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## Role of human factors understanding to enhance aviation safety in Saudi Arabia under vision 2030

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### Abstract

This study is to look at how human factors can help improve aviation safety in Saudi Arabia, following the guidelines set by Vision 2030. The research adopts a qualitative and conceptual approach by using secondary data from aviation authorities, academic literature, industry reports, and relevant aviation safety guidelines. It also includes practical insights from aviation training management to understand how human factors influence safety performance. The study finds that human factors such as fatigue management, communication through Crew Resource Management (CRM), structured training, decision-making, situational awareness, and safety culture significantly influence aviation safety outcomes. Properly understanding and handling these factors can help reduce mistakes made by people and make work safer. Including human factors in aviation operations is crucial for enhancing safety, lowering risks, and aligning Saudi Arabia's aviation industry with global safety standards and the goals of Vision 2030. The study provides useful recommendations for aviation organizations in Saudi Arabia, including the implementation of structured human factor training, fatigue risk management systems, safety culture improvement, and continuous professional development for aviation personnel.

**Keywords:** Aviation Safety, Crew resource management, Human error, Human factors, Safety culture, Saudi Arabia, Training management, Vision 2030.

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### 1. Introduction

The global aviation industry is known around the world as one of the safest ways to travel; but keeping and improving safety standards is still a big task, especially in places where the aviation business is growing quickly. Saudi Arabia is making big changes in its aviation industry as part of Vision 2030, a major plan to boost the country's economy. The goal is to make Saudi Arabia a top global center for air travel and related services. This change involves building more airport facilities, handling more passengers, adding new airline companies, and updating the services related to flying. These

changes bring big chances for money and plans, but they also create tricky situations that require more attention to keeping airplanes safe.

A key part that affects airplane safety is understanding how humans behave and perform. Human factors involve understanding how people work, what they can and cannot do, and how they interact with complex systems, especially in situations where mistakes can have serious consequences, like in aviation. Even though aircraft technology and automation have improved a lot, human performance is still very important for keeping operations safe. Research indicates that aircraft malfunctions and accidents occur as a result of human error. Human error may arise due to fatigue, poor communication, wrong decision-making, and lack of situational awareness, among others. Therefore, knowledge and management of human factors are key elements in risk mitigation and improved safety.

As Saudi Arabia's aviation industry grows, the role of human factors becomes increasingly important. As the business grows bigger and the team becomes more varied and larger, it brings up fresh issues when it comes to teaching people, keeping everyone informed, and shaping the workplace environment. As aviation companies work to follow global safety rules, they are increasingly needing to include human factors ideas in their daily operations and training sessions. This integration helps meet global rules and encourages a forward-thinking way to handle safety.

From a practical point of view, managing training is very important for making sure human elements are included in how aviation operations are carried out. Training managers create and provide programs that help employees better understand how people perform tasks, handle mistakes, and follow safety procedures. Good training programs, like Crew Resource Management and Human Factors Training, have proven to really help people work better together, communicate more clearly, and make better decisions when things are tough. By matching training methods with human factors ideas, companies can help their employees gain the abilities and understanding needed to predict and deal with possible dangers.

Moreover, having a strong safety culture is very important for including human factors effectively. A good safety culture helps people talk openly, learn from mistakes, and report errors without being punished. In these kinds of work settings, workers are more likely to spot and fix possible safety problems before they turn into big accidents. For Saudi Arabia, building a strong safety culture is important for reaching the goals of Vision 2030, especially in creating an aviation industry that is both competitive and dependable on a global level.

Even though people understand how important human factors are, there is still a lack of regular use of human-centered methods in aviation companies in growing markets. In Saudi Arabia, although regulatory groups and aviation officials have made good progress in following international safety rules, more attention is needed on training people, raising awareness, and improving how organizations operate. To fix this issue, we need a full understanding of how human elements affect safety results and how they can be properly included in current systems.

This paper aims at finding out the effect that can be brought about by using human factor knowledge to enhance the safety of aircrafts in the Kingdom of Saudi Arabia. By analyzing concepts and combining them with practice-based knowledge in aviation training management, it will be possible to pinpoint areas of aviation safety where human factors might have a positive influence. The study also considers whether the measures taken to improve aviation safety align with the objectives set in the national strategy, Vision 2030.

