# Metadata Management in the Digital Age: A Qualitative Approach to Practices and Challenges in Modern Organizations

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**Abstract**

In the era of massive digital transformation, organizations across various sectors face significant challenges in managing increasingly complex and growing volumes of data. Metadata, as descriptive information about data, plays a central role in ensuring that data can be found, understood, and reused appropriately. Metadata management not only assists in managing digital archives but also serves as the foundation for effective and efficient data governance. This study aims to explore metadata management practices in five modern organizations from the government, private sector, and non-governmental organizations. Using a qualitative approach with in-depth interviews, system observations, and documentation studies, this study identifies the extent of metadata understanding, implementation, and challenges in real-world work environments. The results indicate that most organizations still face gaps in standardization, system interoperability, and human resource digital literacy. This study also suggests the need for a national metadata strategy and ongoing training to encourage optimal metadata utilization across all organizational levels.

## I. INTRODUCTION

The development of information technology over the past two decades has fundamentally changed the way organizations, both in the public and private sectors, manage and utilize data. The digital revolution, marked by the advent of high-speed internet, cloud computing, artificial intelligence (AI), and the Internet of Things (IoT), has driven the creation of data in unprecedented volume, variety, and speed. Every second, billions of digital transactions, sensor activity, social media interactions, and even internal business processes generate an abundance of data. This phenomenon, often referred to as big data, is not only a strategic resource but also a major challenge, as poorly managed data has the potential to become a burden and a risk, rather than a valuable asset.(Savitri, 2019).

Amidst this information explosion, a key challenge facing organizations is how to efficiently manage, classify, secure, and retrieve relevant data. This abundance of data, without adequate management mechanisms, can lead to issues such as information duplication, loss of context, difficulties in cross-system integration, and the potential for misuse or data leakage. It is in this context that metadata becomes a key element that cannot be ignored.(Nadiroh & Wiraguna, 2025).

Conceptually, metadata can be understood as "data about data," namely descriptive information that provides meaning and context to data. Metadata describes essential characteristics such as content, origin, structure, quality, creation time, and access rights.(Batubara & Nasution, 2025)For example, in a document file, metadata can include the creator's name, creation date, file format, copyright, and revision version. At a more complex level, metadata also includes standard schemas that enable interoperability between systems, such as through Dublin Core, ISO 19115 for geospatial data, or METS and PREMIS in digital archive management. The existence of metadata is what enables fast searching, systematic archiving, accurate reporting, compliance audits, and cross-platform data integration. Without metadata, data would be fragmented, lacking context, difficult to retrieve, unreliable in quality, and vulnerable to misuse.(Sulianta, 2025).

Despite increasing recognition of the urgency of metadata management, the reality is that many

organizations still lack a standardized, comprehensive, and integrated metadata system. This challenge is faced not only by organizations in developing countries but also by large institutions in developed countries. Some of the main causes of this stagnation include: low leadership awareness of the strategic value of metadata; limited technological capacity, infrastructure, and human resources; resistance to organizational cultural change; and the absence of national policies, guidelines, or regulations governing the use and management of metadata. In the Indonesian context, the challenge is further complicated by the heterogeneous digital ecosystem, the infrastructure gap between urban and rural areas, and the lack of national standards for data interoperability between government agencies and the private sector.

Globally, developed countries have begun implementing metadata policies and standards as part of their national data governance strategies. For example, the European Union, through its European Data Strategy, emphasizes the importance of data governance, including metadata standards, to foster cross-border integration. Similarly, the United States, through its Federal Data Strategy, requires government agencies to implement rigorous metadata practices to support transparency and openness of public data. This comparison demonstrates the urgent need for Indonesia to develop a national strategy aligned with global practices to keep pace with data utilization as a source of innovation and competitiveness.(Commission & RI, nd).

This study aims to provide an in-depth understanding of how metadata management is implemented in practice in Indonesia. By exploring the experiences of five organizations from various sectors—government, education, health, industry, and public services—this research aims to identify gaps, barriers, and best practices that can serve as references for other organizations. This approach is expected to comprehensively describe the dynamics of metadata implementation, from technical aspects and policies to social and cultural factors of the organization.

