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Toward a Governance Maturity Model (GMM): A Capability-Based Framework for Adaptive, AI-Enabled Governance Systems

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Abstract

Governance systems across sectors vary widely in their ability to integrate artificial intelligence, real-time monitoring, and adaptive oversight. While advanced organizations increasingly rely on continuous sensing, data-driven decision-support, and event-validated learning, many institutions remain anchored in reactive, compliance-centric governance models. This manuscript introduces the Governance Maturity Model (GMM), a five-level capability framework that evaluates an organization's readiness to implement adaptive, AI-enabled governance systems. The GMM extends the Adaptive Governance Systems Framework (AGSF) and the AI-Enabled Governance Oversight Model (AIGOM) by defining progressive stages of governance capability—from reactive oversight to fully adaptive, intelligence-augmented governance ecosystems. The GMM further establishes governance maturity as a dynamic institutional capability involving governance observability, operational intelligence integration, adaptive recalibration, and cross-domain governance coordination within complex socio-technical environments. The model provides a structured pathway for organizations seeking to modernize governance practices, strengthen accountability, and align oversight mechanisms with the demands of complex, dynamic risk environments.

Keywords: governance maturity; adaptive governance; AI-enabled oversight; capability development; socio-technical systems; governance modernization; organizational readiness

1. Introduction

Governance systems differ significantly in their ability to integrate artificial intelligence, real-time sensing, and adaptive oversight. Some organizations operate with advanced, intelligence-augmented governance structures, while others rely on periodic audits, manual monitoring, and static compliance frameworks (Power, 2007; Rasmussen, 1997). As AI becomes embedded in cyber-physical systems, enterprise operations, and regulatory environments, governance maturity becomes a critical determinant of institutional resilience and accountability (Kaplan & Mikes, 2012; National Institute of Standards and Technology [NIST], 2023).

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Governance maturity, therefore, extends beyond technological adoption alone. It reflects the institutional capacity to generate decision-support intelligence synthesis, sustain operational observability, integrate AI-enabled oversight, recalibrate governance assumptions, and coordinate adaptive decision-making across interconnected operational ecosystems (Dekker, 2011; Endsley, 2017; Woods, 2018).

This manuscript introduces the **Governance Maturity Model (GMM)**, a capability-based framework that defines progressive stages of governance development. The GMM extends the Adaptive Governance Systems Framework (AGSF) (Shawe, 2026) and the AI-Enabled Governance Oversight Model (AIGOM) by providing a structured pathway for organizations to evolve from reactive oversight to adaptive, AI-enabled governance ecosystems.

1.1 Methodological Orientation

This manuscript employs a conceptual, integrative methodology grounded in governance capability synthesis, comparative maturity model analysis, adaptive governance architecture development, and the integration of interdisciplinary socio-technical frameworks (Jabareen, 2009; Torraco, 2005). The Governance Maturity Model (GMM) was developed through structured evaluation of governance maturity theory, adaptive governance frameworks, resilience engineering, operational intelligence systems, human-AI teaming literature, and governance modernization models across critical infrastructure, healthcare, finance, and public administration environments.

Rather than functioning as an empirical maturity assessment study, the manuscript operationalizes a governance capability evolution synthesis approach designed to establish a structured institutional progression architecture for adaptive, AI-enabled governance modernization within interconnected cyber-physical ecosystems. The framework integrates recurring governance capability principles associated with operational observability, decision-support intelligence synthesis integration, adaptive oversight, validation-recalibration capacity, organizational learning, and institutional resilience into a unified governance maturity architecture capable of supporting progressive governance transformation across complex socio-technical environments (Meadows, 2008; von Bertalanffy, 1968).

