Master Data Management Maturity Assessment : A Case Study of a Pasar Rebo Public Hospital

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ABSTRACT

Patient's master data is an important data for hospital's operational. If the master data quality does not meet the expectation, it will affect the billing process and then will affect the income for the hospital. Master data management can help the hospital to integrate all their master data they have so for each data there will be only single source of truth and validity of data will be complied. By doing assessment of master data management maturity, hospital will be able to identify what aspect of master data management that they lack so the process can be improved as well as the quality of master data. Assessment of master data management maturity level is done using Master Data Management Maturity Model (MD3M) oleh Spruitz and Pietzka. The assessment showed 90% of activity related to master data management has been implemented. Some policies need to be implemented regarding to the master data management, such as documentation of the policies and the definition of master data, formal appointment of the data stewards, and the implementation of master data quality management.

Key words: capability, master data management, MD3M, maturity level

1. INTRODUCTION

Data and information are vital assets in the organization, specifically for the hospital as a healthcare service provider. The data owned by the hospital can be transactional data, reference data, master data, and. The example of transactional data is patient's medical record. Medical record document consists of patient's administrative data, such as name, address, age, and insurance number. Medical record also contains clinical data, such as patient's vital signs, diagnosis, and medication. This medical record is used to monitor the patient's health condition. Healthcare is moving from reactive to reactive approach. To keep patients healthy, healthcare service provider should not only treat the illness, but also prevent that illness to occur in the first place [1].

The example for master data is patient's data that is used by several units. Patient's data recorded in the system then matched with the data of insurance used by patients. If these data do not match, it means that the hospital's patient data

quality is lacking. It is caused by several factors, such as invalid data inputted by user. Low data quality will hinder the billing process, as the patient's data in the hospital and the insurance company's system does not match. If these data do not match, then the billing process cannot be settled. The other effect of bad patient's master data quality is waste of time and effort that are used to manage the data. If the time and effort used on managing the data too much, the hospital won't be able to do its core activity, which is providing healthcare services [2].

The patient's master data is also used on analytics activities regarding the overall healthcare services, which includes the analysis of medical record data. The volumes of medical records that refer to master data are growing in volume. To extract the right context information from those data efficiently and effectively, the data used must be accurate and stored efficiently. This could not be achieved if the quality of data is lacking [3].

Master data management activity is done by each unit according to corresponding master data that they manage, using Hospital Management Information System, called SIMRS. By doing assessment of master data management maturity level on the hospital, they will be able to identify which aspect of master data management that should be improved so it also will improve the security and quality of the master data itself. According to the current condition of master data management, the research question is: How is the implementation of master data management in the hospital in the case study?

There are several models that could be used to assess master data management maturity model, such as Oracle Master Data Management Maturity Model, Dataflux Master Data Management Maturity Model, Kumar Master Data Management Maturity Model, and Spruitz & Pietzka Master Data Management Maturity Model. For this case study, the model designed by Spruitz & Pietzka will be used due to its key topics and focus areas are fit with the master data management that are done by the hospital [4].

The following sections in this paper are organized as follows: Section II described the literature reviews related to the topics.

Section III described the methodology used for this research. Section IV reports the result and analysis of the findings. Section V concludes and provides recommendations for further research on this research area.

2. LITERATURE REVIEW

2.1 Master Data

Master data is the data that depict business entity involved in a transaction done by organization. Unlike reference data, organization does not define in the beginning type or range of value that are valid for the master data. Instead, the business rules define the type and range of value for master data. Master data in an organization includes all entities involved in a transaction done by organization, products owned by organization, locations, such as address, and financial structure such as chart of accounts for recording to the general ledger [2].

2.2 Master Data Management

Master data management is a process of defining and manage the process of creating, integrating, maintaining, and the use of master data throughout the organization [2]. The goal of master data management is to provide a centralized data source with high quality data that could be accessed and used by entire business entity based on their authorization. The goal of master data management is also to reduce cost and complexity caused by high data duplication and the difficulty to maintain those data. The other goal of master data management is as an endeavor to reduce system silos in the organization so that the data will be centralized and integrated. The improvement of data quality will have a positive impact on ease of access to information and data needed for decision-making process [2].