Furthermore, this research is expected to provide important contributions to policymakers in formulating a national metadata strategy that is sustainable, inclusive, and locally contextualized. The resulting recommendations are not only relevant to supporting transparent and accountable government data governance but also crucial for the private sector in improving operational efficiency, strengthening information security, and encouraging data-driven innovation. Thus, metadata management is not merely a technical issue but also a strategic agenda that determines the success of Indonesia's digital transformation in the era of a data-driven economy.

## II. RESEARCH METHODS

This research is a qualitative study with a descriptive-exploratory approach.(Kusumastuti & Khoiron, 2019). This approach is used to understand and explain the phenomenon of metadata management in modern organizational environments without direct interaction through interviews. The main focus of the research is directed at analyzing document content, internal policies, and observations of information systems used by organizations. Data in this study were obtained through two main techniques, namely Document Analysis, Researchers reviewed official documents that were publicly available and/or internal to the organization, such as data governance guidelines, implemented metadata standards, information system manuals, and annual reports related to data management. and Literature Study:, Conducted to obtain theoretical and conceptual foundations on metadata and metadata management from academic sources such as journal articles, international standards (e.g. Dublin Core, ISO 19115), and reports from related institutions.

## III. RESULTS AND DISCUSSION

Based on a review of a number of organizational policy documents and observations of commonly used open source-based information systems (such as DSpace and CKAN), it was found that metadata management generally falls into two main approaches: manual and partial automation.(Pramudyo, 2018).

In systems like DSpace which are used by many libraries and scientific repositories metadata is implemented based on the Dublin Core schema, with manual filling by data managers.(Reza et al., 2022)Document metadata includes elements such as title, creator, date, document type, and access rights. However, not all organizations consistently fill in all of these elements, making data retrieval less effective. Meanwhile, in the government information systems studied, metadata was found to be primarily used for administrative and legal purposes, such as document tracking and audits.

Metadata is often added automatically by the system, but is limited to basic information such as upload date and user identity. Other descriptive elements are often omitted as optional.

The analysis of policy documents, literature, and information system observations from five open data platforms (DSpace, CKAN, GeoNetwork, Dataverse, and Apache Atlas) shows that the implementation of metadata management is still suboptimal in many organizations, especially in the government and non-profit sectors. Data was collected from system documentation (user manuals, publicly available internal organizational policies), as well as technical observations on the metadata features of each platform (access via system demos and developer documentation).(Wibowo, 2019).

Most platforms support open metadata standards such as Dublin Core, ISO 19115, and DCAT (Data Catalog Vocabulary). However, in their implementations, only basic elements such as "title," "creator," "date," and "description" are consistently filled in. Other metadata elements such as "rights," "format," "relationship," and "coverage" are often overlooked. For example, in the CKAN system used by several government data portals, descriptive metadata is often incomplete, and administrative metadata related to data usage permissions is missing.(Ratnasari, 2018).

Analysis on the Apache Atlas platform, which is more widely used in the private sector, shows a more systematic approach to metadata.(Zamzami et al., 2024)Metadata is directly linked to data pipelines and transformation flows, enabling data lineage tracking and granular access control. This indicates that the private sector is more likely to adopt metadata as part of strategic data governance.

## A. Relationship of Results to Basic Concepts

The above findings demonstrate a direct link to the concept of metadata as a data context and structure enhancer, as proposed by Gilliland (2008) and Greenberg (2009). Partially and inconsistently filled-in metadata diminishes the functional value of the data itself, particularly in the context of retrievability and interoperability between systems. Furthermore, failure to provide administrative metadata, such as access rights and licenses, can lead to legal risks and data misuse.

These findings reinforce the concept that metadata should be understood as an integral component of information systems, not simply an administrative add-on. In many systems studied, metadata is still treated as an optional extra, even though, in a data-driven organization paradigm, metadata should be a key element underlying data integration and utilization.