Sources were selected for their relevance to governance maturity, adaptive governance, socio-technical systems theory, resilience engineering, organizational learning, human-AI teaming, operational intelligence systems, and governance modernization in complex operational environments. Priority was given to peer-reviewed journal articles, foundational theoretical works, government and regulatory frameworks, governance capability models, and contemporary literature addressing institutional transformation across healthcare, finance, critical infrastructure, public administration, and cyber-physical systems.

The synthesis process employed a comparative capability analysis approach to identify recurring governance characteristics associated with increasing levels of institutional maturity. Literature

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from multiple disciplinary domains was examined to identify common governance functions related to operational observability, adaptive oversight, organizational learning, decision-support integration, validation-recalibration mechanisms, and resilience development. Particular attention was given to governance capabilities that consistently distinguished high-performing adaptive organizations from institutions operating primarily through reactive or compliance-oriented oversight structures.

The Governance Maturity Model (GMM) emerged from integrating recurring patterns of governance capability identified in the reviewed literature. Comparative analysis revealed a progressive evolution in governance characteristics, from reactive oversight and limited information integration to adaptive governance ecosystems characterized by continuous learning, AI-enabled oversight, institutional resilience, and cross-domain coordination. These recurring capability patterns subsequently informed the development of the five maturity levels comprising the Governance Maturity Model. They established the conceptual foundation for the governance evolution architecture presented in the following sections.

The resulting framework conceptualizes governance maturity as a dynamic institutional capability rather than a static administrative benchmark. By organizing governance development into progressive maturity stages, the model provides a structured pathway for organizations to evaluate governance readiness, identify capability gaps, and support long-term governance modernization initiatives in increasingly complex socio-technical environments.

2. Results of Governance Capability Synthesis

2.1 Emergent Governance Capability Themes

The comparative capability synthesis identified five recurring governance characteristics that are consistently represented across the governance maturity literature, adaptive governance scholarship, resilience engineering, socio-technical systems theory, organizational learning research, and human-AI teaming studies (Carayon et al., 2015; Hollnagel, 2014; Leveson, 2011; Woods, 2018). Although terminology varied across disciplines and operational environments, substantial conceptual convergence emerged regarding the institutional capabilities associated with progressively higher levels of governance maturity.

The first recurring characteristic involved the transition from reactive oversight toward structured operational awareness supported by increasing levels of information integration. The second characteristic emphasized the progressive incorporation of digital decision-support capabilities and AI-enabled monitoring systems into governance processes. The third characteristic involved developing cross-functional governance coordination mechanisms to support integrated oversight across organizational domains. The fourth characteristic reflected the emergence of predictive and anticipatory governance capabilities supported by continuous sensing, adaptive learning, and governance recalibration processes. The fifth characteristic

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emphasized institutional resilience, cross-domain coordination, and continuous adaptation of governance as defining features of highly mature governance systems.

Collectively, these themes appeared consistently across the reviewed literature and suggest that governance maturity is best understood as a progressive institutional capability-development process rather than a static compliance condition or administrative benchmark.

2.2 Governance Maturity Progression Outcome

The identification of these recurring governance capability patterns informed the development of the Governance Maturity Model (GMM). The synthesis revealed a consistent progression from fragmented, compliance-oriented governance structures toward adaptive governance ecosystems characterized by continuous learning, AI-enabled oversight, operational observability, and institutional resilience.

The resulting framework organizes governance capability development into five progressive maturity levels: Reactive Governance, Assisted Oversight, Integrated Governance Systems, Proactive Governance, and Adaptive Governance Ecosystem. Each level represents an increase in governance observability, organizational learning capacity, adaptive oversight capability, decision-support integration, and institutional resilience.

These findings provide the conceptual foundation for the Governance Maturity Model presented in the following sections and establish the basis for evaluating governance modernization readiness across diverse organizational and operational environments.

The recurring governance capability patterns identified through the synthesis process provide the theoretical foundation for the GMM and establish the basis for the governance evolution architecture described in the following sections.

