International Journal of Computational Research in Science and Technology
E-ISSN: 3108-0871, Volume 2 Issue 2
Mar-Apr 2026, PP 01-18

A Systematic Evidence Mapping of Enterprise Data Governance Programs in Regulated Industries

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Abstract. Enterprise data governance has become a strategic capability for organizations operating in regulated industries, where ensuring data quality, security, privacy, transparency, and regulatory compliance is essential for effective business operations and risk management. The rapid adoption of cloud computing, big data platforms, artificial intelligence, and distributed enterprise systems has significantly increased the complexity of managing data assets across heterogeneous environments, creating a growing need for comprehensive governance programs. This study presents a systematic evidence mapping of enterprise data governance programs in regulated industries to synthesize existing research, identify prevailing governance frameworks, implementation strategies, technological enablers, and research gaps. The evidence mapping categorizes published studies according to governance objectives, regulatory compliance, metadata management, data stewardship, master data management, data quality, risk management, audit readiness, governance maturity, and supporting technologies such as data lineage, cloud platforms, automation, and artificial intelligence. The analysis reveals that effective enterprise data governance programs are characterized by strong executive sponsorship, clearly defined governance structures, standardized policies, automated metadata management, continuous data quality monitoring, robust compliance mechanisms, and cross-functional collaboration among business and technical stakeholders. Furthermore, the study highlights the increasing adoption of AI-enabled governance, intelligent metadata discovery, policy automation, and real-time compliance monitoring to improve operational efficiency and regulatory responsiveness. Despite these advancements, several challenges persist, including fragmented governance practices, inconsistent metadata standards, interoperability issues, organizational resistance, scalability limitations, and the absence of universally accepted governance maturity models. The evidence mapping also identifies promising future research directions involving autonomous governance frameworks, explainable artificial intelligence, knowledge graph–based governance, intelligent compliance automation, and continuous audit readiness. Overall, this study provides researchers, practitioners, and policymakers with a comprehensive overview of the current landscape of enterprise data governance programs and offers valuable insights for developing resilient, scalable, and technol-

ogy-driven governance frameworks that strengthen regulatory compliance, improve organizational accountability, enhance audit readiness, and support sustainable enterprise data management.

Keywords: Enterprise Data Governance, Data Governance Programs, Data Governance Frameworks, Systematic Evidence Mapping, Evidence Mapping Study, Systematic Literature Review, Regulated Industries, Regulatory Compliance, Regulatory Governance, Information Governance, Data Management, Enterprise Information Management, Enterprise Data Architecture, Data Stewardship, Data Ownership, Data Accountability, Data Policy Management, Data Standards, Data Lifecycle Management, Metadata Management, Metadata Repository, Metadata Governance, Master Data Management (MDM), Reference Data Management, Data Catalog, Business Glossary, Data Classification, Data Lineage, Data Provenance, Data Traceability, Data Quality Management, Data Integrity, Data Consistency, Data Accuracy, Data Validation, Data Profiling, Data Monitoring, Data Discovery, Data Integration, Enterprise Architecture, Business Process Governance, Digital Transformation, Governance Maturity, Governance Models, Governance Frameworks, Risk Management, Enterprise Risk Management, Compliance Management, Audit Readiness, Audit Trail, Internal Controls, Corporate Governance, Information Security, Data Privacy, Data Protection, Cybersecurity Governance, Access Control, Identity and Access Management (IAM), Role-Based Access Control (RBAC), Policy Enforcement, Data Security, Sensitive Data Management, Privacy Regulations, GDPR, HIPAA, SOX, PCI DSS, Basel III, BCBS 239, ISO 27001, ISO 8000, DAMA-DMBOK, Data Compliance, Cloud Governance, Hybrid Cloud, Multi-Cloud, Data Lake Governance, Data Warehouse Governance, Big Data Governance, Artificial Intelligence, Machine Learning, AI Governance, Responsible AI, Explainable AI (XAI), Intelligent Automation, Process Automation, Knowledge Graphs, Semantic Metadata, Graph Databases, Business Intelligence, Analytics Governance, Decision Support Systems, Continuous Compliance Monitoring, Continuous Auditing, Enterprise Data Strategy, Digital Governance, Organizational Governance, Governance Best Practices, Governance Maturity Assessment, Evidence Synthesis, Research Mapping, Enterprise Systems, Information Systems, Data Transparency, Operational Resilience, Organizational Accountability, Data Trustworthiness, Enterprise Compliance, Data-Centric Governance, Enterprise Digital Ecosystems.

