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Implementing Material Master Data Management within SAP EWM – A Case Study

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Master in Management of Services and Technology

Supervisor:
PhD, Susana Isabel dos Santos Ratinho, Invited Assistant Professor, Iscte-IUL

September, 2025

BUSINESS
SCHOOL

Department of Marketing, Strategy and Operations

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Acknowledgements

This long and arduous journey was only possible because I had the unconditional support of a few people. Thus, I would like to thank them all for contributing in some way to my being able to complete this great life project.

Firstly, I would like to thank Professor Susana Ratinho for her availability throughout this period, as well as for her guidance and concern for me. And to Adriana, who never left me alone and always encouraged me to continue.

I would also like to thank the company ROLEAR MAIS for the opportunity it provided, and all the employees who welcomed me and shared their knowledge of the industry with me.

I owe an immeasurable debt of gratitude to my parents, António and Laurinda, and to my grandmother, Felícia. Their unconditional love, patience, and sacrifices have been the foundation of everything I have accomplished. Without their guidance, encouragement, and constant support, this journey would not have been possible. I also wish to thank the rest of my family for their affection and for always being there to cheer me on along the way.

To my boyfriend Manel, I extend my heartfelt thanks for his unwavering support, understanding, and encouragement throughout this process. For all the hours he spent by my side, his presence, patience, and belief in me gave me the strength to persist, even in the most challenging moments.

My sincere gratitude also goes to Paula and Ricardo, for their kindness, generosity, and the way they welcomed me into their family. Their support and care have been deeply meaningful to me.

I would like to thank my gymnastics coach, Andreia, for her guidance, encouragement, and inspiration, as well as all my friends, who have continuously stood by me with companionship, motivation, and words of strength.

Lastly, I would love to dedicate a special thought to the memory of my grandfathers, Amaro and Carlos. Although they are no longer physically present, their values, teachings, and love continue to inspire and guide me. This achievement is also a tribute to them.

Thank you.

Resumo

No contexto atual da transformação digital, a qualidade dos dados é um fator determinante para a eficiência e sustentabilidade da gestão da cadeia de abastecimento. Dentro dos softwares de Enterprise Resource Planning, os Dados Mestre de Material são particularmente importantes, pois mantêm todos os dados utilizados nos processos de aprovisionamento, inventário e armazenamento.

Esta tese seguiu a metodologia de Investigação-Ação e apresenta um caso de estudo desenvolvido na ROLEAR MAIS, uma empresa portuguesa especializada em produtos elétricos, mecânicos e eletromecânicos, que se encontra atualmente a preparar-se para a transição para o SAP S/4HANA. Esta migração é uma excelente oportunidade para corrigir tudo o que são ineficiências da tabela de dados mestre.

O diagnóstico revelou deficiências significativas na tabela de Dados Mestre de Material. Em resposta, foi concebido um processo de referência To-Be e uma estrutura de gestão, com foco nas áreas acima mencionadas. A implementação incluiu a correção e o preenchimento de dados em falta, o redesenho da hierarquia de produtos e a introdução de regras para a criação automática de descrições. A avaliação e a monitorização basearam-se em análises quantitativas e qualitativas, fundamentadas em dashboards desenvolvidos na aplicação Microsoft Power BI.

Os resultados demonstraram melhorias na qualidade dos dados, mecanismos de gestão alinhados e maior preparação organizacional para a migração para o SAP S/4HANA. De uma perspetiva académica, esta dissertação contribui para a literatura ao ilustrar a forma como a Investigação-Ação pode ser aplicada de forma eficaz na gestão de dados mestres em contextos logísticos e de ERP.

Palavras-chave: Dados Mestres de Material, Gestão de Dados, SAP S/4HANA, Gestão Logística

Códigos JEL: C88 - Other Computer Software, M11 - Production Management, M15 - IT Management

Abstract

In the current context of digital transformation, data quality is an essential determinant of the efficiency and sustainability of supply chain management. Within Enterprise Resource Planning (ERP) software, Material Master Data is of particular importance, as it maintains descriptive, logistics, and commercial data used in procurement, inventory, and warehousing processes.

This thesis followed the Action Research methodology and presents a case study developed at ROLEAR MAIS, a Portuguese company specialized in electrical, mechanical, and electromechanical products, which is currently preparing for the transition to SAP S/4HANA. This migration is an excellent opportunity to correct all inefficiencies in the Master Data table.

The diagnosis revealed significant shortcomings in the Material Master Data table. In response, a To-Be referencing process and governance framework were designed, focusing on the areas mentioned above. Implementation included correcting and completing missing data, redesigning the product hierarchy, and introducing rules for automated description generation. Evaluation and monitoring were based on quantitative and qualitative analyses, supported by dashboards developed in the Microsoft Power BI application.

The results demonstrated measurable improvements in data quality, enhanced governance mechanisms, and increased organizational readiness for SAP S/4HANA migration. From an academic perspective, this dissertation contributes to the literature by illustrating how Action Research can be effectively applied to Master Data management in ERP and logistics contexts.

Keywords: Material Master Data, Data Governance, SAP S/4HANA, Logistics Management

JEL Codes: C88 - Other Computer Software, M11- Production Management, M15 - IT Management

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List of Acronyms

ERP	Enterprise Resource Planning
MMD	Material Master Data
EWM	Extended Warehouse Management
EAN	European Article Number
MMDM	Material Master Data Management
MDM	Master Data Management
RFID	Radio Frequency Identification
WMS	Warehouse Management System
CRM	Customer Relationship Management
RACI	Responsible, Accountable, Consulted, and Informed
KPI	Key Performance Indicator
AS/AR	Automated Storage and Retrieval System
VLM	Vertical Lift Module
GTIN	Global Trade Item Number
UMB	Base unit of measure
UMA	Alternative units of measure

1. Introduction

1.1. Context

The digitalization of logistics activities, driven by globalization and rising customer expectations, has brought data quality to the forefront of business operations and strategic decision-making. In this context, Enterprise Resource Planning (ERP) software and its supporting warehouse management solutions have become crucial in enabling businesses to integrate operations, manage flows, and maintain competitiveness. Among the numerous components of ERP, the Material Master Data (MMD) table is highly significant as it integrates the descriptive, logistical, and commercial attributes of every product and serves as a cornerstone for several business processes.

Inadequate or incomplete MMD can lower inventory accuracy, hinder procurement and sales processes, and decrease warehouse efficiency. On the contrary, well-structured MMD underlie proper processes, sound reporting, and appropriate decision-making. In SAP S/4HANA migration, all these problems are intensified, as firms must ensure that historical data is accurate, complete, and in line with the demands of complex modules, such as SAP Extended Warehouse Management (SAP EWM). Migration projects with no data governance focus, typically experience cost overruns, delays, or disruptions after going live.

The company involved in this case study, ROLEAR MAIS, deals in electromechanical equipment and products for both the public and private sectors, as well as in mechanical and electrical equipment and products. With nine outlets and three warehouses, the company offers a diverse range of products, spanning from lighting systems to air conditioning equipment. This diversity complicates MMD governing even further, since every product family is different, and it will have different units of measure and supply chain specifications. Meanwhile, ROLEAR MAIS is also on the threshold of a strategic digital transformation with the implementation of SAP S/4HANA and EWM, and this necessitates having its MMD table strong, accurate, and governed to best practice standards.

This thesis is therefore positioned at the intersection of academic research and organizational practice. It contributes to the scholarly debate on MMD management in logistics and ERP contexts while addressing a concrete organizational need: preparing ROLEAR MAIS for digital transformation through the improvement of its MMD. By adopting the Action Research methodology, the study not only analyzes the problem but also intervenes directly in the organization, producing practical outcomes while generating knowledge about how MMD governance can be improved in similar contexts.