3. Theoretical Foundations of the GMM

3.1 Socio-Technical Systems Theory

Governance capability emerges from the interaction of human, organizational, and technological subsystems (Carayon et al., 2015).

3.2 Human-AI Teaming

Effective governance requires calibrated trust, shared control, and transparent AI-enabled decision-support (Lee & See, 2004; Wickens et al., 2015).

3.3 Resilience Engineering

Mature governance systems adapt to disruptions, learn from events, and evolve (Hollnagel, 2014).

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3.4 Adaptive Governance

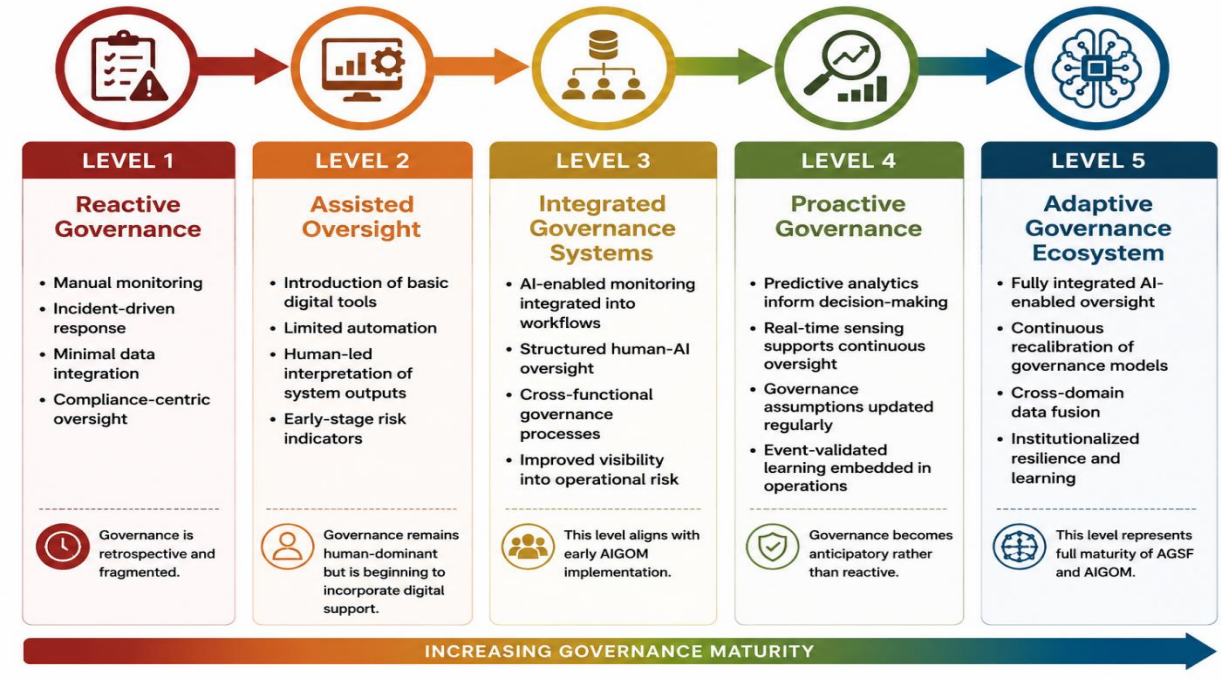
The GMM operationalizes AGSF by defining capability stages that support adaptive oversight (Shawe, 2026). Collectively, these theoretical foundations support the reconceptualization of governance maturity as an adaptive institutional intelligence capability in which governance observability, human-AI coordination, validation-recalibration processes, and organizational learning evolve progressively across interconnected socio-technical ecosystems (Leveson, 2011; Meadows, 2008).

