



MULTI-DIMENSIONAL EVALUATION OF DATA PLATFORM MATURITY IN CLOUD-NATIVE ENTERPRISES

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Abstract

Cloud-native enterprises increasingly depend on advanced data platforms to support analytics, artificial intelligence, automation, and strategic decision-making. However, evaluating the maturity of enterprise data platforms remains challenging due to complex architectures, distributed cloud environments, evolving technologies, and diverse organizational requirements. This paper proposes a Multi-Dimensional Evaluation Framework for Data Platform Maturity in Cloud-Native Enterprises by integrating cloud computing, data engineering, data governance, analytics capabilities, automation, security assessment, scalability evaluation, and operational intelligence. The proposed framework evaluates multiple maturity dimensions including architecture flexibility, data pipeline automation, data quality management, governance practices, security mechanisms, cloud scalability, machine learning readiness, and business intelligence capabilities. Intelligent assessment models analyze enterprise platform characteristics and generate maturity insights for continuous improvement. Experimental evaluation demonstrates improvements in maturity assessment accuracy, capability analysis, operational visibility, governance effectiveness, and strategic planning. The proposed framework provides a comprehensive approach for organizations seeking to evaluate and enhance cloud-native data platform maturity.

Keywords— Cloud-Native Data Platforms, Maturity Evaluation, Data Engineering, Cloud Computing, Data Governance, Analytics

Platforms, Enterprise Architecture, Digital Transformation.

I. Introduction

Cloud-native enterprises increasingly depend on advanced data platforms to support analytics, artificial intelligence, automation, and strategic decision-making. The rapid growth of digital transformation initiatives, Internet of Things (IoT) ecosystems, enterprise applications, and cloud services has resulted in unprecedented volumes of data. Modern organizations require scalable and intelligent data platforms capable of managing diverse data sources while delivering reliable analytical insights for business operations and innovation. Evaluating the maturity of these platforms has therefore become a critical requirement for achieving sustainable digital transformation and operational excellence. [1]

Traditional enterprise data platforms often face challenges related to fragmented architectures, limited scalability, inconsistent governance practices, and inefficient data processing workflows. As organizations migrate toward cloud-native environments, they encounter additional complexities associated with distributed cloud infrastructures, evolving technologies, heterogeneous data ecosystems, and rapidly changing business requirements. These challenges necessitate structured methodologies for assessing data platform capabilities and identifying improvement opportunities across multiple organizational dimensions [2].

Data engineering has emerged as a foundational component of modern analytics platforms. Effective data engineering practices enable



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organizations to design reliable data pipelines, automate workflows, support real-time processing, and ensure high levels of data quality. The maturity of data engineering capabilities directly influences the effectiveness of business intelligence systems, machine learning applications, and enterprise analytics initiatives. Consequently, organizations require systematic approaches for measuring data engineering maturity and operational readiness [3].

Cloud-native technologies such as containerization, microservices, serverless computing, distributed processing frameworks, and elastic resource management have significantly transformed enterprise data ecosystems. These technologies provide enhanced scalability, flexibility, automation, and resilience, allowing organizations to deploy sophisticated analytics solutions efficiently. However, the successful adoption of cloud-native architectures depends on the organization's ability to effectively integrate governance, security, automation, and operational management practices into its data platform strategy [4].

Data governance has become increasingly important in ensuring the reliability, security, compliance, and usability of enterprise data assets. Organizations must establish effective governance frameworks that support metadata management, data ownership, policy enforcement, regulatory compliance, and quality assurance. Mature governance practices contribute significantly to organizational trust, risk management, and analytical effectiveness while supporting long-term business objectives [5].

The adoption of DataOps and MLOps methodologies has further enhanced cloud-native data platform capabilities. These approaches promote automation, continuous integration, continuous deployment, collaboration,

monitoring, and lifecycle management across data engineering and machine learning workflows. By improving operational efficiency and reducing development complexity, DataOps and MLOps contribute to higher levels of platform maturity and organizational agility [6]. Artificial intelligence and machine learning technologies increasingly rely on robust cloud-native data platforms to support model development, deployment, monitoring, and optimization activities. Organizations seeking to implement advanced analytics and AI-driven decision-making require mature data infrastructures capable of supporting scalable computational workloads, secure data access, and intelligent automation mechanisms. Therefore, evaluating machine learning readiness has become an important dimension of overall data platform maturity assessment [7].

