

# MASTER DATA MANAGEMENT ANALYSIS FOR TODAY'S COMPANY: A LITERATURE REVIEW SYSTEM

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## ABSTRACT

Data is one of the most important things in a company. Data can be processed into information that can help a company decide on something important. With a very large amount of data, a company should be able to manage their data. Unfortunately, there are many companies that have no ability to manage their data. Therefore, their company will be affected, and their performance will drop. The trouble can be solved with the implementation of master data management. When a company implements the master data management system, they can more easily manage the valuable data, which will help the company improve their business processes and efficiency. From the results, we can see that each company faces a variety of data related issues, which become the background of each company's implementation of the master data management system. But there are also a few problems after the company implemented master data management. Based on the research, we can conclude that each company employs a unique set of master data management implementation approaches and tools based on their needs. The purpose of this paper is to find out the uses of master data management in a company and the tools that companies use to implement master data management. The research used in this paper was done by reviewing 20 papers that discuss master data management. This paper is intended to find out more information about the tools and uses of master data management in a company.

**Keywords:** *Master Data Management, data, Master Data Management Tools*

## 1. INTRODUCTION

Data is one of the most important things in a company. Especially when the company can correctly and properly process and use the data. Properly handled data that is owned by a company can provide more and better insight for the company to develop and run its business processes [2]. The modern industry is aware that collecting and analyzing data can give them better insight to develop and improve their technology and procedures [2]. Unfortunately, there are still many companies that don't have proper data quality, especially in their master data and it affects the company's performance.

From several papers that were used, we found that there are many companies that are facing the same problem and many other problems, which becomes the reason why they implement the master data management system. We found that more than five companies face the same problem of data duplication, which is continued by inconsistent data and data

differentiation. Data duplication is one of the problems faced by European banks [11]. They have duplication in their product data that causes inefficient sales support [11]. Inconsistent data and data differentiation can also lead to monetary and qualitative losses in a business [12].

There are other issues such as data duplication, missing data, unstandardized data, poor database system, etc. [3], [4], [8], [12], [16]. Beside that, there are several other factors related to the systems owned and managed by the company. There are also some issues that arise after the companies implement master data management in their database system.

All the problems that are caused by poor master data quality can cause obstructed and less efficient business processes. This is also another reason why companies start implementing master data management into their database systems. One of the

optimal ways to solve this problem is to implement master data management into their database systems.

The objective of this paper is to find out more about the reasons why the company needs to implement master data management, the problems found after implementing master data management, the approach that they used, and the tools to implement master data management. This paper can help a researcher or a company while they are considering implementing master data management in their database system. With this paper, we can also know what the reason is behind a company implementing master data management, what tools they used, and what approach the company used for implementing master data management. This paper consists of an introduction, a literature review, a research method, a result and discussion, and a conclusion.

The motivation of this study is to learn more about master data management in a company, especially the purpose, approach, problems, and **tools**. The method used to achieve this motivation is to use the system literature review (SLR) method. This method is used by taking the results and summarizing the research from the previous study.

The contribution of this paper is to further explain the uses of master data management in a company. Particularly in companies with a large amount of data, so that they can manage their own data effectively. Furthermore, the contribution of this research is to show which approach and what tools that most of the companies use to implement master data management. So, when there are companies that consider implementing master data management, they can decide which approach and tools they will use and what the considerations of implementing master data management are.

## 2. THEORITICAL FOUNDATIONS

### 2.1 Master Data

Master data is one of the most important types of data owned by a company [15] and a valuable asset for the company. It's because master data contains essential information about the business processes of the company. Master data can be shared and reused on various types of information systems and company business process applications [11], [20]. There are some examples of master data, such as customer data, supplier data, employee data, etc. [15].

Even though data looks important in a company's business process, not all types of data can be categorized as master data. There are six types of data in a company [13] such as:

1. Unstructured — This type of data can be found in email, contact record, images, video, etc [13].
2. Structured — This type of data is about other data, and it may be stored formally or in other ways. For example: Invoices, sales data, etc [13].
3. Metadata — This type of data is about other data, and it may be stored formally or in other ways. For example: XML files, description column in a database, log files, etc [13].
4. Hierarchy — This type of data is stored as data with a hierarchical relationship to one another [13].
5. Analytical — Analytical data is a type of data that stores information that will be used for company decision making. Data warehouses with a variety of features are used to store this type of data for further analysis and aggregation [13].
6. Master data — The master data contains an asset for the company. Master data can be divided into four data categories: people (Employee, customer), places (supplier location, office location), things (currency), concepts (warranty, license) [13].