4. Governance Maturity Model (GMM)

Building upon the constitutional governance architecture established through the Adaptive Governance Systems Framework (AGSF) and the operational intelligence architecture operationalized through the AI-Enabled Governance Oversight Model (AIGOM), the Governance Maturity Model (GMM) establishes a progressive governance evolution architecture that defines how organizations advance from reactive oversight toward adaptive, intelligence-augmented governance ecosystems (Leveson, 2011; Dekker, 2011). Figure 1 illustrates the five progressive stages of governance maturity and the evolution of governance observability, adaptive oversight capability, decision-support intelligence synthesis integration, and institutional resilience across interconnected socio-technical environments.

Figure 1

Governance Maturity Model (GMM)



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Note. Author created. The figure illustrates five progressive levels of governance capability, ranging from reactive oversight to fully adaptive, AI-enabled governance ecosystems.

As illustrated in Figure 1, governance maturity emerges through the progressive integration of governance observability, AI-enabled oversight, decision-support intelligence synthesis generation, validation-recalibration capability, and adaptive organizational learning that collectively transform governance systems from fragmented compliance structures into fully adaptive governance ecosystems capable of continuous oversight, institutional resilience, and evidence-driven governance modernization across complex operational environments.

The GMM comprises five progressive stages of governance evolution that collectively represent increasing levels of governance observability, adaptive oversight capability, governance-relevant insight synthesis integration, institutional resilience, and operational governance maturity.

Importantly, the GMM does not conceptualize governance maturity as a linear progression of compliance. Rather, the framework positions governance maturity as an evolving institutional capability characterized by increasing levels of governance observability, adaptive oversight, organizational learning, and the integration of resilience. This perspective distinguishes the GMM from traditional maturity models that primarily evaluate procedural compliance or administrative controls and do not explicitly address the development of adaptive governance capability.

4.1 Level 1 — Reactive Governance

Characteristics:

- Manual monitoring
- Incident-driven response
- Minimal data integration
- Compliance-centric oversight

Governance is retrospective and fragmented.

4.2 Level 2 — Assisted Oversight

Characteristics:

- Introduction of basic digital tools
- Limited automation
- Human-led interpretation of system outputs
- Early-stage risk indicators

Governance remains human-dominant but is beginning to incorporate digital support.

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4.3 Level 3 — Integrated Governance Systems

Characteristics:

- AI-enabled monitoring integrated into workflows
- Structured human-AI oversight
- Cross-functional governance processes
- Improved visibility into operational risk

This level aligns with early AIGOM implementation. Governance systems at this stage begin to transition from fragmented oversight structures to integrated, governance-relevant insight-synthesis ecosystems that support coordinated operational observability and adaptive oversight processes (Shneiderman, 2022; Woods, 2018).

4.4 Level 4 — Proactive Governance

Characteristics:

- Predictive analytics inform decision-making
- Real-time sensing supports continuous oversight
- Governance assumptions updated regularly
- Event-validated learning embedded in operations

Governance becomes anticipatory rather than reactive.

4.5 Level 5 — Adaptive Governance Ecosystem

Characteristics:

- Fully integrated AI-enabled oversight
- Continuous recalibration of governance models
- Cross-domain data fusion
- Institutionalized resilience and learning
- Governance-relevant insight synthesis orchestration
- Continuous governance observability
- Adaptive cross-domain coordination

This level represents the institutional convergence of AGSF constitutional governance architecture and AIGOM operational intelligence integration within a fully adaptive governance ecosystem (Argyris & Schön, 1978; Senge, 2006).

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5. Cross-Sector Applicability of the GMM

The GMM provides a scalable governance evolution architecture that supports institutional transformation across critical infrastructure, healthcare, finance, public administration, and other complex governance ecosystems operating amid technological acceleration and operational uncertainty (Perrow, 1984; Woods, 2018).

5.1 Critical Infrastructure

Supports real-time monitoring of grid stability, transportation networks, and water systems (NIST, 2024).

5.2 Healthcare

Enhances clinical governance, patient safety oversight, and operational risk management (Carayon et al., 2015).

