

Analysis of the Sriwijaya Air SJ-182 Accident Factors from the OSH Perspective.pdf

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Analysis of the Sriwijaya Air SJ-182 Accident Factors from the OSH Perspective

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Abstract

This study analyzes the causes of the Sriwijaya Air SJ-182 plane crash that occurred on January 9, 2021, in the Thousand Islands area, from the perspective of Occupational Safety and Health (OSH). This qualitative study employs a literature review method, utilizing data from official reports by the National Transportation Safety Committee (KNKT), academic journals, and credible media sources. The findings reveal that the accident resulted from a combination of technical factors, such as autothrottle failure; human factors, including the crew's unpreparedness to respond to malfunctions; and organizational factors, such as inadequate training and weak oversight. These findings indicate gaps in the implementation of OSH principles within the aviation sector. Therefore, this study highlights the importance of comprehensive OSH application in all aspects of flight operations. The proposed policy recommendations include enhancing crew training quality, conducting regular and thorough aircraft maintenance, and strengthening risk-based decision-making systems. The implementation of these measures is expected to prevent similar incidents in the future and to improve aviation safety standards in Indonesia.

Keywords:

Aviation safety, Sriwijaya Air, autothrottle, human error, OSH

INTRODUCTION

The aviation industry is one of the most vital transportation sectors, playing a strategic role in supporting the mobility of people and goods, while also driving both national and global economic growth. Its advantages in terms of speed and efficiency make air transport the preferred mode of travel, especially for business activities, tourism, and logistics distribution. In many countries, including Indonesia, the aviation industry is even considered an indicator of technological advancement and civilization. However, behind these advantages lies a high level of operational risk that demands a rigorous, comprehensive, and sustainable safety system. In this context, Occupational Safety and Health (OSH) is an essential aspect that cannot be overlooked in ensuring safe aviation operations, both for passengers and crew members.

The implementation of OSH in the aviation sector is not merely a normative or administrative obligation, but rather an integral part of quality and risk management systems that must be consistently applied. OSH covers a wide range of aspects, including intensive training for crew and technicians, periodic technical inspections, well-documented routine maintenance, and the management of psychosocial and ergonomic risks that may affect performance and focus during duty. Furthermore, fostering a strong safety culture is a fundamental element in promoting collective awareness and adherence to established procedures and operational standards (Noviar, 2025).

Globally, aviation safety has seen significant improvements due to international standardization by organizations such as the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA). Nevertheless, challenges remain, especially in developing countries that still face limitations in infrastructure, supervision, and risk management. In Indonesia, despite various regulatory and structural improvements, recurring aviation accidents indicate persistent gaps in the implementation of comprehensive safety systems, including those related to OSH.

Literature shows that aviation accidents are rarely caused by a single factor; rather, they result from a complex interaction of human error, extreme weather conditions, maintenance negligence, and technological failure (Mauidzoh, 2016). In this regard, a systemic approach is crucial to understanding how accidents can occur through the failure of multiple interconnected safeguards. The Swiss Cheese Model, developed by James Reason, is widely used to illustrate how errors can pass through several layers of defense, ultimately leading to an accident when the "holes" in each layer align (Reason, 2000; Prosyd Academy, 2024).

From a broader systems perspective, Leveson (2011) emphasizes that accidents often emerge not merely from component failures, but from inadequacies in the system's ability to control interactions and manage safety constraints. This view reinforces the need for aviation

safety systems to integrate hazard anticipation, control mechanisms, and systemic resilience into daily operations.

Moreover, organizational culture and bureaucracy play an equally important role. According to Dekker (2014), safety management often becomes overly bureaucratized, where compliance with formal procedures may overshadow adaptive learning, flexibility, and professional judgment. This bureaucratization can lead to a false sense of security while masking latent hazards that remain unaddressed within the organization (Saefullah et al., 2025).