1.2. Problem Statement

Despite its strategic importance, MMD is often undervalued in organizations. At ROLEAR MAIS, the preliminary audit revealed inconsistencies in material codes, incomplete and unstandardized descriptions, missing logistical fields, and inadequate configuration of units of measure. For example, many materials lacked the European Article Number (EAN), packaging dimensions, or their gross weight. At the same time, conversion factors between units were either absent or embedded in description fields rather than system fields. Furthermore, Material Groups and Product Hierarchy were based on supplier brands rather than technical or functional characteristics.

These deficiencies would have a direct impact on warehouse operations, procurement effectiveness, and inventory accuracy. Material code errors resulted in duplication and confusion during the purchasing process. At the same time, missing units of measure resulted in inefficiency in reception, storage, and picking, while missing weights or dimensions led to inefficient slotting and transportation planning. Beyond operational inefficiency, the absence of a governance model meant that the same errors were repeatedly introduced when new materials were created.

With the upcoming migration to SAP S/4HANA, these problems represent a substantial risk. Without a clean and governed MMD table, the migration could replicate existing errors into the new system, undermining the effectiveness of the investment and jeopardizing the adoption of advanced warehouse management functionalities. The problem addressed by this thesis has therefore two points of view: the current lack of data quality and governance in the MMD table, and the need to prepare ROLEAR MAIS for a seamless transition to SAP S/4HANA.

1.3. Objectives

General Objective

The general objective of this thesis is to analyze and improve the governance of MMD at ROLEAR MAIS, with a focus on preparing the organization for SAP S/4HANA migration.

Specific Objectives

From this general objective, the following specific objectives were defined:

- Diagnose the current state of the MMD table at ROLEAR MAIS, identifying inconsistencies, inefficiencies, and missing fields.

- Design a To-Be referencing process and governance framework for MMD management aligned with best practices and SAP requirements.
- Implement corrective actions in response to critical issues like material codes, descriptions, measurements, logistic fields, and product hierarchy.
- Access the efficiency of actions taken based on quantitative (data completeness, error reduction) and qualitative perception (stakeholder feedback, effect on operations).
- Contribute to the advancement of knowledge regarding how Action Research can be used to develop expertise in data governance in logistics and ERP environments.

1.4. Research Questions

To help direct the research and maintain comparison between goals and research design, the following research questions were established:

1) What are the current MMD management limitations of ROLEAR MAIS, and how do these affect warehouse operations and ERP effectiveness?
2) How should a To-Be reference process and governance organization be structured to surpass these limitations and meet SAP S/4HANA needs?
3) What correction actions work best to ensure data quality for codes, descriptions, units of measure, logistic fields, and hierarchy?
4) How is the effectiveness and sustainability of such actions monitored and measured in the long run?

1.5. Methodological Approach

This thesis employs the Action Research method, which is particularly suitable when the researcher not only wants to examine a problem but also seeks to become actively involved in it. It allows the researcher to work collaboratively with organizational stakeholders, ensuring that the solutions are grounded in practice while generating academically relevant knowledge.

In the context of this project, it enabled the integration of theory and practice. The diagnosis phase mapped the As-Is processes and identified gaps in the MMD table. The planning phase designed the To-Be referencing process and governance model. The action phase implemented specific corrective measures, while evaluation and monitoring ensured continuous improvement. This methodology was chosen because it combines rigor with relevance, enabling ROLEAR MAIS to benefit from immediate practical outcomes while also contributing to the broader understanding of data governance in ERP systems.

2. Literature review

In the following section of the thesis, the main primary theoretical concepts related to the implementation of Material Master Data Management (MMDM) within SAP EWM are presented and examined. In addition to providing a conceptual synopsis of the applicable topics, such as Master Data, ERP systems, and Logistics and Warehouse Management, it will also include references to their real-world implementation in SAP environments and digital transformation.

The objective is to defend the methodological decisions made during the process and offer an organized theoretical basis to support the project. A thorough literature review was conducted to ensure a comprehensive and rigorous academic foundation, using a range of academic databases and digital libraries, including B-on, Scopus, Emerald, EBSCO, and Google Scholar, which provided access to high-quality and updated academic resources.

Several research parameters were employed to narrow the scope of the results and ensure their scientific validity; thus, only peer-reviewed academic journals, books, and conference proceedings written in the English language were considered.

To ensure conceptual congruence, a collection of pertinent keywords was identified and applied whenever feasible, thereby narrowing the search strategy. Among these were terms like "data governance", "Material Master Data," "ERP migration," "SAP EWM," "warehouse automation," and "data quality management". This method ensured that only articles thoroughly examining the critical ideas of interest were chosen, excluding those that merely made passing references to the phrases. To support and enhance the debate in the ensuing sections, several foundational books from the domains of supply chain management, ERP implementation, and data governance were added, in addition to the scholarly publications and conference papers.

2.1. Logistics and Warehouse Management Context

The digital and technological revolution has driven substantial changes and innovations in every aspect, including in Logistics Management. Focusing on inventory and warehouse management, these advancements primarily aim to integrate Industry 4.0 technologies, including IoT, automation, and AI, to enhance processes while reducing unnecessary operational costs.

2.1.1. An Overview of Logistics and Inventory Management

The Council of Supply Chain Management Professionals (CSCMP, 2013) as the most prestigious logistics organization, it defines Logistics management as a "part of supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption to meet customers' requirements". As it involves the strategic coordination of the flow across the supply chain, a key component is inventory management.

According to Christopher et al. (2011) inventory is used as a buffer between uncertain demand and the challenging lead times experienced in the market, ensuring that organizations can maintain a high service level even in volatile conditions. However, holding excess stock leads to increased storage costs, capital tied up in unsold goods, and potential obsolescence, making it essential to strike a balance between availability and efficiency (Christopher et al., 2011). Furthermore, in complex warehouse operations, the ability to categorize stock based on usage frequency, value, or physical characteristics allows for more efficient allocation of space and resources. In this context, the quality of the Master Data is indispensable for supporting an automation system and its integration with advanced warehouse management solutions.

With the advent of Industry 4.0, inventory management has become increasingly data-driven. As Waller and Fawcett (2013) explain, the integration of real-time analytics, predictive models, and big data transforms traditional replenishment practices into demand-driven inventory systems, enabling organizations to optimize their inventory levels and responsiveness to market shifts in unprecedented ways.

Tubis and Rohman (2023) focus on the evolution towards Warehouse 4.0, as it can significantly reshape how organizations manage their inventory and MMD. As the two authors explain, modern warehouse operations are becoming completely reliant on advanced technologies such as Automated Storage, RFID solutions for real-time inventory tracking, and artificial intelligence for forecasting and decision support.

These innovations not only enhance throughput while reducing operational lead times but also ensure that warehouses can operate with greater agility and accuracy. More importantly, such technologies depend on structured and reliable Master Data to function correctly. Without it, the potential of Warehouse 4.0 systems cannot be fully realized, as automated processes rely on precise information to manage all operations, highlighting the crucial need for robust data management practices, particularly in environments preparing for integration with automated software.

2.1.2. Warehouse Management Principles

Warehouse management is a core logistical function that aims to efficiently transport, process, and store goods within a facility while maintaining a high level of service. Many authors have similar opinions about this topic, and the typical conclusions are:

- The key functions of Warehouse Management include inventory tracking, space utilization, order picking, replenishment, and shipping coordination (Richards et al., 2014).
- Having an effective warehouse management is crucial for reducing lead times and operational costs, while supporting high service performance (Baker & Canessa, 2009).
- A well-managed warehouse improves inventory accuracy and order fulfillment by integrating structured workflows and precise data recording (Ramaa et al., 2012).

In summary, warehouse management is a dynamic balance between the supply chain strategy, in-house operations, and its software systems. It is essential to note that this alignment relies heavily on the accuracy and quality of MMD, which enables technologies such as barcode scanning, Warehouse Management Systems (WMS), and automated systems to function reliably (Bartholdi & Hackman, 2019).

