Harnessing Technology: Implementation of Automated Decision Support Systems (ADSS) as a Strategy for Managing Air Traffic Growth in the Philippines

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Abstract

This study examines the implementation of Automated Decision Support Systems (ADSS) to manage air traffic growth in the Philippines, addressing inefficiencies and safety risks in traditional systems. Through qualitative interviews with licensed air traffic controllers, it highlights the challenges due to increased air traffic and the lack of automated tools. The findings indicate that ADSS could enhance efficiency and safety by offering predictive analytics and improving coordination among stakeholders. While ADSS shows promise, further research is needed to customize it for the Philippines. The study recommends collaboration between the government and technology providers for effective integration.

Keywords: ADSS, ATC

I. INTRODUCTION

1.1. Background of the Study

The Philippines relies heavily on air transport for both passenger and cargo movement, driven by economic development, tourism, and the rise of budget airlines. This surge has strained air traffic management systems, leading to congestion, flight delays, and safety risks. Traditional air traffic control (ATC) systems in the Philippines, while functional, struggle to cope with increasing demands and are prone to inefficiencies and errors due to heavy human involvement.

To address these challenges and improve efficiency, safety, and capacity, the adoption of Automated Decision Support Systems (ADSS) is being explored. Machine intelligence includes the elements propelling the world into the next generation. Its applications have significantly expanded, especially in automation. Some of the most successful implementations are automated teller machines, robotics, heuristic internet searches, and decision support systems.

Despite global advancements in ADSS, there has been limited focus on implementing these technologies specifically in the Philippines. Current ATC methods may not adequately meet the complexities of modern aviation, highlighting the need to assess the potential benefits and challenges of ADSS in this context.

These systems, powered by AI, machine learning, and advanced algorithms, promise to optimize airspace use, reduce delays, and enhance safety by analyzing real-time data such as weather conditions, flight schedules, and airspace constraints.

One significant aspect of ADSS is its ability to provide predictive analytics and proactive management of air traffic. By utilizing historical data and real-time inputs, these systems can anticipate potential conflicts and suggest optimal routes, thereby minimizing the risk of mid-air collisions and runway incursions. Furthermore, ADSS can facilitate better coordination between different stakeholders in the aviation ecosystem, including airlines, airports, and regulatory bodies, ensuring a more integrated approach to air traffic management.

In the Philippine context, the successful integration of ADSS requires a comprehensive understanding of local conditions, regulatory frameworks, and infrastructural limitations. Collaborative efforts between the government, aviation authorities, and technology providers are essential to develop a customized ADSS solution that addresses the unique challenges of the region. This study aims to explore and understand the views and experiences of air traffic controllers in the aviation industry of the Philippines regarding the challenges and potential solutions for managing the rapid growth of air traffic. Specifically, it seeks to find out how air traffic controllers describe the challenges they face due to the rapid increase in air traffic and its impact on their decision-making processes. Furthermore, the study aims to gather insights about the lack of automated decision support tools and how this affects their ability to efficiently process data and make the best decisions in real-time. Through this comprehensive exploration, it will provide valuable insights and recommendations for improving air traffic management in the Philippines, highlighting the potential role of ADSS in addressing current challenges and enhancing the overall efficiency and safety of air traffic operations.

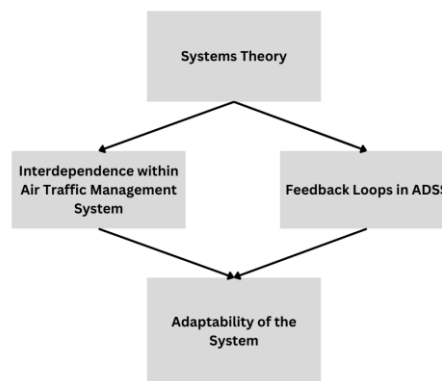## 1.2. Theoretical Framework

The study is based on two primary theories: Systems Theory and the Technology Acceptance Model (TAM).

The Systems Theory, introduced by Ludwig von Bertalanffy, sees intricate systems as interconnected networks. Within the realm of Air Traffic Control, this theory aids in addressing the complexities and interdependencies within air traffic management. This approach ensures that the implementation of ADSS is considered not just in isolation but as part of an interconnected system, ultimately leading to more effective and sustainable management of air traffic growth in the Philippines.