I. Introduction

Background

Data has become one of the most valuable strategic assets for modern enterprises, enabling organizations to drive innovation, optimize operations, enhance customer experiences, and support evidence-based decision-making. Organizations operating in regulated industries such as banking, healthcare, insurance, pharmaceuticals, telecommunications, energy, and government generate enormous volumes of structured and unstructured data every day. The rapid expansion of cloud computing, big data platforms, Internet of Things (IoT), artificial intelligence (AI), and distributed enterprise applications has significantly increased both the volume and complexity of enterprise information.

As a result, ensuring that organizational data remains accurate, secure, compliant, and trustworthy has become a critical business objective. Enterprise data governance programs provide the policies, standards, roles, technologies, and processes necessary to

manage data as a strategic organizational asset while supporting regulatory compliance and operational excellence.

Despite substantial investments in governance initiatives, many organizations continue to experience challenges related to fragmented governance practices, inconsistent metadata, poor data quality, limited accountability, and evolving regulatory requirements.

Enterprise Data Governance

Enterprise data governance refers to the coordinated management of organizational data through standardized policies, governance structures, business rules, accountability mechanisms, and technological controls. Its primary objective is to ensure that enterprise data remains accurate, consistent, secure, accessible, and compliant throughout its lifecycle. Governance programs establish clear ownership responsibilities, define data standards, monitor data quality, and support collaboration between business units, information technology teams, compliance officers, and executive leadership.

A mature governance program enables organizations to improve decision-making, reduce operational risks, strengthen regulatory compliance, enhance business intelligence capabilities, and maximize the overall value of enterprise information assets.

Regulated Industries and Governance Requirements

Organizations operating within regulated sectors must comply with numerous national and international regulations governing information security, privacy, financial reporting, healthcare records, cybersecurity, and consumer protection. Regulations such as the General Data Protection Regulation (GDPR), Health Insurance Portability and Accountability Act (HIPAA), Sarbanes–Oxley Act (SOX), Payment Card Industry Data Security Standard (PCI DSS), Basel III, BCBS 239, and ISO governance standards require organizations to maintain transparent, secure, and auditable information management practices.

Meeting these regulatory obligations requires governance programs capable of providing complete visibility into enterprise data assets, supporting data lineage, maintaining audit trails, enforcing access controls, and continuously monitoring compliance across distributed information systems.

Motivation for Systematic Evidence Mapping

Although enterprise data governance has attracted considerable research attention over the past decade, existing studies are distributed across multiple research domains, including information systems, computer science, enterprise architecture, business management, and regulatory compliance. This fragmentation makes it difficult for researchers and practitioners to obtain a comprehensive understanding of governance frameworks, implementation methodologies, technological advancements, and emerging research trends.

Systematic evidence mapping provides a structured research methodology for categorizing, synthesizing, and analyzing existing literature. Unlike traditional literature reviews, evidence mapping emphasizes research classification, publication trends, governance themes, industry coverage, technological adoption, and research gaps, thereby providing a broad overview of the knowledge landscape.

II. Fundamentals of Enterprise Data Governance

Definition and Objectives

Enterprise data governance is a collection of organizational policies, governance structures, decision rights, standards, and operational procedures designed to manage enterprise information throughout its lifecycle. Governance ensures that data remains reliable, secure, compliant, and aligned with business objectives.