2.1.3. Pallet Shuttle Systems and Vertical Lift Modules (VLMs)

Warehouse storage systems are essential components of the logistics infrastructure, designed to support the organized, efficient storage and retrieval of materials. Many factors can influence the decision of what is the most appropriate storage system. According to Richards et al. (2014) these factors include product dimensions, turnover rate, inventory handling strategies, and available space. Following the same author, the trade-off is between speed, cost, and capacity.

As advances in technology emerge, the variety of storage systems continues to increase. This range goes from the conventional static shelving to automated solutions, each offering varying levels of accessibility, space utilization, and automation. Proper alignment between storage system capabilities and material characteristics is crucial for maximizing operational efficiency and minimizing handling time.

Among semi-automated high-density solutions, Pallet Shuttle systems are a modern alternative to the traditional drive-in racking ones. The first systems mentioned offer better space optimization and higher throughput compared to the latter, as they eliminate the need for forklifts to enter the storage lanes and are controlled via overhead Warehouse

Management Systems software or handheld devices (Franke & Manemann, 2024). According to a Fraunhofer IML study, the Pallet Shuttle reduces the need for equipment and mitigates the damage and safety risks associated with conventional racks, offering greater flexibility in both FIFO and LIFO operations (Franke & Manemann, 2024).

Similarly, the Vertical Lift Module, also known as VLM, is an Automated Storage and Retrieval System (AS/RS) unit that brings goods to an operator at an ergonomic access point, significantly saving the floor space by 66,3% and reducing picking times (Tompkins et al., 2010). According to Tompkins et al. (2010), order picking is a labor-intensive and costly activity within warehouse operations, often accounting for up to 60% of total operating costs, as it involves the picking and travel time. The latter is the dominant factor as it accounts for 50% of the total picking time. Knowing this, it can be inferred that the VLM system will drastically reduce the travel time in picking orders, enhancing its speed and ergonomic conditions. When an operator requests a product by using its code number, a tray is pulled to the picking station. Immediately after all the wanted items are picked, the tray is pulled back to a free position inside the VLM (Tavira et al., 2024).

From an integration point of view, both the shuttle and the VLM systems require a structured and accurate MMD, including dimensions, weight, units of measure, and its identification code, also known as GTIN. Any discrepancies in data can lead to missed picks, damaged inventory, or system downtime.

2.2. Enterprise Resource Planning Systems

Enterprise Resource Planning, also known as ERP, is a software that, when implemented, unifies and optimizes operations across various departments within a company. Various authors defend that organizations can automate tasks like accounting, supply chain management, human resources, and production by using the mentioned systems with a shared database and modular architecture (Monk & Wagner, 2008; Moon, 2007). The ERP system plays a crucial role in removing data barriers, improving decision-making, and enhancing operational productivity.

2.2.1. ERP concepts and architecture

Traditionally, ERP systems follow a multi-tier architecture that enhances scalability, flexibility, and ease of maintenance. Early ERP solutions adopted a two-tier structure, client-server, wherein client workstations handle the user interface and business logic, while a central server

manages data storage and processing (Hall et al., 1994). This approach improved performance compared to single-instance systems, but it still had limitations in terms of modularity and distribution.

To address these limitations, ERP suppliers such as SAP and Oracle adopted a three-tier architecture. The latter was composed of a presentation, an application logic, and a database layer (Bahssas et al., 2015; Kurbel et al., 2003). The presentation tier provides user interfaces, either desktop or browser-based, while the business logic tier processes application workflows, and the data layer manages storage. This separation enables better reutilization of the business components, improves its fault isolation, and simplifies its maintenance and security deployment (Bahssas et al., 2015; Kurbel et al., 2003).

More recently, ERP systems have embraced cloud-native architectures and microservices-based approaches, offering modular, independent, deployable services that are aligned with the evolving business requirements (Lee et al., 2024). The shift towards a Service Oriented Architecture and microservices enhances system agility, enabling components such as finance, procurement, warehousing, and analytics to be dimensionally independent and updated without disrupting the entire system (Dragoni et al., 2017).

This modularity is crucial for real-time ERP platforms like SAP S/4HANA, which utilize in-memory databases and microservices to support a wide range of operations, including Extended Warehouse Management (EWM). The ability to run warehouse processes in real-time, accessing up-to-date material master and transaction data, depends on this next-generation architecture, enabling faster responses and adaptability to operational changes.

2.2.2. Implementing ERP systems: Process and challenges

Implementing an ERP system is a multi-phase process characterized by its complexity, cost, and organizational impacts.

Planning and preparation is the first step, where organizations identify their requirements, objectives, and potential challenges. It is in this phase that the project team needs to be assembled and the most appropriate ERP supplier chosen. Zhang et al., (2003) and Huang and Yasuda (2016) defend that the critical success factors in this phase include having a supportive upper management with a clear project scope, and effective communication.

In the second step, Business Process Reengineering, ERP systems often require significant adjustments to the current workflows. To increase efficiency, business process

reengineering synchronizes organizational procedures with the capabilities of the ERP system (Davenport, 1998). Moreover, stakeholder engagement and training are essential at this phase, as they tend to exhibit resistance to change (Olson David L. and Zhao, 2006).

After reengineering the necessary processes, the next phase involves System Configuration and Customization. The ERP system is set up to meet the company's requirements; however, while customization is made possible, it also requires complexity and time to implement (Moon et al., 2007). To preserve the system’s integrity and to minimize its costs, Monk and Wagner (2008), affirm that the best practice should be to avoid customization.

Data Migration and Integration should only occur after the prior steps are completed. All data from the previous system should be corrected/, cleaned, and standardized before the transfer. According to Botta-Genoulaz and Millet (2005) this integration guarantees seamless data flow across modules. Furthermore, Huang and Yasuda (2016) ensure that efficient data governance during the migration process reduces errors and guarantees data consistency. The fifth step involves Testing and Deployment, where specialists conduct extensive testing to ensure system readiness and user acceptance.

Lastly, Post-Implementation Support and Optimization is the step that closes the implementation process. Continuous monitoring and feedback help address issues, optimize system performance, and identify areas where improvements are needed. With this, the authors recommend that corporations implement training programs and user support.

2.2.3. Benefits of ERP integration in Warehouse contexts

ERP offers numerous advantages that can significantly enhance an organization's performance and competitiveness. Through automating repetitive procedures and eliminating redundancies, these systems will improve overall productivity and efficiency. Monk and Wagner (2008), and Zhang et al., (2003), advocate that centralization of data activities, ensures its accuracy and uniformity, while also providing on-demand access to key resources, thereby assisting in making better and faster decisions.

The information gaps disappear, and interdepartmental collaboration is achieved. Based on shared data, processes, and procedures, standardization is promoted through the use of ERP systems. It provides added value by enhancing interdepartmental cooperation and alignment through this integrated approach (Botta-Genoulaz & Millet, 2005). Moreover, modern ERP solutions are more flexible and scalable, allowing organizations of varying sizes to utilize them. The adoption of cloud-based ERP solutions increases accessibility, which is

beneficial to meeting company requirements while lowering infrastructure expenses (Huang & Yasuda, 2016).

Furthermore, improved regulatory compliance is yet another important benefit. By offering audit trails, consistent reporting procedures, and strong data security features, ERP systems make it easier to comply with regulatory industry requirements and lower the possibility of non-compliance fines (Olson & Zhao, 2006).

Additionally, the operational efficiencies and data transparency enabled by ERP systems translate into better customer service. Monk and Wagner (2008), suggest that greater responsiveness to the customer can enhance both satisfaction and loyalty, thus increasing business. These benefits indicate the major improvement in organizational excellence and long-term growth that ERP systems can provide.

