

**Translating AI-Enabled Hazard Detection into Governance Decision-Making:
From Operational Safety Systems to Board-Level Risk Oversight**

Dr. Robb Shawe

Capitol Technology University, Department of Occupational Health & Safety, 11301 Springfield
Road, Laurel, MD, USA

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Abstract

This research examines how AI-enabled hazard-detection systems, particularly YOLO-based computer-vision technologies, can be translated from operational safety tools into strategic governance instruments for organizational decision-making. Building on the AI-Augmented Safety Governance Model (AASGM) and its associated maturity framework, the study explores how real-time hazard-detection data can be transformed into board-level risk indicators to inform capital allocation, risk management, and oversight priorities. The paper introduces a governance translation framework that bridges technical outputs with executive decision-making processes, emphasizing the role of human oversight, accountability, and regulatory alignment. The findings demonstrate that the effectiveness of AI-enabled safety systems depends not only on detection performance but also on the ability to translate technical insights into actionable governance information. The study advances Safety 4.0 by linking operational safety technologies to strategic leadership and policy decision-making.

Keywords: AI governance; risk oversight; board-level decision-making; AASGM; Safety 4.0; hazard detection; organizational governance

1. Introduction

The integration of artificial intelligence (AI) into occupational safety systems has primarily focused on improving hazard detection and operational safety performance. Technologies such as YOLO-based computer vision systems enable real-time monitoring and rapid identification of unsafe conditions, significantly enhancing detection accuracy and response time (Bourou et al., 2023; Nath et al., 2020).

However, the value of these systems extends beyond operational improvements. AI-enabled hazard detection generates large volumes of real-time data that can inform strategic-level organizational decision-making. Despite this potential, most organizations lack structured mechanisms for translating technical safety data into governance-relevant insights.

This gap limits the ability of executive leadership and boards of directors to leverage AI-enabled safety systems in risk oversight and strategic planning. The paper addresses this gap by introducing a **governance translation framework** that connects operational AI outputs with board-level decision-making processes.

The study contributes to a broader research program advancing the AI-Augmented Safety Governance Model (AASGM) by translating technical, human, and governance insights into executive-level decision-making frameworks. Building on prior analyses of system performance, socio-technical integration, regulatory alignment, comparative variability, and maturity-based implementation, this research examines how organizational leaders can leverage AI-enabled hazard-detection systems to inform strategic planning, risk management, and institutional oversight. By situating AI-enabled safety systems within an executive governance context, this study provides a structured approach for aligning technological capabilities with organizational objectives, regulatory responsibilities, and long-term safety outcomes.

Furthermore, the research represents the culmination of prior studies within this coordinated research series by synthesizing empirical findings, governance frameworks, and implementation models into a strategic perspective that supports executive oversight, policy integration, and organizational decision-making at the highest levels.

This manuscript is part of the Shawe Series, a coordinated research program examining artificial intelligence-enabled hazard detection, socio-technical safety integration, and governance frameworks in regulated workplace environments. The series advances the AI-Augmented Safety Governance Model (AASGM) as a unifying framework linking real-time detection technologies, human oversight, regulatory compliance, and organizational decision-making.

2. From Operational Data to Strategic Insight

AI-enabled hazard detection systems generate multiple data types, including detection-accuracy metrics, time-to-detection indicators, PPE-compliance rates, and incident-precursor indicators. While these metrics are valuable at the operational level, they are not inherently structured for executive decision-making. Boards and senior leadership require translated indicators such as risk exposure levels, compliance trends, operational vulnerabilities, and resource allocation priorities. These translation processes align with established enterprise risk management and governance frameworks that emphasize transforming technical risk data into decision-relevant information for executive oversight and strategic planning. The challenge lies in converting technical outputs into governance-relevant information.

Enterprise risk management frameworks such as COSO (2017), governance-oriented risk analysis approaches (Power, 2007), and strategic risk-management models emphasizing organizational uncertainty and oversight (Kaplan & Mikes, 2012) further reinforce the importance of translating technical operational data into executive-level decision-support information.

2.1 Methodological Approach

This study employs a qualitative governance-analysis approach grounded in socio-technical systems theory and the AI-Augmented Safety Governance Model (AASGM). The analysis synthesizes findings from prior studies within the Shawe Series, including research related to AI-enabled hazard-detection performance, socio-technical integration, governance frameworks, regulatory alignment, cross-sector implementation variability, and organizational maturity modeling.

The study further incorporates governance-oriented analysis of enterprise risk management frameworks, executive oversight structures, and strategic decision-making processes to examine how AI-generated operational safety data can be translated into governance-relevant indicators for board-level risk oversight. This integrative analytical approach supports the development of a governance translation framework that links operational AI outputs to executive-level organizational decision-making.