### 2.2 Master Data Management

Master data management is a method or process that is used to manage all data so that master data management can produce a single, consistent master record [4]. The master data can be used in all business process applications in a company later [16], so that all the company's business process applications can show consistent data to the user. In the process of data management, master data management will use the data from the company, so there will be no new data created [9].

By implementing master data management, all data that is owned by a company will be optimized, resulting in fewer mistakes or errors, and the process will be simplified [2], [21]. They are expecting that the implementation of master data management in a company can resolve all the problems with data quality, such as data consistency, different data formats, data duplication, etc.

Besides all that, there are several other master data management implementation functions [17]. These functions include :

1. Know the Customer Better — By creating a centralized master data repository for critical company data such as master data for customers, a company will have a better perspective and will be able to better understand their customers. It's because the data will become consistent and centered around a single record [17].
2. Increasing Competition — With master data management, a company can start a new business opportunity with a lower complexity level. When the company needs to integrate their data and system, master data management will provide a lower level of complexity. So, the company can increase their competitiveness in their new business opportunities [17].
3. Reduce Risk — Master data management can eliminate data duplication in a database owned by the company up to a low degree of granularity. With that, the information obtained by the company will be more accurate and consistent, reducing the risk faced by the company [17].
4. Increase operational efficiency and reduced costs — By creating a unified view of the data, the business can lower the operation expenses and workloads [17].
5. Maximize Decision Making — Master data management can provide consistent information for the company's business processes. It will help minimize the trust issue with the data owned by the company. So, the decision can be made more quickly and clearly [17].
6. Maximize analysis and planning expenses — Master data that is linked to one another can improve the ability to aggregate purchases, forecast future expenses, and improve supplier management [17].

### 2.3 Master Data Management Approaches

There are few approaches that can be used by a company to implement a master. A company can use two different approaches if they need it. Its because sometime when a company use two different approaches. A company may use two approaches to strike a balance between interoperability and integration within the company [6]. All of the comparison between master data approach can be seen on table I.

1. Consolidation Approach — This technical approach aims to implement a central master data hub that will filter all data owned by the company. Then the data will be transformed and cleaned to become master data [5]. This type of approach will focus on central data stored location.
2. Registry Approach — This technical approach keeps a basic set of data, which will then be uniquely identified. Then the system will generate the master data automatically. This approach has the goal of storing the master data in the source system and retrieving the master data when it is needed [5].
3. Coexistence Approach — With this approach, the master data will be stored in a central master data database and the backups of the master data will also be stored in the source systems [5].
4. Centralization / Transactional Approach — With this approach, all updates to the master data will be done at the central master database. When all the updates are finished, the system will validate the data and make sure its quality is appropriate. The system will assign a unique identification number to the data. When the unique identification number is given, the system will distribute the data to all business applications in the company [5].
5. Parallel Approach — By partitioning the central master data database and the capabilities between source systems and the central database, distributed master data facilities were created [5].

There is no good or bad master data management approach. Only the company can consider which approach is best for their company [6]. It may also be influenced by the company’s problem. Besides that, there are several aspects that are key to success in implementing master data management such as system architecture, data storage, roles, and responsibilities, the implementation process, validation, and data optimization [2].

**3. RESEARCH METHOD**

This paper is studied using the literature study technique. The reason for using this technique is to learn and understand master data management in a company. This technique is done by collecting journals or papers that are related to master data management. Then, after all the papers have been collected, it will be analyzed and summarized again,

Table 1 : MDM Implementation Approach Used by the company

Approach Style	Data Stored Location	Data Latency	Downstream Data Distribution	Real-time Data Warehouse Integration
Consolidation Approach	Central	Real time	Yes	No
Registry Approach	Source	Event-driven	Yes	No
Coexistenchn Approach	Central	Event-driven	Yes	No
Centralization / Transactional Approach	Central	Real-time	Yes	No
Parallel Approach	Central and Soruce	-	Yes	No