2.3. Master Data and its governance

Master data and its governance lay the groundwork for integrated, efficient ERP systems, particularly when warehouses employ advanced technologies like Warehouse Management Systems, pallet shuttles, and vertical lift modules. The definitions and roles of data are formalized through Master Data Management (MDM) and overseen by Master Data Governance (MDG). Master Data depends on rigorous data quality practices and structured migration methods. These initiatives collectively ensure that material master records serve as reliable, consistent, and auditable assets, enabling enterprises to achieve high performance in warehouse operations and systems scalability.

2.3.1. Definition and Role of Master Data

DAMA International, as The Global Authority in Data Management Excellence, declares that Master Data is the core of business operations by assuring there are consistent definitions and semantic alignment across organizational functions (Dama International et al., 2017). Furthermore, Master Data is considered by Spruit and Pietzka (2015) as a crucial competitive factor for organizations, since it is a type of data that has been cleaned, standardized, and incorporated into an enterprise-wide system, and utilized in several business fields (Berson & Dubov, 2007).

Nevertheless, not all data is considered Master Data, and efforts have been made to differentiate Master Data from other types of business data. According to Wolter & Haselden (2006) there are four general data domains: customers, which include the customer,

employee, and salesperson subdomains; and products, which encompass the product, part, store, and asset subdomains. Within the location's domain, there are office locations and geographic divisions, as well as the Other domain, which includes sub-domains such as contracts, warranties, and licenses.

Master data has a critical role in high-tech and automated warehouse environments, where inaccuracies in attributes like unit of measure, product dimensions, or weight can disrupt processes, cause picking errors, lead to stock discrepancies, and even pose safety hazards (Gu et al., 2010).

2.3.2. Master Data Management (MDM)

Master Data Management (MDM) has become a vital subject for companies seeking to combine critical business data, enhance data quality, and streamline data governance. According to research, MDM, Master Data, forms the basis for effective operations across a range of corporate activities (Loshin et al., 2008). MDM ensures that this data is accurate, consistent, and accessible across different departments, thus enabling more cohesive decision-making and operational efficiency.

In MDM literature, architectural strategies and governance are major areas of interest. Typically, architectures can be classified as hybrid or federated, which large companies can benefit from, since they offer more flexibility when integrating multiple sources of data, (Cleven and Wortmann, 2010; Otto and Reichert, 2010), or they can be centralized, where data governance and quality control are simplified by centralizing all Master Data into a single repository.

From an analytical perspective, MDM supports data warehousing and business intelligence applications. From an operational perspective, MDM integrates systems such as ERP and CRM to enable real-time data. These are the two primary applications that commonly support MDM systems in terms of technological implementation. When combined, these programs guarantee that Master Data may be utilized for both strategic analysis and daily operations (Apostol et al., 2007).

As the amount and diversity of data grow, there is also an increasing focus on integrating MDM with big data, which poses challenges in terms of data speed, diversity, and volume, necessitating sophisticated data processing and storage solutions. To efficiently aggregate, clean, and manage data, MDM frameworks need to change (Li & Smith, 2024).

The use of MDM best practices is becoming increasingly crucial, as businesses strive to stay competitive in a data-driven environment and make informed decisions. This ensures that data management, when aligned with corporate goals and technology developments, will increase operational efficiency while facilitating strategic data use across departments.

2.3.3. Master Data Governance (MDG)

Effective data management, particularly in large companies, relies on the creation and utilization of fundamental frameworks and models within Master Data Governance (MDG). These frameworks serve as blueprints that outline the positions, procedures, and tools necessary to maintain data quality, consistency, and compliance with corporate goals.

Wende et al. (2007) Defends the notion that one of the core frameworks should be a data stewardship model, as it highlights the importance of assigning roles and responsibilities, such as data owners who are accountable for data strategy and data stewards who manage operational tasks, including data validation and quality checks. Ultimately, these roles can be attributed through the RACI (acronym for the four types of interaction: Responsible, Accountable, Consulted and Informed) chart to ensure that Master Data is actively monitored, thereby minimizing the risk of errors and inconsistencies.

Furthermore, Otto and Reichert (2010) propose an integrated governance framework that aligns organizational data governance needs with the operational aspects of MMD, ensuring alignment with the entities' business objectives. This alignment ensures a mutual reinforcement between technology and governance, promoting operational effectiveness and adherence to legal requirements.

Besides the two frameworks presented, a third one, known as the policy standardization process, can also be considered. This entails creating uniform policies and procedures for data entry, categorization, and usage. In enterprises that operate across multiple locations and/or systems, policy uniformity is especially crucial; thus, differences in data practices can lead to significant inefficiencies. By establishing a single source of truth for crucial data assets, standardized policies will not only enhance data quality but also make regulatory compliance efforts easier, according to studies by (Spruit & Pietzka, 2015).

Therefore, these frameworks provide businesses with a strong foundation for efficiently managing their Master Data by emphasizing the integration of roles, procedures, and technology. To simplify governance procedures and enhance scalability in increasingly complex data environments, future research and practice may further refine these models by integrating advancements such as artificial intelligence and machine learning.

2.3.4. Data Quality and Cleansing Approaches

To successfully run an ERP and other warehouse automation systems, a company must maintain high-quality Master Data. Inaccurate or inconsistent data can lead to process failures, poor decision-making, and increased operational costs (Redman, 1998).

Effective data quality management ensures that material master records are accurate across key attributes, such as units of measure, dimensions, weights, and product classifications, which directly affect inbound logistics, storage configuration, and outbound picking processes. According to studies by Wang and Strong (1996), ensuring data quality requires a multidimensional approach that extends beyond mere accuracy, involving completeness, consistency, and timeliness.

The International Organization for Standardization (ISO), responsible for setting quality standards for products distributed across borders, assembled a norm specifically for Master Data, ISO 8000. This document notes that specific intrinsic components of Master Data require consideration. Those are their Syntax, Semantics, Source, Fitness, Accuracy, and Completeness, detailed below (ISO 8000, 2022).

- Syntax: The structure of data elements influences how easily data can be combined, integrated within, and across organizations.
- Semantics: The capacity to understand data concerning its clarity through all stakeholders
- Source: The ability to trace who created, validated, or transferred the data through an organization.
- Fitness: Evaluate whether a specific dataset meets its requirements and fits its purpose.
- Accuracy: The method determines the ability to validate data accuracy.
- Completeness: Specific approach to evaluate the capacity of Master Data integrity.

A clear understanding of these dimensions provides the foundation for developing effective data profiling and cleansing strategies within any software implementation projects.

Once data quality dimensions are assessed, the next step is to identify data anomalies, which means it is crucial to apply effective cleansing methodologies. Data cleansing involves correcting and eliminating inaccurate, incomplete, or improperly formatted data to ensure that data becomes reliable and consistent across systems (Rahm & Do, 2000).

Ehrlinger et al. (2019) found that data quality tools used for profiling, measurement, and monitoring are compelling for functional data governance. Their research also underlines that

rigorous Master Data profiling is essential for trustworthy automated processes (Ehrlinger et al., 2019).

2.3.5. Data Migration in ERP Projects

Data migration is a pivotal phase in ERP implementation, as it involves transferring large volumes of data, such as material master records, from one system to another.

According to Willis and Willis-Brown (2002) inadequate migration processes can lead to significant disruptions in operations, financial inaccuracies, and user mistrust. In the specific context of warehousing and logistics integration with a Warehouse Management System, ensuring the MMD is trustworthy, particularly concerning units of measure, dimensions, and product classifications, is essential for the same authors, maintaining accurate stock levels, seamless system interfacing, and effective automation workflows (Willis & Willis-Brown, 2002).

O'leary et al., 2000 emphasizes that a complete migration strategy must include thorough data profiling, rule-based transformations, and expert validation to preserve data integrity and ensure compliance. Therefore, before undertaking all migration activities, organizations must implement and regularly review processes following the ISO 8000 recommendations to avoid downstream errors and support reliable ERP operations.