The primary objectives include:

- Improving data quality
- Enhancing regulatory compliance
- Protecting sensitive information
- Increasing organizational accountability
- Standardizing enterprise data
- Supporting digital transformation
- Improving business intelligence
- Reducing enterprise risk

These objectives collectively enable organizations to establish trust in enterprise information while supporting sustainable business growth.

Components of Enterprise Data Governance

A successful governance program consists of multiple interconnected components that collectively ensure effective enterprise information management.

Data Stewardship

Data stewards are responsible for maintaining data quality, resolving governance issues, approving business definitions, and coordinating governance activities across departments. Their role bridges business operations and technical implementation while ensuring organizational accountability.

Data Ownership

Clearly defined ownership establishes responsibility for enterprise information assets. Data owners determine access permissions, approve governance policies, authorize data usage, and ensure compliance with applicable regulations.

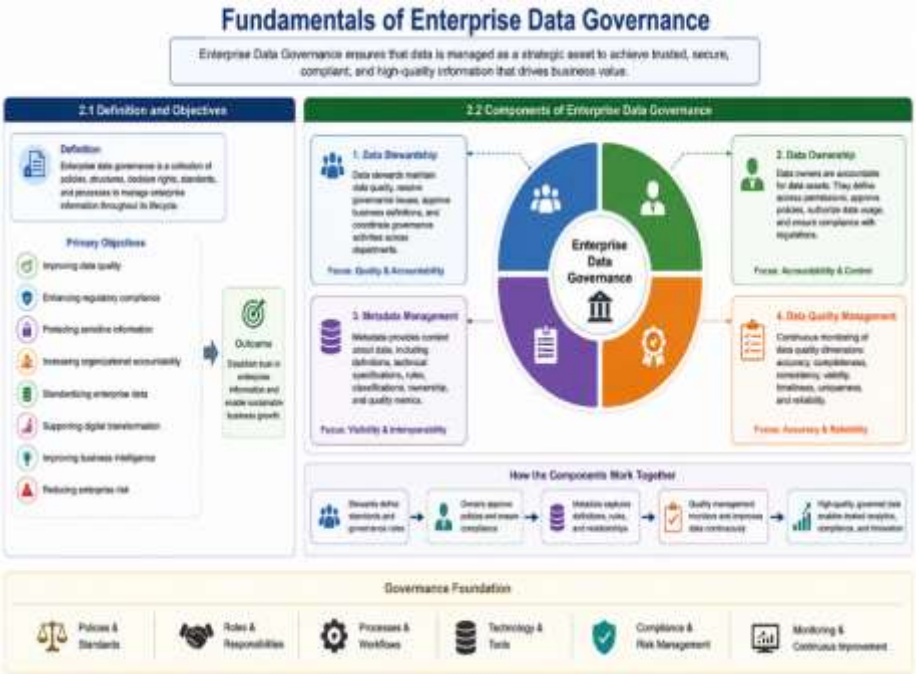
Metadata Management

Metadata serves as descriptive information about enterprise data, including business definitions, technical specifications, transformation rules, classifications, ownership

details, and quality metrics. Effective metadata management enhances data discovery, interoperability, and governance efficiency.

Data Quality Management

Governance programs continuously monitor data quality dimensions such as accuracy, completeness, consistency, validity, timeliness, uniqueness, and reliability. Automated quality monitoring enables organizations to identify inconsistencies before they affect business operations.



III. Governance Frameworks in Regulated Industries

Governance Architecture

Enterprise governance architecture defines the organizational structure supporting governance implementation. It specifies governance committees, executive sponsors, data councils, stewardship teams, metadata repositories, compliance units, and operational workflows.

A governance architecture establishes standardized communication channels, decision-making processes, policy enforcement mechanisms, and continuous monitoring procedures that ensure governance objectives are consistently achieved across the enterprise.