Recent research on AI governance, intelligent monitoring systems, and data-driven organizational oversight further suggests that AI-enabled technologies increasingly influence strategic risk management and executive decision-making processes. Emerging studies on Safety 4.0, adaptive governance systems, and AI-assisted organizational analytics indicate that the value of AI extends beyond operational automation to include strategic forecasting, institutional resilience, and governance optimization (Yousif et al., 2024). These developments reinforce the need for structured governance frameworks that translate technical outputs into decision-relevant information for executive leadership and board-level oversight. These governance-oriented approaches are also consistent with broader cybersecurity and risk-management frameworks emphasizing adaptive governance, institutional resilience, and continuous organizational oversight in complex technological environments (NIST, 2024).

3. Governance Translation Framework

The proposed framework builds on the AASGM and introduces a structured process for translating AI-generated data into governance insights.

To illustrate how AI-generated hazard-detection data can be systematically transformed into governance-relevant insights for executive decision-making, Figure 1 presents a governance translation framework that links operational detection outputs to board-level risk indicators. The framework highlights the processes through which technical performance data are interpreted, contextualized, and integrated into strategic decision-making structures.

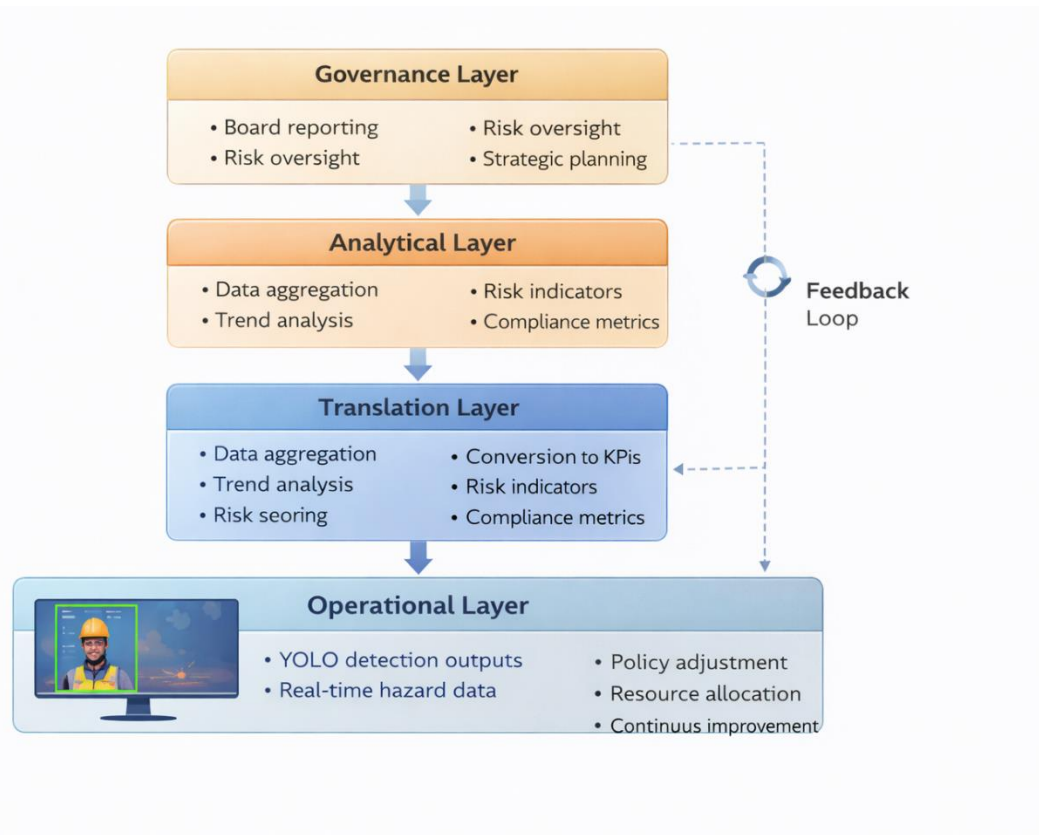
The governance translation framework provides a structured mechanism for converting AI-generated hazard detection outputs into strategic decision-making inputs, enabling organizations to align operational safety data with executive-level risk oversight and governance processes.

Consider a manufacturing organization implementing AI-enabled hazard-detection systems across multiple production facilities. Operational safety systems continuously generate data related to PPE violations, equipment proximity hazards, incident precursors, and environmental safety risks. Within the proposed governance translation framework, these operational outputs are aggregated into executive-level risk indicators that identify emerging compliance trends, operational vulnerabilities, and resource-allocation priorities.