According Data Management Body of Knowledge (DMBOK) by DAMA, the master data management is done alongside reference data management. Reference and master data management process divided into ten activities. The activities are understanding reference and master data integration needs, identifying master and reference data sources and contributors, defining and maintain the data integration architecture, implementing reference and master data management solutions, defining and maintaining match rules, establishing “golden” records, defining and maintaining match rules, planning and implementing integration of new data sources, replicating and distributing reference and master data, and managing changes to references and master data [2].

2.3 Master Data Management Maturity Model

Master data management maturity model is a measurement standard for organization’s capability to continuously perform master data management. The higher the maturity level, it can be concluded that the organization has higher level of awareness of master data management, better master data management, and could optimizing maintaining and use of master data.

There are several master data management maturity models that will be compared. Those models are Oracle, Dataflux, Kumar, and Spruitz & Pietzka. Oracle model consists of 5 focus areas those are user data profiling, data strategy definition, definition of data consolidation plan, data maintenance, and data utilization. For each focus area, oracle divide maturity level into 4 level, that is marginal, stable, best practice, and transformational. According to Spruitz & Pietzka the maturity model defined by oracle does not match their model, because the focus areas are still considered too general. Despite that, this model is sufficiently enough to depict master data management condition, starting from inconsistent and unorganized data, and then developed into performing master data management utilizing information technology across all organizational unit [4].

Master data management maturity model defined by Dataflux consists of 6 focus areas those are architecture, governance, management, identification, integration, and business process management. For each area, Dataflux divide maturity level into 5 levels. Those are initial, reactive, managed, proactive, and strategic performance. According to Spruitz & Pietzka, this model is inadequately structured for each focus area and maturity level. Even though there are business processes related to master data management depicted in each focus area and maturity level, the process of lower maturity level and the higher one cannot be compared properly [4].

Master data management maturity model defined by Kumar consists of 6 maturity level. Those levels are ignorant (level 0), initial (level 1), isolated (level 2), organized (level 3), unified (level 4), and optimized (level 5). Each maturity level has its own characteristics. Compared to other model, this model does not have focus area, so this model only could be used to depict general process of master data management. Due to the unstructured nature of this model, this model cannot be used to assess maturity level of organization’s master data management activities [4].

Master data management maturity model defined by Spruitz and Pietzka consists of 5 key topics, that is data model, data quality, usage and ownership, data protection, and maintenance. Data model topics focused on the definition of master data, data model, and organization’s data landscape. Data quality topic focused on data quality assessment, impact of data quality on business, awareness of quality gaps. Usage and ownership topic focused on data usage, data ownership, and data access. Data protection topic focused on data security and data access mechanisms [5].

Each topic on Spruitz and Pietzka model consists of 5 maturity level, that is initial, repeatable, defined process, managed and measurable, and optimized. Each level describes the organization’s achievement on all focus area for each key topic related to master data management activity. Table 1 described each maturity level of Spruitz and Pietzka model [5].

Table 1: Description of Maturity Level of spruitz dan pietzka Model

Level	Description
(1) Initial	Organization is aware of issues related to master data management process
(2) Repeatable	There is initiative from individual or certain unit to independently resolves issues related to master data management process.
(3) Defined Process	There is collaboration between units to resolves issues related to master data management process.
(4) Managed & Measurable	There is defined and documented process to manage master data management that communicated to all individuals and units in the organizations.
(5) Optimized	The process of master data management is optimized and done effectively and efficiently

2.4 Comparison of Master Data Management Maturity Model

The master data management models compared on this research consist of four to six maturity level. The overview of the topics on all models is described on table 2. The table shows that MD3M Spruitz and Pietzka and Dataflux have similar topics [4].