Policy Management

Governance policies define organizational expectations regarding data creation, classification, storage, sharing, retention, access, security, and disposal. Effective policy

management ensures that all stakeholders understand their responsibilities while enabling consistent implementation throughout enterprise systems.

Policy repositories provide centralized access to governance documentation, regulatory requirements, and organizational standards, thereby improving compliance and reducing ambiguity.

Governance Maturity Models

Governance maturity models enable organizations to assess their governance capabilities across multiple dimensions, including leadership, policies, stewardship, metadata, technology, compliance, and organizational culture.

Typical maturity stages include:

- Initial
- Managed
- Defined
- Quantitatively Managed
- Optimized

Organizations use maturity assessments to identify improvement opportunities and prioritize governance investments.

IV. Evidence Mapping Methodology

Research Objectives

The primary objective of this evidence mapping study is to systematically classify published research on enterprise data governance programs in regulated industries. The study investigates governance frameworks, implementation approaches, regulatory compliance strategies, governance technologies, and future research opportunities.

Specific objectives include:

- Categorizing governance frameworks
- Identifying publication trends
- Analyzing research methodologies
- Evaluating governance technologies
- Identifying research gaps
- Mapping regulated industry applications

Literature Identification

Relevant publications are identified using digital libraries, scientific databases, conference proceedings, journals, and industry reports. Search strategies employ predefined keywords related to enterprise data governance, regulatory compliance, metadata management, stewardship, governance maturity, audit readiness, and information management.

Multiple inclusion and exclusion criteria ensure that only high-quality and relevant studies are included within the evidence mapping process.

Study Classification

Selected publications are classified according to several research dimensions, including:

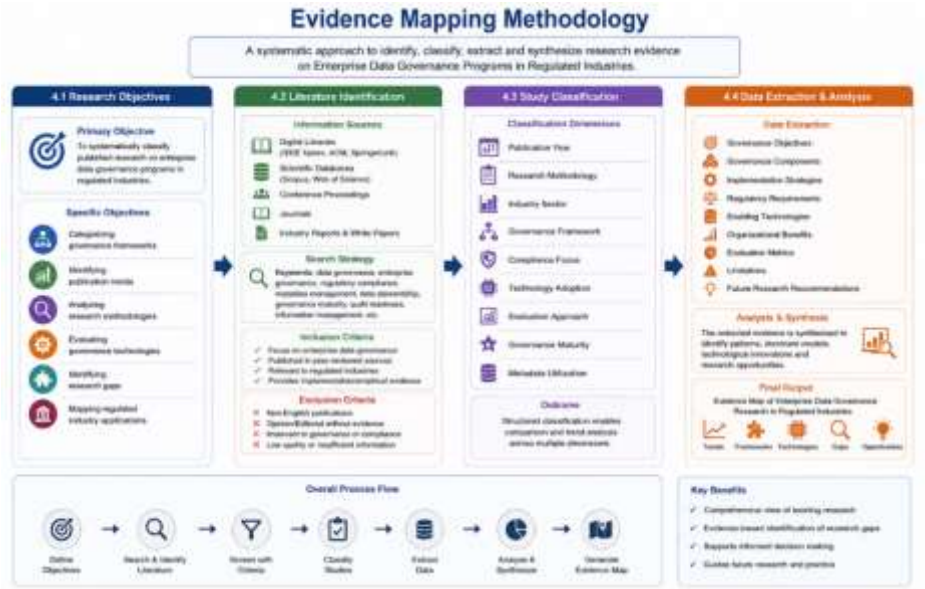
- Publication year
- Research methodology
- Industry sector
- Governance framework
- Compliance focus
- Technology adoption
- Evaluation approach
- Governance maturity
- Metadata utilization

This classification facilitates comprehensive analysis of existing research trends.

Data Extraction and Analysis

Relevant information extracted from each publication includes governance objectives, governance components, implementation strategies, regulatory requirements, enabling technologies, organizational benefits, evaluation metrics, limitations, and future research recommendations.