The Technology Acceptance Model (TAM), created by Davis in 1989, describes the process of how users embrace and utilize a technology. It suggests that an individual's intention to use technology is influenced by how useful and easy to use it is, which then impacts their actual usage of the technology. The study uses TAM to analyze air traffic controller's willingness and confidence in automated decision support systems.
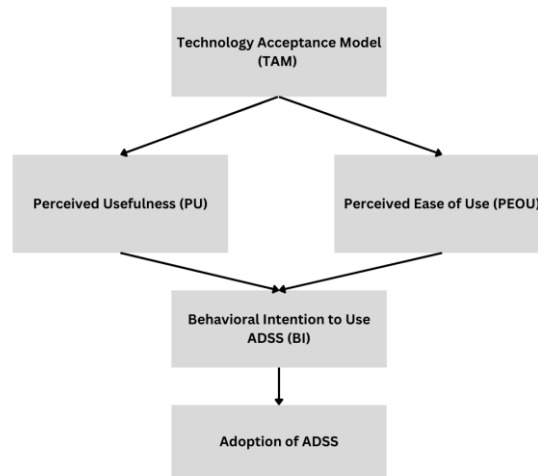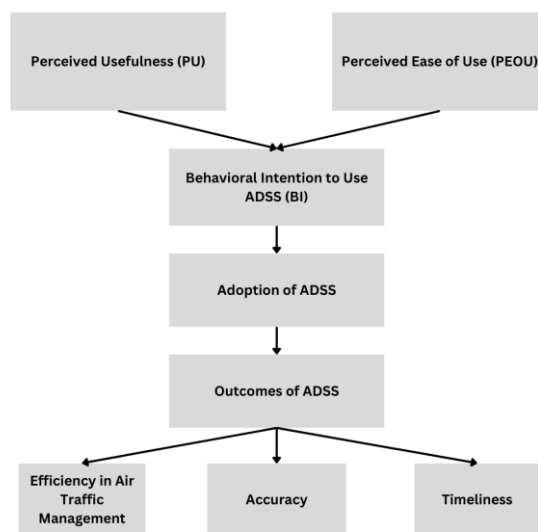
Fig. 1. Technology Acceptance Model

Fig. 2. Systems Theory Model

1.3. Conceptual Framework

Fig. 3. Conceptual Framework

The figure presents an integrated theoretical framework that examines the adoption of Automated Decision Support Systems (ADSS) in air traffic management. The framework combines principles from Systems Theory, which views ADSS as complex, interconnected systems, and the Technology Acceptance Model, which analyzes how user perceptions of usefulness and ease of use influence their intention to adopt these systems. The model posits that the system interdependence, feedback mechanisms, and adaptability of ADSS along with their perceived usefulness and ease of use, directly impact the behavioral intention to use ADSS, ultimately leading to improved outcomes in air traffic management, such as increased efficiency, enhanced safety, and better user satisfaction.

1.4. Statement of the Problem

This study aims to answer the following questions:

1. How do air traffic controllers in the Philippines describe the challenges they face due to the rapid growth of air traffic and its impact on their decision-making processes?
2. How do air traffic management personnel in the Philippines describe the current reliance on manual processes and human decision-making in their systems, and what are the perceived issues and limitations of this approach?
3. What are the insights of personnels regarding the lack of automated decision support tools and how it affects the ability of air traffic controllers to efficiently process data and make optimal decisions in real-time?
4. What are the expectations of key stakeholders in the aviation industry of the Philippines regarding the potential benefits, feasibility, and effectiveness of implementing ADSS to improve decision-making efficiency, accuracy, and timeliness?
5. What are the perspectives of air traffic management professionals and technology experts in the Philippines on the key components, applications, and potential challenges and barriers to the successful implementation of ADSS in the Philippines.

1.5. Hypothesis

The Implementation of Automation Decision Support System (ADSS) within the air traffic management in the Philippines is expected to bring significant improvements to the workflow and decision making process of air traffic management. By leveraging the technology the ADSS can address the growing challenges faced by air traffic controllers due to the rapid increase in air traffic volume nowadays. The Automation Decision Support System (ADSS) will enhance the efficiency, accuracy and timeliness of air traffic management, mitigating the errors, limitations and inefficiencies associated with human decision making and high stress working environments.

1.6. Significance of the Study

The implementation of Automated Decision Support System (ADSS) acts as a representation of developing advancement in the field of Aviation. It aims to investigate the significant involvement of autonomous Air Traffic Control systems.

With these, the beneficiary of this study involves the following:

Civil Aviation Authority:

The results of this study can help the government design the aviation sector's long-term strategy. ADSS helps create laws and policies that promote the efficient and sustainable expansion of aviation by examining patterns and projecting future air traffic growth.

Furthermore, Air traffic controllers, airports, and airlines are among the stakeholders that ADSS helps to make collaborative decisions with.

General Public:

This study provides the general public a number of advantages, including increased air travel volume as well as economic growth and environmental sustainability. In addition to enhancing the traveler experience, these developments support the development of a more technologically sophisticated and sustainable aviation sector.

Travelers and communities alike may benefit from a more dependable, secure, and ecologically friendly air travel experience brought about by the broad implementation of autonomous ATC systems.

Airline Corporations:

With the help of the Automated Decision Support system, airline corporations can enhance their overall profit by reducing the delays, optimizing flight patterns for fuel efficiency, and better communication between the pilots and ATC workers.