**2.4 Master Data Quality**

Master data quality is a combination of master data and data quality [16]. Data quality is one of the reasons for the implementation of a master data management system in a company [9]. The problem of data quality in a database can be identified by understanding the master data source owned by the company. The things that determine good or bad data quality are the business and the company business process application [6]. There are several things that cover the data quality concept, such as [7]:

1. Master Data Life Cycle — There are few stages of master data life cycle. It starts with data creation, storage, usage, and deactivation of the data.
2. Identification of Data Quality Barriers — The identification of data quality barriers is different in every data and can be found on each data. For example, data with much information, inaccurate data, data with no unique column, etc.
3. Data Quality Evaluation — The data quality evaluation is used to determine if the data has met the objective.
4. Improvement of Data Quality — The improvement of data quality is used to know what changes should be made to the data.

and all the important parts will be discussed and used in this paper. With that technique, all the major discussion points from this paper will be achieved, especially in the function and master data management implementation technique in a company.

**3.1 Collecting Paper**

After determining what topic will be discussed, the process of searching the paper begins. The paper search process was done with Google and Google Scholar. The papers collected are published by the Institute of Electrical and Electronics Engineers (IEEE), International Journal of Information Technology and Electrical Engineering (IJTEE), IAEME Scopus, Springer Link, Atlantis Press, dl.acm, and several educational institutions that published their own papers such as Utupub.fi, Trepo.tuni.fi, diva-portal.

**3.2 Sorting Paper**

After finishing collecting the papers, all the papers will be selected again, and there are now 21 papers or journals left. The papers or journals that will be used will discuss why a company implements master data management and what they get after the implementation of master data management. This paper also used several papers or journals as the basic theory.

### 3.3 Using Paper

Table 2: Number Studies in Selected Sources

Source	Journals Found	Candidate Studies	Selected Studies
IEEE	32	10	7
Springer	29	11	2
Elsevier	42	4	2
Other Publishers	897	18	10
Total		43	21

In this section, all the papers or journals will be analyzed and summarized by taking the required data, such as what problem the company faced before or after the master data management implementation, what solution they used to resolve the problem, what is the purpose of implementing the master data management, and what tools they used to implement their master data management system.

## 4. RESULT AND DISCUSSION

### 4.1 Problems Faced by The Company

Table 3: The Problems Facing the Companies Before They Implement the Master Data Management System

No.	Problem	Total Papers / Journals	Number
1	Problem with their database system	1	[3]
2	Outdated data and not updated automatically	2	[3], [19]
3	Poor implementation of Big Data	1	[4]
4	Inconsistent data and Data differentiation	5	[3], [4], [9], [10], [19]
5	Lack of information on the data	2	[7], [19]
6	Unstandardized database	3	[8],[9],[16]

7	Data duplication	5	[3], [10], [11], [12], [14], [15]
8	The amount of data is getting bigger	1	[6]
9	Difficulty in maintaining the data access	1	[12]

Based on the 21 journals that have been collected and reviewed there are 13 journals that discuss the problem faced by the company. Most of the journals have issues with their data, and one journal has an issue with its database system. However, the issues have not been limited to the company that has not implemented the master data management system. There are also a few problems faced by the company that has already implemented the master data management system.

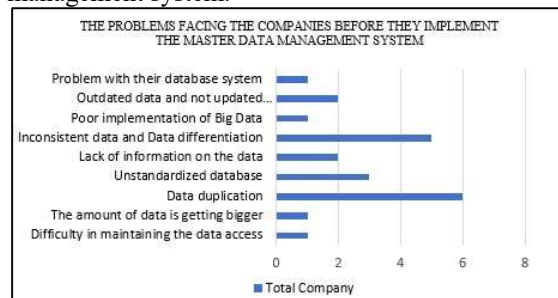


Fig 1. The problems facing the companies before they implement the master data management system

From Figure 1, we can see that the most common problem faced by the companies was the problem of data duplication. Data duplication is one of the problems regarding the quality of a company's data [4]. This is one of the reasons why the company needs to implement master data management. If their data is duplicated, it will become an obstacle for processing the data. The second common problem faced by the company is inconsistent data and data differentiation. There are 5 companies face that problem.

