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Enhancing Master Data Management Maturity: A Case Study of Institution XYZ

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MD3M;
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ABSTRACT
Data has become a strategic asset that supports decision-making in the digital era. Master Data Management (MDM) is used to assure quality, accuracy, and consistency of master data. However, government electronic certification services face challenges related to data inconsistencies due to the use of two applications with separate databases. This study assessed the MDM maturity level in government electronic certification services (Institution XYZ) using the Spruit & Pietzka Master Data Management Maturity Model (MD3M). It then provided improvement recommendations aligned with the Data Management Body of Knowledge (DMBOK). The research applied five domains: data model, data quality, use and ownership, data protection, and maintenance, encompassing 62 required capabilities. Data were collected through interviews with the data management team. The results indicated that 69.36% of the capabilities in the MD3M model had been implemented.This study identified areas for improvement in master data management within government electronic certification services and provided strategic recommendations to enhance data management effectiveness. This approach is expected to support more effective, secure, and standardized data management in accordance with organizational and regulatory requirements.

INTRODUCTION

Information and data are important assets that play a critical role as competitive factors over time (Spruit & Pietzka, 2015). Organizations rely on data to support fast and accurate decision-making processes (Biswas et al., 2024; Gade, 2021; Khong et al., 2023; Kościelniak & Puto, 2015; Ojeda et al., 2025). Good data quality plays a crucial role in an organization's ability to respond to change and improve services (Nulhusna, Taufiq, & Ruldeviyani, 2022).

The most important data in an organization is master data. Master data refers to data that represents key business entities forming the foundation of an organization's operations, such as business partners, products, or employees (Spruit & Pietzka, 2015). Master data differs from transaction data (e.g., invoices or orders) and inventory data, as it describes the core characteristics of real-world entities (Iqbal et al., 2019). It provides context for transaction data and is characterized by consistency, accuracy, and quality (Ko, Adywiratama, & Hidayanto, 2021).

The increasing volume of data presents a significant challenge for organizations. As a result, many organizations experience fragmented or siloed master data, leading to inconsistencies and inaccuracies (Iqbal et al., 2019). One approach to addressing this issue is Master Data Management (MDM).

MDM is the process of managing a consistent and unified set of business entities that represent the core activities of an organization (Rishartati, Rahayuningtyas, Maulina, Adetia, & Ruldeviyani, 2019). It aims to consolidate and integrate data from various master data sources into a single source of truth (Ko et al., 2021). MDM also addresses data complexity arising from the alignment, integration, and cleansing of redundant data, while improving efficiency through standardized data structures and business processes (Ko et al., 2021). Therefore, organizations can implement MDM to enhance data quality, reduce duplication, optimize time and costs, and improve data accuracy (Pansara, 2021).

Master data management maturity assessments are conducted to evaluate the extent to which an organization has effectively managed its master data (Ko et al., 2021). This assessment provides an overview of the current ("as-is") state of master data management within an organization (Iqbal et al., 2019). In addition, it helps identify capabilities that need improvement to optimize MDM processes (Qodarsih, Yudhoatmojo, & Hidayanto, 2018).

Institution XYZ plays an important role in managing electronic certification data in the public sector. The system manages personal data such as name, employee identification number, official email address, job title, organization, and mobile phone number. This data is used by Institution XYZ to support regulatory reporting, meet leadership information needs, and provide inputs for internal dashboards.

However, Institution XYZ faces problems related to inconsistencies in user data due to the use of two applications with separate databases. Such conditions can lead to data inconsistency, which may undermine data reliability, particularly when used for reporting and internal information needs.

The importance of integrated and standardized data management is emphasized in organizational transformation initiatives. This approach highlights the need for accurate, up-to-date, integrated, accountable, easily accessible, and shareable data (A. et al., 2019).

Based on the background described above, two research questions were formulated:

RQ1: What is the maturity level of master data management in government electronic certification services?

RQ2: What recommendations can be proposed to improve master data management in government electronic certification services?