Table 2: Comparison of Master Data Management Models According To Spruitz And Pietzka

Scope	Oracle	Kumar	Dataflux	MD3M
Definition of Master Data	v	v	v	v
Master Data Model	v	v	v	v
Data Landscape	v		v	v
Assessment of Data Quality	v	v	v	v
Impact on Business		v	v	v
Awareness of Quality Gaps	v	v	v	v
Improvement	v	v	v	v
Data Usage	v		v	v
Data Ownership	v		v	v
Data Access	v		v	v
Data Security			v	v
Storage	v	v	v	v
Data Lifecycle	v	v	v	v

3. RESEARCH METHODOLOGY

On the process of assessment of master data management maturity level, the first step is to identify problem that is already explained on section I. The second step is to do literature review to know about the theories related to master data management and its implementation on the organization. Literature review is also done to identify several models used to determine the master data management maturity level. After that, those maturity models are compared to determine which

model will be used to do the assessment. On this step, it is decided that the model defined by Spruitz and Pietzka will be used [6]. The next step is to collect data that will be used to do assess the master data management maturity level. The methods used to collect data are observation and questionnaire.

3.1 Observation

One of the methods used on this research is observation. We will observe the usage of SIMRS simulated by IT manager. Some of the elements that will be observed are master data management process in the application and the usage of data master in the transaction. Besides, observation will be conducted for process related to data landscape, data usage, data ownership, data access, data storage, and master data lifecycle in SIMRS.

3.2 Questionnaire

On the questionnaire used in this research, there will be two set of questions. On the first set of question, there will be questions regarding the organization's influential factors, which includes the size of the organization, interaction with the external party, and the number of systems used by the organization. On the second set of questions, there will be questions regarding the organization's capability to conduct master data management capability. Spruitz and pietzka split the questions into two sets because there are several things related with organization's capability to manage master data that may not fit with the required condition in the questionnaire so the assessment may not be applicable on that area. For example, the smaller size organizations may not need to conduct complex master data management activities or using the latest technology to do it. Another example is a non-profit organization that gaining profit efficiently may not be their goal. This questionnaire will be filled by subject-matter-expert (SME).

Table 3: Question Regarding Organizational Influential Factors and Its Impact On The Assessment

Question	Impact
Does your company belong to a group and your company needs to interact regularly with other internal members of the group and exchange data?	If the answer is "Yes", then the capability "Definition of master data"-E will be enabled
Is your company a non-profit organization, and/or a governmental or military organization?	If the answer is "No", then the capabilities "Impact on Business"-D and "Impact on Business"-E will be enabled
Does your company exceed a number of employees of approximately 250?	If the answer is "Yes", then capability "Assessment of data quality"-C will be enabled
Do the employees need to work with many different systems for executing their daily work and have to follow different processes when doing this?	If the answer is "Yes", capability "Data Landscape"-E will be enabled

Table 3 shows questions related to organizational influential factors. First question will affect the organization's capability to conduct data exchange with another organization within the same group. The second question will affect organization's capability to assess non-financial impact of a data, classifying the financial effect, and determine if a data will have an impact to organization's reputation. The third question will affect organization's capability to assess data quality considering the need of data quality of each business units. The fourth question will affect on the organization's capability to manage data resource across all the systems according to the organization's data landscape.

This questionnaire then will be mapped into the table to identify the maturity level. If the answer is "Yes", then it means the organization has been implemented the said focus area. If the answer is "No", then it means the organization has not been implemented the said focus area yet.

The second set of questions contains the questions regarding organization's capability to conduct master data management. The second set of questions contains 65 questions, but that will be reduced to 60 questions, according to the answers on the first set of questions.

3.3 Data Collection

The questionnaire will be filled by 2 Subject Matter Expert (SME) through group discussion. The SMEs that will be fill the questionnaire are IT manager and non-IT manager, who in this research that will be the manager of healthcare service. The unit of healthcare service is a unit that interacts a lot with the SIMRS on the transactional process that involved many of master data. The answer of this questionnaire will be used to calculate the maturity level of master data management process. On this stage, the observation of the healthcare management information systems (SIMRS) will also be conducted.

3.4 Maturity Level Determination

The assessment process will be divided into several stages. On the first stage, the assessment will be done for each focus area. On each focus area, there will be 5 questions that must be answered by SME. The answers will only have three options, that is "Implemented", "Not yet Implemented", or "Not Applicable", according to answer of the first questionnaire. The maturity level determination will be done based on how much capability has been implemented before the question that has "Not yet implemented" or "Not applicable" as an answer. For example, if the first three questions regarding capability of a focus area that have "Implemented" as an answer, and the fourth question is answered "Not yet implemented" or "Not applicable", then the maturity level of that focus area is 3, even though the answer of the fifth question is also "Implemented".