Air Traffic Controller:

With the help of Automated Decision Support System, ATC controllers will have better situational awareness, mitigates risk, improves operational efficiency, and reduces workload. They can effectively manage the high volume of air traffic while also ensuring the safety and reliability in operating within the Philippine Airspace.

Future Researchers:

This study focuses on the application of Automated Decision Support System (ADSS) in the aviation industry. This is also to test how trustworthy and reliable the system is. Thus, it provides researchers additional knowledge and opportunities to identify deeper understanding about the autonomous ATC system.

1.7 Review of Related Literature

According to Bertalanffy, L. V. (2017), the study analyzes the evolution of general system theory from its inception to its contemporary applications. He explores the interdisciplinary nature of GST, which seeks to recognize the complex systems by taking into consideration the interactions and relationships of their components. He also discussed the experimental implications of GST in various domains, that includes engineering, social sciences, and management. He also stated the importance of perspective when it comes to addressing real-world issues and for advocating integrations to different scientific disciplines.

According to Davis, F. D. (1987), the study explores the factors that influence the user acceptance to the use of information systems. He presents the theoretical framework that details the development and validation of TAM, where it provides a strong model that predicts technology acceptance. The study also discusses the indications of the findings related to system design and implementation, advocating for user-centered design practices that categorizes the functionality and usability.

According to Brittain, M., & Wei, P. (2018), the study includes all the detailed simulations and evaluated events on the proposed system, here it demonstrates all the possible benefits in contrast to the traditional ATM methods. The study also highlights the skills to adapt and scalability of their HDRL-based system, where it suggests that it can effectively handle different variations of traffic densities and complex airspace conditions.

According to Balakrishna, P., Ganesan, R., & Sherry, L. (2010), the study evaluates the benefits when it comes to implementing next generation technologies in the area or airspace. This includes, data communications and automatic dependent surveillance-broadcast, and their possible impact on flight frequency. The study highlights the operational advantages of NextGen, emphasizing on how enhanced communication and surveillance capabilities can lead to precise navigation and improved traffic

management. The study also discusses the implications of it for the aviation industry, suggesting that NextGen can come up with a more sustainable and resilient air traffic system.

II. METHODOLOGY

2.1. Research Design

The study will use a qualitative approach by conducting an interview. This design allows for in-depth exploration of key aviation professionals' experiences, perceptions, and insights regarding the implementation of Automated Decision Support Systems (ADSS) in the Philippine air traffic management system.

2.2. Respondent

For the purposes of this study, the researchers will gather data from air traffic controllers responsible for managing the safe and orderly flow of air traffic. This group of respondents is crucial as they are the primary users of the Air Traffic Management (ATM) systems and have firsthand experience with the challenges and potential improvements that ADSS could bring. Their insights will provide a comprehensive understanding of the efficiency and safety impacts of autonomous air traffic control systems from the perspective of those directly involved in air traffic management.

2.3. Settings

The study will be conducted at PATTS College of Aeronautics, located at Lombos Street, San Isidro, Parañaque, 1700 Metro Manila, Philippines, under the supervision of Ms. Alexandra Legaspi, The researchers remotely conducted the interview through online meeting platforms to obtain the data from the respondents regarding their perception to the implementation if Automated Decision Support Systems in the Aviation industry in the Philippines and how it can greatly affect in terms of efficiency improvements, safety enhancement, reliability and trust of the general public and adaptation and implementation.

2.4. Instrumentation

This study aims to analyze the implementation of autonomous ATC systems in the aviation industry, the impacts on safety, and the factors to consider before trusting and accepting the usage of this system. To obtain accurate data that would either validate or contradict the hypothesis, the researchers would ask the respondents a series of questions through online interviews, the respondents could state their responses to the questions provided. The respondents' answers will determine their opinion about the system, and the researchers can see how the respondents perceived the autonomous ATC system.

2.5. Data Analysis

The researchers collected data for this thesis study through online interviews to gauge respondents' perceptions of implementing Automated Decision Support Systems (ADSS) as a strategy for managing air traffic growth in the Philippines. The researchers utilized these methods to analyze textual information and observations, aiming to interpret the specific attributes of ADSS implementation. This process involved analyzing qualitative data to uncover nuanced contexts, providing a comprehensive evaluation of how ADSS influences efficiency and safety. By integrating a qualitative research design and incorporating interviews to gather data, the study aims to offer a thorough understanding of the potential benefits and challenges associated with ADSS implementation in the Philippines.

2.6. Ethical Considerations

During the data gathering, participants voluntarily participate and have the right to withdraw at any time. Also, the researchers ask the permission of the respondents to record the interview as compliance with the

Data Privacy Act of 2012. All data gathered will be treated with strict confidentiality and only used for research purposes. Researchers also comply with the school administration ethics committee to ensure that the study avoids any harm and risk to any human participants.