The Sriwijaya Air SJ-182 plane crash on January 9, 2021, was a tragic event that drew public, regulatory, and international attention. The Boeing 737-500 aircraft, operating a Jakarta–Pontianak route, lost contact shortly after takeoff and was later confirmed to have crashed into the waters near the Thousand Islands, killing all 62 people on board. Beyond the national mourning, the incident reignited concerns about the resilience of Indonesia's aviation safety system. It raised questions about how well OSH measures had been applied and how effective they were in preventing systemic failure.

The investigation conducted by the National Transportation Safety Committee (KNKT) revealed that the crash was caused by a combination of technical failures involving the autothrottle system, crew inadequacy in responding to the malfunction, and weaknesses in training and operational oversight (Ishraqi, 2023). The report also pointed out that repeated technical issues had not been properly documented or addressed, indicating flaws in maintenance records and risk management practices. This illustrates that the failure did not stem solely from technical or human error, but from a broader systemic deficiency in hazard anticipation and mitigation.

In academic discourse, many studies on aviation accidents have primarily focused on either technical failures or human error in isolation (Saefullah et al., 2023). Few have adopted an Occupational Safety and Health perspective as a comprehensive and multidimensional approach, especially within the context of civil aviation in Indonesia. This represents a significant research gap that underpins the rationale of this study (Istiningsih & Zainuddin, 2024).

This study offers a novel perspective by positioning OSH as the central framework for evaluating the causes of the Sriwijaya Air SJ-182 accident. This approach not only examines technical failures and human error, but also investigates organizational policies, training system shortcomings, lack of safety audits, and non-compliance with standard procedures as critical components of the aviation safety system.

The novelty of this research lies in the comprehensive and systemic application of OSH in analyzing an aviation accident. By framing the analysis through an OSH lens, this study is able to explore managerial dimensions, organizational policies, and external supervision roles in shaping

a robust safety system. It bridges theory and practice, and aims to contribute to strengthening the safety culture within Indonesia's aviation industry.

Based on this background, the main objective of this research is to analyze the causes of the Sriwijaya Air SJ-182 accident from an Occupational Safety and Health perspective. The study specifically focuses on evaluating the implementation of OSH standards within the Indonesian aviation sector and identifying systemic weaknesses that contributed to the incident. The findings are expected to offer practical insights for improving aviation safety policies, enhancing risk management systems, and developing more effective training and supervision mechanisms in the future.

METHODS

This research employs a qualitative approach using the library research method to explore in depth the factors contributing to the crash of Sriwijaya Air SJ-182 from the perspective of Occupational Health and Safety (OHS). This approach was chosen because it allows the researcher to examine a wide range of documented and credible information relevant to the research topic, offering a contextual and comprehensive understanding of aviation safety failures.

The library research method involves the collection and analysis of data from various reliable and valid written sources. The primary sources of data include:

- Official investigation reports from the National Transportation Safety Committee (KNKT) concerning the Sriwijaya Air SJ-182 incident.
- Publications from international aviation organizations, such as the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA).
- Scientific journals accessed through academic databases such as ScienceDirect, SpringerLink, JSTOR, and ProQuest, which discuss OHS, human error, aviation risk management, and aircraft accident case studies.
- Trusted news articles from both national and international media to complement the chronological and factual narratives of the accident.

Data collection was carried out by selecting documents that met three key criteria: validity (source credibility), relevance (alignment with OHS focus), and recency (published between 2015–2024).

The data analysis tool used in this study is content analysis, a method of systematically identifying, categorizing, and interpreting the content of documents based on specific themes. The analysis process was conducted through the following stages:

1. Data reduction: Filtering relevant information from all sources into quotations or segments directly related to the causes of the crash and OHS elements.

2. Thematic categorization: The data were grouped into several main themes, including:
 - o Technical failure (specifically the autothrottle system)
 - o Human error
 - o Inadequate training and crew preparedness
 - o Risk management and safety culture
3. Data interpretation: Each theme was analyzed critically to identify patterns and cause-effect relationships, and to connect these findings to the underlying theoretical frameworks.