On the next stage the assessment will be done on each key topic. For each key topic, its maturity level is its lowest focus area level. On the last stage, the assessment will be done for organization's overall master data management maturity level. The organization's maturity level is its lowest key topics level.

3.5 Policy Making Process

Policy-making process regarding to master data management activity will be done based on SME answers to the questionnaire. If SME answer "Not yet implemented" on the questionnaire regarding a specific capability, then the policy to implement the said capability will be formulated internally by the SMEs with the top-level managers.

4. CASE STUDY

4.1 Organization's Profile

Pasar Rebo Public Hospital is belonged to the government of DKI Jakarta located in Eastern Jakarta. This hospital provides various healthcare services, ranging from outpatient and inpatient care, emergency care, laboratory, radiology, and other services. This hospital has 754 employees, including 19 general practitioner and 54 specialized practitioners. This does not include outsourced employee. There is an integrated system used by this hospital to perform their healthcare services. This system is a hospital management information system, called SIMRS that connect all units within the hospital. This system also integrated to government's public health office's dashboard system. This integration is done so government can monitor the healthcare performance of not only Pasar Rebo Public Hospital, but also monitoring all public hospitals within DKI Jakarta area [7].

4.2 Result

Table 4 shows that the organization belongs to a group of public hospitals under public health office of DKI Jakarta, that has to exchange data with the public health office. This condition enables capability "Definition of master data"-E will be included in the assessment process. This organization is a non-profit organization, so capability "Impact on business"-D and "Impact on business"-E will not be included in the assessment process. The number of employees in this organization exceeds 250, so capability "Assessment of data quality"-C will be included in the assessment process. For the last question on influential factors regarding the number of systems that the employees interact with will cause capability "Data landscape"-E to be included in the assessment process.

Table 4: Answers of Influential Factors Questions

Question	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?	Yes
Do the employees need to work with many different systems for executing their daily work and have to follow different processes when doing this?	No

The result of master data management maturity assessment is shown on table 5. The influential factors are also included in the matrix.

Table 5: The Result of Master Data Management Maturity Assessment

TOPIC	L1	L2	L3	L4	L5
DATA MODEL					
Definition of Master Data	I	I	I	NI	I
Master Data Model	I	I	I	I	I
Data Landscape	I	I	I	I	NA
DATA QUALITY					
Assessment of Data Quality	I	I	I	NI	NI
Impact on Business	I	I	I	NA	NA
Awareness of Quality Gaps	I	I	I	I	I
Improvement	I	I	I	I	I
USAGE & OWNERSHIP					
Data Usage	I	I	I	I	I
Data Ownership	I	I	I	I	NI
Data Access	I	I	I	I	I
DATA PROTECTION					
Data Security	I	I	I	I	I
DATA MAINTENANCE					
Storage	I	I	I	I	I
Data Lifecycle	I	I	I	I	I

Matrix above maps the topics and its corresponding focuses related to master data management activity. If the answer is “No”, then “NI”, means “not implemented” will be filled in the table. If the answer is “Yes”, then “I”, means “implemented” will be filled in the table. If the answer is “NA”, means “not applicable”, shows that the capability is not applicable to the organization. L1, L2, L3, L4, and L5 is the sequence of the question based on the questionnaire designed by Spruitz and Pietzka, which is point A, B, C, D, and E.

After mapping the answer of the questionnaire into the matrix, the next step is to determine the master data management maturity level for each topic. For each topic, the capability that has been implemented will be summarized. If a capability of the higher level on a focus area has been implemented but the lower level has not yet implemented, then the maturity level will be the highest capability level before the capability that has not yet implemented.

Table 6: Maturity Level of Pasar Rebo Public Hospital

Key Topic	Maturity Level
Data Model	3
Data Quality	3
Usage & Ownership	4
Data Protection	5
Data Maintenance	5
Overall maturity level	3

Table 6 shows the result of calculation of maturity level for each topic. The maturity level of key topic data model and data quality is 3. The maturity level of key topic usage and ownership is 4. The maturity level of key topic data protection is 5. The maturity level of key topic data maintenance is 5.