III. RESULT AND ANALYSIS

3.1. Results

This study revolves around interviews with six respondents where the first three were given set A questionnaires, while set B questionnaires were given to the remaining respondents. The set A and set B questionnaires both consist of 5 questions each. The respondents are licensed and currently working as air traffic controllers here in the Philippines. The focus of the interview is to gain insights regarding the current air traffic management and to analyze the benefits and challenges of implementing the Automated Decision Support System (ADSS) in the Philippines.

SET A

Question 1: Can you describe how the rapid growth in air traffic has made coordination and communication with pilots and other controllers more challenging?

- **Informant 1**
- The informant believes that the rapid growth in air traffic is mainly a technological challenge, as since the pandemic, air traffic has continued to rise, making service delivery faster, and although the technology currently used in air traffic control can still keep up, it shows signs of being outdated, leading to system lapses that slow down operations and indicate a need for updates, and to prevent further problems, having more backups and alternatives is essential, emphasizing that technology is both a challenge and a potential solution in managing the rapid growth in air traffic.

- **Informant 2**
- The informant identifies communication as a fundamental challenge for air traffic controllers, particularly highlighting language barriers with foreign pilots as a primary issue; with Ninoy Aquino International Airport being the main gateway for international travel, these barriers are especially prominent.
- The rapid growth in the aviation industry, especially post-pandemic, intensifies communication challenges due to increased air traffic. Despite these challenges, air traffic controllers are trained extensively (approximately 10 months) to handle high-stress situations and manage numerous aircraft efficiently.
- The increase in air traffic leads to congested communication frequencies, requiring controllers to manage multiple requests from pilots simultaneously. Air traffic control services are crucial for preventing collisions and maintaining an orderly flow of air traffic, highlighting the importance of effective communication despite the challenges.

- **Informant 3**
- The informant says that with more flights, air traffic controllers face increased workload and must manage various frequencies for pilot requests.
- Handling multiple requests on the same frequency is particularly challenging.
- The informant notes that the system is first-come, first-served but also considers flight plans and departure times, leading to congestion. Pilots often compete for priority, complicating communication.
- Coordination between controllers, especially when transferring flights between sectors, is essential to avoid traffic issues and ensure smooth operations.

- **Question 2:** How do you manage the increased workload associated with manual processes during high-traffic situations, and what specific challenges do you face?
- **Informant 1**
- The informant described the challenges of managing increased workloads during high-traffic situations in a facility lacking advanced technology, particularly radar systems.
- The facility operates without radar, unlike many international airports. This requires using conventional visual, graphical, and geographical methods for air traffic control.
- The controllers must thoroughly study the surrounding area and landmarks, especially its distance to the facility to effectively manage traffic.
- The facility does not utilize the Camsoft Aeronautical Data Access System (CADAS), which is crucial for sending and receiving aeronautical messages like NOTAMs and advisories. This limitation requires controllers to manually coordinate messages with relevant units, leading to delays.
- The lack of radar and automated systems complicates decision making processes, as controllers must rely on manual methods to sequence and clear aircraft effectively.
- The informant's experience highlights the significant challenges faced in air traffic control facilities that lack modern technological support, emphasizing the reliance on manual processes and the need for thorough situational awareness.
- **Informant 2**
- The informant shared their perspective on managing increased workloads in air traffic control. Particularly emphasizing the role of radar systems and procedural training.
- The informant works in a radar-equipped operations center, simplifying their workload by providing real-time aircraft positions for efficient traffic management.
- Controllers practice managing traffic without radar to develop a mental picture of traffic dynamics and maintain awareness of aircraft positions, similar to learning to drive a manual car before transitioning to an automatic.
- The informant noted that managing increased workloads becomes challenging without radar. Without real-time data, maintaining appropriate separation distances between aircraft is more difficult, necessitating larger separations to ensure safety.
- **Informant 3**
- The informant provided insights into how they manage increased workloads during high-traffic situations in air traffic control, particularly focusing on their manual processes.
- The air traffic control system in their tower is predominantly automated, which streamlines operations.
- The only manual task involves recording communications with pilots and airlines in a logbook. This is done by hand to maintain a record of requests and interactions.
- The manual logging serves as a contingency plan in case the automated system fails. It ensures that there is a reliable backup for critical information.
- The informant highlighted the challenges associated with decision-making as an air traffic controller. They noted that multiple factors must be considered, including: ground situations, air traffic levels, and overall traffic management.
- The complexities associated with decision making necessitate careful manual oversight to ensure the efficiency control and flow of aerodrome traffic, especially during peak times.
- **Question 3:** What difficulties do you encounter when making real-time decisions without automated

support tools, and how does this affect your efficiency in processing data?