ERP data migration typically follows a structured, multi-phase lifecycle that encompasses planning and analysis, extraction, transformation and cleansing, loading, post-load testing and validation, and go-live, with continuous reconciliation. This approach is supported by El Mariouli and Laassiri (2021), Ramachandran and Agarwal (2023), Hajra and Goel (2025), and other recent studies, which highlight iterative testing cycles, stakeholder involvement, and the importance of Data Governance at each stage.

Chimpiri et al., (2024) compared the batch versus the phased migration strategies, and concluded that the latter one can reduce risks and costs, especially when combined with automated conversion and human oversight processes.

2.4. Warehouse management systems – WMS

Warehouse Management System (WMS) is often integrated with an ERP platform to enhance efficiency and visibility of warehouse operations, such as tracking inventory levels, order fulfillment, and storage management. When working in tandem, ERP and WMS provide a comprehensive platform that enhances overall supply chain efficiency through accurate visibility on warehouse operations, correct inventory data monitoring, and effective logistics

coordination (Faber, 2013). This integration enhances operational efficiency by providing real-time updates on inventory levels, which helps minimize stock discrepancies and ensure accurate stock management.

By automating workflows, reducing lead time, and increasing delivery accuracy, this supports fulfilling orders through enhanced customer satisfaction by employing an integrated WMS (Baruffaldi, 2018). It also enhances visibility in the supply chain, offering complete transparency across processes, which in turn makes forecasting more accurate, resource allocation more efficient, and planning more strategic (Faber, 2013). Hence, automation in the warehouse, such as picking, packing, and restocking, drives down operational costs and reduces human errors, contributing to further increases in effectiveness and reliability.

Besides, this integration fulfills the scalability and flexibility required by a business to adapt its operations according to a dynamic environment. It enables the continuous addressing of changing demands while preserving its benefits in the face of competitive challenges. WMS solutions are market staples that help businesses to grow in a manner that does not disrupt their overall productivity over the long run, which is especially important for companies competing in market environments such as today (Baruffaldi, 2018). Together, ERP and WMS systems enable organizations to optimize warehouse operations, improve supply chain performance, and deliver superior value to customers.

2.4.1. The role of WMS in Material Master Data Management

A WMS controls storage processes and manages stock. It is most useful in distribution and logistics activities, particularly in assisting with MMD and streamlining logistical processes. MMD is crucial in preventing inconsistencies across various supply chain processes since it defines, organizes, and monitors all inventory items. This is made possible by a WMS when it integrates with other enterprise systems, such as ERP, for up-to-date information delivery, thereby reducing inaccuracies related to inventory and order management (Faber et al., 2013).

2.5. SAP Extended Warehouse Management (SAP EWM)

SAP Extended Warehouse Management (SAP EWM) is a crucial component of modern supply chain and warehouse operations, as it offers a comprehensive solution designed to optimize and automate various warehouse processes. EWM, a crucial component of SAP's enterprise resource planning toolkit, is tailored to satisfy the needs of intricate, high-throughput warehouse settings while still being adaptable enough to cater to smaller businesses. Its

integration capabilities, specifically with the use of S/4HANA, are key for businesses looking to increase efficiency and scalability in their logistics framework.

Hence, the increasing complexity of supply chains requires a sophisticated system, such as SAP EWM, to handle the challenges posed, for instance, by demand fluctuations, inventory structures, and compliance with regulatory requirements. Through providing advanced functionalities such as real-time inventory management, automated warehouse task allocation, and seamless process integration, EWM ensures enhanced visibility, control, and efficiency.

This topic will explore SAP EWM's implementation best practices, its advantages for businesses, and its integration with SAP S/4HANA. Through an analysis of theoretical frameworks and real-world applications, this literature review clarifies how SAP EWM continues to redefine warehouse management and generate value in supply chains worldwide.

2.5.1. Implementation and good practices

To maximize performance and cost-effectiveness, SAP EWM implementation requires meticulous planning and adherence to best practices. Using SAP Best Practices' pre-configured templates and workflows is one of the best practices, streamlining and expediting deployment. On the one hand, Decentralized EWM works well for large-scale activities, as it can handle a larger throughput. On the other hand, centralized EWM helps medium-sized enterprises by integrating the solution into SAP S/4HANA, which streamlines the system environment and lowers expenses (*InsideSCM*, 2024).

Performing thorough requirements research, ensuring data integration is solid, and funding user training are all essential tactics for effective deployment. Accuracy and efficiency in warehouse jobs are improved by utilizing cutting-edge capabilities such as automation for handling units (HUs) and integration with radio frequency devices (*SAP Community*, 2024).

2.5.2. The integration of SAP with SAP S/4HANA

The integration of SAP EWM with S/4HANA represents a significant advancement in warehouse and ERP management, as it eliminates the intricacies of managing multiple systems. It offers a unified information technology framework that improves data consistency, accelerates transactional processes, and enhances operational efficiency.

According to SAP Community (2024) and InsideSCM (2024) this embedded architecture ensures that Master Data is stored in a single database, so the need for an external replication tool will not be necessary. Therefore, when processing this type of data in real-time, businesses can execute time-sensitive operations, such as inventory updates and order processing, with unprecedented speed and precision.

Another standout feature of integrating the SAP S/4HANA, which empowers businesses, is its built-in analytics engine, where the use of pre-configured reports and live dashboards that offer thorough insights into warehouse operations, while using Key Performance Indicators (KPIs) like order fulfillment rates, stock levels, and labor efficiency, can be tracked in real time by decision-makers. Therefore, proactive decision-making is made possible when having access to comprehensive analytics, which aids businesses in reacting quickly to demand fluctuations or operational constraints (*InsideSCM*, 2024).

Furthermore, SAP Community (2024) defends that SAP S/4HANA supports extensive customization to address unique business needs. Using available extensions, companies can adapt EWM functionalities, such as warehouse task creation, resource planning, and advanced picking strategies, to suit specific operational requirements. For instance, businesses operating in highly regulated industries can implement custom compliance checks directly within their warehouse workflows.

2.5.3. Benefits of having SAP and SAP S/4HANA

Numerous advantages are provided by SAP EWM, which significantly improve supply chain effectiveness and warehouse operations. Its ability to seamlessly integrate with SAP S/4HANA, resulting in a single platform for managing warehouse and enterprise resource planning (ERP) tasks, is one of its key advantages.

SAP S/4HANA provides significant enhancements in performance management, particularly in the retail and consumer goods industries. The system enables real-time performance management, which can lead to major opportunities for companies. However, achieving these benefits requires a solid business design and harmonized processes and data structures (Poschadel, 2019).

For enterprises, implementing SAP S/4HANA is frequently a significant undertaking that alters their interactions with both internal and external stakeholders. For adoption to be successful, these changes must be fully understood and articulated throughout the implementation process (Kulkarni, 2019).

3. Methodology

The next chapter provides a brief explanation of the methodology used, which was an instrument for conducting the research and achieving the project goals. Due to the practical nature of the work in identifying, analyzing, and enhancing the quality of MMD in preparation for the SAP EWM implementation, the chosen framework for the research was the Action Research Methodology. One methodology is particularly appropriate when the researcher is involved in diagnosing a problem in the field setting, making conscious choices for change, and reflecting on the consequences within an actual organizational context.

3.1. Action research methodology

The action research methodology is defined by O'Leary et al (2007) as "Research strategies that tackle real-world problems in participatory, collaborative and cyclical ways in order to produce both knowledge and action". Action research employs research methodologies that aim to achieve change at both social and professional levels. Since its objectives are oriented towards this transformation, rather than just gathering information, the studies carried out focus on everyday issues and the subsequent implementation of practical solutions to existing problems. Has this approach facilitated an iterative problem identification, intervention, and assessment cycle that connected theoretical framing and practical action. It helped to shorten the gap between stakeholders, promote continuous learning, and encourage the structured adoption of good practices for data management.

