From Failure to Foresight: Leveraging Past Risks for Future Opportunities, A Systematic Integrative Review

FELIX N. IGBEGHE[1], OKONKWO OKWUDILI P.[2], EJOMARIE EWOMAZINO K.[3], OGHENEVWAIRE IYABO S.[4]

Department of Mechanical Engineering, Faculty of Engineering, University of Port Harcourt, Rivers State, Nigeria

Abstract- This study examines the critical role of failure in shaping and advancing proactive risk management strategies across various organizational and industrial contexts. Traditionally perceived as a consequence to be avoided, failure is increasingly recognized in the literature as a valuable source of insight for anticipating and mitigating future risks. By synthesizing findings from diverse fields including organizational theory, systems engineering, behavioral science, and enterprise risk management, this review explores how post-failure analyses contribute to the development of early warning systems, risk sensing capabilities, and adaptive governance models. The themes include the institutionalization of lessons learned, the function of near-miss reporting, and the role of psychological safety in encouraging transparent failure reporting. The study also discusses how failure-driven learning supports the transition from reactive to proactive risk cultures. Ultimately, this review highlights that embracing failure not only enhances organizational resilience but also fosters innovation in risk identification and response frameworks.

Keywords: Failure, Anticipating, Mitigating, Risks and Early Warning Systems.

I. INTRODUCTION

Safety experts consistently seek ‘leading’ indicators to help organizations identify and address threats before accidents occur. This goal is captured in the concept of proactive safety management. However, current analyses suggest that safety science and engineering still lack the necessary tools and measures to detect early warning signs of major failures. Effectively recognizing when operations approach critical safety limits remains a developing challenge, with calls for better foresight mechanisms often expressed more as aspirations than concrete action plans Woods (2009). Failure be it in the form of operational breakdowns, strategic missteps, system errors, or near-miss events has historically been regarded as a negative outcome to be minimized or concealed. Yet, a growing body of literature suggests that failure can serve as a rich source of information, providing unique insights into blind spots, systemic vulnerabilities, and emergent threats that are otherwise difficult to detect in stable operational conditions. As such, failure is increasingly recognized not merely as a trigger for reactive responses, but as a foundational element in the development of proactive risk management capabilities.

When firms adopt incremental IT improvements, they often gain temporary information advantages, creating an illusion of increased economic value based on past decisions referred to here as “starlight.” These gains boost stock prices, reflecting investor confidence in leadership. However, major disruptive forces like globalization and technological shifts occur unpredictably and are not sustainable like gradual IT improvements. Most executives struggle to fully comprehend these complex, chaotic changes due to cognitive limits, leading to fragmented responsibilities and organizational tension. As a result, firms often miss critical opportunities and may suffer economic losses during crises, struggling to recover from near-chaotic conditions Peterson (2002). Examining the dynamic environment, resilient leadership marked by adaptability, innovation, and emotional intelligence is essential for transforming challenges into opportunities for growth and sustainability. This paper emphasizes shifting mindsets to view failure not as an endpoint but as a valuable input that fosters resilience and drives proactive, forward-looking risk management strategies, Paul (2024).

In today’s volatile business environment, organizations must proactively manage risks to prevent corporate disasters and ensure long-term resilience. This study highlights the importance of enterprise risk management (ERM) in identifying, assessing, and mitigating risks, fostering a risk-aware culture, and strengthening an organization’s capacity to maintain financial stability and continuity during crises, Amuah (2023).

This study aims to explore how lessons derived from failure can be systematically harnessed to enhance organizational risk preparedness and foresight. It synthesizes interdisciplinary research across domains such as organizational learning, systems thinking, behavioral risk analysis, and enterprise risk management to uncover the mechanisms through which failure informs strategic resilience. Hence, investigate how failure-driven learning and post-failure analyses contribute to the development of proactive risk management capabilities, including early warning systems, risk sensing, and adaptive governance models across organizational contexts. The areas of focus include post-incident analysis, learning from near-misses, the psychology of failure acknowledgment, and the creation of feedback systems that transform short-term crises into long-term organizational learning.

II. LITERATURE

Wang et al. (2024) explored how employees' interpretations of promotion failure affect career proactivity. Using attribution theory and cognitive models, they surveyed 359 IT employees across three time points. Results showed that those attributing failure to internal factors engaged in reflective thinking, boosting proactive career behaviors and reducing inaction. Conversely, attributing failure to external causes led to rumination and reduced proactivity. While offering valuable insights into the cognitive effects of promotion failure, the study is limited by its industry-specific sample and self-reported measures, which may affect generalizability. Tam et al. (2016) investigated how personal cultural orientations influence customer attributions in intercultural service encounters. Using a conceptual model, they conducted scenario-based experiments with 640 Chinese and Western customers in a restaurant setting. Results showed that customers were more likely to blame service employees and firms for failures rather than themselves or cultural differences. Cultural orientations partially moderated these attribution patterns. The study suggests firms implement strategies like customer education programs to manage attributions. Limitations include reliance on experimental scenarios; future studies could use surveys or critical incident techniques.

