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Maturity Model of Master Data Management at Enterprise Level

Ronak Ravjibhai Pansara[1]

[1]Master Data Specialist, Tesla, Draper, USA

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***Corresponding author:** Ronak Ravjibhai Pansara
Master Data Specialist, Tesla, Draper, USA

Abstract **Original Research Article**

Data is one of the most important things in a company. Data can be processed into information It might aid a business in making a crucial decision. Even with massive amounts of data, a company's data management capabilities should be adequate. A lot of businesses just cannot handle data management, unfortunately. Consequently, they will see a decline in performance and the impact on the organization will be seen. Implementing master data management will fix the problem. Businesses can streamline their operations and increase productivity by using an artist data management system, which makes it easier to handle critical data. Based on the findings, all companies deal with different types of data-related problems. These problems serve as a foundation for how each firm uses the central data management technique. However, with the implementation of master data management, a few issues have also arisen. The study's findings suggest that, depending on their specific requirements, different businesses use different methods and tools to accomplish master data management. Finding out how and why businesses employ master data management as well as the methods and technologies that facilitate its implementation are the primary goals of this article. Twenty papers on master data management were surveyed for this paper's research. The purpose of this paper is to obtain a better understanding of master data administration and its applications in a business setting.

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

1. INTRODUCTION

Among the most asset of any business is its data. That is, unless the business can handle and utilize the data appropriately. A company's data, if managed correctly, can yield more and better insights that can be used to build and operate its business operations [2]. Data analysis and collection have long been recognized by modern businesses to enhance their processes and products [2]. Many businesses still struggle with poor data quality, particularly in their master data, which has a negative impact on their operations.

Our research into the literature revealed that many businesses share this and related issues, which motivates them to use a master organizing information system. Based on our research, we know that data duplication, inconsistent data, and data differentiation are all issues that over five firms deal with. European banks are dealing with data duplication, among other issues [11]. They have inefficient sales support due to duplicate product data [11]. A company can lose both money and quality due to inconsistent information and data differentiation [12]. Data duplication, data that was lacking, unstandardized data, and a bad database system are some of the additional problems [3-16]. And that is not all: the company's owned and operated systems are also relevant to several other considerations. After businesses integrate master data management into their database system, a few problems emerge. Business operations might become more inefficient and clogged because of all the issues created by low master data quality. Companies are beginning to include master data administration into data storage systems for this same reason and more. Implementing is one of the best solutions to this problem. Regardless of how data appears to be important in the purpose of the paper is to gain a better understanding of the company's requirement for the handling of master data, the challenges encountered after establishing the system, the methodology employed, and the resources made available for the implementation. Anyone thinking about adding master data management to their database system can benefit from reading this paper. In addition to learning how and why a company implemented master data management, this report also reveals the tools and methods used by that company. There is an introduction, a review of relevant literature, a description of the study methodology, findings, and a discussion of the paper's implications. Their database systems with master data management. Company’s operations, but not every kind

of data. The study's impetus is to gain a better understanding of corporate master data management, including its goals, methods, challenges, and resources. The system the literature review (SLR) approach is utilized to accomplish this goal. The results and a synopsis of the prior study's research are utilized in this strategy. Master data management is a useful tool for any business, and this paper adds to the existing literature by expanding on those benefits. Especially for businesses that collect and store vast amounts of data, this will allow them to better manage their own data. In addition, this study adds to the literature by illuminating the method and tools used by most firms to execute master data management. This way, businesses may learn about the benefits of master data administration, the factors to consider, and the methods to employ when putting it into practice.

2. THEORITICAL FOUNDATIONS

2.1 Master Data

When it comes to a company's data, master data is among the most precious assets and among the most crucial kinds of data [15]. The reason behind this is because master data is a treasure trove of information regarding the company's operations. Organizations can benefit from sharing and reusing master data across a wide range of systems of information and business process technologies [11-20]. Data on customers, suppliers, employees, etc., is an example of master data. Fall into the category of master data. A business keeps six distinct kinds of data [13].