The extracted evidence is synthesized to identify recurring themes, dominant governance models, technological innovations, and research opportunities across regulated industries.



V. Core Enterprise Data Governance Programs

Data Stewardship Programs
Data stewardship programs establish clear responsibilities for maintaining enterprise data quality, resolving governance issues, monitoring compliance, and coordinating cross-functional governance activities. Effective stewardship strengthens accountability while improving organizational collaboration.

Metadata Governance Programs
Metadata governance focuses on standardizing enterprise metadata through centralized repositories, business glossaries, semantic models, and automated metadata discovery. Standardized metadata improves interoperability, lineage tracking, regulatory reporting, and enterprise-wide data understanding.

Master Data Governance
Master Data Governance ensures consistency of core business entities such as customers, suppliers, products, employees, and financial records across multiple enterprise systems. Governance policies eliminate duplication, improve synchronization, and support enterprise-wide consistency.

Data Quality Governance
Continuous monitoring of enterprise data quality enables organizations to identify anomalies, duplicate records, incomplete information, and inconsistent business rules. Governance frameworks incorporate automated validation, profiling, cleansing, and quality dashboards to support informed decision-making.

Compliance Governance Programs
Compliance governance aligns enterprise data management practices with regulatory obligations through policy enforcement, continuous monitoring, risk assessment, audit documentation, and automated reporting. These programs enable organizations to demonstrate accountability while reducing compliance risks.

VI. Technologies Enabling Enterprise Data Governance

Metadata Management Platforms
Metadata management platforms form the technological foundation of enterprise data governance by providing centralized repositories for technical, business, and operational metadata. These platforms enable organizations to maintain comprehensive information about enterprise datasets, including data definitions, ownership, classifications, transformation rules, quality metrics, and regulatory requirements. By integrating metadata from databases, cloud services, ETL pipelines, APIs, and business applications, organizations gain a unified view of their information assets. Centralized metadata repositories also improve collaboration among business users, data stewards,

compliance officers, and technical teams while supporting efficient governance decision-making.

Modern metadata platforms include automated discovery capabilities that continuously scan enterprise environments, identify new datasets, detect schema changes, and synchronize metadata repositories. This automation reduces manual documentation efforts while ensuring governance information remains accurate and up to date.

Data Catalogs

Enterprise data catalogs provide searchable inventories of organizational data assets, enabling users to discover, understand, and access trusted information efficiently. Data catalogs integrate metadata, business glossaries, lineage information, ownership details, quality scores, and governance policies into a single interface. These capabilities improve data accessibility while reducing duplicate data creation and inconsistent reporting.

Organizations increasingly deploy intelligent data catalogs capable of recommending datasets, identifying duplicate assets, and automatically classifying sensitive information using artificial intelligence. Such capabilities significantly improve governance efficiency and support regulatory compliance initiatives.

Data Lineage Technologies

Data lineage technologies automatically document the movement of enterprise data across operational systems, integration platforms, analytical environments, and reporting applications. These technologies capture relationships among source systems, transformation processes, databases, APIs, and downstream consumers, enabling organizations to understand how information flows throughout the enterprise.

Lineage supports governance by improving transparency, simplifying impact analysis, facilitating root cause investigations, and providing evidence for regulatory audits. Automated lineage also enhances metadata quality by maintaining accurate relationships between enterprise information assets.

Artificial Intelligence and Machine Learning

Artificial Intelligence (AI) and Machine Learning (ML) are increasingly integrated into enterprise data governance programs to automate governance activities, improve metadata quality, and enhance decision support. AI algorithms analyze enterprise metadata, detect anomalies, classify sensitive information, recommend governance policies, and predict potential compliance risks.

Machine learning models continuously learn from historical governance activities to improve metadata enrichment, identify governance gaps, optimize data quality monitoring, and support intelligent compliance management. These technologies reduce operational workloads while increasing governance scalability and responsiveness.