Table 4: Problems After Implementing the Master Data Management

No	Problem	Total Journals	Journal Number
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1	Master data management systems that are not properly implemented	1	[1]
2	Bad timing management on the master data management systems that affecting the database performance	1	[5]

In those 13 journals that discuss the problems facing the companies before they implement the master data management system, nine different problems were found for 19 companies. Of those nine problems, there are seven problems related to data problems, and two problems regarding the database problem. All these problems can be seen in Table 3, and they are the reasons why companies need to implement a master data management system.

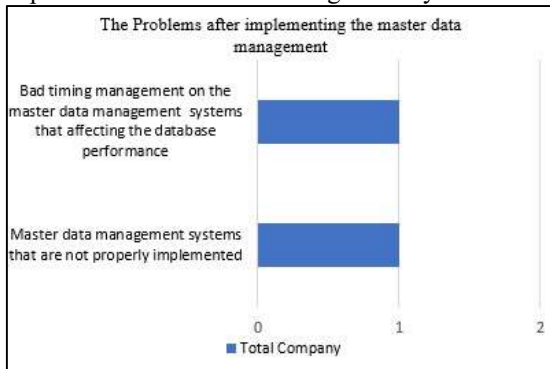


Fig 2. The Problems after implementing the master data management

Even though the master data management has already been implemented, there are still some issues that still occur in their database system. In those 4 journals, 3 different problems were found. Out of all the problems, there are 2 problems that are related to previously implemented master data management. All the problems will be mentioned in table 4.

From Figure 2, we can see that there are 2 companies facing the problem about the master data management system that implemented in their database system. The first one is because the timing was not set correctly and it's affecting the database performance and the second is because the master

data management was not properly implemented in their database system.

#### 4.2 The Master Data Management Implementation Method Used by The Company

Table 5: Master Data Management Implementation Approach Used by the Companies

No	Implementation Method	Total Papers / Journals	Journal Number
1	Parallel Approach	1	[5]
2	Registry Approach	3	[6], [19], [21]
3	Centralization / Transactional Approach	2	[6], [9]
4	Consolidation Approach	2	[10], [12]
5	Coexistence Approach	1	[11]

Due to the database problem experienced by several companies, all companies that had not yet implemented master data management began to integrate the master data management into their database systems. Table IV shows that there are five different various of approaches used by the company to integrate the master data management. The company decided which approach they needed to use by analyzing their system and their previous problems. From there, they can decide which approach they will use.

From Figure 3, it showed that the registry approach are the common approaches in a business. The registry approach is used by 3 companies. The second common approach is transactional approach and consolidation approach. Each of these approaches is used by two companies. The parallel approach and coexistence approach are the two other approaches used by each company while implementing the master data management system.

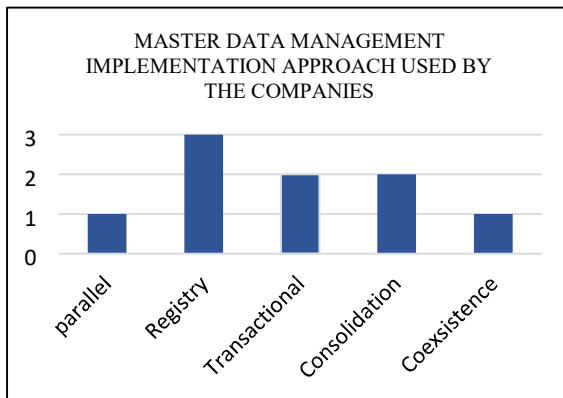


Fig 3. Master Data Management Implementation Approach Used by The Companies

### 4.3 Solution and Tools

Due to the database problem experienced by several companies, all companies that had not yet implemented master data management began to integrate the master data management into their database systems. Table IV shows that the implementation of master data management takes various approaches depending on the company system and previous problems. From Figure 3, it showed that the registry approach are the common

1. The Number of Attributes — This criterion means that the amount of data that can be managed as master data. This can depend on your business process and your business process application.

2. Data Consolidation — Data consolidation is the process of locating the data in MDM by taking and processing master data from a variety of data sources. The requirement for this criteria depend on two aspects: the number of data sources used in the master repository and the expectation for each master entity to have a “single view”. With more data sources that are used in the master environment, there will be more complexity.