According to Coughlan and Coghlan (2002), the pieces necessary for the success of this methodology are the researcher and the employees of the organization under study. People must be willing to actively participate in the project and adapt to changes within the organization. This methodology is the most appropriate as it integrates both theoretical and practical perspectives, bridging the gap between academic research and real-world applications. The study aims to address the challenges of managing MMD within warehouse operations, exploring how SAP EWM can enhance data accuracy, streamline processes, and improve decision-making. By actively engaging stakeholders, this methodology ensures that the findings are relevant and applicable to the organization's context.

3.2. Action research cycle

When considering the Action Research methodology, special attention needs to be given to its cycle, as this methodology is characterized by its constant, cyclical structure, comprising stages of planning, action, observation, and reflection. Arising with Lewin et al., (1946), this

spiral cycle serves as a dynamic framework for linking theory and practice through repeated interventions and learning processes (Kemmis et al., 2014). Each cycle begins when a problem is identified or an opportunity for improvement is recognized, followed by designing and executing targeted interventions, observing the effects in real-time, and reflecting to inform subsequent cycles (Mckay & Marshall, 2000).

Like most authors, Kemmis et al. (2014) outlines four core phases: Plan, Act, Observe, and Reflect. As it is cyclical, the process can be repeated across several cycles, each building on the results of previous interventions to improve both action and understanding (Kemmis & McTaggart). When applying this methodology in practice, these stages may overlap, with flexibility and responsiveness to discovering new insights or unexpected outcomes, often referred to as the “messiness” of action research (Mckay & Marshall, 2000).

From O’Brien et al., (2001) point of view, the methodology in question consists of five interdependent and cyclical phases: Diagnosis, Action Planning, Taking Action, Evaluation, and Specifying Learning. If the results are not as desired, this process can be repeated from the diagnostic phase onwards. This model emphasizes the importance of redesigning processes and structures based on reflection, rather than superficially correcting symptoms (Argyris & Schön, 1978; cited in Baskerville & Wood-Harper, 1996).

As shown in the figure below (Figure 1) the action research cycle considered for this project consists of the five steps defined by O’Brien et al., (2001), where there is a problem, diagnosis, action planning, implementation, and evaluation of the measures taken.

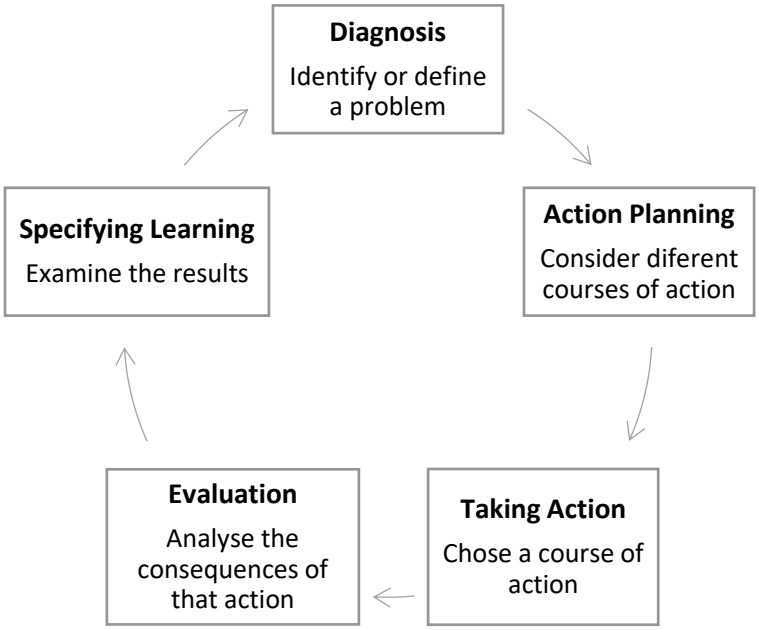


Figure 1: Action Research methodology cycle

3.2.1. Diagnosis

The first stage, Diagnosis, consists in mapping the As-Is processes, which will determine the main obstacles and weaknesses in the material Master Data management procedures, collaborate with stakeholders, such as data governance teams, IT personnel, and warehouse managers, to collect information through on-site process walkthrough, surveys, and interviews, and examine how the MMD in SAP S/4HANA and SAP EWM are currently integrated to find opportunities for improvement and inefficiencies. This will allow a better understanding of how the tasks that the project will affect were carried out.

At this stage, it is important to pay special attention to Master Data quality, i.e., its completeness, accuracy, and consistency (Batini, 2009). Quantitative assessments, such as data profiling and completeness checks, can be applied to datasets extracted from SAP S/4HANA and SAP EWM. These analyses help identify duplicates, missing values, and outliers that may indicate systemic issues.

After the As-Is mapping, it will be possible to identify the problems and constraints present in the areas under study that hinder the smooth operation of the company's tasks and can lead to non-value-added activities. Thus, it is necessary to identify existing problems by analyzing flowcharts, and data extracted from companies' documents, as well as through interviews and questionnaires with various employees. This step is fundamental, as this is the only way to assess the current situation and subsequently make the necessary changes to improve the functioning of the activities carried out.

Therefore, a script was developed to support the interviews, gathering all the necessary information to study the company's current situation, as outlined in the questions below.

- What activities are carried out?

- Who carries out these activities, and how are these activities carried out?

- What difficulties do you encounter on a day-to-day basis?

- What changes do you think need to be made to make the job you do work better?

- If there are any problems, how do you resolve them?

- Is there communication with the other departments?

By analyzing the interview results and utilizing the *Bizagi Modeler* software, it was possible to prepare flowcharts that mapped out the processes in different areas, detailing the various tasks and their sequence.

Subsequently, the company provided documents in an .XLSX format, allowing the table of materials, material movements, and stock data to be analyzed, which enabled an assessment of the company's potential current problems.

Once identified, it is necessary to analyze the cause of the company's problems, i.e., the origin of the constraints it is experiencing. Consequently, it is possible to propose solutions to these constraints. Thus, tools such as the Why-Why Diagram and the Fishbone Diagram can be used to identify the root causes of the problem.

The success of this phase depends heavily on active collaboration and iterative feedback, as Baskerville and Myers (2004) emphasize. Thus, findings from the diagnostic activities should be validated through workshops and discussion sessions with stakeholders to ensure alignment and accuracy of interpretation.

3.2.2. Action Planning

During the Planning phase, the objective is to create solutions that respond directly to the issues identified in the first phase, the diagnosis. This includes formulating corrective actions for the inconsistencies found in Master Data, structuring a new framework for material data governance, and mapping out a step-by-step approach for standardizing and cleansing data.

Guidance for the planning came from established literature in data governance. Key principles included assigning clear data ownership roles, embedding Master Data steward roles, and defining robust validation rules (Otto & Reichert, 2010). The planning process progressed in iterative cycles, gathering stakeholder input at each step to ensure that the designs remained realistic, compatible with system limitations, and aligned with the broader organizational objectives.

Additionally, detailed documentation was prepared to facilitate upcoming migration tasks. This documentation specified transformation rules, compiled validation checklists, and articulated measurable success criteria. This approach aligns with the standard practices recommended for ERP data migration, which emphasize the importance of thorough, upfront planning to minimize the likelihood of migration setbacks (Chimpiri, 2024).

Therefore, in this second stage of Action Planning, through brainstorming sessions with those responsible for each area and their respective employees, proposals for improvement to the problems found in the previous stage were identified, for instance, where possible solutions should be presented based on the study carried out previously, discussing the improvements to be implemented with the rest of the team. This was the time to develop a

comprehensive implementation plan for material Master Data management using SAP EWM, defining the scope, objectives, and success criteria for the intervention. The plan aligned with organizational goals and compliance requirements, and designed effective workflows and governance structures for material Master Data management within SAP EWM.