5.3 Finance

Improves fraud detection, risk modeling, and regulatory compliance (Kaplan & Mikes, 2012).

5.4 Public Administration

Enables responsive policy implementation and oversight of service delivery (Wachter et al., 2017).

5.5 Illustrative Governance Maturity Progression Scenario

To illustrate the operational progression of the GMM, consider a regional healthcare network transitioning from fragmented compliance oversight toward adaptive AI-enabled governance integration. At Level 1 (Reactive Governance), patient safety oversight primarily relies on retrospective incident reporting, manual audits, and delayed compliance reviews.

As the organization advances toward Level 2 (Assisted Oversight), digital monitoring tools and basic analytics begin supporting operational awareness and early-stage anomaly detection. At Level 3 (Integrated Governance Systems), AI-enabled monitoring architectures become integrated across clinical workflows, operational risk management systems, and governance coordination processes, enabling structured human-AI oversight and improved operational observability.

At Level 4 (Proactive Governance), predictive analytics, continuous telemetry integration, and event-validated learning mechanisms support anticipatory governance intervention and adaptive recalibration of oversight protocols. Finally, at Level 5 (Adaptive Governance Ecosystem), governance systems operate through fully integrated AI-enabled governance intelligence

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architectures capable of continuous sensing, adaptive oversight coordination, institutional learning, and cross-domain resilience orchestration across interconnected healthcare ecosystems. This progression demonstrates how the GMM operationalizes the evolution of institutional governance from fragmented oversight structures toward adaptive governance ecosystems capable of sustaining continuous operational observability, governance-relevant insight synthesis integration, and evidence-driven resilience modernization.

6. Implications for Governance Modernization

The GMM enables organizations to evaluate readiness for governance transformation, identify institutional capability gaps, and strategically align governance modernization initiatives with adaptive oversight, governance-relevant insight synthesis integration, and long-term operational resilience objectives.

6.1 Strategic Planning

The GMM provides a roadmap for developing governance capabilities.

6.2 Resource Allocation

Organizations can target investments based on maturity gaps.

6.3 Regulatory Alignment

The model supports compliance with emerging AI governance standards.

6.4 Organizational Resilience

Higher maturity levels correlate with improved adaptability and risk mitigation.

6.5 Governance Implementation Implications

The GMM provides organizations with a structured roadmap for governance modernization that supports progressive institutional transformation from reactive oversight to adaptive, intelligence-driven governance ecosystems (Organisation for Economic Co-operation and Development [OECD], 2024; World Economic Forum, 2023). Executive leadership may utilize the framework to evaluate governance readiness, identify institutional capability gaps, prioritize governance modernization investments, and align governance transformation strategies with organizational resilience objectives.

Regulators and governance authorities may apply the GMM to evaluate organizational governance maturity, strengthen adaptive oversight capability, improve governance observability, and support evidence-driven governance modernization initiatives across AI-enabled operational environments (OECD, 2024).

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Operational governance teams may use the framework to coordinate cross-domain governance integration, strengthen synchronization of governance intelligence, improve validation-recalibration processes, and institutionalize adaptive organizational learning mechanisms that support continuous resilience modernization across interconnected socio-technical ecosystems.

7. Discussion

7.1 Theoretical Implications

The Governance Maturity Model (GMM) contributes to governance scholarship by reconceptualizing governance maturity as a dynamic institutional capability rather than a static compliance benchmark. Traditional governance assessments frequently emphasize regulatory adherence, policy conformance, and administrative controls. In contrast, the GMM positions governance maturity as an evolutionary process characterized by increasing levels of governance observability, adaptive oversight capability, organizational learning, operational intelligence integration, and institutional resilience.

The framework further extends adaptive governance theory, resilience engineering, socio-technical systems theory, and human-AI teaming research by demonstrating how governance systems evolve from reactive oversight structures toward adaptive governance ecosystems capable of continuous sensing, validation, recalibration, and evidence-informed decision-making (Carayon et al., 2015; Hollnagel, 2014; Leveson, 2011).