- **Unstructured**

Formal or informal storage options are available for this data category, which is about other data. Take invoices and sales data as an example [13].

- **Metadata**

Data having a hierarchical relationship is used to store this type of information [13].

- **Hierarchy**

Formal or informal storage options are available for this data category, which is about other data. Take invoices and sales data as an example [13].

- **Analytical**

Data having a hierarchical relationship is used to store this type of information [13].

- **Master Data**

Formal or informal storage options are available for this data category, which is about other data. Examples include XML files, database description columns, log files, and so on [13].

2.2. Master Data Management

A single, coherent master record can be produced using master data management, which is a technique or method for managing all data [4]. To ensure that all a company's business process apps provide users with consistent data, master data can be utilized in all of them in the future [16]. Managing master data will make use of existing firm data in the data management process, eliminating the need to generate any new data [9]. There will be fewer errors and a streamlined procedure when a corporation employs master data management to optimize all its data [2-21]. Data consistency, various data formats, duplicate information, and other data quality issues are believed to be fixable if a corporation implements master data management.

Besides All That, There Are Several Other Master Data Management Implementation Functions [17]. These Functions Include

- **Know the Customer Better**

A business can get a bird's-eye view of its customers and get insight into their needs by establishing a central repository for master data, which includes customer master data. The reason behind this is that all the data will start to fit neatly into one record [17].

- **Increasing Competition**

A corporation might begin a new business prospect with less complexity level with master data management. Using the administration of master data will make data and system integration easier for the business. Consequently, the firm will be better able to compete in the new markets it enters [17].

- **Reduce Risk**

Up to a certain level of granularity, master handling data can remove duplicate data from a company-owned database. The company's risk will be reduced since the information it obtains will be more reliable and consistent [17].

- **Increase Operational Efficiency and Reduced Costs**

A more streamlined understanding of the data will help the company cut costs and save time [17].

- **Maximize Decision Making**

To the Max: Decision Maximization

With master data management, the company's operations can benefit from consistent data. The problem of mistrust about the company's data will be lessened as a result. This allows for a clearer and faster decision-making process [17].

- **Maximize Analysis and Planning Expenses**

Better supplier management, improved purchase aggregation, and future expense forecasting are all possible outcomes of interconnected master data [17].

2.3 Master Data Management Approaches

A corporation can install a master in a few different ways. If necessary, a business can deploy two distinct strategies. Reason being, there are occasions when a corporation employs two distinct strategies. To

find a happy medium between internal integration and interoperability, a business may employ two strategies [6]. You can see all the comparisons between the master data method in table I.

- **Consolidation Approach**

A fundamental set of data is retained by this technical method and subsequently assigned a unique identifier. Automatic generation of the master data will thereafter occur within the system. With this method, the master data can be saved in the original system and then retrieved whenever necessary [5].

- **Registry Approach**

Under this setup, the source systems will also keep backups from the master data, in addition to storing the master data in a central database [5].

- **Coexistence Approach**

This method relies on a central master database to save all changes to the master data. After all the updates have been completed, the system will verify the data to ensure it meets the required standards of quality. A distinct identifier will be given to the data by the system. After the system receives the unique identifier, it will send the data to all the company's business applications [5].

- **Centralization / Transactional Approach**

This method relies on a central master database to save all changes to the master data. After all the updates have been completed, the system will verify the data to ensure it meets the required standards of quality. A distinct identifier will be given to the data by the system. After the system receives the unique identifier, it will send the data to all the company's business applications [5].

- **Parallel Approach**

Methodology which works in tandem with the use of a partition that separates the source systems' capacities from the primary master data database,

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
Coexistence Approach	Central	Event-driven	Yes	No
Centralization / Transactional Approach	Central	Real-time	Yes	No
Parallel Approach	Central and Source	-	Yes	No

2.4 Research Method Approach

Which strategy will work best for their business is something only they can decide [6]. Moreover, it could the literature review for this paper was shaped by the issue faced by the company. Furthermore, method. One of the main reasons this method is so effective is that it covers all the bases when it comes to master data management, which is essential for any business that wants to succeed in this field. Using this method, you can compile a library of articles and journals pertaining to master data duty, implementation, management, data storage, and system architecture. Afterwards, distributed general information facilities were established after every article had been entered into the central database [5]. Validation and data optimization have been accomplished [2]. Data will be gathered, examined, and recapped.