- **Informant 1**
- The informant explains that even though it is conventional controlling, your workload is cognitive, which will lead to exhaustion. We have limits and are not artificial intelligence (AI) that can work nonstop. Due to a lack of equipment, processing data is not as quick as it should be and will likely result in a delay because they have to relay it. For it to be dependable and have strong support, we must rely on other working roles.
- **Informant 2**
- The informant explained that naturally,Their first priority is to always stay below the separation minimum, which is defined as the closest, furthest, or nearest distance between aircraft. In the event that they, as air traffic controllers, are without a radar system, we will rely on our traffic picture, and since we lack radar, the separation will increase and cause more delays to the airport's scheduled operations.
- It affects efficiency because the aircraft should be kept apart. The main goal of the Air Traffic Service is to prevent collisions between aircraft. Those are the difficulties encountered without a radar system.
- **Informant 3**
- The informant clarified that four positions in Manila Tower share the common objective of managing traffic at NAIA. The informant clarified that the most challenging task is balancing the traffic because there is an excessive amount of transfer from one area to another. Determining the AWAT position requires accurate, real-time communication, and it is also a contributing factor to the traffic at the NAIA due to its two runways.
- The informant concluded that while this does not imply that it is ineffective, handling flow and control will happen more quickly if a mechanism exists that facilitates people informing one another of their intentions.
- **Question 4:** What significant benefits do you anticipate from the implementation of Automated Decision Support System (ADSS) in air traffic management?
- **Informant 1**
- The informant describes that the Automated Decision Support System (ADSS) can help to lessen the cognitive workload of the controllers. The informant also stated that it will also lessen the effects of human factors such as fatigue, making them recover easily.
- **Informant 2**
- The informant stated that with the help of AI, they would be able to work faster and help them decide on which action is much better. The informant also said that the traffic in the airport where he works could increase since they can cater to aircraft faster.
- **Informant 3**
- The informant expects that the AI would help them lessen their duties like talking to the pilots at some periods, and manually controlling the air all the time. The informant also said that with the help of Automated Decision Support System (ADSS) they will be able to cross out other duties and focus more on the weather, and deviating pilots when it comes to unexpected scenarios.
- The informant highlighted the benefits of AI when it comes to faster service for aircrafts, easier duty, and lesser fatigue.

Question 5: How do you think effective training programs are for preparing air traffic controllers to use ADSS, and what challenges might arise in developing and implementing these programs?

● **Informant 1**

The informant concluded,, effective training programs are crucial for preparing air traffic controllers to use Automated Decision Support Systems (ADSS). Given the complexity and high stakes involved in air traffic management, comprehensive training ensures that controllers are well-versed in the system's functionalities, limitations, and best practices. This preparation is essential for the safe and efficient integration of ADSS into live air traffic operations. However, developing and implementing these training programs present significant challenges. Economically, the cost of developing comprehensive training modules and ensuring access for all relevant personnel can be substantial and may depend on the authorities' budgetary constraints. Furthermore, the generational gap among trainees could lead to differing levels of acceptance and adaptability, with some individuals embracing the new technology while others resist it. This divergence can complicate the training process and delay the full implementation of ADSS. In summary, while the importance of thorough training for ADSS cannot be overstated, addressing the economic and generational challenges will be key to the successful adoption and effective use of this advanced technology in air traffic management.

● **Informant 2**

In conclusion, effective training programs are essential for preparing air traffic controllers to use Automated Decision Support Systems (ADSS), especially given the varying levels of technical proficiency among individuals. Not everyone is "tech-savvy," and the complexity of these systems necessitates thorough and well-structured training. This is particularly important for AI-based systems, which, if not properly understood and managed, could lead to misuse or unintended consequences. The challenges in developing and implementing these training programs are multifaceted. First, the procedural aspects of training are already demanding, and integrating AI technology adds another layer of difficulty. Since technology can be intimidating or unfamiliar to many, a gradual approach to training is necessary. This phased implementation should include comprehensive dry-runs and a timeline that allows controllers to become proficient over several years, rather than rushing the process. Additionally, while some controllers may resist adopting new technology, it is crucial for the profession to stay open to advancements that could improve air traffic management. Therefore, a combination of patience, persistence, and support will be needed to ensure that all controllers are comfortable and capable of using ADSS effectively. The ultimate goal is to enhance safety and efficiency in air traffic management, making the investment in training both worthwhile and necessary.

● **Informant 3**

To summarize, effective training programs for preparing air traffic controllers to use Automated Decision Support Systems (ADSS) are essential for enhancing efficiency and reducing controller stress by providing reliable decision-making support. However, several challenges arise in developing and implementing these programs. A primary challenge is the risk of over-reliance on automated systems, as evidenced by the incident on January 1, 2023, when a failure at the ATMC headquarters highlighted the dangers of sole reliance on computer systems. This incident underscores the need for controllers to maintain strong fundamental and procedural knowledge, ensuring they can manage air traffic manually if necessary. Therefore, while incorporating ADSS into training programs can greatly benefit air traffic management, it is essential that these programs reinforce the controllers' foundational skills. Balancing the adoption of new technology with a solid understanding of traditional procedures will help mitigate the risks associated

with system failures and ensure the safety and efficiency of air traffic operations.