2.1 Cross-Disciplinary Insights into Failure and Adaptive Responses

Jones et al. (2009) examined how different cognitive processing styles rumination vs. self-reflection interact with promotion goal failure to influence depressive symptoms. In a cross-sectional study, they found that individuals experiencing high levels of promotion goal failure reported more depressive symptoms if they also engaged in moderate to high rumination. However, for those high in self-reflection, failure did not significantly increase depressive symptoms. These findings suggest that self-reflection may buffer against the emotional impact of failure. The study's cross-sectional design limits causal conclusions, indicating a need for longitudinal research. Li et al. (2024) introduced a Digital Twin (DT)-driven proactive-reactive scheduling framework to address uncertainties in integrated port equipment scheduling. Targeting quay cranes, IGVs, and yard cranes, the framework responds to variables like equipment failures and route conflicts. A virtual port simulation based on real-world layouts evaluated its performance. Results showed the DT-driven approach reduced makespan by up to 19.56% and energy consumption by 3.67% in large-scale scenarios, with greater savings under higher uncertainty. While promising, the framework's real-world applicability needs further validation beyond simulations. Sensitivity analysis supports strategic equipment allocation decisions.

Shipley et al. (2022) provide an overview of failure analysis, emphasizing root-cause analysis (RCA) as a key engineering tool for improving product quality and preventing failures. The article defines failure at multiple levels and explores its relevance to quality assurance and user expectations. Equipment failures are categorized by root causes design, manufacturing/installation, service, and material each illustrated with examples. It outlines failure modes such as deformation, fracture, corrosion, and wear, and reviews analytical tools and RCA methods. While comprehensive, the article focuses on theory and examples, lacking empirical case studies for validation. Mo et al. (2024) investigated how after-hours supervisory ICT demands impact employee behavior, using attribution theory. Across two three-wave studies in China (N=397 and N=493), results showed that such demands increased proactive behavior via performance-promotion attributions, but also led to unethical behavior through self-serving attributions. Additionally, ICT centrality moderated these effects employees who viewed ICT as central to their work showed stronger links between ICT demands and proactive behavior. While insightful, the study's focus on Chinese firms and self-reported data may limit generalizability. The findings offer practical guidance on managing digital work boundaries.

2.2 Failure Prevention Through Engineering and Organizational Learning

Hopkins (2012) highlights the importance of learning from engineering failures particularly in pressure systems like oil and gas pipelines to prevent future incidents. Failures often result from deterioration, changing conditions, human error, and weak safety culture. The paper emphasizes that while technical threats are well-known, less attention is paid to management failures and organizational factors. It advocates for a broader view of "best practice," encompassing not only engineering but also staff competency and leadership. Limitations include its conceptual nature; future work could benefit from empirical validation of proposed safety improvements. Bourassa et al. (2016) examined the role of equipment failure in industrial accidents through a case study of a pulp and paper company's accident database. Analyzing 773 events, they found that 272 were linked to failures in machines, tools, or material handling equipment, with 13 resulting in direct human harm. The study identified failure types, causes, and their impact on accident severity. Findings underscore the critical role of equipment reliability in workplace safety. However, the study's focus on a single company limits generalizability to other industrial contexts.

Golabchi et al. (2025) developed a Safety Maturity Framework (SMF) to help construction organizations shift from reactive to proactive safety management. Addressing the limitations of lagging indicators, the SMF integrates safety leading indicators across five maturity stages, linking cultural evolution with measurable practices. Using a systematic literature review and interviews with safety professionals, the study identified leadership commitment, organizational learning, and workforce engagement as the enablers. Findings highlight the dynamic relationship between safety culture and leading indicators. While offering practical guidance, the framework's effectiveness requires further validation through longitudinal industry application. Roos et al. (2006) explore the role of guidelines, codes, and standards in ensuring the long-term safety and quality of mechanical systems, structures, and components (SSC) in nuclear power plants. The study emphasizes ageing management as a core component of lifetime management, requiring preventive maintenance and system-specific damage analysis. It highlights the importance of identifying degradation mechanisms and monitoring key parameters. Both continuous and periodic measures are recommended. While the paper outlines technical and organizational strategies for quality assurance, it is largely conceptual and lacks empirical validation or case studies.

