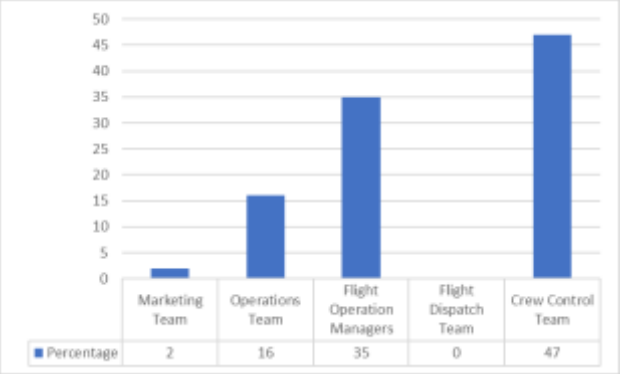

Fig. 2: Issues with predicting flight crew availability for emergency situations
Source: Authors'

The results for how frequently there has been an experience of issues with aircraft maintenance schedule. The maintenance schedule conflicts with the actual operations period has been reported by the maintenance team (40%) and flight operations manager (33%). The main cause has been explained as miscommunication and also as some maintain ace tasks are delayed beyond planned time periods (Figurer 3).

Fig. 3: Issues with aircraft maintenance schedule
Source: Authors'

The non-scheduled maintenance is any technical issues that occur during the operations. Maintenance Team (20%) while flight operations manager (33%) and operations control team (47%). This has been identified as a major operations efficiency factor.

The results of how frequently each department had issues with predicting realistic aircraft turnaround times, it was noted that flight operations (27%) flight operations manager (13%), and maintenance team (27%) reported issues. This is also a factor affecting the operational performance efficiency. The realistic turnaround time would

facilitate better planning in case of aircraft delay and passenger supports (Figure 4).

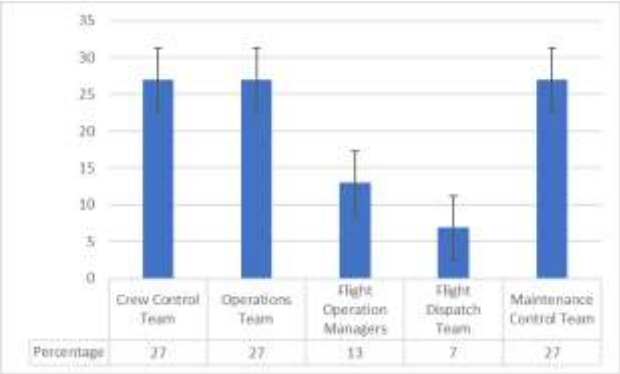

Fig. 4: Issues with predicting realistic aircraft turnaround times
Source: Authors'

Predicting flight crew fatigue is a complex issue that requires a multifaceted approach. While there are challenges associated with predicting fatigue, there are also several strategies that can be used to mitigate the risks associated with fatigue in aviation. By implementing comprehensive fatigue risk management systems, providing education and training to flight crews, and developing policies and procedures that prioritize rest and limit flight hours, airlines can help to ensure the safety of their passengers and crew (Figure 5).

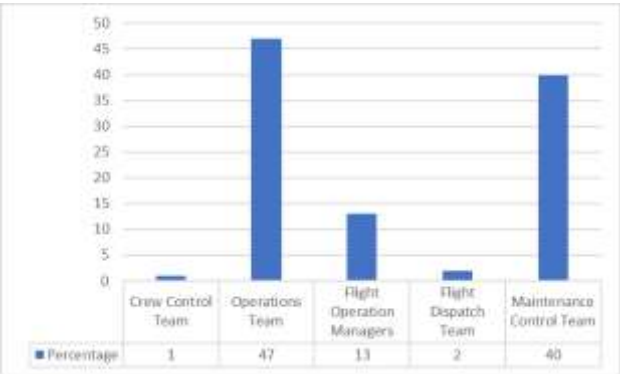

Fig. 5: Predicting flight crew fatigue
Source: Authors'

Summing up, we can distinguish the main operational impact factors (Figure 6).

Fatigue can impact the safety of airline operations by impairing a pilot's ability to make decisions and react quickly. The third most commonly reported issue was slot and permits, with 10% of respondents indicating that this was a significant challenge.

Slot and permit issues can arise when airlines are unable to secure the necessary landing slots or permits to operate in certain airports or regions, this can lead to the delay and cancellation of flights. Still, the major impact factors, according to the respondent view were two – time-consuming operations (47%) and crew fatigue (27%).

