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DESIGN OF MASTER DATA ARCHITECTURE

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Abstract— **Master data management (MDM) is a concept that is gaining traction in both the scientific and practitioner communities of information systems. MDM is a set of operations that must be completed to achieve business needs, for example, regulatory compliance, business unification, and inclusive customer management. The design and maintenance of the master data is a very critical task. Surprisingly, the scientific community has been almost deafeningly mute on how enterprises approach master data architecture design. This article discusses the report of a research study conducted at Bosch Group to shed light on this under-researched area. The report demonstrates that master data architecture design is a multifaceted effort that necessitates harmonizing the objectives of several stakeholders, handling various technical options, and satisfying the requirements of multiple master data classes.**

Keywords— **Master Data, Master Data Architecture, Master Data Architecture design**

I. INTRODUCTION

A. Purpose and scope

Master data represent the essential business items of a corporation. Because these essential business objectives are the cornerstone of its business purpose, they must be employed consistently throughout the organization. Distributor, consumer, materials, product information, and personnel and asset data are common master data types [1]. For a long time, master data management has sparked the interest of both the practical and scientific Information System communities. One reason for this is master data's role in fulfilling several requirements associated with a strategic business, such as the customer's all-round view [2], adherence with a growing set of regulatory [3], and integrated global and synchronized business processes [4], [5].

For example, ZF Friedrichshafen, a well-known automotive supplier, has developed a new servicing business unit that combines its previously independent aftermarket, replacement parts, as well as service activities on a corporate level [6]. Thus, the corporate reorganization necessitated completely incorporated and coordinated master data regarding clients, the company's goods, and customers' products. Smith and McKeen [7] describe master data management (MDM) as an application-independent procedure that identifies, owns, and achieves essential corporate data entities. By offering a single set of principles of management, it maintains the reliability and correctness of this data, resulting in a consistent interpretation of essential corporate data that might or might not be kept in a shared data source." This description includes three fundamental principles:

i. MDM isn't an application system; it's a function of an organization that requires master data ownership.
ii. The quality of the data is a performance metric for MDM.
iii. For storing and delivering master data, many architectural techniques exist.

The first two concepts are hotly debated in the IS world right now. Loshin [5], Otto and Reichert [8], Sarsfield [9], and Swanton [10] all contributed to the structure of MDM. The beginnings of master data quality studies are traced back to data quality management research [11], and they are primarily undertaken as case studies. Surprisingly, the third notion, master data architecture, has received little attention thus far. Two case studies [12], [13] examined ERP-centric techniques for MDM, and a study by Allemang [14] on the utilization of corresponding data in businesses are among the rare scholarly contributions in the area. All three pieces scratch the surface of the subject. Otto and Schmidt conducted a complete morphological investigation [15]. Their study does not provide in-depth insight into how businesses approach the numerous considerations associated with master data architecture design.

B. Research Problem

The absence of scientific understanding about this current issue prompted the writing of this study. Its goal is to offer light on the unanswered issue of how firms should handle master data architecture design. The article aims to show what design decisions organizations must decide upon and what alternatives are available. The case study research was selected as an appropriate method since there is currently little understanding of the phenomenon. The research investigates the design of Bosch Group Master Data. Bosch is a global engineering business located in Germany, using a single-case approach. In IS, single-case studies are usually employed to investigate unusual or severe instances.

II. PROPOSED ALGORITHM

2.1 Master Data Management

The Master Data (MD) of a firm recognizes and classifies the most important business elements. Supplier, product, customer, and material master data are common [1]. Many

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efforts to describe MD by isolating it from the other different categories of data, for example, contractual, inventory, and transactional data, have been made [16]. However, this difference does not appear to be useful when looking beyond specific examples because of its vagueness. Contractual data, for instance, may be viewed as master data in the utility sector due to its long-term stability, but transactional data in the communications industry as a result of contracts being regularly canceled or amended by online-service clients.

Regardless of the absence of an agreement among scientists and practitioners on what constitutes master data, this study used the following definition throughout the investigation: Master data is information on the properties of a company's primary business items that is well defined and uniquely identifiable across the organization. MDM has gotten a lot of interest in the practitioner community in recent years. Large software providers, who created specific MDM systems, have aided this growth to some extent. On the other hand, MDM is widely agreed to be more than a class of data systems; it is a business function called "application-independent" [7]. Conferring to DAMA International [17], MDM aims to fulfill three goals: delivering a dependable source of great quality master data, reducing complexity and costs by using standards, and improving business analytics and integration of information.