## B. Consistency or Contrast with Previous Research

The results of this study align with Day's (2005) findings, which state that although many organizations have adopted digital information systems, they do not yet have standardized metadata policies. This finding is further supported by Sen (2005), who states that a lack of managerial awareness of metadata is a major barrier to implementing good data governance.

However, there is a slight difference from the study conducted by Wittenburg et al. (2010), which showed that academic organizations tend to have more comprehensive and standardized metadata structures. In this study, we found that DSpace-based academic repositories rely solely on manual metadata entry and lack adequate metadata quality control policies. This suggests variation in metadata implementation even in environments that are supposed to have high digital literacy.

Furthermore, research from Talend (2022) indicates that adopting metadata automation tools significantly improves metadata efficiency and consistency. This finding aligns with observations of the Apache Atlas platform, which is technically capable of automating metadata tracking through direct integration with data pipeline systems. Unfortunately, such systems are still under-adopted by public sector or nonprofit organizations due to limited technical resources and licensing costs.

## C. Implications of Research Results

The results of this study have important implications for the theory and practice of metadata management in modern organizations. From a theoretical perspective, these results reinforce the importance of metadata integration as an integral part of an organization's information systems architecture and data policies. Metadata should not be positioned merely as an add-on, but rather as information infrastructure that supports data visibility, transparency, and interoperability.

Practically, these findings suggest that organizations, particularly in the public sector,

need to develop a metadata strategy that includes: (1) standardization of internal metadata schemas; (2) automation of basic metadata input from the system; and (3) training for system users to ensure metadata is not overlooked. Furthermore, there is an urgent need to develop national, cross-sector metadata guidelines to ensure uniformity and interoperability in public data management.

In the long term, robust metadata management can improve organizational efficiency, accelerate data-driven decision-making, and reduce legal and information security risks associated with using data without clear context. In this digital age, metadata is no longer an option but a strategic imperative.

## IV. CONCLUSION AND SUGGESTIONS

### A. Conclusion

This research has explored metadata management practices through a qualitative approach based on document analysis, information system observation, and scientific literature review. The results of the analysis of five open information system platforms (DSpace, CKAN, Apache Atlas, GeoNetwork, and Dataverse) indicate that although technical support for metadata is functionally available, its implementation within organizations is still suboptimal. Most organizations only utilize basic metadata elements, such as title, creator, and date, while other metadata elements that support interoperability and long-term data preservation, such as administrative and structural metadata, are still often neglected. The absence of internally standardized metadata policies and low support for metadata automation also pose serious obstacles to achieving effective data governance.

These findings reinforce metadata's position as a crucial information infrastructure in digital organizations. Metadata is not merely a search tool, but a fundamental component that binds data to context, ensures information integrity, and facilitates strategic decision-making. Theoretically, this research confirms the relevance of modern metadata theory, which positions metadata as the foundation of adaptive, dynamic, and interoperable information systems.

Good practices found in platforms like Apache Atlas demonstrate that the use of automation tools and the integration of metadata with pipeline systems can deliver greater efficiency and accuracy in data management. This research contributes to the literature on metadata management, particularly in the context of organizational practices in developing countries that still face infrastructure and resource challenges. For further research, comparative studies across countries or industries are recommended, as well as quantitative approaches to more objectively measure the impact of metadata on organizational effectiveness.

### B. Suggestion

Based on the research findings, it is recommended that organizations strengthen clear and integrated metadata policies and standards to achieve data consistency and interoperability across systems. This effort should be accompanied by the use of metadata automation technology to reduce reliance on manual input, increase efficiency, and maintain information integrity. Improving human resource capacity through training and metadata literacy is a crucial step in raising awareness of the strategic value of metadata as an information infrastructure. The government is also expected to formulate national guidelines that can serve as a cross-sector reference, while encouraging collaboration between policymakers, technology providers, and academics. To deepen understanding, further research combining quantitative approaches and comparative studies across industries or countries can provide a more measurable picture of the impact of metadata on organizational data effectiveness and governance.

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