3. Data Synchronization — All data in the business process application must be synchronized. Its to ensure that the data is compatible and has a same value in the company.

4. Access to The Data — This criterion means that the company should give more access to its data. With more access to the data, there will be a more flexible and open design for the master data management implementation. With more data access, the company can use the registry approach.

approaches in a business. The registry approach is used by 3 companies. The second common approach is transactional approach and consolidation approach. Each of these approaches is used by two companies. The parallel approach and coexistence approach are the two other approaches used by each company while implementing the master data management system. Solution and Tools

Through all the problems, there are several companies that have not yet implemented master data management. The solution they used in their company was to implement the master data management system in their database system. Although all the implementation techniques and tools they use in their implementation process are different.

Before implementing the master data management system, a company needs to determine which technique they will use when they start implementing master data management into their database system based on their database system and their needs [9]. According to Loshin [17], there are six criteria that can be used as a benchmark to help a company determine which technique they will use. There criteria include:

5. Service Complexity — The service complexity can be determined using master data management in the company. The master data management system can be set up as a heavyweight hub or a thin repository.

6. Performance — When a company has implemented the master data management, all business process applications should gather the data from the master data. If the business process application has its own data, it will affect the master data performance.

Loshins’s criteria can still be changed and customized based on the company’s goals and needs. Based on the results, each of the companies has a different evaluation point, as described in the journal [11]. The journal uses five criteria when comparing four types of master data management implementation approaches, these criteria include:

1. MDM Scope — What will the MDM do with the implementation styles

2. MDM Stored Location — Where the MDM will store the master data

3. MDM Verification Location — Where the master data will be verified

4. Data sources and Targets — Where the data source and the target will be located
5. Data Quality Process — Where the process will be process or executed

Table 6: Tools Used in Implementation of Master Data Management

No	Open Source Platform	Journal Number
1	Pentaho Data Integration and Technology for Virtualization	[11]
2	Talend	[21]

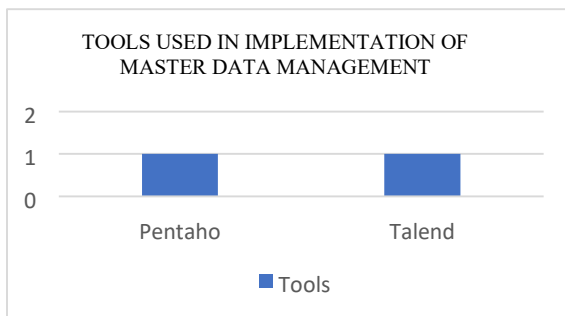


Fig 4. Tools used in implementation of master data management

Few businesses have used tools to integrate master data management into their systems. The tools used can be an open-source program or paid software. There are several journals that use the open-source platform to implement their master data management system. From Table V and Figure 4 we can see that the platforms they used were Pentaho Data Integration and Technology for virtualization, Docker, and Talend. The company in Journal No. 11 has several reasons why they used Pentaho Data Integration and Technology for Virtualization. With this platform, they will reduce the operational costs of their company because they used the coexistence approach. The other reason is that they used the coexistence implementation approach, which will solve their problem if they use this platform. And for Journal No. 21, they used the Talend open-source platform because it would suit their project to build a smart city.

## 5. CONCLUSION

This paper demonstrates that each company faces a variety of data related issues. The problems that arise before the implementation of master data management are mostly related to the quality of the data. The problems do not only occur in a company

that has not implemented the master data management system, but it also occurs in a company that has already implemented the master data management system.

From the research, we can know that there are two open source tools that companies can use to implement master data management into their database system. If the company needs to use more complete and easier tools, it can also use paid tools to implement the master data management. But paid tools are not mentioned in this paper.

From the research, it can be concluded that there are several reasons why companies need to implement master data management into their database system. Through this discussion, it can be concluded that there are several companies that use open-source platforms so that they can reduce costs, but there are other paid version tools that can be used such as Pentaho Data Integration and Talend, to implement master data management into the company database system. From the approach that the company uses, we can see that the most frequently used approach is the registry approach, followed by transactional approach. However, the approach that will be used must be appropriate for the company.

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