To sum up, taking into account the development plans in Saudi Arabia and further expansion of the aviation sector in the country, there is no alternative for applying knowledge about human factors in aviation safety management.

## **2. Literature Review**

Human factors have been widely researched in the field of aviation owing to their great importance regarding the safety performance of any particular organization. The notion refers to the mental, psychological, and organizational factors affecting human performance within specific environments.

Among the first major contributions to the development of human factors theory, there can be mentioned the creation by James Reason of the so-called "Swiss cheese model." According to the theory, accidents happen when both latent failures associated with the functioning of an organization itself and active errors made by people involved happen to interact with each other. Thus, instead of blaming people for what happened, the theory promotes an approach that pays attention to such systemic issues as lack of training, poor communication, and ineffective processes within organizations.

Human error continues to be a major contributor to aviation accidents. Research studies carried out by the International Civil Aviation Organization and the Federal Aviation Administration show that human factors account for about 70% to 80% of all aviation accidents. The types of human errors that occur in aviation include skill-based errors, decision errors, and perceptual errors. Skill-based errors usually arise because of lack of concentration or poor performance in repetitive activities, decision errors emerge from faulty judgment or insufficient knowledge, and perceptual errors arise because of erroneous interpretation of sensory data, especially in difficult environments.

Training and competency building play a pivotal role in dealing with human factors in aviation. The concept of Crew Resource Management (CRM) has been found to be highly useful in human factor training. CRM aims at improving communication skills, leadership qualities, teamwork, and decision making among the flight crew and the operational staff. Evidence suggests that organizations that conduct training based on CRM have fewer cases of human error. In terms of training management, CRM can be incorporated in training programs in order to make employees prepared for tough situations.

Another key consideration for human factors in aviation is fatigue management. It has been found that fatigue has played an important role in impairing cognitive functions, reducing response time, and affecting decision-making capabilities. The International Air Transport Association highlights the significance of FRMS as a crucial part of the human

factor in aviation. This system includes using a data-driven approach to manage schedules, workload, and rest periods. Fatigue management becomes very important in fast-growing aviation industries like that in Saudi Arabia.

It is universally agreed upon that safety culture is one of the basic factors that play a crucial role in the improvement of aviation safety. Safety culture promotes open communication, constant learning, and proper management of risks. The European Union Aviation Safety Agency has claimed that companies with a strong safety culture enjoy high compliance and low occurrence of incidents. Some of the major attributes of a healthy safety culture are leadership commitment, employee engagement, and non-punitive reporting mechanisms.

In relation to Saudi Arabia, the development of the aviation industry is being witnessed with rapid pace due to Vision 2030. This vision seeks to develop the country economically while making it more connected with the rest of the world. In such a scenario, not only technical expertise becomes essential for workers engaged in aviation activities but also knowledge about human factors. Nevertheless, there exist some difficulties in the effective integration of human factors in the organization for emergent aviation industries as highlighted by the literature review.

Training managers play a crucial role in helping close the identified gap. Training programs should be developed by taking into account all important aspects that may affect employee training. In particular, simulation, scenario analysis, and evaluation are among the techniques that may increase the efficiency of training programs. Another key point to mention here is the need to adhere to international requirements in developing training courses. The latest research findings reveal that it is vital to combine human factors and technological developments.

Specifically, modern technology such as data analysis and artificial intelligence can help identify human mistakes before an accident occurs. Nevertheless, scientists stress that technology must always complement human skills and decision making. Only then will it be possible to achieve positive results.

To conclude, the body of literature highlights that human factors play an extremely crucial role in aviation safety. Human factor management, CRM and fatigue management techniques, as well as building a safety culture, are some of the approaches that can ensure improved safety outcomes. From the perspective of Saudi Arabia, it is very important to incorporate such practices in the process of realizing the goals set under Vision 2030. The knowledge gained through literature review offers great insight into exploring the application of human factors in aviation safety within Saudi Arabia.

### *2.1. Research Gap*

Even though many studies show that human factors are very important for safety in aviation, most of them look at aviation in general around the world, not specifically at the situation in Saudi Arabia. The ICAO stresses the importance of training on human factors and safety management systems to lower risks in operations [1] whereas the FAA focuses on research about human performance, how cockpits are designed, and ways to prevent mistakes in flying activities [2]. EASA also emphasizes safety culture, organizational responsibility, and non-punitive reporting systems as important factors for making aviation safer [3]. These views show that human factors are seen as very important for keeping aviation safe; but not much research has been done on how to use these ideas in practice within Saudi Arabia's quickly growing aviation industry, especially with the goals of Vision 2030.