Several frameworks can be used to measure MDM maturity, such as the DataFlux Master Data Management Maturity Model, Oracle Master Data Management Maturity Model, Spruit & Pietzka Master Data Management Maturity Model, and Kumar Master Data Management Maturity Model (A. et al., 2019). This study adopted the MD3M framework developed by Spruit & Pietzka, as it covers five evaluation domains: Data Model, Data Quality, Use & Ownership, Data Protection, and Maintenance (Spruit & Pietzka, 2015). This model was considered suitable for assessing MDM maturity.

Meanwhile, improvement recommendations were developed based on the Data Management Body of Knowledge (DMBOK) (Haristya, Laksmi, Astuti, & Dewi, 2020), which provides a comprehensive and systematic framework for data management (Pansara, 2021).

DMBOK also serves as a reference for developing data governance policies, including data standardization and mechanisms to ensure data consistency, accuracy, and integrity (A. et al., 2019).

This study aimed to evaluate the maturity level of MDM, identify areas for improvement, and provide recommendations to enhance master data management. The results are expected to offer clear guidance for achieving more effective, secure, and regulation-compliant data management, thereby supporting organizational operations optimally.

METHOD

This study presents five previous studies related to measuring MDM maturity. These studies were then compared to form the basis for synthesizing the current research. This comparison is presented in the following Table 1.

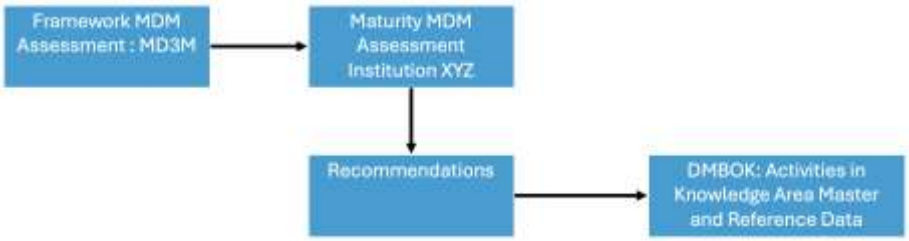
Table 1. Comparison of Previous Studies

Paper/ Study	Compare	Contrast	Criticize	Summarize
(Krismawati et al., 2019)	Adopted Spruit & Pietzka's MD3M (2015) focusing on five key domains of MDM	Recommendations derived from MD3M maturity gap analysis and alignment with DAMA-DMBOK2 principles.	Limited inter-agency scope; lacks post-assessment implementation tracking.	Evaluated MDM maturity in BPS using MD3M to improve register integration and stewardship.
(Ko et al., 2021)	Used Spruit & Pietzka MD3M to assess MDM readiness in a public institution	Recommendations based on MD3M assessment results and data governance practices from DMBOK2 and IT governance frameworks	Did not include evaluation metrics for implemented improvements.	Assessed data governance readiness and proposed policy-based MDM consolidation at the Presidential Secretariat
(Alfiandi & Ruldeviyani, 2024)	Applied MD3M by Spruit & Pietzka for government judicial data context	Recommendations sourced from MD3M domain analysis and DMBOK2 guidance on ownership and governance	Did not connect MDM maturity results to organizational outcomes	Examined HR and case data management maturity and proposed centralized governance
(Permata Sari & Nizar Hidayanto, 2024)	Utilized Spruit & Pietzka MD3M with questionnaire and interview methods	Recommendations aligned with MD3M maturity evaluation and ISO 27799 (health data governance) plus DMBOK2	Overly technical focus; limited linkage to business value	Analyzed private sector MDM using MD3M, suggesting improvements in data model and data protection
(Prastowo, Nugroho, & Ruldeviyani, 2025)	Applied Spruit & Pietzka MD3M for healthcare EMR data integration	Combined MD3M results with ISO 8000 Data Quality and DMBOK lifecycle principles for recommendations	Limited to single case; lacks broader sector comparison	Focused on EMR data stewardship and maintenance process improvement using MD3M

Based on those studies, the MD3M model can be used to appraise the MDM maturity level in an institution. Using MD3M, the weaknesses that need to be addressed can be identified. Various frameworks can be used to guide the improvement activities. Therefore, MD3M was chosen because it evaluates five key areas: Data Model, Data Quality, Usage and Ownership, Data Protection, and Maintenance, compared to other models. Therefore, MD3M evaluates all areas related to MDM.