2.3 Lifecycle Strategies for Risk and Equipment Management

Yakovenko et al. (2021) address lifecycle management challenges of modular equipment, focusing on unified units and assemblies amid rapid product obsolescence. Drawing on Ukrainian industrial practices, the study develops an expanded lifecycle model using CALS concepts and modern IT to optimize the use duration of modular components. A new design model for modular machine tools is proposed to extend equipment lifespan, reduce design and manufacturing costs, and support certification through information integration across lifecycle stages. The research emphasizes reengineering during restoration and modernization. However, practical implementation and performance evaluations of the model remain to be demonstrated. Gubaydulina et al. (2016) analyze key phases in the lifecycle of mechanical engineering products, proposing methods to enhance design, manufacturing, operation, and recycling. They emphasize the economic lifecycle, defined as minimizing combined consumer and producer costs, as crucial for organizing production. The study highlights the link between machine design and manufacturing to maximize company profit. Recycling is framed as a feedback phase, making the product lifecycle a self-organizing system. While offering foundational principles, the paper is conceptual and suggests these could underpin automated Product Lifecycle Management (PLM) systems, pending further practical development.

Dimova (2023) addresses Plant Life Extension (PLEX) challenges for aging nuclear power plants, focusing on Bulgaria's regulatory gaps. The paper presents a methodology to assess lifetime characteristics of NPP components, aligning with PLEX stages. This approach includes equipment classification, identification of major material degradation mechanisms, assessment of degradation effects, control methods for ageing, and evaluation methodologies. While offering a structured framework for managing long-term operation, the study is primarily methodological and lacks empirical validation across diverse plant conditions. Further application is needed to confirm its effectiveness in real-world settings. Sumrit and Keeratibhubordee (2025) address risk management in the plastic recycling supply chain by proposing an integrated framework combining SWARA and QFD within a Fermatean fuzzy set approach. They identified 11 risk factors and 8 proactive mitigation strategies through literature and expert input. Using a Thai plastic packaging waste recycler as a case study, the framework prioritized risks and linked them to strategies, aiding managers in decision-making. While effective in this context, broader validation across different recycling sectors is needed to confirm the framework's generalizability and impact on business performance.

III. METHODOLOGY

This study employs an integrative, interdisciplinary literature review to examine how failure both technical and organizational can be leveraged to enhance proactive risk management across complex systems. Drawing from empirical and conceptual contributions in organizational theory, systems engineering, behavioral science, and enterprise risk management, the review synthesizes findings from ten peer-reviewed studies published between 2006 and 2025. These sources were selected for their relevance to failure analysis, safety improvement, and resilience-building in high-risk and technologically. intensive industries, such as nuclear energy, construction, manufacturing, and ICT-enabled workplaces.

The methodology includes thematic analysis, organizing insights under two primary domains: (1) integrating lessons from failures for safety and resilience, and (2) proactive lifecycle and risk management for sustainable resilience. Within these domains, the study compares approaches ranging from root-cause analysis and lifecycle modeling to behavioral attribution and digital risk frameworks. Attention is given to both validated empirical findings and conceptual models to highlight the complementary roles of technical and non-technical insights. Through this structured synthesis, the study identifies the mechanisms such as institutional learning, early warning systems, and risk culture transformation that support the shift from reactive to foresight-driven risk strategies.

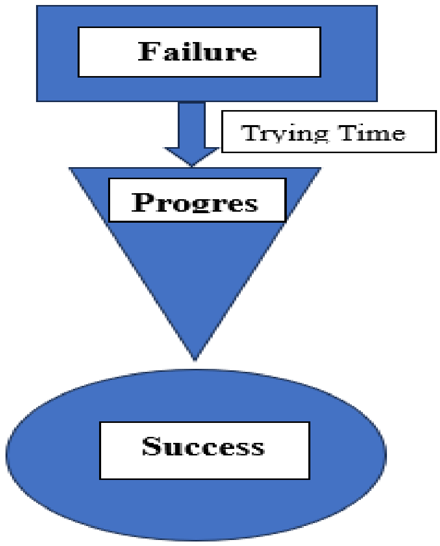

Figure 1: Failure as a Proactive Step Toward Sustainable Success

Failure, when viewed through the lens of leveraging past risks, is not just a setback but a valuable source of insight and learning. It reveals vulnerabilities and gaps, offering opportunities to rethink strategies and innovate. By analyzing failures, individuals and organizations can proactively adapt, improve safety, and enhance performance. This reframing transforms failure into a catalyst for growth and resilience, enabling future risks to be managed more effectively. Ultimately, failure becomes a strategic tool to drive continuous improvement and unlock new opportunities for success.