Recent studies also highlight the increasing role of modern technology, artificial intelligence, human-machine interaction, and data-driven monitoring in aviation safety [4-10]. These developments show that aviation safety is no longer dependent only on technical systems, but also on how well human performance, training, fatigue, communication, and organizational culture are managed. Even though there has been some progress, there is still a noticeable lack of research on how human factors, training management, and safety culture come together in Saudi aviation organizations. So, this study looks at how understanding human factors can improve aviation safety in Saudi Arabia and help achieve the goals of the national aviation transformation outlined in Vision 2030.

## **3. Research Methodology**

The research design employed in this study is qualitative and conceptual. It aims to explore the influence of understanding human factors on improving aviation safety in Saudi Arabia from the perspective of Vision 2030. This methodology will ensure that theory and practice are both considered through the integration of scholarly work with practical knowledge in aviation training management. Given that human behavior is complex and dynamic, it is necessary that the methodology adopted be qualitative.

### *3.1. Research Design*

The study employs the exploratory and descriptive research design, aimed at assessing the influence of human factors on the safety performance in the aviation industry. An exploratory research design is suitable for situations where adequate literature regarding the study topic does not exist. For example, conducting an exploratory research regarding human factors in the aviation sector in Saudi Arabia is appropriate. Also, the study involves the descriptive approach in order to assess the current trends in safety management practices.

Primary data is not involved in the current study since surveys and experiments are not included. The study relies on a conceptual synthesis research method that involves secondary data and industry data analysis.

### *3.2. Data Sources*

The research is grounded on the use of secondary data sources, including:

- \* Reports published by international organizations of aviation (ICAO, IATA, FAA)
- \* Articles published in scientific journals on the subject of human factors in aviation safety

- \* A storehouse of data on case studies and aviation safety
  - \* Records pertaining to aviation industry studies and Saudi Vision 2030 policy
  - \* Guidelines for training programs and aviation operations
- Moreover, practical information drawn from professional experience as a Training Manager in the aviation industry will be included in the research process to increase the relevance of the research results.

### 3.3. Data Analysis Method

The study employs a thematic analysis technique to evaluate and interpret the collected information. Thematic analysis involves identifying, analyzing, and reporting patterns (themes) within data. This method is widely used in qualitative research, particularly in fields related to human behavior and organizational studies.

The analysis was conducted in the following stages:

#### 3.3.1. Data Familiarization

The relevant literature and reports were reviewed for an in-depth study of human factors in aviation.

#### 3.3.2. Identification of Themes

Some important themes have been identified through recurring topics in the literature. These include:

- \* Mistakes and limits of people
- \* Skills and training
- \* Managing the risk of fatigue
- \* Working together and talking about CRM
- \* Behavior and culture of safety in the workplace

#### 3.3.3. Grouping into Themes

The themes noted have been grouped under other themes to establish an association between human factors and safety outcomes.

#### 3.3.4. Interpretation and Synthesis

The results obtained were considered for the aviation sector in Saudi Arabia and its Vision 2030.

### 3.4. Conceptual Model

As part of the analysis process, the research proposes a conceptual model which outlines the interaction between the different aspects of human factors and aviation safety.

**Table 1.**  
Key Human Factors and Their Impact on Aviation Safety.

<b>Factor</b>	<b>Impact on Safety</b>
Training	Improves decision-making
Fatigue	Reduces alertness
CRM	Enhances teamwork
Culture	Improves reporting

**Table 2.**  
Common Human Factor Issues and Recommended Safety Solutions.

<b>Issue</b>	<b>Solution</b>
Human Error	CRM Training
Fatigue	FRMS
Miscommunication	SOPs

### 3.5. Justification of Methodology

The use of a qualitative and conceptual approach in this case is necessary due to the type of issue that is being addressed. Factors that influence humans are subjective aspects such as perception, cognition, and behavior, which cannot be addressed through the use of a quantitative approach. Besides, the use of professional experience will provide more depth and relevancy, making a link between theory and practice.