The framework used in the assessment is the Spruit and Pietzka MD3M, which aims to appraise master data maturity in an institution. In addition, it provides effective master data management guidelines that allow various institutions to compare their maturity (Prataman, Astana, Yudhoatmojo, & Hidayanto, 2018).

Furthermore, to develop improvement recommendations for Institution XYZ, the strengths and weakness of the MD3M measurement results will be mapped against the MDM activities in the DMBOK. The integration with the DMBOK is based on best practices in data management and provides steps for managing master data. The steps involved can be seen in Figure 3.



Picture 3. Steps for Developing Improvement Recommendations

To address the research objectives, the research steps (research methodology) were carried out, as shown in Figure 4.

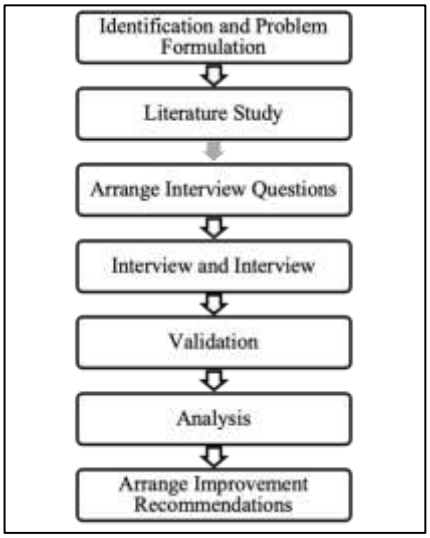


Figure 4. Research Methodology

1. Problem Identification and Formulation

   At this stage, issues within Institution XYZ were identified. This was conducted through interviews with data analyst responsible for data management at Institution XYZ. The identified problem was data duplication among agencies.

2. Literature Study

   At this stage, a literature review was conducted on the concepts of master data, master data management, and models used to measure data management maturity. The review also covered organizational context and explanations related to MDM practices. In addition, previous studies were analyzed to examine how MDM maturity assessments have been implemented and to understand the approaches used in such assessments. Based on the literature review, the Spruit and Pietzka MD3M model was selected to assess maturity. Additional references related to the dimensions addressed by MD3M were also collected.

3. Developing Interview Questions

   At this stage, interview questions were developed based on the MD3M framework. The questions were structured into two sections (Spruit & Pietzka, 2015): those related to influential factors, as presented in Table 2, and 13 focus areas listed in Table 3. The interview questions were tailored to the context of Institution XYZ.

4. Interviews and Observations

   At this stage, interviews were conducted with the team at Institution XYZ using a focus group format. This discussion consisted of three participants: one Subject Matter Expert (SME) or team leader of data management and two employees responsible for data management. The interview questions were predetermined.

   Following this, observations were conducted to support evidence documents collected by Institution XYZ, such as internal guidelines and data management within the application. This process was necessary to confirm that MDM management had been properly implemented. The results of the process were used as the basis for measuring MDM maturity.

   The questions in the capability assessment questionnaire for implementing master data management are closed-ended questions with “Yes” or “No” responses. If institution XYZ had implemented the control referred to in a question, the answer was marked “Yes”. However, if the institution XYZ had not implemented the control, the answer was marked “No”.

5. Validation

   Validation of the maturity measurement results was guided at the end of the interview sessions. This validation aimed to ensure the appropriateness of the answers and the accuracy of the data prior to further analysis. Furthermore, during this validation stage, Institution XYZ also determined the maturity targets to be achieved, which were used as the basis for prioritizing improvement recommendations.