3.2.3. Taking Action

Once the proposals for improvement are approved, the next and third stage is Taking Action. During this phase, the goal is to execute the proposed implementation plan, with a focus on integrating SAP EWM. At the same time, configuring and testing MMD objects is crucial to ensure the alignment between organizational processes and warehouse management requirements.

At this stage, attention is focused on MMD objects, such as base units of measure, product hierarchies, material groups, storage methods, and packaging data, ensuring they are aligned with business processes and system logic (Ahmad & Pinedo-Cuenca, 2013). Master data is crucial for ensuring accuracy and consistency, especially during this phase, as chronic errors can undermine processes across the system, leading to failures or inefficiencies in the warehouse. For this reason, comprehensive system tests, such as integration tests and user acceptance tests, should be conducted to confirm that the relevant data structures and processes are executing as intended in SAP EWM.

Moreover, user training and stakeholder engagement also stand out as crucial elements in this phase. There is evidence showing that inadequate training is a top user-centered reason for ERP failures (Al-Mashari, 2003). Therefore, it is helpful to formulate a comprehensive change management approach that considers targeted training, communications, and feedback mechanisms to guide stakeholders in embracing a shift in role and processes (Fui-Hoon Nah, 2001). Such an approach will help enhance the shift while supporting the system and responsibility, which will, in turn, support stakeholder trust.

By the end of the Taking Action phase, the changes should be fully implemented, and the system should be functioning in a production-like environment, ready for performance monitoring and final evaluation.

3.2.4. Evaluation

When the previous actions were implemented, the Evaluation phase assesses the effectiveness of the actions taken and determines whether the project's objectives have been

achieved. This evaluation process is centered on weighing the change in performance at the pre- and post-implementation phases. This change is measured both qualitatively and quantitatively. It is essential to assess whether the integration of SAP EWM and the modifications to the MMD have led to process efficiencies, reduced data anomalies, and improved operational workflows (Laudon & Laudon, 2018; Somers & Nelson, 2001).

An important activity in this phase is the mapping of the To-Be processes, which involves capturing the redesigned workflows and information flows as new flowcharts and system models. These new diagrams clarify the depiction of processes for various tasks within the ERP framework, thereby enhancing transparency. They thus act as a source of information for compliance and training (Davenport, 1998). The mapping aids in process governance and serves as a point of reference for benchmarking for continuous improvement initiatives.

To facilitate the adoption and correct execution of new processes, information, and clarification sessions are usually suggested by most authors. These sessions should equip employees with the relevant information about the changes and outline their specific roles under the new framework. Communication and training in the post-implementation stage are crucial for realizing ERP advantages and mitigating resistance.

Moreover, key stakeholders, including end users, managers, and IT staff, should be interviewed and surveyed on the new system's usability, data accuracy, and overall satisfaction. These qualitative assessments are essential to inform the understanding of what further changes can be made and to enhance stakeholder participation (Markus et al., 2000).

3.2.5. Specifying Learning

The last phase of Specifying Learning focuses, within the frame of the Action Research Cycle, on the outcomes of the actions taken, as well as the research, while implementing a systematic reflection technique. This phase synthesizes lessons learned throughout the entire project by assessing the Evaluation phase, paying attention to results, challenges, and potential areas for growth. This is the reason why, as Susman and Evered (1978) pointed out, this is not simply a summary but a critical learning step where researchers and practitioners attempt to convert experiences into organizational knowledge.

In this phase, input from stakeholders, including end-users, management, and the IT team, is critical for assessing the practical impacts of the changes made, as well as capturing a comprehensive range of views. Triangulation of this input with performance indicators and project reports provides a basis for evaluating the impact of the technical and participatory approaches on the project (Avison et al., 1999). It is within this phase that one can evaluate

the appropriateness of the Action Research methodology, given its collaborative and iterative nature.

Furthermore, all lessons learned must be recorded and communicated, enabling the organization to establish the best practices and guidelines for future projects. This knowledge can also aid in similar ERP or data governance projects throughout the organization, as well as in sustaining ongoing refinement initiatives. As R. L. Baskerville and Wood-Harper (1996) noted, the action learning component of Action Research distinguishes it from other research methods by achieving organizational learning as its final product.

Ultimately, the phase known as Specifying Learning incorporates theoretical concepts into practical applications, thereby informing the social-scientific discourse on organizational transformation through the functioning of ERP systems, data governance, and collaboration with other stakeholders (Coghlan & Brannick, 2014). It helps to ensure that the work undertaken to diagnose, act, and evaluate processes results in positive and enduring change, as well as the nurturing of a more data-driven and agile organization.

4. Case study

The Case study chapter presents the case study developed to achieve the objectives set in the beginning, as well as answer the research questions defined. Following the Action Research methodology described in the previous chapter, the project is explained through various phases, from diagnosing the current situation of material Master Data management to implementing and evaluating improvement actions.

4.1. Company's context and purpose

The company ROLEAR MAIS is an organization specialized in the market of electrical, mechanical, and electromechanical products and equipment for public and private spaces. This company is heavily committed to promoting sustainable technologies and solutions. ROLEAR MAIS has nine stores, mainly located across the southern and central regions of Portugal; however, the primary operations are conducted in Vialonga and Areal Gordo, where the project was executed.

The project started in October 2024 and is part of a strategic initiative to prepare the organization for the transition to SAP S/4HANA, with a particular focus on the optimization of warehouse management processes through SAP EWM. Currently, in warehouse operations, the MMD is regarded as the cornerstone of a streamlined and precise logistics operation. Poor governance of this data leads to inaccurate inventory control, backlog in orders, and a subsequent rise in operational expenses.

Due to the magnitude and intricacy of ROLEAR MAIS's inventory, as well as the diverse range of materials it manages, the governance of MMD becomes increasingly critical. This project aims to diagnose the state of the governance of Master Data and implement specific changes to streamline logistics processes while strengthening the entity's data governance. This will enable the company to transform digitally and enhance its logistics operations' efficiency, traceability, and data accuracy.

4.2. Diagnosis

Once the context and purpose of the project were established, the Diagnosis phase was initiated to identify and understand the current limitations in the management of MMD. This phase was essential for mapping the existing processes, also mention as the As-Is processes, and detecting inconsistencies, inefficiencies, and data quality issues that affect warehouse

operations. The following sections present the process mapping and key findings that support the definition of targeted actions in subsequent phases.

4.2.1. The As-is process mapping

Through the collection and analysis of qualitative and quantitative data, obtained via system reports, document analysis, and interviews with key stakeholders, it was possible to assess and highlight areas requiring improvement.

As illustrated in Annex A**Error! Reference source not found.**, the flowchart represents the current process for creating a new material in SAP, undertaken by a member of the procurement team, from the initial need to its completion.

The mentioned process can be initiated through two different scenarios: when a material is either returned from a construction site without an existing SAP material code or a new product line is introduced, or when a purchasing order (PO) is received.

In the first case, the operator verifies, based on their experience with the task, whether a similar material already exists. If so, the SAP material code of the similar product is used to generate the new one. If not, a new code is created through the transaction “MM01”. This involves selecting the center where the code will be opened; in the company’s case, this is always in the center corresponding to Areal Gordo. The process involves gathering information from supplier tables in SharePoint, completing the product description, and filling in the necessary logistics data fields.

The second entry point to the process occurs upon receiving a PO with the code starting with the number 1000 (one thousand), the personnel responsible begin by opening the transaction “ZGEMM33” in the SAP cockpit to create a material code.

The member of the procurement team now needs to introduce the supplier’s material reference included in the PO into the system. At this point, the process requires verification of whether a corresponding SAP material code linked to that supplier reference already exists. If the code is found, the process is simplified. It continues with its registration in the requisition, followed by the conversion into a supplier order, and subsequent dispatch to the corresponding supplier. On the other hand, if the code does not exist, the workflow follows the same steps as in the case of new or returned materials, requiring the creation of a new material code through transaction MM01.