Moreover, this approach has been adopted in most literature that has been done on aviation safety where issues are concerned with humans; besides, it gives an opportunity for interpretation based on the socio-cultural environment of Saudi Arabia.

### 3.6. Reliability and Validity

For the research to be reliable and valid, the following measures will be taken:

- \* The data to be used will be gathered from reliable international agencies
- \* Triangulation of data will be achieved through using more than one data source
- \* Themes will be identified through the literature review process

\* Professional viewpoints will be adopted in validating the practicality

While there will be no statistical validation of the research, it will have high credibility due to the use of sound literature and professional practices.

### *3.7. Limitations of the Study*

Even though the study has many strengths, there are some limitations associated with it:

- \* Primary data collection was not done in this research, which may reduce empirical proof.
- \* Research findings are based on theoretical analysis only and can overlook some practical nuances.
- \* The study's geographical orientation may hinder the process of generalization.

On the positive side, these limitations are outweighed by thorough secondary data and expert opinion utilization.

## **4. Results and Discussion**

From the analyses conducted on the gathered data and literature on the industry, it is evident that human factors have an instrumental role in the results of aviation safety, especially in growing aviation industries like Saudi Arabia. The results are classified into thematic topics, including human error management, training, fatigue management, communications, and organizational safety culture, among others. These issues have a direct effect on operational safety and Vision 2030 goals.

### *4.1. Human Factors and Error Reduction*

The findings show that human error is still one of the most prominent causes of aviation accidents. Nevertheless, the study reveals that errors occur not only due to personal carelessness but rather because of deficiencies in the organizational system. Poor training, lack of clear instructions, and high levels of work load facilitate human mistakes. Using human factors theory, one can move away from responding to mistakes reactively toward creating an effective error management program. The latter involves recognizing problematic aspects, introducing preventive actions, and creating an open-to-error atmosphere. This will help decrease the frequency of accidents.

### *4.2. Effectiveness of Training and Competency Development*

Training becomes an important aspect that can improve human performance and minimize risk. Based on the findings, human factors training, especially those that include Crew Resource Management (CRM) program, directly influence decision-making skills, situation awareness, and cooperation. In terms of training management, use of realistic cases, simulators, and ongoing evaluation increases the efficiency of these training programs.

Given the current situation in Saudi Arabia, characterized by a diverse workforce and growing operations, organizations need customized training programs. According to the results, those companies and airlines that continuously invest in professional development and human factors training achieve better safety results and higher proficiency rates among employees.

### *4.3. Fatigue Management and Human Performance*

Fatigue is considered an important risk factor impacting the performance of humans in aviation operations. According to the research, fatigue is associated with reduced alertness, poor judgments, and slow reactions, thus threatening the safety of the operation. The use of Fatigue Risk Management Systems (FRMS) is found to be effective in reducing such risks.

In the case of Saudi Arabia, the increase in aviation activities, including long-haul flights, calls for an effective fatigue risk management system. The study has highlighted that organizations taking a more scientific approach in planning and managing their workload have more potential of performing optimally. In addition, the inclusion of fatigue knowledge in the training program makes employees more sensitive to the risks.

### *4.4. Communication and Team Coordination*

The ability to communicate effectively and work in teams is one of the key elements of aviation safety. One of the findings is that a lack of proper communication is one of the common causes for accidents. CRM training is proven to enhance interpersonal communication and conflict management skills.

It was discovered that organizations with established procedures for good communication perform better and make fewer mistakes in their operations. In particular, when it comes to the aviation industry in Saudi Arabia, which is characterized by multicultural environments, proper communication practices become especially important.

### *4.5. Safety Culture and Organizational Influence*

A strong safety culture is identified as one of the most influential factors in enhancing aviation safety. The findings suggest that organizations with a proactive safety culture—characterized by leadership commitment, transparency, and non-punitive reporting systems—demonstrate significantly better safety performance.

For Saudi Arabia, the development of an internationally competitive aviation industry will depend on moving away from conventional compliance practices to a holistic safety culture. It was discovered that if workers were allowed to freely express their concerns and participate in safety initiatives, companies would be better able to spot problems and take prompt action. Such a move will help attain the goal set out in Vision 2030.