2.5 Master Data Quality

The two components of master data quality are data quality and master data [16]. An organization may decide to install a master system for organizing data in order to improve the quality of their data [9]. By learning about the company's master data source, you can find out where the database's data quality is going wrong. The company. The company's implementation of business processes are the things that decide the quality of the data [6]. Several sources address the idea of data quality, including [7].

- **Master Data Life Cycle**

The life cycle of master data consists of a few stages. The process begins with data production and continues through data storage, usage, and deactivation.

- **Identification of Data Quality Barriers**

Data quality obstacles can be identified in many ways and on various data sets. For instance, data that is very detailed, data that is incorrect, data that lacks a unique column, etc.

- **Data Quality Evaluation**

The data quality evaluation is used to determine if the data has met the objective.

- **Improvement of Data Quality**

Finding out what must be changed to the data is done by improving its quality. And this paper will cover all the crucial aspects. Using such method, the paper's main arguments—particularly those about the function and the approach for implementing master data management in a company—will be realized.

3.1 Collecting Paper

The first step in searching the paper is deciding on a topic to discuss. The Google & Google Scholar respectively were utilized for the paper search process. The following organizations and websites have contributed to the collection of papers: IEEE, IJTEE, IAEME Scopus, Springer Publishers. Link, Atlantis Publishers, and several academic journals and websites that publish their own work, including Utupub.fi, Trepo.tuni.fi, and diva-portal.

3.2 Sorting Paper

They are now 21 articles or journals remaining after sorting paper step 3.2, which involves gathering all the papers again. Using these articles and publications, we may learn more about the benefits of the handling of master data and the reasons why businesses use it. The fundamental theory in this study was also drawn from several other papers or journals.

3.3 Using Paper

Here we will review and synthesize all the articles by collecting the necessary information, such as the following: the problem the company had before or after implementing master data management, the solution they used to fix the problem, their reason for implementing master knowledge management, and the tools they employed to carry out their master data management system.

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

➢RESULT AND DISCUSSION

4.1 Problems Faced by the Company

Table 3: The Problems Facing the Companies Before

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]

Thirteen of the twenty-one publications that were culled and evaluated address the issue that the business is facing. While one publication is experiencing problems with its database system, most journals are experiencing problems with their data. But it is not only the corporation that has not used the master data governance system; everyone is having problems. The business that has recently deployed the main information management system is also experiencing some issues.

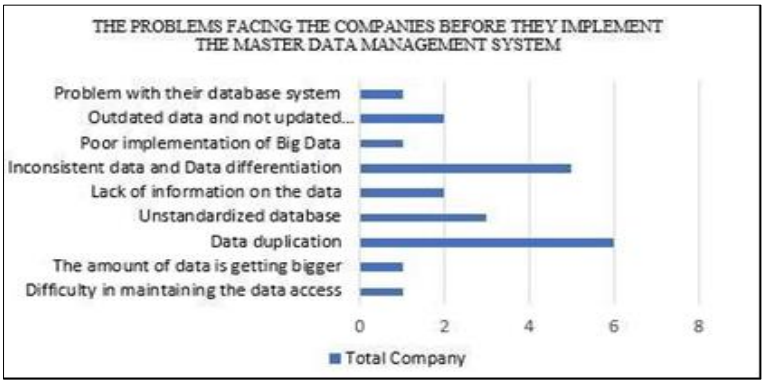

Fig. 1: What businesses need to know before using a master system for managing data

Data duplication was the most prevalent issue that businesses encountered, as seen in Figure 1. Concerns about the accuracy of a business's data include data duplication [4]. One of the reasons the organization should establish master data management is because of this. It will be difficult to process the data if it is duplicated. Discordant data and data segmentation constitute the second prevalent issue encountered by the organization. That issue affects five different businesses.