6. Data Analysis

   The next stage was the analysis of the measurement data using the MD3M. The output of this stage was the MDM maturity score for Institution XYZ. This analysis identified strengths and weaknesses in the implementation of master data management. Unimplemented capabilities identified during this stage were used as inputs for developing improvement recommendations.

   The MD3M assessment consists of five areas, each with its own constituent aspects. The assessment method does not rely on weighting or averaging; instead, all aspects within an area must meet the criteria for a given level before progression to the

next level [1]. If an aspect fails to meet the criteria at a particular level, the maturity level is assigned the lower level. This approach also applies to area-level assessments. Consequently, the final maturity level corresponds to the level at which all aspects or areas satisfy the defined criteria.

7. Preparation of Improvement Recommendations

   Weakness in master data management identified during the analysis were used to formulate improvement recommendations. These recommendations were developed based on activities outlined in the Data Management Body of Knowledge (DMBOK) and aim to enhance MDM practices at Institution XYZ.

RESULT AND DISCUSSION

MDM Maturity Assessment

This section explains the research results. The results were obtained through focus group discussions with Subject Matter Experts (SMEs) based on the MD3M questionnaire. The discussions used two types of questionnaires: the Influential Factors and the MD3M.

Influential Factors are used to map characteristics of institution through questions posed in the MD3M matrix. The answers to the influential factor questions influence several questions in the results matrix.

The characteristics of Institution XYZ are presented in Table 2. Institution XYZ is an organization that needs to regularly interact with other teams and exchange data. This condition prompted the inclusion of the Master Data Definition point E, as shown in Table 3 (green column). Institution XYZ operates as a public sector institution; therefore, the Impact on Business points D and E were excluded, as indicated in Table 3 (red column).

Table 2. Table Influential Factors

Influential Factor	Answer
Does your company belong to a group, and your company needs to interact regularly with other internal members of the group and exchange data?	Yes
Is your company a non-profit organization, and/or a governmental or military organization?	Yes
Does your company exceed a number of employees of approximately 250?	No
Do the employees need to work with many different systems for executing their daily work and have to follow different processes when doing this?	Yes

Institution XYZ has fewer than 250 employees; therefore, Data Quality Assessment Point C is also excluded, as shown in Table 3 (red column). The final factor, namely the presence of multiple disparate information systems, allows the inclusion of the Data Landscape capability at point E, as shown in Table 3 (green column).

Table 3. Table Influential Factors

Focus Area	Level 1	Level 2	Level 3	Level 4	Level 5
Data Model					
Definition Master Data	√	√	√	X	X
Master data model	√	√	X	X	X
Data Landscape	√	X	√	X	X

Data Quality					
Assessment of Data Quality	√	X		X	X
Impact on Business	√	√	√		
Awareness of Quality Gaps	√	√	√	√	√
Improvement	√	√	X	X	X
Data Usage & Ownership					
Data Usage	√	√	√	√	√
Data Ownership	√	√	√	√	X
Data Access	√	√	√	√	√
Data Protection					
Data Security	√	√	√	√	√
Data Maintenance					
Storage	√	√	X	X	√
Data Lifecycle	√	√	X	X	√

Notes:

Implemented (√)

Not Implemented (X)

The results of the MDM maturity assessment questionnaire at Institution XYZ are presented in Table 3. Influential factors have been marked in the matrix using green and red columns.

The matrix illustrates the main activities within the MD3M framework. An answer of "No" indicates that a capability is unimplemented. Conversely, an answer of "Yes" indicates that the capability has been implemented according to the relevant topic and capability.

After the matrix is mapped, the maturity level is appraised. The maturity level of each area is measured based on the implemented capabilities. A level is obtained only when all required capabilities at that level have been checked. Even if a upper-level capability has been completed, the maturity level is considered unachieved when a bottom-level capability has not been implemented.

The results of the MDM maturity level for each focus area at Institution XYZ are presented in Table 4.