#### **4.6. Integration of Human Factors with Vision 2030 Objectives**

The analysis also indicates that the inclusion of human factors is directly tied to the larger objectives set forth by Vision 2030 through the improvement of training processes, competency among employees, and the establishment of a safety-conscious organizational culture.

It can be concluded from the findings that human factors must not be considered separately from the rest of the strategies developed for aviation; rather, they are an essential component of the process. Organizational entities that incorporate human factors into their operations will find it easier to deal with issues brought about by the fast-paced growth of the industry.

#### **4.7. Overall Discussion**

On the whole, the analysis proves that an increased focus on human factors contributes substantially to aviation safety through consideration of both individual and organizational performance issues. Despite continuous advancement in technologies, humans remain at the core of safety issues.

In terms of Saudi Arabia, there is a need for consistent application of human factors practices throughout the entire aviation sector, which should be facilitated through training programs, safety culture development, and other measures. Training managers play a pivotal role in this case as their responsibility lies in applying theoretical knowledge to practice.

Concluding, the findings suggest that an integrated strategy toward human factors application, based on efficient training, proper safety culture development, and aligned with the goals of Vision 2030, can contribute to aviation safety significantly.

### **5. Conclusion**

In the scope of this paper, the importance of human factors knowledge in improving the safety levels within the dynamic industry of aviation in Saudi Arabia has been assessed within the framework of the Vision 2030 project. As the results show, human factors still continue being an important factor for determining safety performance at both individual and organizational levels regardless of the great progress in aviation technologies.

Among other things, this study has demonstrated that although the human mistake is traditionally regarded as one of the major causes of aviation accidents, its occurrence is mostly determined by organizational and systemic issues rather than personal reasons. For example, inadequate training, fatigue, communication errors, and lack of proper safety culture are some of the common reasons leading to higher risks of accidents in aviation.

One of the major conclusions drawn in this research is the importance of training and competency development as effective ways of addressing human risk factors in aviation. Through training, the skills of decision making and situational awareness may be enhanced greatly. At the same time, as far as Saudi Arabia continues developing its aviation industry, more attention should be paid to human factors training.

Additionally, the significance of establishing a safety culture that promotes openness, leadership involvement, and a non-punitive environment in reporting safety incidents cannot be overlooked from the results of the study. It will allow the firm to take a proactive step in addressing any safety hazards within the firm. Undeniably, this strategy is consistent with the Vision 2030 policy framework, emphasizing the relevance of human factors for sustainable development and competitiveness in the aviation sector.

In summary, the integration of human factors within the aviation industry in Saudi Arabia cannot simply be seen as a compliance matter. Rather, it should be understood as a strategy for improving aviation performance within the kingdom. Indeed, by focusing on human factors, developing a training model, and embracing safety culture, the aviation industry in Saudi Arabia will be able to improve its safety performance. Future studies may consider empirical validation using primary data analysis.

### **6. Recommendations**

According to the results of this research, there are some recommendations suggested for improving the role of human factors in aviation safety in Saudi Arabia. The purpose of these suggestions is to improve operational procedures, increase personnel competence, and establish a proactive attitude towards safety issues.

Firstly, aviation companies need to develop systematic training courses in human factors for all operational teams. In particular, CRM training, fatigue management, decision-making skills, and techniques of effective error management should be included. Simulation exercises and real-life case studies will significantly contribute to the understanding of human factors among aviation professionals.

Secondly, Fatigue Risk Management Systems (FRMS) need to be established and strengthened. In this context, an evidence-based approach may be used to evaluate the workload of employees, optimize their schedules, and provide sufficient rest time.

Thirdly, it is important for aviation regulators and organizations to pay attention to the cultivation of a sound safety culture. It can be realized through fostering non-punitive reporting mechanisms, advocating open communication, and demonstrating leadership support for safety. Workers need to feel safe when raising concerns and incidents, which will help organizations recognize underlying problems.

It is crucial to design training programs that meet the criteria set by the international bodies in aviation. The regulators need to enhance their supervision systems to make sure that human factors are implemented in all activities within the aviation industry.

Lastly, financial resources must be invested in conducting scientific research to integrate technology in the process of analyzing human behavior and training personnel.

With these measures in place, Saudi Arabia will develop an effective aviation safety framework that aligns with the goals of Vision 2030 and positions the country among the leaders in the aviation sector worldwide.

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