SET B

Question 1: Do you think the technology infrastructure at your current facility is ready for ADSS implementation?

- **Informant 4**
- The informant says that Philippines infrastructure is not yet ready for ADSS, he also highlighted the difficulties when the machines shutdowns yet still can manage the operations manually.
- The informant is hesitant for the implementation of the ADSS solely because of different factors, he insisted that some situation still needs human decision like if there are bad weather conditions that the systems can be sometimes faulty, decision between pilot and controllers
- The informant mention also that the system need to be integrated to their workflow gradually
- The informant highlighted that there is a short on budget on the government side to acquire or fully implement the ADSS in the system He also mention that other people in the industry is quite still not familiar to AI system so their might be a confusion on the older people side that are not that fan of AI in their line of work
- **Informant 5**
- The informant says that the current facility is not that ready for implementing the ADSS system if we are talking about Manila Control Tower, although there are some systems that are integrated like CSNATM (Communication Surveillance, Navigation and Air Traffic Management) there's still some technological advancements that other countries have that our country still lacks
- The informant is still hopeful that with the new management which is the SMC, that the facility will greatly improve especially the Manila Control Tower because the facility is a little bit old to integrate new systems that can improve air traffic management here in the philippines
- **Informant 6**
- The informant says that the facility is still not ready, especially the equipment, that our country is late to the technology that is supposed to be in the aviation industry.
- The informant also adds that there are several things to consider like lack of resources
- **Question 2:** What manual processes and human decision-making task impact air traffic management, and how do you ensure accuracy, timeliness, and anticipate improvements with ADSS implementation
- **Informant 4**
- The informant says that decision making is based on the controllers' learned safety procedures and they always have a back up plan to ensure safety.
- **Informant 5**
- According to the informant's, they always ensure that all controllers are able to multitask by simultaneously monitoring the environment and radars.
- Air Traffic controllers are skillful to be flexible in all stations..
- **Informant 6**
- According to the informant, air traffic controllers are taught to manually manage traffic as part of their training. They run through scenarios or have a plan in place in case the technology fails and they are still able to function manually.
- Based on the informant, the Air Traffic Controller's daily experience is the basis for decision-making.

There will be various situations.

- **Question 3:** Can the current air traffic management infrastructure feasibly support the implementation of ADSS? What key factors or improvements are needed to ensure successful integration?

- **Informant 4**

- The informant stated that the management can support the implementation of ADSS as long as the CAAP provides the money for supporting the use of ADSS.

- The informant also stated that the usage of ADSS should only be for second or third opinions to the controllers. It should only be classified as a guidance to assist the air traffic controllers.

- **Informant 5**

- The informant stated that the tower facility should be the first to be improved before adding the usage of ADSS since there is a lot of equipment to be used when using new technology.

- **Informant 6**

- The informant stated that the capabilities to gather resources and manpower should be considered. Because before using the new technology, air traffic controllers should go under another training that is related to using the ADSS to avoid human errors in the field of job.

- The ability of air traffic controllers is also a factor when it comes to the implementation of ADSS, since there is a chance that some controllers would not be able to fully understand how to use this new technology of AI.

- **Question 4:** Do you see significant benefits from using automated decision support system tools in your daily operations?

- **Informant 4**

- The informant somehow sees that the ADSS have benefits if the controllers treat it as a second opinion to their decision making only.

- **Informant 5**

- The informant says that using ADSS would help them to easily monitor the traffic. It will also ease up the overall responsibility of the air traffic controllers.

- **Informant 6**

- The informant stated that they can proceed to focus on the parts of their job that require more attention and focus that includes decision making.

- **Question 5:** How does the rapid increase in air traffic negatively impact overall flight safety, and what measures can be implemented to manage the growing volume of air travel while ensuring flight safety?

- **Informant 4**

- The informant somewhat disagrees with the negative impact of the rapid increase of volume flights as long they are regulated

- **Informant 5**

- The informant says that the negative impact on the flight safety is that because of the plenty of the aircraft they cater for, they usually compromise safety.

- The informant also adds that there have been a proposal regarding the extension of one of the taxiways and additional parking bays

- The informant mentioned that the on-going construction of the bulacan airport will greatly help decongest the manila international airport, that some VFR flights must be diverted there

- **Informant 6**
- The informant has the same dilemma as the informant 5 regarding the volume of flights, because of limited space that the airport had additionally the communication dilemma between personnels.
- The informant also adds that because of the the repairs that are happening in some part of the airside of the airport additional delays are piling up and because of this their have been a domino effect on other operations
- There have been some letter of agreement between the ramp personnel and some other facilities to avoid confusion during operations
- The informant also adds that for general aviation they've given an allotted time to operate in the airspace to help decongest the airport or sometimes they are given alternate airport

3.2 Analysis

From the interview, several key points can be highlighted:

1. **Challenges with Rapid Traffic Growth:** The challenges posed by rapid traffic growth in air traffic management are multifaceted, encompassing technological, communicative, operational, and infrastructural issues. Addressing these challenges will require strategic upgrades, enhanced training, and improved coordination among stakeholders to ensure the safety and efficiency of air travel.