The primary theoretical framework employed in this study is ⁴ the Swiss Cheese Model, developed by James Reason. This model explains that accidents do not occur solely due to a single point of failure, but rather as a result of multiple layers of systemic weaknesses within an organization's safety defenses. Each layer has potential "holes" (vulnerabilities), and when these holes align, they create a pathway through which an accident can occur.

To strengthen the analysis of human error and organizational contribution to the accident, this study also incorporates ⁵ the Human Factors Analysis and Classification System (HFACS) developed by Wiegmann and Shappell (2003). HFACS ¹¹ provides a structured framework for analyzing the active failures, unsafe supervision, preconditions for unsafe acts, and organizational influences that collectively contribute to aviation incidents.

Additionally, the analysis is framed within the systems thinking approach proposed by Leveson (2011), which emphasizes that safety should be understood as a dynamic control problem, not merely the prevention of individual component failures. Leveson's model underscores the importance of analyzing how interactions among system elements, control structures, and feedback mechanisms influence safety outcomes. This integrated theoretical approach combining the Swiss Cheese Model, HFACS, and Leveson's systems thinking offers a multidimensional lens to understand how technical, human, and systemic organizational factors interact and contribute to aviation accidents.

This qualitative approach does not aim to produce generalizations but instead focuses on a contextual and reflective understanding of systemic failures in aviation safety. The findings of this analysis are expected to provide substantive contributions to the formulation of risk mitigation strategies, the improvement of competency-based training, and the development of more robust OHS-based safety management systems within Indonesia's aviation industry.

RESULT AND DISCUSSION

The official investigation by the National Transportation Safety Committee (KNKT) reveals that the crash of Sriwijaya Air flight SJ-182 resulted from a complex interaction of technical

failure, human error, and organizational system weaknesses (KNKT, 2022). A primary cause was the chronic malfunction of the autothrottle system, which had occurred more than 60 times since 2013 without receiving adequate corrective action (CNN Indonesia, 2022). The imbalance in thrust between the left and right engines caused the aircraft to experience extreme yaw, leading to a total loss of control (BBC Indonesia, 2022). Ironically, the Cruise Thrust Split Monitor (CTSM) system, which should have detected and corrected this imbalance, also failed to function. This finding illustrates how a technical failure contributed significantly to the accident.

From a human factors perspective, the flight crew did not respond effectively when the automatic system malfunctioned. This indicates a lack of training in handling emergency scenarios, especially upset recovery situations that require high manual control skills (Final Report SJY182, 2022). The over-reliance on automation without sufficient manual flying competencies exacerbated the situation, leading to a failure in mitigation during critical conditions. Prior studies, such as Helmreich et al. (1999), have emphasized that excessive dependence on automation can erode a crew's readiness to intervene manually.

More importantly, ¹⁸the root causes of human error often extend beyond the individual. As Li and Harris (2006) observed, pilot errors are frequently influenced by decisions made at higher levels of the organizational hierarchy, including resource allocation, operational policy, and leadership culture. This aligns with the HFACS framework (Wiegmann & Shappell, 2003), which classifies error not only at the operational level but also within supervisory practices, organizational influences, and unsafe preconditions. When applied to SJ-182, HFACS can help identify how systemic management flaws may have indirectly shaped crew behavior.

Organizationally, the failure in training systems and documentation was a key factor contributing to the managerial breakdown that led to this accident. The airline lacked a structured system to evaluate recurring technical issues and failed to integrate such feedback into a proactive risk management strategy (Priardanto, 2023). This reflects a deep-seated deficiency in safety oversight and organizational learning. Comparisons with similar investigations by the NTSB highlight how the absence of a feedback loop for recurring failures significantly increases accident probability.