2.2 Master Data Architecture

Master Data Management responsibilities include designing and administration of the master data architecture. By managing shared access, duplication, and flow, the master data architecture maintains data quality [17], [18]. Schmidt and Otto have made early scientific contributions to the discipline [15]. According to the two researchers, the master data architecture consists of a master data application architecture and a conceptual master data model. On one hand, the master data source and destination systems, and on the other hand, data flows, can be segregated further in the master data application architecture. The authors also describe a set of design considerations for master data architecture.

Unlike many other firms, Bosch has a long history of using master data management as a corporate function and building a company-wide master data architecture. Bosch published a group guideline in 2006 that included enforceable criteria for MDM. The group guideline is divided into two sections: organizational and technical. On June 17, 2010, Bosch was invited to an MDM Working Group meeting in Germany to discuss the key concepts of the master data architectural design they use. Hence, the Bosch case may be deemed highly exploratory and excellent for establishing the groundwork for future multi-case studies.

III. MASTER DATA ARCHITECTURE AT BOSCH

3.1 Master Data Management at Bosch

Bosch has a lot of expertise with divisional master data management. By adopting a group guideline in 2006, the corporation took the first step toward organizing Master data management on a corporate level [20]. The guideline establishes a legally obligatory structure for managing group master data - all master data utilized on a group level. The group policy is not applicable to master data that is solely utilized by one division. The responsibilities of various personnel involved in the mater data operations are introduced in the group guideline. A set of MDM activities is identified in the group guideline, separated into technical and organizational activities. The former is under the control of the corporate department of IT, while the latter is under the control of the MDO.

Figure 1. The MDM reference framework at Bosch

Governance System Master Data Provisioning, Utilization, and Master Data Concepts & Projects are the four components of Bosch's MDM reference architecture [20]. The Governance System consists of MD Strategies for every master data class and MD Controlling activities that assess MDM maturity and master data quality for every MD class. The design and maintenance of an MDM organization, MD processes, MD model, together with the development and administration of an application system for storing and delivering master data fall under MD Provisioning. Master data officers' responsibilities and IT responsibilities are available in the master data model. At Bosch, MD, Utilization refers to using master data and other business application systems in its daily business operations.

MD Concepts & Projects examines the various master data classes from a lifecycle viewpoint. Business requirements management for master data, the formulation of technical and functional specifications, and the technical and organizational execution of the specifications through projects are all related activities. The master data architecture design at Bosch group is lined up with three characteristics; the application's group-wide scope, the data governance framework, the system architectural framework, and the desired application system's product strategy vendor. Taking these factors into account, Bosch came up with a solution. Master data architectures may be approached in four ways; analytical, transactional, coexistence, and parallel.

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3.1.1. Analytical Approach

All master data management tasks, such as creation, update, and deletion, are assumed to be conducted by local source systems in the analytical method. When new master data is produced, the local system also assigns the primary basic property. Data is subsequently loaded into a central Master Data Server regularly (MDS), which assigns all imported master data records a global or company-wide unique identification number and optionally keeps references to local key properties. The MDS will detect duplicate records.

3.1.2. Transactional approach

The transactional method presupposes that the MDS maintains global master data properties. The MDS includes global identification numbers, data maintenance workflows, duplication checks during data entry, distribution, and export to local systems. The target systems can only read global master data; updating or modifying it is not permitted. This method is utilized in commercial circumstances that demand a high level of data responsibility. This method is demonstrated by the organization's chart of accounts, which adheres to the International Financial Reporting Standards (IFRS).

3.1.3. Coexistence approach

The analytical and transactional approaches are combined in the coexistence approach. Local systems keep track of master data and issue primary keys to records in the MD. The data is subsequently transferred to a master data server and given a globally unique identifier. The data is then aggregated by a smaller group of specialists, returned to the source systems, and (if requested) disseminated to other local target systems. Human resources MD illustrates data in this approach, which must adhere to local norms while simultaneously being centralized for identity management and corporate human resources tasks.

3.1.4. Parallel approach

In the parallel method, the maintenance role of the central MD is shared between a central master data server and local application systems. Workflow management assists local system users in producing, modifying, and removing master data. All transactions that must adhere to the ACID principle [19], which defines the atomicity, consistency, isolation, and resilience of database transactions, are coordinated with the central master data server, which allocates primary keys to MD records, validates and looks for identical records.

IV.CONCLUSION

The master data architecture of Bosch has been presented in this paper. The work of designing the master data architecture entails both technological and organizational considerations. Master Data design and management is an expensive, time-consuming process. It is crucial to select an appropriate architecture and complementing technology that fits an organization's goals while blending in with the current IT environment. It's just as crucial to pay attention to Data Governance and Data Quality to adopt MDM, preferably by developing an overarching vision and plan for data management. This document may be helpful to practitioners since it provides direction and advice in the difficult work of creating a master data architecture.

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