Table 4. Table MD3M Maturity Level Each Focus Area

Focus Area	Level
Data Model	1
Data Quality	1
Usage & Ownership	4
Data Protection	5
Data Maintenance	2
Overall Level	1

The total of implemented capabilities compared to unimplemented ones is 43 out of 62. This indicates that 69.36% of the capabilities have been implemented, while 30.64% remain unimplemented. Table 5 shows the implemented and unimplemented capabilities for each area.

The area with the highest level of implementation is Usage and Ownership, with 14 capabilities implemented, representing 93.33%. institution XYZ has implemented all capabilities (100%) in the Data Protection area. In the Data Model area, there are still 8 capabilities that have not been implemented, representing 53.33%. meanwhile, the Data

Quality area has implemented 11 out of 17 capabilities. Furthermore, the Data Maintenance area has implemented 6 capabilities, or 60%.

Table 5. Table Percentage of Capabilities Implemented by Area

Area	Capability	Implemented		Unimplemented	
		#	%	#	%
Data Model	15	7	46.67	8	53.33
Data Quality	17	11	64.47	6	35.29
Usage & Ownership	15	14	93.33	1	6.67
Data Protection	5	5	100	0	0
Data Maintenance	10	6	60	4	40
Total	62	43	69.36	19	30.64

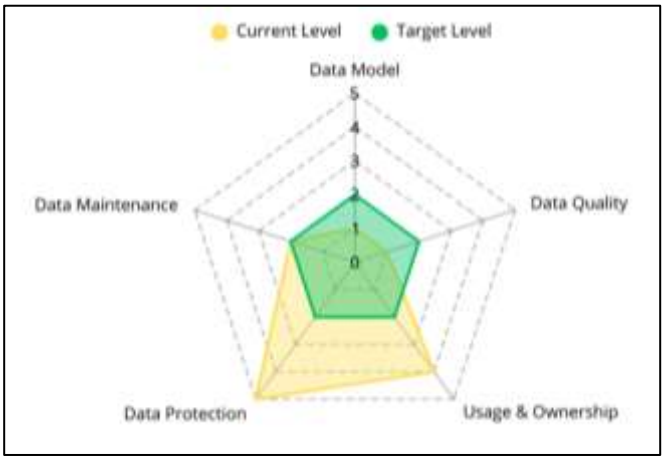
As shown in Table 6, 13 capabilities at the Initial level (level 1) have been implemented. At the Repeatable level (level 2), two capabilities have not been implemented, representing 15.38%. at the Defined Process level, eight capabilities have been implemented, accounting for 66.67%. Meanwhile, at the Managed Measurable level, seven capabilities have not been implemented, representing 58.33%. At the Optimized level, six capabilities have been implemented.

Table 6. Percentage of Capabilities Implemented by Level

Level	Capability	Implemented		Unimplemented	
		#	%	#	%
1: Initial	13	13	100	0	0
2: Repeatable	13	11	84.62	2	15.38
3: Defined Process	12	8	66.67	4	33.33
4: Managed & Measurable	12	5	41.67	7	58.33
5: Optimized	12	6	50	6	50
Total	62	43	69.36	19	30.64

Result

Overall, the maturity of MDM at Institution XYZ can be seen in Figure 5. The achievement target is set one level higher than the current value in each area, unless the current value has reached Level 5, which is the maximum level. Based on the evaluation, the Data Protection area has reached Level 5; therefore, the target remains at Level 5. Areas that require improvement are Data Model and Data Quality, as they are currently at Level 1, with respective targets of Level 2. In addition, Data Maintenance is still at Level 2, with a target increasing to Level 3. Meanwhile, the maturity level in the Usage and Ownership area is at Level 4, with a target of reaching Level 5.



Picture 5. Radar Chart for Maturity Level by Area

The overall maturity at Institution XYZ is at Level 1. This indicates that the institution has made initial efforts to organize master data and has increased awareness of its importance. However, improvements are needed in the Data Model and Data Quality.

1. Data Model

   The maturity area of the Data Model in Institution XYZ reached Level 1. The following explains each focus area.