In addition, the Swiss Cheese Model (Reason, 2000) explains that such an accident resulted from a series of latent failures within multiple layers of the safety system. From unreliable technology, weak oversight, to inadequate crew preparedness, the "holes" in each defense layer aligned to form a direct trajectory for failure (Handayani, 2025). Each of these gaps could have been prevented or mitigated had a robust safety system been in place.

From a Health, Safety, and Environment (HSE) perspective, this case also illustrates shortcomings in hazard identification, risk evaluation, and incident response. The airline's inability to recognize the criticality of repeated autothrottle failures highlights a weak system for safety data analysis and reporting (Synergy Solusi, 2025). As Leveson (2011) argues, safety management must go beyond component failures and instead focus on the adequacy of system-level control structures and feedback mechanisms that prevent error escalation.

Another critical weakness lies in the safety culture itself. A culture that fails to encourage open reporting or timely follow-up on safety concerns is inherently fragile. Dekker (2014) criticizes such environments as overly bureaucratic where compliance with procedures often masks deeper operational risks, and organizational learning is stifled by rigid rule-following rather than adaptive thinking.

Furthermore, effective safety management must integrate **non-technical skills (NTS) such as communication, teamwork, decision-making, and situational awareness**. As Flin et al. (2008) assert, these competencies are as vital as technical know-how, particularly during abnormal or high-stress situations. The SJ-182 incident revealed a potential lack of such preparedness, as the crew failed to communicate and coordinate effectively under pressure.

In response to these findings, there is an urgent need to embed systemic thinking and proactive management into aviation safety governance. This includes implementing a fully functional Safety Management System (SMS) that is predictive, evidence-based, and capable of managing organizational risk dynamics (Ishraqi, 2023). As Wiegmann et al. (2004) also emphasize, an effective SMS must operate across all organizational levels to identify risk precursors and close feedback loops. Additionally, adopting principles from High Reliability Organizations (HRO) such as preoccupation with failure, resilience, and sensitivity to frontline operations can enhance organizational robustness (Li & Harris, 2006). The implementation of scenario-based training, independent audits, and transparent incident reporting channels are vital steps to improving the system's adaptive capacity. These findings underscore the need for comprehensive reform in aviation safety governance. From enhancing flight crew training and decision-making skills to improving technical oversight and leadership accountability, all stakeholders must commit to embedding safety into every aspect of operations organizational, technical, and human (Tjiwidjaja, 2025).

CONCLUSION

This study aimed to analyze the root causes of the Sriwijaya Air SJ-182 accident through the lens of Occupational Safety and Health (OSH), with a focus on identifying systemic weaknesses in the Indonesian aviation sector. The findings reveal that the crash was not merely the result of

isolated technical or human error, but rather a consequence of multi-layered failures ranging from chronic autothrottle malfunction and inadequate crew response, to insufficient risk management, poor documentation, and organizational oversight. These findings are best explained by Reason's Swiss Cheese Model, which highlights how hazards can penetrate multiple defenses when latent conditions align. Additionally, the study reaffirms that organizational decisions at higher levels such as those affecting maintenance protocols, safety monitoring, and crew training significantly influence front-line errors. Furthermore, the absence of adaptive control mechanisms in the airline's safety system, underscores the need for a dynamic, system-wide approach to accident prevention.

Based on these insights, the study strongly recommends several policy measures. First, airlines must adopt comprehensive scenario-based training programs to improve crew readiness in handling automation failures and emergency situations. Second, the implementation of a proactive, risk-based Safety Management System (SMS) is essential to ensure that early warning signs, such as recurring technical faults, are promptly addressed. Third, independent safety audits and regular oversight must be institutionalized to detect and close gaps in operational safety. Lastly, a shift toward a just culture where reporting is encouraged and bureaucratic rigidity is minimized (Dekker, 2014) is critical in fostering organizational learning and resilience. Through these efforts, the Indonesian aviation industry can move toward a more sustainable and systemically safe future.

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