Based on the maturity levels, it can be concluded that the overall master data management maturity level is 3, based on the lowest maturity level of all key topics.

The organization is aware of the quality of master data and the impact of bad master data quality. Despite this, there is no formal document that defines the required quality of master data. On the system used by the organization, there is a control mechanism to maintain data quality using form validator to standardize field format and reduce null value fields. Despite this, there is no formal standard within the organization that defines the content of that mandatory field so there is still a possibility that the mandatory is filled, without any meaningful value of that field. Data quality checking only conducted when there is a problem caused by the bad data quality, such as incomplete patient's data. The patient's data that usually have incomplete or incorrect value are citizen ID number and the patient's address. This caused the billing settlement process with the insurance company subscribed by that patient will be hindered.

Table 7 shows that out of 62 capabilities regarding master data management activity, 58 capabilities (93,55%) has been implemented, meanwhile the other 4 capabilities (6,45%) has not yet implemented by Pasar Rebo public hospital.

Table 7: Comparison of Capabilities Implemented and Not Implemented Related With Master Data Management

Maturity Level	Total	Implemented	Not Implemented
1	13 (100%)	13 (100%)	0 (0%)
2	13 (100%)	13 (100%)	0 (0%)
3	13 (100%)	12 (92,31%)	1 (7,69%)
4	12 (100%)	10 (83,33%)	2 (16,67%)
5	11 (100%)	9 (81,81%)	2 (18,19%)

5. DISCUSSION

The overall master data management maturity level of Pasar Rebo public hospital is 3. It means that there is a formal standard documented for master data management process in the organizations. The maturity level of master data key topic is 3. It means that there is a formal standard regarding master data model and master data quality. The maturity level of usage and ownership key topic is 4. It means that the master data management is well managed and measured properly. The maturity level for data protection and data maintenance is 5. It means that the master data management process is optimized.

For data model focus area, there is an understanding about master data on each unit in the organization. Despite that, there is no formal and documented policy regarding master data. This makes it difficult to socialize the definition of master data to the new employee that will manage and interact with the master data owned by the organization. This problem can be solved by making a formal document regarding master data and socialize it to all employees that manage master data.

For data quality focus area, there is an understanding about master data quality. Despite that, there is no overall assessment regarding master data quality. The data quality is only checked when there is a problem of data when it is used in transactional process in SIMRS. To solve this problem, the organization can plan a regular data quality assessment to assess their current master data. After the data is assessed, then the organization can identify which aspect of data quality that could be improved.

For usage and ownership focus area, the data usage process and data ownership has conducted properly. Despite that, there is no specific role in the organization related to data stewardship. Therefore, there is no clear definition about data quality that is supposedly defined by data steward. This problem can be solved by appointing a data steward for each group of master data. The other way is to add job descriptions of data steward to selected employee with selected roles in the organization.

For data protection focus area, the data protection mechanisms are implemented properly. The organization has defined standardized procedures regarding data access and data protection. But to improve data security, the organization can make policies to secure the data regarding good password making and to advise all employees to lock their computer when they are away from computer. This can be done because currently there is no policies regarding those, even though some employees are already made their password that complies with common practice, such as making a password that combines capital, small letters, number, and symbols. Besides, some employees are already accustomed to lock the computer when they are away from their computer.

For data maintenance focus area, the data storage process has been optimized. These is shown by the existence and utilization of tools to check duplicate and redundant data. Therefore, data quality and validity will be improved. This will also affect the efficiency of data query.

6. CONCLUSION

The result of master data management maturity level assessment can be used as an input to the organization to improve their maturity level to the higher level. For organization to improve their data quality, they should not only improve the maturity level of one focus area or key topics, but also improve the maturity level of the others, because the overall master data management maturity level is determined by the lowest maturity level of all key topic. Besides, the organization needs to conduct an assessment to maintain and improve their master data management performance regularly. This can affect the increase in efficiency and effectiveness of business process in the organization.

The organization has been assessed based on master data management activity using MD3M model by Spruitz and Pietzka. The result of assessment shows that the organization's maturity level is 3. This means that there is an

effort done by the organization to manage their master data. By implementing solution proposed in section V, the organization can improve their maturity level to the higher level.

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