   1) Definition of Master Data

      MD3M measurements indicate that master data definitions in Institution XYZ are not yet fully documented, in accordance with the maturity level at Level 1 (Initial). Master data, such as user information including name, national employee identification number, official email address, position, and institution do not have uniform definitions across the two application systems. For example, name formats are stored using full capital letters in one system but mixed case in another. This lack of uniformity creates uncertainty in determining data standards for reporting and internal purposes.

      Institution XYZ has a shared understanding of master data definitions across its various departments. However, this master data definition has not been formally defined to reflect specific conditions and institution needs.

   2) Master Data Model

      MD3M measurements in the Master Data Model focus area are at the Repeatable level (Level 2). Based on the analysis, several departments within Institution XYZ can provide a general overview of master data related to their scopes of work. However, a weakness remains: the lack understanding of data models used by other departments.

      This indicates inconsistencies in the master data structures among two application systems. This inconsistency indicates that institution XYZ lacks a standardized governing data model. This leads to data synchronization errors.

   3) Data Landscape

      Master data management in Institution XYZ is still spread across two application systems with separate databases. Data landscape analysis reveals that data flows between two systems lack an automatic synchronization mechanism;

therefore, changes data in one system do not directly affect data in the other system. For example, updates to job title data in one system are not automatically updated in the other, resulting in asynchronous data.

MD3M measurements indicate that data landscape is still at an early stage. This indicated a general overview of systems that operate master data. However, this overview needed refinement and does not yet pinpoint which systems they had access to.

2. Data Quality

The Data Quality at Institution XYZ is at Level 1 (Initial). The following explains each focus area.

1) Assessment of Data Quality

MD3M measurement results indicate that the Data Quality Assessment focus area remains at the Initial level. Interview indicate that the data management team has a strong understanding of what constitutes good data and that good data can add value to institution. Based on the analysis results,gaps were still found in the automatic data validation mechanism.

2) Impact on Business

Based on the MD3M assessment, the Impact on Business area is at the Defined Process level (Level 3). Institution XYZ understands how bad master data will impact the business, specifically financial losses. Data discrepancies between systems can degrade data quality. This will undoubtedly impact the institution's reporting to the regulatory entities.

3) Awareness of Quality Gaps

In this area, Institution XYZ has a high level of awareness of data quality gaps. However, a weakness remains, namely the lack of formal mechanisms or procedures to address these data quality gaps. This results in most improvement efforts being reactive, while very few proactive efforts are being implemented.

Based on the MD3M assessment, the focus area related to Awareness of Quality Gaps has reached the Optimal level. These results indicate that institution XYZ is aware of the internal weaknesses within the organization that contribute to these data quality gaps, as well as the underlying reasons for these weaknesses.

4) Improvement

Based on the assessment results, the focus area for Improvement in institution XYZ has reached the Repeatable level, which indicates an increase in recognition of the value of data quality to support effectiveness and efficiency.

3. Usage and Ownership

Regarding the Usage and Ownership area in institution XYZ, it is at level 4. The following is an explanation for each focus area:

1) Data Usage

The capability in the Data Usage area at institution XYZ has reached Optimal condition at Level 5. This illustrates that all available resources have been utilized by employees using certain systems to obtain the required data.

2) Data Ownership

Interview results indicate that data accountability has reached Level 4 (Managed & Measurable) out of a maximum of Level 5. This demonstrates the identification and appointment of data managers from each relevant department. However, these appointments are still informal, and the data management process remains ad-hoc. This is due to the lack of an official policy defining the tasks and duties of each party in data management, and the absence of formal procedures or mechanisms to serve as a basis for the data management process.

3) Data Access

Based on the analysis results in the Data Access area, Institution XYZ has reached the Optimized level (Level 2). Institution's primary strength in this focus area is each employee's understanding of the data requirements for each specific purpose, as well as the data sources they can access to meet those data needs.