2. **Reliance on Manual Processes:** It poses significant challenges, particularly in facilities lacking modern technology such as radar and Camsoft Aeronautical Data Access System (CADAS). While training and experience equip controllers to handle increased workloads and complex decision-making, the limitations of manual operations highlight the need for technological advancements to enhance safety and efficiency in air traffic management.

3. **Lack of ADSS:** Their responses underscore the cognitive and operational difficulties that arise in managing air traffic without advanced technology. There is support for implementing ADSS but it needs careful planning, funding, and training to ensure that the controllers can effectively utilize these type of tools.

4. **ADSS Implementation Expectations:** The expectations are overwhelmingly positive. Informants anticipate that ADSS will reduce cognitive workload, enhance decision-making speed and quality, streamline duties, and improve traffic monitoring.

5. **ADSS Key Components and Challenges:** It is viewed as a critical advancement for enhancing safety, efficiency, and the overall effectiveness of air traffic controllers. While ADSS presents significant opportunities, it needs careful consideration of training, economic factors, and the balance between automation and manual skills. Through fostering an environment that both embraces technological advancements and foundational knowledge, the air traffic management community can ensure the effective use of ADSS in improving operational outcomes.

Cross-Analysis:

- Informants 2 and 3 pointed out the challenges in handling the growing number of flights at crowded airports like NAIA. Informant 2 mentioned that without radar, maintaining necessary separation distances becomes challenging, leading to delays in operations. Informant 3 stressed how tricky it is to balance traffic flow and the need for real-time communication, which is further strained by rapid traffic growth.

- Informants 1 and 2 talked about how much they depend on manual processes due to the lack of automated systems. Informant 1 pointed out that cognitive workload increases significantly, leading

to exhaustion among controllers. Informant 2 added that not having radar means they need to keep a closer eye on things. This makes it harder to make decisions and increases the chances of mistakes.

- The informants for the set b questionnaire expressed a cautious yet positive outlook on implementing ADSS. Informant 4 highlighted that management supports ADSS as a supplementary tool, while informant 5 stated that facility upgrades are necessary before the implementation.
- All the informants highlighted the importance of proper training to ensure that they can effectively use ADSS, indicating that successful implementation hinges on proper preparation and infrastructure.
- Informants 2, 3, and 4 stated that reliable communication systems and user-friendly interfaces are essential.

IV. DISCUSSION

4.1. Conclusions

- The rapid growth in air traffic has significantly complicated coordination and communication between air traffic controllers and pilots. As highlighted by Informants 1, 2, and 3, the increasing volume of flights exacerbates challenges such as language barriers, congested communication frequencies, and the need for seamless coordination between controllers. These issues underscore the necessity for technological advancements to enhance communication efficiency and reduce operational bottlenecks.
- The current reliance on manual processes in air traffic management, particularly in facilities lacking advanced technology like radar systems and Camsoft Aeronautical Data Access System (CADAS), poses significant challenges. Informants 1 and 2 emphasized that managing increased workloads without automated support tools leads to cognitive overload and operational delays. This reliance on manual methods highlights the critical need for technological upgrades to enhance decision-making efficiency and overall safety.
- Informants consistently expressed positive expectations regarding the implementation of Automated Decision Support Systems (ADSS). They anticipate that ADSS will alleviate cognitive workload, improve decision-making speed and accuracy, and streamline various operational tasks. This optimism reflects a strong belief in the potential of ADSS to enhance air traffic management, provided that the systems are properly integrated and supported by adequate training and infrastructure.
- The informants highlighted several challenges related to the implementation of ADSS, including technological readiness and the need for comprehensive training programs. Informants 4, 5, and 6 pointed out that the current infrastructure in the Philippines is not fully prepared for ADSS integration. They also emphasized the necessity of gradual implementation, adequate funding, and overcoming generational gaps in technological proficiency among controllers. Addressing these challenges is crucial for the successful adoption of ADSS.
- While the implementation of ADSS offers significant advantages, it is essential to balance automation with the retention of manual skills. Informants underscored the importance of maintaining strong foundational knowledge and procedural skills to ensure that controllers can effectively manage air traffic manually when necessary. This balance will help mitigate risks associated with over-reliance on automated systems and ensure the resilience and adaptability of air traffic management operations.

In summary, the discussions in Chapter 4 reveal a complex interplay of challenges and opportunities in air traffic management in the Philippines. The rapid growth in air traffic demands technological advancements, such as ADSS, to enhance communication, coordination, and overall operational efficiency. However, successful implementation requires careful planning, adequate funding,

comprehensive training, and a balanced approach to automation and manual skills. Addressing these factors will be key to managing air traffic growth effectively and ensuring the safety and efficiency of air travel in the Philippines.