Cloud-Based Governance Solutions

Cloud computing has transformed enterprise governance by enabling organizations to manage data assets distributed across multiple cloud providers, hybrid infrastructures, and Software-as-a-Service (SaaS) platforms. Cloud-native governance solutions provide centralized policy management, metadata synchronization, automated compliance monitoring, and scalable governance services capable of supporting rapidly growing enterprise environments.

Cloud governance platforms also facilitate integration with modern analytics services, data lakes, AI platforms, and streaming technologies while maintaining consistent governance policies across diverse infrastructures.

VII. Governance Challenges in Regulated Industries

Regulatory Complexity

Regulated industries operate under multiple national and international regulations that frequently evolve to address emerging technological and security challenges. Organizations must simultaneously comply with privacy regulations, financial reporting standards, cybersecurity requirements, industry-specific mandates, and regional legislation. Managing compliance across numerous regulatory frameworks significantly increases governance complexity.

Governance programs must continuously adapt policies, metadata repositories, monitoring procedures, and compliance controls to accommodate evolving legal obligations while minimizing operational disruptions.

Data Silos

Enterprise information is often distributed across numerous operational systems, cloud platforms, departmental databases, legacy applications, and third-party services. These isolated data silos create inconsistencies, duplicate information, fragmented governance practices, and limited organizational visibility.

Effective governance requires integrated metadata management, standardized data models, and enterprise-wide collaboration to eliminate silos and establish unified governance processes.

Organizational Resistance

Implementing enterprise governance frequently involves organizational restructuring, new responsibilities, standardized procedures, and cultural transformation. Employees may resist governance initiatives because they perceive additional administrative responsibilities or changes to established workflows.

Executive sponsorship, stakeholder engagement, continuous training, and effective communication are essential for overcoming organizational resistance and promoting governance adoption.

Scalability Challenges

Modern enterprises generate massive volumes of structured and unstructured information through digital business operations, IoT devices, social media, mobile applications, and real-time analytics. Governance frameworks must scale efficiently to monitor, classify, secure, and manage continuously expanding data ecosystems without degrading system performance.

Scalable governance architectures require distributed processing, cloud-native technologies, metadata automation, and intelligent monitoring capabilities.

Data Quality Issues

Poor data quality remains one of the most significant obstacles to successful governance implementation. Duplicate records, incomplete information, inconsistent business definitions, outdated metadata, and inaccurate transformations reduce confidence in enterprise information and negatively impact business decision-making.

Continuous data profiling, automated validation, quality scorecards, and governance dashboards enable organizations to proactively identify and resolve quality issues.

VIII. Emerging Trends and Future Research Directions

Intelligent Data Governance

Next-generation governance frameworks increasingly incorporate artificial intelligence to automate metadata discovery, governance policy enforcement, risk prediction, and

compliance monitoring. Intelligent governance systems reduce manual intervention while improving governance consistency and organizational agility.

Future governance platforms are expected to provide self-learning capabilities capable of continuously improving governance recommendations based on organizational behavior and regulatory changes.

Autonomous Governance

Autonomous governance represents an emerging paradigm in which AI agents independently perform governance activities such as metadata synchronization, policy validation, anomaly detection, compliance reporting, and governance optimization. Autonomous systems minimize operational workloads while improving governance responsiveness.

Research into autonomous governance will focus on balancing automation with human oversight to ensure transparency, accountability, and regulatory acceptance.

Knowledge Graph–Based Governance

Knowledge graphs establish semantic relationships among enterprise data assets, business concepts, governance policies, regulatory requirements, and organizational processes. Integrating knowledge graphs into governance programs enhances metadata interoperability, intelligent search, contextual understanding, and automated reasoning. Knowledge graph technologies also improve enterprise data discovery and support explainable governance decisions.