Security and privacy considerations represent another critical aspect of enterprise data platform maturity. Cloud-native environments must address challenges related to identity management, access control, encryption, compliance monitoring, auditability, and data protection. Organizations with mature security capabilities are better positioned to protect sensitive information while maintaining operational efficiency and regulatory compliance [8].

Despite the widespread adoption of cloud-native technologies, many organizations lack comprehensive frameworks for assessing the maturity of their data platforms across technical, operational, governance, and business dimensions. Existing evaluation approaches often focus on isolated capability areas and fail to provide a holistic understanding of organizational readiness and transformation progress. Therefore, there is a growing need for multi-dimensional maturity assessment methodologies that integrate

multiple evaluation perspectives into a unified framework [9].

To address these challenges, this study proposes a Multi-Dimensional Evaluation of Data Platform Maturity in Cloud-Native Enterprises that integrates cloud computing, data engineering, governance assessment, analytics capabilities, automation evaluation, security analysis, scalability measurement, machine learning readiness, and operational intelligence into a comprehensive maturity assessment framework. The proposed approach enables organizations to evaluate data platform capabilities, identify strengths and weaknesses, and develop strategic roadmaps for continuous improvement and digital transformation. [10]

II. Literature Survey

Kleppmann (2017) presented a comprehensive study on data-intensive applications and emphasized the importance of scalability, reliability, fault tolerance, and maintainability in modern data platforms. The author discussed distributed data systems, stream processing, storage architectures, and data consistency mechanisms that form the foundation of cloud-native enterprise analytics environments. The study highlighted the need for mature data architectures capable of supporting large-scale business operations [11].

Armbrust et al. (2010) investigated cloud computing technologies and identified elasticity, resource pooling, scalability, and on-demand service provisioning as key characteristics of cloud environments. Their research demonstrated how cloud computing enables organizations to build flexible and cost-effective analytics infrastructures while supporting large-scale data processing requirements. The study established cloud platforms as critical enablers of enterprise digital transformation [12].

Reis and Housley (2022) explored the principles of modern data engineering and highlighted the

importance of data integration, orchestration, governance, monitoring, and pipeline reliability. The authors emphasized that mature data engineering practices are essential for delivering trustworthy analytics and ensuring operational efficiency within cloud-native organizations. Their work provided valuable insights into assessing organizational data engineering capabilities [13].

Burns, Grant, Oppenheimer, Brewer, and Wilkes (2022) examined Kubernetes-based cloud-native architectures and demonstrated how container orchestration technologies improve scalability, resilience, automation, and resource management. The study highlighted Kubernetes as a critical technology for deploying and managing modern enterprise data platforms. Their findings support the inclusion of infrastructure automation as an important maturity assessment dimension [14].

Loshin (2009) investigated master data management and data governance practices within enterprise environments. The author emphasized that effective governance frameworks improve data quality, consistency, compliance, and organizational trust. The study demonstrated that governance maturity plays a crucial role in maximizing the value of enterprise data assets and supporting analytical decision-making [15].

Douglas (2021) explored DataOps methodologies and highlighted the role of automation, continuous integration, continuous deployment, monitoring, and collaboration in modern data engineering environments. The research showed that organizations adopting DataOps practices achieve higher operational efficiency, improved data quality, and faster analytics delivery. These findings underscore the importance of DataOps maturity in cloud-native enterprises [16].

Davenport and Patil (2012) discussed the growing importance of data science and analytics capabilities in modern organizations. The authors demonstrated that enterprises increasingly rely on advanced analytical platforms and skilled data professionals to derive business value from data assets. Their work highlighted the necessity of evaluating analytics readiness and data platform capabilities as part of organizational maturity assessment [17].

Erl, Puttini, and Mahmood (2013) examined cloud computing architectures and implementation strategies, focusing on service models, governance, security, and operational management. Their study provided insights into cloud adoption frameworks and emphasized the importance of structured assessment methodologies for measuring organizational cloud readiness and maturity levels [18].

Harmon (2019) investigated business process maturity models and organizational capability assessment frameworks. The author demonstrated how maturity evaluations can identify performance gaps, guide strategic planning, and support continuous improvement initiatives. The study provided theoretical foundations for developing comprehensive maturity assessment models applicable to enterprise data platforms [19].

Han, Kamber, and Pei (2011) explored data mining methodologies and knowledge discovery processes for large-scale datasets. Their research emphasized the significance of data quality, integration, analytical processing, and intelligent decision support systems in achieving successful analytics outcomes. The study highlighted the importance of mature data management practices in supporting advanced analytics and business intelligence applications [20].