Table 4: Problems after Implementing the Master Data Management

No	Problem	Total Journals	Journal Number
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 the thirteen journals that address the issues that business face prior to implementing the overall data management programmed, nine distinct issues were identified for nineteen different firms. There are a total of nine issues, with seven pertaining to data and two to the database. Table 3 shows all these issues, and they are the main reasons why businesses should introduce a master the fields of data management system.

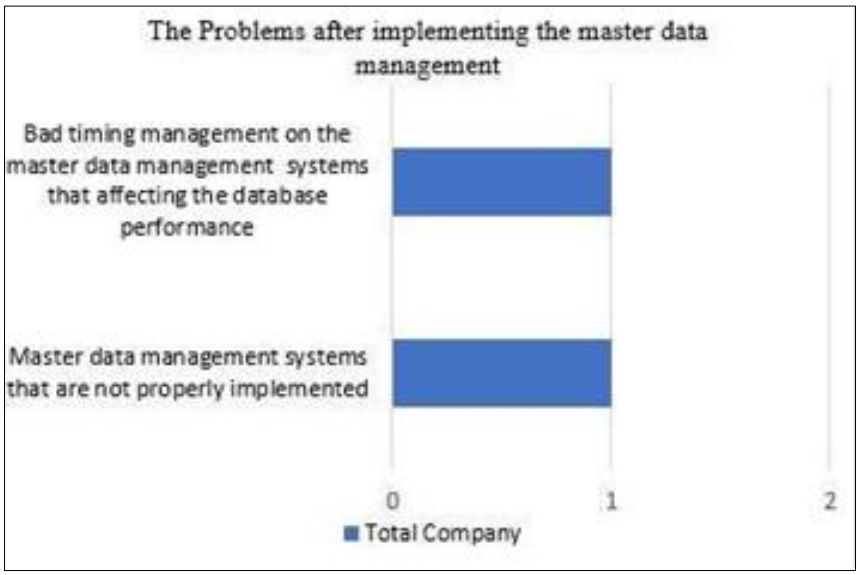

Fig. 2: The Problems after implementing the master data management.

Their database system is still experiencing certain challenges, even though the handling of master data has previously been established. Three distinct issues were identified in those four journals. Two of the issues stems from the master data management system that was previously put into place. Table 4 will detail all the issues.

The first is that their database performance is suffering due to improperly configured timing, and the second is that their database system is ill-equipped to handle master data management.

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]

All businesses that had not previously used master data management started integrating it into database systems after experiencing database problems. According to Table IV, the organization has utilized five distinct methods for integrating master data management. Following an evaluation of their system and past issues, the organization settled on a necessary strategy. They can then choose a method from that point forward.

The registry strategy is one of the most prevalent methods used by businesses, as seen in Figure 3. Three businesses do not adopt the registry-based strategy. The transactional and consolidation approaches are the second most frequent. Both methods are employed by two separate businesses. Every business also makes advantage of the coexistence and parallel ways when putting the master.