4.2. Recommendations

Based from the discussed conclusions, the recommendations are as follows:

- **Investment in Advanced Communication Technologies**
- Address the communication inefficiencies by investing in advanced communication technologies. This includes upgrading to digital communication systems that can handle higher volumes of traffic and reduce language barrier issues.
- Implement advanced radar systems and Camsoft Aeronautical Data Access System (CADAS) to replace manual processes and reduce cognitive overload on controllers.

- **Phased Implementation of ADSS:**
  o Implement ADSS in a phased manner, starting with pilot projects in select airports to assess performance and identify potential issues.
  o Ensure that the integration of ADSS is supported by comprehensive training programs to enhance the technical proficiency of controllers.

- **Infrastructure Development:**
  o Upgrade the existing infrastructure to support the integration of ADSS. This includes enhancing hardware and software systems, ensuring robust internet connectivity, and providing adequate power supply backups.
  o Secure adequate funding from government and private sectors to support these infrastructure improvements and ensure sustainable implementation.

- **Training and Skill Development:**
  o Develop and implement comprehensive training programs for air traffic controllers to ensure they are proficient in using ADSS. These programs should also address generational gaps in technological proficiency.
  o Maintain regular refresher courses to ensure controllers retain their manual air traffic management skills alongside their ADSS capabilities.

- **Balanced Approach to Automation:**
  o Encourage a balanced approach to automation by ensuring that manual air traffic management skills are not neglected. Controllers should be trained to handle situations where manual intervention is required.
  o Conduct regular assessments to ensure that controllers can switch between automated and manual processes seamlessly, thus maintaining the safety and efficiency of air traffic management operations.

References:

1. Bertalanffy, L. V. (2017). The History and Status of General Systems Theory. In *journals.aom.org* (10.5465/255139). Academy of Management Journal, VOL 15, NO. 4. Retrieved June 23, 2024, from https://journals.aom.org/doi/full/10.5465/255139
2. Davis, F. D. (1987). User acceptance of information systems: The Technology Acceptance Model (TAM) (Working Paper No. 529). Ross School of Business, University of Michigan. https://quod.lib.umich.edu/b/busadwp/images/b/1/4/b1409190.0001.001.pdf
3. Federal Aviation Administration (FAA). (2020). *NextGen Air Traffic Control: The Future of Flying.*

Retrieved from https://www.faa.gov/nextgen

4. Eurocontrol. (2019). *Challenges of Growth: Managing Air Traffic Growth and Safety*. Retrieved from https://www.eurocontrol.int/publication/challenges-growth-2019

5. Brittain, M., & Wei, P. (2018). Autonomous aircraft sequencing and separation with hierarchical deep reinforcement learning. *Icrat*, (June). http://www.aere.iastate.edu/~pwei/proceedings/icrat18_autoATC.pdf

6. Balakrishna, P., Ganesan, R., & Sherry, L. (2010). Benefits assessment of NextGen technologies for the en route domain. Journal of Air Transport Management, 16(1), 46-52.

7. Endsley, M. R. (1999). Situation awareness in aviation systems. Handbook of Aviation Human Factors, 257-276.

8. Jung, Y., Hoang, T., Montoya, J., & Shively, R. (2017). A concept and evaluation of merging arrival aircraft using air traffic management automation. Journal of Aerospace Information Systems, 14(5), 238-251.

9. Kopardekar, P., Rhonda, W., & Prevost, T. (2016). Unmanned Aircraft System Traffic Management (UTM) Concept of Operations. AIAA Aviation Forum.

10. SESAR Joint Undertaking. (2020). SESAR Solutions Catalogue. SESAR Joint Undertaking.

11. [REFERENCES USED IN SOP]

12. Manal, A. (2019). ADSS: Automated Decision Support Systems. International Journal of Advanced Trends in Computer Science and Engineering, 231-237. https://doi.org/10.30534/ijatcse/2019/4281.12019

13. Some, L. (n.d.). Automated decision-making in project management. https://su.diva-portal.org/smash/get/diva2:1811458/FULLTEXT01.pdf

14. Langer, M., König, C. J., & Busch, V. (2020). Changing the means of managerial work: effects of automated decision support systems on personnel selection tasks. Journal of Business and Psychology, 36(5), 751–769. https://doi.org/10.1007/s10869-020-09711-6

15. Šmaižys, A. (n.d.). VILNIUS GEDIMINAS TECHNICAL UNIVERSITY A STUDY ON IMPLEMENTATION OF AUTOMATED DECISION PROCESS INTO THE INFORMATION SYSTEMS. Retrieved July 1, 2024, from https://vb.vgtu.lt/object/elaba:2077065/2077065.pdf