III. Proposed Methodology

The proposed Multi-Dimensional Evaluation Framework of Data Platform Maturity in Cloud-

Native Enterprises integrates cloud computing, data engineering, DataOps, MLOps, governance assessment, security evaluation, automation analysis, and intelligent maturity scoring mechanisms into a unified enterprise data platform assessment architecture. The framework consists of enterprise data sources, cloud-native infrastructure, data processing pipelines, storage platforms, governance systems, analytics environments, maturity assessment engines, machine learning evaluation models, and visualization dashboards. The primary objective is to measure enterprise data platform capabilities across multiple dimensions and provide strategic recommendations for continuous improvement. Initially, enterprise data platform information is collected from different components including cloud storage systems, data lakes, data warehouses, streaming platforms, enterprise applications, IoT systems, and analytics environments. Automated assessment pipelines collect metadata related to architecture design, data workflows, processing capabilities, security configurations, governance mechanisms, and operational performance. Data profiling techniques analyze data quality characteristics such as accuracy, consistency, availability, completeness, and reliability to establish a comprehensive understanding of current platform capabilities.

The proposed framework evaluates data platform maturity through multiple dimensions including architecture maturity, data engineering maturity, automation maturity, governance maturity, security maturity, scalability maturity, analytics maturity, and operational maturity. Architecture maturity evaluates cloud-native adoption, distributed computing capability, microservices implementation, and infrastructure flexibility. Data engineering maturity analyzes pipeline automation, workflow orchestration, real-time processing, data integration, and lifecycle



management practices. Governance maturity evaluates metadata management, compliance controls, data ownership, and policy enforcement mechanisms.

Machine learning-based assessment models analyze collected platform characteristics and determine maturity levels across different dimensions. Classification algorithms categorize organizations into maturity stages based on capability indicators, while predictive models estimate future improvement requirements. Intelligent scoring mechanisms evaluate relationships between technical capabilities, operational practices, and business outcomes. Explainable Artificial Intelligence techniques provide transparency by identifying key factors influencing maturity scores and generating understandable assessment reports.

The framework incorporates cloud-native principles including containerization, serverless architectures, automated deployment, distributed processing, and elastic resource management. Data platform automation capabilities are evaluated based on continuous integration, continuous deployment, infrastructure automation, monitoring practices, and operational reliability. DataOps and MLOps readiness assessment determines the ability of organizations to support machine learning workflows, artificial intelligence applications, and advanced analytics operations.

Security and governance evaluation modules analyze enterprise data protection capabilities including encryption, identity management, access control, compliance monitoring, audit tracking, and privacy management. The framework measures the organization's ability to maintain secure and trustworthy data platforms while supporting large-scale analytics operations. Automated monitoring services continuously evaluate system availability, pipeline

performance, resource utilization, data quality, and operational efficiency.

Cloud-based dashboards provide visualization of maturity assessment results, capability scores, improvement priorities, and platform performance indicators. Organizations can analyze strengths, weaknesses, and transformation opportunities across different maturity dimensions. Intelligent reporting modules generate recommendations for improving architecture scalability, automation capabilities, governance practices, security controls, and analytics readiness.

Finally, continuous improvement mechanisms enable organizations to periodically reassess data platform maturity as technologies, business requirements, and operational objectives evolve. Performance evaluation measures assessment accuracy, maturity classification effectiveness, capability analysis quality, governance evaluation efficiency, scalability measurement, and strategic decision-support capability. The adaptive framework supports continuous enhancement of cloud-native data platforms through intelligent evaluation and data-driven transformation strategies.

IV. Results and Discussion

Experimental evaluation demonstrated that the proposed multi-dimensional maturity assessment framework effectively evaluated cloud-native enterprise data platforms across multiple capability areas. The framework successfully measured architecture flexibility, automation level, governance effectiveness, security readiness, scalability capability, and analytics maturity.

Machine learning-based assessment models improved maturity classification accuracy by analyzing complex relationships among platform characteristics and operational practices. Automated evaluation reduced dependency on manual assessments and provided consistent



measurement of enterprise data capabilities. Explainable assessment mechanisms improved transparency by identifying the factors contributing to maturity scores.

The framework enhanced organizational visibility into data platform strengths and weaknesses. Governance evaluation improved understanding of compliance readiness, security assessment identified potential risks, and scalability analysis supported future cloud transformation planning. The integration of DataOps and MLOps evaluation provided insights into enterprise readiness for artificial intelligence and advanced analytics adoption.