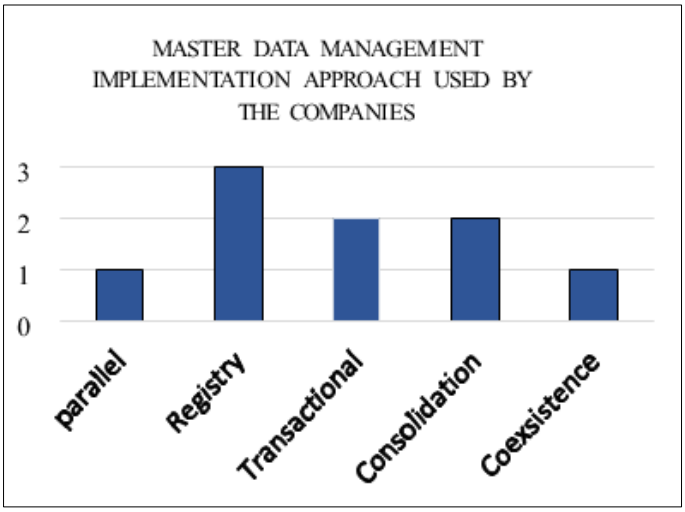

Fig. 3: Master Data Management Implementation Approach Used by the Companies

4.3 Solution and Tools

All businesses that had not previously used master data management started integrating it into their data storage systems after experiencing database problems. According to Table IV, different approaches are taken when implementing master data management based on the company's system and past issues. They use the registry approach as their primary database management system, as seen in Figure 3. Even though every single one of their implementation strategies and methods is unique. To begin integrating master data administration into their database system, a corporation must first decide which technique to adopt, considering both their database management system and their

specific demands [9]. Loshin [17] states that for a business to choose a method, there are six standards that should be met.

There Criteria Include

- **The Number of Attributes**

This criterion dictates the maximum data size that may be handled by master data management systems. The nature and implementation of your business process will determine this.

- **Data Consolidation**

Collecting and analyzing master data from several sources is what data consolidation is all about when it comes to master data management (MDM). Both the amount of data sources used by the master repository nor a expectation that each master entity would have a "single view" determine whether these criteria are required. The number of data sources used by the master environment directly correlates to the level of complexity.

- **Data Synchronization**

The business handle app cannot function properly without synchronized data. This is to guarantee that all the data is consistent and useful to the business.

- **Access to the Data**

If the business wants to meet this standard, it needs to make more of its data available. The adoption of master data management will be more adaptable and transparent if more people have access to the data. The business can use the register method once it has access to more data.

- **Service Complexity**

The company's master data management system can tell you how complicated the service is. Both a thick repository and a heavyweight hub configuration are possible for the master the fields of data management system

- **Performance**

All business process components should retrieve data from the centralized data once a corporation has implemented master data management. The primary information's performance could be impacted if the corporation process application uses its own data.

The parameters set by Loshins can still be adjusted and tailored to meet the specific requirements of the firm. According to the findings, as detailed in the journal article [11], every company has a unique evaluation point. When contrasting four different methods for implementing master data management, the journal uses the following five criteria:

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

Fig 4. Tools used in implementation of master data management

Master data management integration options have been mostly untapped by organizations. The software that is utilized can be either free and open-source or purchased. The open-source platform is used by multiple magazines to establish their master organizing information system. Figure 4 and Table V show that what platforms they utilized were Talend, Docker, and Pentaho Integration of Data and Innovation for virtualization. Pentaho data integration services and Innovation for Virtualization were utilized by the organization in Journal No. 11 for multiple reasons. Using this platform, they were able to lower their operational costs by embracing the coexistence approach. The second justification is that they have already implemented the coexistence strategy, which, when applied to this platform, will eliminate their issue. And since their goal was to construct a smart city, the Talend free and open-source platform was appropriate for Journal No. 21.

5. CONCLUSION

This study shows that there are many data-related problems that every business has to deal with.

Data quality is usually at the root of issues that crop up prior to master data management deployment. Regardless of whether a corporation has deployed the underlying information management system or not, the difficulties still recur. According to the findings, two open-source technologies exist that businesses may utilize to integrate the administration of master data into their existing database infrastructure. The organization has the option to invest in commercial tools for master data management implementation if it requires more comprehensive and user-friendly solutions. The article does not refer to premium tools, though. According to the findings, there are several compelling arguments in favor of businesses incorporating the administration of master data into their existing database infrastructure. So far, we have covered how some businesses cut costs by using open-source platforms; however, if you want to add master data management capabilities to your company's database system, you can also use paid tools like Talend or Pentaho Data Integration. Based on the methods employed by the organization, the registry approach is the most common, followed by the transactional approach. Nevertheless, the strategy to be employed ought to be suitable for the business.

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