Progress involves the continuous advancement made by learning from past risks and failures. It reflects an organizations or individual's ability to adapt, innovate, and improve processes based on previous challenges. By systematically analyzing failures, progress is achieved through enhanced decision-making, proactive risk management, and strengthened resilience. This ongoing development transforms setbacks into stepping stones, allowing for safer, more effective strategies and improved performance. Progress, therefore, represents the forward momentum gained by turning lessons from past risks into valuable opportunities for growth and future success. While Success is the outcome of effectively transforming past risks and failures into learning experiences that drive innovation and resilience. It reflects an organizations or individual's ability to proactively adapt and improve by addressing vulnerabilities revealed through failure. By leveraging these insights, success is achieved not just by avoiding repeated mistakes but by using risks as catalysts for growth, enhanced safety, and better performance. Ultimately, success emerges when setbacks are reframed as strategic opportunities that enable sustained progress and long-term value creation.

IV. RESULTS AND FINDING

Shipley et al. (2022) and Mo et al. (2024) offer complementary insights into leveraging past risks for future opportunities. Shipley et al. (2022) focus on technical failures, using root-cause analysis to categorize equipment failures and improve engineering quality. Although theoretical, their work supports proactive design and systematic learning from failure. Mo et al. (2024) examine behavioral risks, showing that after-hours ICT demands can drive both proactive and unethical behaviors, depending on employee attributions. Their empirical findings highlight the need for balanced digital management. Together, these studies underscore the value of addressing both technical and organizational failures to build resilient, forward-looking systems.

4.1 Integrating Lessons from Failures for Safety and Resilience

These four studies offer multidisciplinary insights into how past failures can inform future safety, resilience, and innovation. Hopkins (2012) emphasizes learning from engineering failures in high-risk systems like oil and gas pipelines, highlighting that technical threats are well understood, but organizational and management failures often go under-addressed. Bourassa et al. (2016) provide empirical support through a case study of industrial accidents, showing that equipment reliability is critical for preventing harm, though their single-company focus limits generalizability. Golabchi et al. (2025) take a forward-looking approach by introducing a Safety Maturity Framework (SMF) to guide construction organizations toward proactive safety culture using leading indicators, leadership engagement, and organizational learning. Meanwhile, Roos et al. (2006) stress the importance of lifecycle-based ageing management for long-term system integrity in nuclear facilities, although their work remains largely conceptual. Together, these studies reinforce that both technical and non-technical failures offer valuable lessons. By integrating empirical insights with conceptual models, organizations can move beyond reactive risk management to develop foresight-driven strategies that improve safety, optimize performance, and enhance long-term resilience.

4.2 Proactive Lifecycle and Risk Management for Sustainable Resilience

These studies explore how lifecycle management, risk mitigation, and system longevity can be improved through proactive frameworks. Yakovenko et al. (2021) address modular equipment obsolescence by proposing a digitally integrated lifecycle model to extend equipment use and reduce costs, though real-world implementation remains untested. Gubaydulina et al. (2016) take a conceptual approach to mechanical product lifecycle management, emphasizing cost-efficiency and recycling as a feedback mechanism, envisioning a self-organizing, automated system. Dimova (2023) presents a structured methodology for extending the operational life of nuclear power plants, focusing on ageing components and regulatory challenges, though practical validation across varied plant contexts is still needed. Sumrit and Keeratibhubordee (2025) shift to supply chain risk, using fuzzy logic-based tools to develop a decision-support framework for risk prioritization and mitigation in the plastic recycling sector. Together, these studies highlight that leveraging past failures whether technical obsolescence, lifecycle inefficiencies, or supply chain vulnerabilities requires structured, forward-looking models. By emphasizing integration, digitalization, and proactive assessment, they collectively promote long-term resilience, sustainability, and strategic foresight across engineering and industrial domains.

CONCLUSION

In conclusion, the collective insights from these studies underscore the critical importance of learning from both technical and organizational failures to foster resilience and innovation. A foundational framework encourages systematic identification and mitigation of equipment failures, supporting proactive engineering design. Complementing this, research reveals the nuanced behavioral risks associated with digital work demands, highlighting the need for balanced management of human factors. Further studies emphasize integrating empirical evidence with conceptual models to move beyond reactive risk management toward foresight-driven safety cultures and lifecycle management. Others demonstrate the value of digital integration, lifecycle optimization, and risk prioritization frameworks. Together, these multidisciplinary approaches advocate for a holistic, proactive stance that transforms past failures into strategic opportunities, enhancing long-term system safety, sustainability, and performance across diverse industries.

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