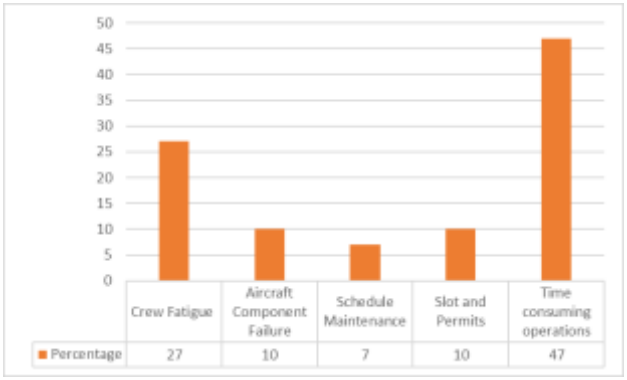

Fig. 6: Major impacting factors for SmartLynx Operational Performance
Source: Authors'

These results, in fact, demonstrate the necessity of periodic (at least twice a year) audits of operations, improvement of feedback channels (open door policies); as well as development risk management systems.

The next issue researched was the one of use of AI-supported tools in daily operations (Figure 7).

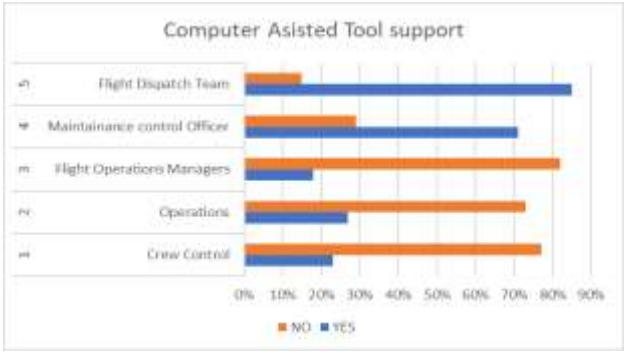

Fig. 7: AI tools in various departments of SmartLynx Airlines
Source: Authors'

The above-mentioned figure depicts the level of usage of AI tools in various departments of the company. The highest levels were reported by the flight dispatch team responsible for planning and coordinating flight schedules (85%) and maintenance control (71%). Surprisingly though, a much lower level of the usage of AI tools was reported by the departments of operations staff (27%), crew control (23%), and flight operations managers (18%). This leads to the conclusion that although the AI-supported tools are rather common in the day-to-day operations, not all departments at present are equally well prepared to do that. Still,

we have to keep in mind the fact that in some cases (e.g. crew control department) face-to-face interactions and personal decision-making skills are of a higher value. This, in turn, asks for putting emphasis on the development of solving problem-solving, critical thinking, and design thinking skills of the employees.

4 Conclusion

The task of the current article was to investigate the level of use of AI tools in the day-to-day operations of SmartLynx Airlines. In order to achieve that the authors carried out the survey of employees of various departments of the company, such as The flight dispatch team; Maintenance control officer; Flight operation managers; Operations; and Crew control. The authors have come to the following conclusions.

Regarding the issue of predicting flight crew availability in emergency situations, there are two main departments that report the probability of them, i.e., the crew control (47%) and flight operations manager (35%).

The main cause for the maintenance schedule conflicts with the actual operation period is miscommunication and delay of planned works. This has been identified as a major operations efficiency factor.

Another factor affecting operational performance is the one predicting realistic aircraft turnaround times. This issue eventually resulting in better planning can be solved by the efficient application of the AI tools in the process.

Predicting flight crew fatigue is yet another risk factor that asks for the introduction of a multifaceted risk management strategy that would include staff education and training, as well as standardization of procedures by the means of the AI. To ensure results it is necessary to carry out periodic (at least twice a year) audits of operations, and improvement of feedback channels.

Although the AI-supported tools are rather common in the day-to-day operations of the SmartLynx Airlines company, it is evident that not all departments are equally well prepared to do that; again – this points to the necessity of systematic training and education.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT in order to check the context of research of the given topic. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

- Velga Vevere, Kanchan Dange are the authors of the idea of the article, as well as they carried out the extensive literature review and planning of the empirical research.
- Iveta Linina and Rosita Zvirgzdina have executed the survey, data collection and systematization.

Interpretation of the results was carried out by all four authors.

Sources of Funding for Research Presented in a Scientific Article or Scientific Article Itself

No funding was received for conducting this study.

Conflict of Interest

The authors have no conflicts of interest to declare.