4. Data Protection

For the Data Protection focus area, Institution XYZ has reached the Optimized Level, namely Level 5. In protecting data security, Institution XYZ has implemented various security procedures from the procedural, system, and infrastructure aspects. Some of the security methods that have been implemented in Institution XYZ are data encryption, the use of firewalls, and physical and system access control. However, the implementation of these security procedures does not mean eliminating risks completely, because threats to data will still exist, especially since the data is stored in 2 different systems. This means that security management must be carried out comprehensively on both systems, to minimize the occurrence of security gaps.

5. Data Maintenance

Data Maintenance aspect in Institution XYZ is still at Level 2. The following is an explanation for each focus area in Data Maintenance.

1) Storage

The measurement results indicate that the Storage aspect is still at level 2 (Repeatable). Interviews revealed that data logic was routinely monitored and evaluated to ensure it remains up to date. However, weaknesses remain in this area. The identified weakness is the lack of procedures to ensure there was no duplication and inconsistency between data. Even though data was stored in two different systems, there is a risk of data inconsistency.

2) Data Lifecycle

The Institution XYZ data lifecycle assessment remains at Level 2 (Repeatable). This indicates that the Institution XYZ understands that data is a valuable organizational asset. However, the Institution XYZ lacks an understanding of data management throughout its lifecycle.

Recommendation

Based on the assessment, several focus areas remain weak. Areas that need improvement include Data Landscape and Data Quality Assessment. These areas remain at Level 1 (Initial). Five recommendations are proposed to improve the MDM maturity level at Institution XYZ. These recommendations are developed based on activities within the MDM

domain of the Data Management Body of Knowledge (DMBOK). Table 7 shows the mapping of findings with MDM activities in DMBOK:

Table 7. Recommendation Mapping

Findings	DMBOK MDM Activities	Reason
Institution XYS is not yet able to provide a complete picture of the interrelationships among systems connected to MDM	Define Architectural Approach	The recommendation for the architectural approach activity is based on the findings indicating that a comprehensive overview of MDM at Institution XYZ is not yet available. Meanwhile, the architectural approach activity for MDM includes developing an MDM architecture, starting with the business strategy, existing data source platforms, and the data itself (Henderson et al., 2017). This activity describes the various source systems that need to be consolidated into the Master Data solution, and the system programs that need to be considered when directing the integration. Based on this explanation, the MDM architectural approach activity is deemed appropriate to address these findings.
MDM is built by Institution XYZ itself	Define Stewardship and Maintenance Processes	The recommendations for the Establish Governance and Maintenance Process activity are based on findings that indicate that the MDM was built by the Institution XYZ itself without involving other stakeholders, thus managing it independently. Meanwhile, the governance and maintenance activities for the MDM indicate that the process needs oversight, not only to direct documentations that deviates, but also to correct and refine processes that caused records to deviate from the initial process (Henderson et al., 2017). Thus, this process can indicate the duties and responsibilities of each stakeholder involved in the MDM.
Maintenance is only a daily activity at Institution XYZ, there is no periodic maintenance plan or defined responsibilities	Establish Governance Policies	The recommendation to establish governance and maintenance processes is based on findings indicating that MDM lacks planning and guidelines for MDM maintenance. Meanwhile, governance and maintenance activities for MDM ensure a continuous maintenance to verify data quality by providing feedback to source systems and input that can be used to refine and improve the algorithms that drive the MDM solution (Henderson et al., 2017).
Institution XYZ does not yet have an overview of system access that can read or change data on MDM	Model Master Data	The recommendation to build a master data model is based on findings indicating that Institution XYZ did not yet have a mapping of access for each system that can read or modify data in the MDM. The MDM modeling activity explains that, to ensure consistency and control the integration of new sources as the institution expands, it is necessary to model data within subject areas. A logical or canonical model can be explained above the subject areas within the data repository (Henderson et al., 2017). This will enable institutional definitions of subject area entities and attributes.