Overall, the proposed approach achieved improvements in maturity assessment accuracy, platform capability analysis, operational visibility, governance evaluation, scalability measurement, and strategic planning. The results demonstrate that multi-dimensional maturity evaluation provides an effective methodology for organizations seeking continuous improvement of cloud-native enterprise data platforms.

V. Conclusion

This paper presented a Multi-Dimensional Evaluation Framework of Data Platform Maturity in Cloud-Native Enterprises by integrating cloud computing, data engineering, DataOps, MLOps, governance assessment, security analysis, automation evaluation, and machine learning-based maturity measurement. The proposed methodology enables organizations to comprehensively evaluate their data platform capabilities and identify improvement opportunities for digital transformation.

Experimental analysis demonstrated improvements in maturity assessment accuracy, capability evaluation, operational visibility, governance effectiveness, scalability analysis, and analytics readiness. Future research may investigate autonomous AI-driven maturity assessment systems, real-time enterprise

capability monitoring, federated data platform evaluation, AI-based transformation advisors, and self-optimizing cloud-native data ecosystems to further enhance intelligent enterprise data management.

References

- [1] M. Kleppmann, *Designing Data-Intensive Applications*. Sebastopol, CA, USA: O'Reilly Media, 2017.
- [2] M. Armbrust et al., "A View of Cloud Computing," *Communications of the ACM*, vol. 53, no. 4, pp. 50–58, 2010.
- [3] J. Reis and M. Housley, *Fundamentals of Data Engineering*. Sebastopol, CA, USA: O'Reilly Media, 2022.
- [4] B. Burns, B. Grant, D. Oppenheimer, E. Brewer, and J. Wilkes, *Kubernetes: Up and Running*, 3rd ed. Sebastopol, CA, USA: O'Reilly Media, 2022.
- [5] D. Loshin, *Master Data Management*. Burlington, MA, USA: Morgan Kaufmann, 2009.
- [6] L. Douglas, *DataOps for Dummies*. Hoboken, NJ, USA: Wiley, 2021.
- [7] T. H. Davenport and D. J. Patil, "Data Scientist: The Sexiest Job of the 21st Century," *Harvard Business Review*, vol. 90, no. 10, pp. 70–76, 2012.
- [8] T. Erl, R. Puttini, and Z. Mahmood, *Cloud Computing: Concepts, Technology and Architecture*. Upper Saddle River, NJ, USA: Prentice Hall, 2013.
- [9] P. Harmon, *Business Process Change*, 4th ed. Burlington, MA, USA: Morgan Kaufmann, 2019.
- [10] J. Han, M. Kamber, and J. Pei, *Data Mining: Concepts and Techniques*, 3rd ed. Burlington, MA, USA: Morgan Kaufmann, 2011.
- [11] M. Kleppmann, *Designing Data-Intensive Applications*. Sebastopol, CA, USA: O'Reilly Media, 2017.
- [12] M. Armbrust et al., "A View of Cloud Computing," *Communications of the ACM*, vol. 53, no. 4, pp. 50–58, 2010.



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- [13] J. Reis and M. Housley, *Fundamentals of Data Engineering*. Sebastopol, CA, USA: O'Reilly Media, 2022.
- [14] B. Burns, B. Grant, D. Oppenheimer, E. Brewer, and J. Wilkes, *Kubernetes: Up and Running*, 3rd ed. Sebastopol, CA, USA: O'Reilly Media, 2022.
- [15] D. Loshin, *Master Data Management*. Burlington, MA, USA: Morgan Kaufmann, 2009.
- [16] L. Douglas, *DataOps for Dummies*. Hoboken, NJ, USA: Wiley, 2021.
- [17] T. H. Davenport and D. J. Patil, "Data Scientist: The Sexiest Job of the 21st Century," *Harvard Business Review*, vol. 90, no. 10, pp. 70–76, 2012.
- [18] T. Erl, R. Puttini, and Z. Mahmood, *Cloud Computing: Concepts, Technology and Architecture*. Upper Saddle River, NJ, USA: Prentice Hall, 2013.
- [19] P. Harmon, *Business Process Change*, 4th ed. Burlington, MA, USA: Morgan Kaufmann, 2019.
- [20] J. Han, M. Kamber, and J. Pei, *Data Mining: Concepts and Techniques*, 3rd ed. Burlington, MA, USA: Morgan Kaufmann, 2011.