Explainable Artificial Intelligence

As AI assumes greater responsibility within governance programs, explainability becomes increasingly important. Explainable Artificial Intelligence (XAI) enables governance stakeholders to understand how AI-generated recommendations, compliance assessments, and governance decisions are produced.

Transparent AI models improve trust, facilitate regulatory acceptance, and support responsible governance implementation.

Continuous Compliance Monitoring

Traditional compliance audits are gradually being replaced by continuous compliance monitoring systems capable of validating governance policies in real time. These systems monitor enterprise activities continuously, identify violations immediately, generate automated alerts, and provide organizations with up-to-date compliance dashboards.

Continuous monitoring reduces regulatory risks while enabling proactive governance management.

IX. Discussion

The systematic evidence mapping demonstrates that enterprise data governance has evolved from a collection of isolated data management practices into a strategic organizational capability that supports regulatory compliance, operational efficiency, and digital transformation. Across regulated industries, governance programs increasingly integrate data stewardship, metadata management, master data management, data quality monitoring, security controls, and compliance automation into comprehensive governance frameworks. The evidence indicates that organizations adopting mature governance practices experience improvements in information reliability, decision-making, audit readiness, and organizational accountability.

The analysis also highlights the growing importance of enabling technologies such as artificial intelligence, machine learning, cloud-native governance platforms, metadata repositories, data catalogs, and automated lineage solutions. These technologies enhance governance scalability by reducing manual effort, improving metadata accuracy, and supporting continuous compliance monitoring. Nevertheless, the evidence reveals persistent challenges, including fragmented governance initiatives, inconsistent metadata standards, organizational resistance, interoperability limitations, and the absence of universally accepted governance maturity models. Addressing these issues requires stronger executive leadership, enterprise-wide governance strategies, standardized frameworks, and ongoing investment in governance capabilities.

Furthermore, the evidence mapping identifies substantial opportunities for future research in autonomous governance, explainable AI, intelligent metadata management, knowledge graph integration, governance maturity assessment, and policy-driven automation. Continued research in these areas will support the development of adaptive governance frameworks capable of responding to rapidly changing regulatory and technological environments.

X. Conclusion

Enterprise data governance has become an indispensable component of modern organizations operating in regulated industries, where regulatory compliance, information quality, transparency, and accountability are essential for sustainable business operations. This systematic evidence mapping provides a comprehensive synthesis of existing research on enterprise data governance programs by categorizing governance frameworks, implementation approaches, enabling technologies, regulatory considerations, and emerging research trends. The findings demonstrate that successful governance programs rely on clearly defined organizational structures, executive sponsorship, standardized policies, effective data stewardship, metadata management, continuous data quality monitoring, and integrated compliance mechanisms that collectively improve the management of enterprise information assets.

The study further reveals that modern governance programs are increasingly supported by advanced technologies such as artificial intelligence, machine learning, cloud computing, automated metadata management, enterprise data catalogs, and data lineage solutions. These technologies enable organizations to automate governance processes, strengthen regulatory compliance, improve operational efficiency, and enhance decision-making capabilities. Despite these advancements, challenges such as fragmented governance practices, heterogeneous enterprise environments, inconsistent metadata standards, organizational resistance, scalability limitations, and evolving regulatory requirements continue to affect governance maturity across industries.

The evidence mapping also highlights several promising research directions, including autonomous governance systems, explainable artificial intelligence, knowledge graph–based governance, intelligent compliance automation, and continuous governance monitoring. These innovations have the potential to transform traditional governance models into adaptive, self-managing ecosystems capable of supporting increasingly complex digital enterprises. Overall, this study contributes to the growing body of knowledge on enterprise data governance by providing researchers, practitioners, and policymakers with a structured overview of current evidence, identifying research gaps, and offering practical insights for designing resilient, scalable, and technology-driven governance programs that strengthen regulatory compliance, improve audit readiness, enhance organizational trust, and maximize the strategic value of enterprise data.

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