There has been no inventory and periodic review of data source redundancy, no audit and no planning for improving data quality from data sources	Evaluate and Assess Data Sources	Recommendations for building, evaluating, and assessing data sources are based on findings indicating a lack of regular review of data source redundancy and a lack of audits to ensure data quality. MDM data source assessment activities highlight the importance of understanding the form and content, as well as the steps by which it was gathered or produced. The benefit of MDM efforts is improved metadata produced through activities to appraise quality in its current state. The objective is to recognize the completeness of the data in relation to the attributes that complete master data (Henderson et al., 2017).

The following explains the four recommendations:

1. Assess Data Sources

   Institution XYZ needs to conduct an inventory of all systems, including databases and data tables connected to MDM. The purpose of this inventory is to map the relationships between systems, thereby identifying primary systems (recording systems), supporting systems, as well as user systems. This identification can help Institution XYZ identify potentially inconsistent or redundant data. The inventory will also help facilitate Institution XYZ's control and oversight of compliance with established MDM governance.

2. Determine the Architectural Approach

   Institution XYZ, along with other units within the institution, need to develop a data architecture for the entire organization, including a Master Data Management (MDM) architecture. This data architecture is connected to other architectures such as business processes, services, systems and applications, infrastructure, and security mechanisms, which collectively form an enterprise architecture (EA). This data architecture must include references and metadata for each data component. This architecture must include references and metadata for each data component. This architecture is expected to clarify the development of data integration mechanisms, so that data duplication can be reduced and data between systems can be synchronized.

3. Model Master Data

   An integrated MDM model/ topology is needed for all related systems, both systems that consume data from MDM. This model needs to describe the create, read, update, and delete (CRUD) rights or authorities for each system related to this MDM. Furthermore, this model must have clear references to data formats and attribute structures in accordance with established rules, for all related systems, so that each connected system can comply with applicable standards. With this model/ topology, it is hoped that il will facilitate control and supervision in maintaining MDM data quality.

4. Define Stewardship and Maintenance

   Institution XYZ needs to develop regulations governing who can change data in MDM and the authority of each role. These regulations should also outline what data or attributes can be changed, the procedures for changing each type of data, and how changes are monitored and evaluated. Additionally, regulations related to data maintenance can be included, such as data maintenance mechanisms/ procedures, data backup and restore periods, and the responsibilities of the roles involved.

CONCLUSION

Based on the results of the research conducted, the overall MDM maturity level in government electronic certification services was at Level 1 (Initial). The services had implemented 69.36% of the required capabilities, while 30.64% had not yet been implemented. Meanwhile, each domain demonstrated different maturity levels. In the Data Protection dimension, the maturity level had reached Level 5 (Optimized), indicating strong capability in ensuring data security within the MDM framework.

In other domains, the maturity level remained at Level 1. The analysis results indicated a lack of clarity and understanding regarding system integration within the MDM environment. In addition, the Data Maintenance domain showed a low maturity level at Level 2, indicating that MDM and connected systems were not yet optimally maintained.

This study provided five recommendations to improve MDM maturity to Level 2. These recommendations were based on MDM activities outlined in the Data Management Body of Knowledge (DMBOK). The proposed recommendations included defining a data architecture approach, designing MDM models, establishing MDM management and maintenance processes, and conducting an inventory of connected systems and data. Implementing these recommendations is expected to improve MDM at Institution XYZ, resulting in more consistent and accurate data. This will positively impact operational processes at Institution XYZ and ensure compliance with applicable regulations.

This study encountered several limitations. One limitation was the use of a single assessment model for evaluating MDM maturity. The study applied only the Spruit and Pietzka MD3M model, which, although comprehensive, may limit the consideration of other relevant organizational factors. Furthermore, the assessment was conducted only within specific units through interviews and document reviews; therefore, it does not fully reflect integration challenges with external applications. In addition, the number of participants was limited to three respondents. Future research should increase the number of participants and involve additional stakeholders.

This study contributes to the literature on MDM maturity assessment in government organizations managing electronic certification services. Suggestions for future research include expanding the scope of analysis, for example by linking MDM maturity levels to organizational performance. This study may also be used to compare MDM governance implementation across government institutions, thereby helping to identify national-level MDM governance patterns.

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