The increasing emphasis on governance resilience, anticipatory regulation, adaptive oversight, and responsible AI integration within contemporary governance scholarship further reinforces the need for governance architectures capable of continuous learning, dynamic adaptation, and evidence-informed institutional decision-making (National Institute of Standards and Technology [NIST], 2024; Organisation for Economic Co-operation and Development [OECD], 2024; World Economic Forum, 2023).

7.2 Governance Transition Challenges

Although the GMM's progression framework offers a structured pathway for governance modernization, organizations may encounter significant transition challenges as they advance through maturity levels. Common barriers include resource limitations, workforce resistance to change, insufficient governance expertise, fragmented information systems, inadequate leadership support, and organizational cultures that remain heavily oriented toward compliance-based oversight.

Successful governance modernization therefore requires not only technological investment but also institutional commitment to organizational learning, adaptive leadership, cross-functional coordination, and long-term governance capability development.

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7.3 Stakeholder Implications

The implications of governance maturity differ across stakeholder groups. Executive leadership may utilize the GMM to guide governance modernization strategy and resource prioritization. Regulators may employ maturity assessments to evaluate organizational readiness for adaptive oversight models. Operational governance teams may use the framework to identify capability gaps, coordinate governance integration efforts, and strengthen resilience-building activities. Technology leaders may apply the model to align AI-enabled governance capabilities with broader organizational objectives and accountability requirements.

7.4 Limitations and Future Research

This manuscript presents a conceptual maturity-model framework and does not include empirical maturity assessments, longitudinal implementation studies, simulation-based validation, or sector-specific benchmarking analyses. Although the framework is grounded in interdisciplinary governance scholarship and comparative capability synthesis, its operational effectiveness remains to be evaluated.

Future research should examine governance maturity indicators, maturity-transition thresholds, governance performance metrics, and organizational outcomes associated with progression through the five maturity levels. Additional studies may explore sector-specific maturity assessment instruments, implementation barriers, governance capability benchmarking approaches, and comparative validation against existing governance and maturity frameworks.
Particular attention should also be given to developing quantitative governance maturity indicators, maturity-transition measurement criteria, and sector-specific benchmarking instruments capable of supporting empirical validation of governance capability progression across diverse organizational environments.

8. Conclusion

The Governance Maturity Model (GMM) advances governance scholarship by providing a structured capability-development framework through which organizations can evaluate, strengthen, and progressively modernize governance systems operating within increasingly complex socio-technical environments. By defining five progressive stages of governance maturity, the framework establishes a practical pathway for organizations seeking to improve governance observability, adaptive oversight capability, organizational learning, and institutional resilience.

The model contributes to governance modernization research by conceptualizing governance maturity as a dynamic institutional capability rather than a static compliance benchmark. This perspective supports the evolution of governance systems beyond reactive oversight toward adaptive, evidence-informed governance architectures capable of continuous learning and cross-domain coordination.

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Although conceptual in nature, the GMM provides a foundation for future empirical validation, maturity-assessment development, implementation studies, and comparative organizational evaluations. Future research should examine governance maturity indicators, transition thresholds, and organizational outcomes associated with progression across the five maturity levels within diverse operational settings.

References

Argyris, C., & Schön, D. A. (1978). *Organizational learning: A theory of action perspective*. Addison-Wesley.

Carayon, P. (2006). Human factors of complex sociotechnical systems. *Applied Ergonomics, 37*(4), 525–535.

Carayon, P., Schoofs Hundt, A., Karsh, B. T., Gurses, A. P., Alvarado, C. J., Smith, M., & Flatley Brennan, P. (2006). Work system design for patient safety: The SEIPS model. *Quality and Safety in Health Care, 15*(Suppl. 1), i50–i58. https://doi.org/10.1136/qshc.2005.015842

Committee of Sponsoring Organizations of the Treadway Commission. (2017). *Enterprise risk management: Integrating with strategy and performance*.