Executive leadership and board-level oversight structures may utilize these translated indicators to support strategic decision-making related to workforce safety investments, compliance monitoring, operational risk management, and long-term safety governance planning. In this context, AI-enabled hazard-detection systems function not only as operational safety tools but also as strategic governance instruments that inform institutional oversight and organizational resilience strategies.

Figure 1

Governance translation framework for AI-enabled hazard detection systems



Note. Author created. The framework illustrates how operational AI-generated data are transformed into governance-relevant indicators that support board-level risk oversight and strategic decision-making.

As illustrated in Figure 1, translating AI-enabled hazard-detection data into governance-relevant insights requires a structured process that integrates technical analysis with organizational context and decision-making frameworks. The model demonstrates that AI's effectiveness in occupational safety extends beyond detection performance to encompass its ability to inform strategic governance, risk oversight, and resource allocation. This translation process reinforces the AASGM's role as a bridge between operational safety systems and executive decision-making structures. This perspective is also consistent with human-factors research emphasizing the importance of aligning technological systems with organizational decision-making structures and human oversight mechanisms (Wickens et al., 2015).

4. Discussion

The findings of this study highlight the importance of integrating AI-enabled safety systems into governance structures. While operational improvements are significant, the broader value of AI lies in its ability to inform strategic decision-making.

The effectiveness of AI-enabled safety systems ultimately depends on the organization's ability to translate technical outputs into governance-relevant insights that inform risk prioritization, resource allocation, and strategic decision-making.

The governance translation framework provides a pathway for organizations to leverage AI-generated data in risk oversight and policy development. This approach aligns with broader trends in data-driven governance and supports the evolution of Safety 4.0.

Beyond operational and governance considerations, these findings have direct implications for executive leadership and strategic decision-making. The integration of AI-enabled hazard-detection systems into organizational safety practices requires leaders to align technological capabilities with broader institutional objectives, risk-management strategies, and regulatory responsibilities. Executive oversight plays a critical role in ensuring that AI-driven safety initiatives are effectively governed, resourced, and integrated into long-term organizational planning. Within the AI-Augmented Safety Governance Model (AASGM), these results demonstrate how safety data can be elevated from operational insights to strategic intelligence, enabling informed decision-making at the highest levels of organizational leadership.

From a practical perspective, the proposed governance translation framework may support organizations in integrating AI-generated safety intelligence into enterprise risk management processes, strategic planning initiatives, and executive oversight structures. By converting operational hazard-detection outputs into governance-oriented indicators, organizations may improve board-level visibility into safety performance trends, compliance exposure, and

emerging operational risks. This capability may further support proactive decision-making related to resource allocation, workforce protection strategies, regulatory preparedness, and long-term organizational resilience.

5. Limitations

This study is subject to several limitations. First, the analysis of executive-level decision-making and the strategic integration of AI-enabled safety systems is based on conceptual synthesis and prior findings. It may not fully capture the variability in leadership practices across different organizational contexts. Second, the implementation of AI-driven safety governance at the executive level may be influenced by factors such as organizational size, resource availability, leadership priorities, and institutional culture, which may limit the generalizability of the findings. Third, the rapidly evolving nature of artificial intelligence technologies and regulatory environments introduces uncertainty regarding long-term strategic planning and governance structures. Future research should examine empirical applications of executive-level AI governance, including case-based analysis, cross-sector leadership strategies, and the effectiveness of strategic decision-making frameworks in diverse organizational settings.

6. Conclusion

This study demonstrates that AI-enabled hazard detection systems can function as strategic governance instruments when operational outputs are effectively translated into decision-relevant information for executive leadership and board-level oversight. The proposed governance translation framework extends the AI-Augmented Safety Governance Model (AASGM) by connecting operational safety analytics with enterprise risk management, strategic planning, and institutional decision-making processes.

Unlike traditional operational safety systems that primarily support incident detection and compliance monitoring, the proposed framework positions AI-enabled safety technologies as governance-oriented tools capable of informing organizational resilience, resource-allocation strategies, and long-term safety governance planning. By integrating technological performance with executive oversight structures, the framework advances Safety 4.0 by aligning operational intelligence, governance accountability, and strategic organizational decision-making.

Future research should focus on empirical validation of executive-level AI governance frameworks, including cross-sector implementation analysis, leadership adoption patterns, and the effectiveness of governance-oriented AI translation systems in supporting organizational oversight and institutional resilience.

Conflict of Interest Statement

The author declares no conflicts of interest related to the research, analysis, or preparation of this manuscript. No external funding, sponsorship, or commercial support was received for this

study. All interpretations and conclusions reflect the author's independent scholarly judgment and professional expertise.

Originality Statement

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