Dekker, S. (2011). *Drift into failure: From hunting broken components to understanding complex systems*. Ashgate Publishing.

Endsley, M. R. (2017). From here to autonomy: Lessons learned from human-automation research. *Human Factors, 59*(1), 5–27. https://doi.org/10.1177/0018720816681350

Hollnagel, E. (2014). *Safety-I and Safety-II: The past and future of safety management*. Ashgate.

Jabareen, Y. (2009). Building a conceptual framework: Philosophy, definitions, and procedure. *International Journal of Qualitative Methods, 8*(4), 49–62. https://doi.org/10.1177/160940690900800406

Kaplan, R. S., & Mikes, A. (2012). Managing risks: A new framework. *Harvard Business Review, 90*(6), 48–60.

Lee, J. D., & See, K. A. (2004). Trust in automation: Designing for appropriate reliance. *Human Factors, 46*(1), 50–80.

Leveson, N. G. (2011). *Engineering a safer world: Systems thinking applied to safety*. MIT Press.

Meadows, D. H. (2008). *Thinking in systems: A primer*. Chelsea Green Publishing.

National Institute of Standards and Technology. (2023). *Artificial intelligence risk management framework (AI RMF 1.0).* U.S. Department of Commerce. https://doi.org/10.6028/NIST.AI.100-1

National Institute of Standards and Technology. (2024). *The NIST Cybersecurity Framework (CSF) 2.0.* U.S. Department of Commerce. https://doi.org/10.6028/NIST.CSWP.29

Occupational Safety and Health Administration. (2024). *Occupational safety and health standards (29 CFR Part 1910).* U.S. Department of Labor.

Organisation for Economic Co-operation and Development. (2024). *Framework for anticipatory governance of emerging technologies*. OECD Publishing.

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Perrow, C. (1984). *Normal accidents: Living with high-risk technologies*. Princeton University Press.

Power, M. (2007). *Organized uncertainty: Designing a world of risk management*. Oxford University Press.

Rasmussen, J. (1997). Risk management in a dynamic society: A modelling problem. *Safety Science, 27*(2–3), 183–213.

Reason, J. (1997). *Managing the risks of organizational accidents*. Ashgate.

Senge, P. M. (2006). *The fifth discipline: The art and practice of the learning organization* (Rev. ed.). Doubleday.

Shawe, R. (2026). *From probabilistic compliance to event-validated resilience*. International Journal of Advanced Engineering and Management Research.

Shneiderman, B. (2022). *Human-centered AI*. Oxford University Press.

Torraco, R. J. (2005). Writing integrative literature reviews: Guidelines and examples. *Human Resource Development Review, 4*(3), 356–367. https://doi.org/10.1177/1534484305278283

von Bertalanffy, L. (1968). *General system theory: Foundations, development, applications*. George Braziller.

Wachter, S., Mittelstadt, B., & Floridi, L. (2017). Why a right to explanation of automated decision-making does not exist in the General Data Protection Regulation. *International Data Privacy Law, 7*(2), 76–99. https://doi.org/10.1093/idpl/ipx005

Wickens, C. D., Lee, J. D., Liu, Y., & Gordon-Becker, S. (2015). *An introduction to human factors engineering* (2nd ed.). Pearson.

Woods, D. D. (2018). The theory of graceful extensibility: Basic rules that govern adaptive systems. *Environment Systems and Decisions, 38*(4), 433–457. https://doi.org/10.1007/s10669-018-9708-3

World Economic Forum. (2023). *The Global Risks Report 2023* (18th ed.). World Economic Forum.

Yousif, A., Al-Dahoud, A., & Al-Momani, A. (2024). Safety 4.0: The role of artificial intelligence in occupational safety systems. *Safety Science, 170*, 106356.