Once this information is collected, the material description is defined, and the logistics data fields are completed. When the data is not correct, adjustments must be made, either by

rewriting the product description or by correcting logistical information. If the data is confirmed to be accurate, the process continues with the completion of the commercial fields, using transactions MEK1 and VK11.

Following this, the person responsible for this task evaluates whether the code needs to be urgently available in another center. If this is the case, the expansion to all centers is forced to ensure cross-organizational accessibility. When an urgency is not identified, it must then be determined whether the material is a leftover from a construction project. If that is the case, the process terminates at this point. Otherwise, the validated SAP material code is entered into the requisition, then is converted into a supplier order, and sent to the supplier, represented by documents with the code starting with 4000.

4.2.2. Data quality auditing of the Material Master Data table

As a complement to the Diagnosis phase, a focused audit of the MMD table was completed to assess the quality, consistency, and completeness of information supporting warehouse operations. The exercise allowed for the identification of systemic weaknesses that compromise the reliability of inventory data and hinder the effective migration to SAP S/4HANA.

The auditing revealed several critical problems across different dimensions of Master Data. At the beginning of the project, the table had one hundred fifty-three thousand six hundred thirty-eight lines. The main constraints identified had to do with the format of the material codes and their descriptions, the Units of Measure, the completion of the logistics fields, the Product Hierarchy, and the material group.

Material code

First, concerning material codes, it was identified that there is no standardization in their structure. The codes do not follow a uniform format, as some are composed only of numbers, while others only have letters. Moreover, the total number of characters varies across the database, resulting in inconsistencies. The table below illustrates the distribution of code lengths and the respective number of materials associated with each format.

Code lengths	Number of Materials
1	10
2	90
3	464
4	492
5	3
6	152 579
Total	**153 638**

Table 1: Distribution of material codes by length in the MMD table

This inconsistency not only complicates searches and reporting but also undermines the principles of unique and sequential identification recommended in MDG (Otto, 2011). Without a consistent coding structure, there is a greater risk of duplicates, misclassification, and errors in system integration.

Material descriptions

A second problem is related to material descriptions. The auditing revealed multiple inconsistencies, including duplicated descriptions across distinct materials, incoherent naming conventions, for example, mixing abbreviations such as “F.” and “FERRO”, using special characters such as the asterisk, underscore, or the plus sign, and the use of supplier codes within description fields. Additionally, there are a large number of descriptions that indicate the status of the material with the letter “Z”, which means that the material is obsolete. However, there is a specific field in SAP for this purpose. In many cases, descriptions lacked semantic value, being either incomplete or ambiguous. In the following table, all the constraints related to the material description are identified, as well as the number of materials associated with each one.

Description constraints	Number of Materials
Duplicated descriptions	1 174
Descriptions with special characters	15 229
Description with supplier codes	67 105
Descriptions with the status of material (“Z”)	42 880

Table 2: Identified constraints in material descriptions and the number of affected materials

These practices reduce the effectiveness of searches, hinder material identification, and create confusion for users across procurement, logistics, and sales. Beyond operational inefficiencies, poor description management undermines Master Data governance, as SAP provides specific fields and conventions to ensure descriptions are accurate, standardized, and semantically meaningful.

Units of Measure

Significant problems were also detected in the definition of Units of Measure. The base unit of measure, also known as UMB, was often incorrectly set, and conversion factors were inconsistently included within the description field rather than configured correctly in the database. Additionally, many records lacked alternative units of measure (UMA), which are essential for supporting warehouse and logistics operations.

To quantify this issue, a script was developed in *R* to evaluate the completeness of the Units of Measure fields. Specifically, the code counted the number of active material codes and all of those that had the Units of Measure fields individually filled. Moreover, it counted all of the active codes that had the UMB and the first, second, and third alternative unit of measure (UMA [1], UMA [2], and UMA [3]) properly filled, as it was, in agreement with the objectives of the project, the correct measurement. This analysis provided an objective measure of the data quality gap, confirming that a significant proportion of materials lacked the necessary UMA definitions to support warehouse operations and stock conversions. In this measurement, confirm that of the one hundred and one thousand, six hundred and twenty-seven, only eleven thousand nine hundred and sixty-nine materials had the UMB, and the first, second, and third alternative unit of measure filled. The results of the analysis can be found in the table below.

Units of Measure filled	Number of Materials
UMB	101 627
UMA [1]	101 627
UMA [2]	19 476
UMA [3]	11 969
UMA [4]	5 682
UMB, UMA [1], UMA [2], and UMA [3]	11 969

Table 3: Completeness of Units of Measure (UMB and UMA) in the MMD table

These inconsistencies jeopardize inventory accuracy, as stock movements may be recorded in different units without accurate conversion rules. They also complicate warehouse operations such as the reception, picking, packing, and shipping, which depend on well-structured unit conversions.

Logistics fields

In the context of the MMD and the present project, logistics fields refer to the characteristics that define the physical and identification details of a material, namely the EAN, dimensions (length, width, height), and gross weight, which are essential for storage, handling, and automated processes in SAP EWM.

Similar to the *Units of Measure* topic, a script was developed in R to evaluate the completeness of the logistics fields and assess the extent of the issue. The code counted the number of active material codes and all of those that had the Units of Measure fields individually filled. Additionally, it considered all of the active codes that had the Logistic fields of the first, second, and third alternative unit of measure correctly filled.

In conclusion, the analysis of logistics-related fields showed extremely low levels of completeness. Fewer than 1% of the codes had all required fields, including EAN codes, dimensions, and gross weights, correctly filled. The table below provides a detailed breakdown of the results from the mentioned measurements.

Logistic fields complete	Number of Materials
UMA [1]	2 737
UMA [2]	8 104
UMA [3]	3 860
UMA [4]	1 377
UMA [1], UMA [2], and UMA [3]	295

Table 4: Completeness of Logistic fields (UMA) in the MMD table

These attributes are critical for SAP EWM, as they determine how materials are stored, transported, and handled in the warehouse. Missing weight and dimension data prevents the system from calculating storage allocation and transport requirements, while missing EANs create difficulties in barcode scanning and automated identification processes. Thus, the logistics data is incomplete, which will directly undermine the efficiency of warehouse operations and increase reliance on manual intervention; therefore, there is more space for errors.

Product Hierarchy

Another set of issues was identified in the Product Hierarchy, which in ROLEAR MAIS is structured across three levels: (1) area, (2) family, and (3) subfamily. At the time of analysis, the hierarchy consisted of sixteen areas, seventy-seven families, and one hundred and eighty subfamilies, totaling three hundred and fifty-five distinct levels. Despite appearing comprehensive, this structure was found to be fragmented, redundant, and inconsistent with best practices in Master Data management.

A key problem was the excessive granularity and low representativeness of many subfamilies. Approximately twenty-five percent of subfamilies had fewer than ten materials, and several subfamilies contained only one or two references. This extreme segmentation is

shown in the Table 5 and Figure 2 bellow, unnecessarily complicates classification, inflates the hierarchy, and makes reporting less meaningful.

Areas	Number of materials per Area	Number of Families	Number of Subfamilies
000_EIT	1 770	4	13
001_Instalação	27 807	5	30
002_Cabos	3 065	5	16
003_Distribuição	23 556	4	22
004_Iluminação	30 725	7	43
005_Automação	10 720	6	25
006_Segurança	5 023	5	11
007_Electrodomésticos	1 433	3	11
008_AVAC	22 398	6	38
009_Electromecânica	10 067	8	35
010_Aquecimen./Solar	7 764	6	52
011_Renováveis	1 809	9	42
012_Gas	1 634	4	7
666_Nula	153	1	1
998_Engenharia	6	1	6
999_Outros	4 714	3	3
∑ = 16 areas		**77 Families**	**355 Subfamilies**

Table 5: Fragmentation of the Product Hierarchy by areas, families, and subfamilies

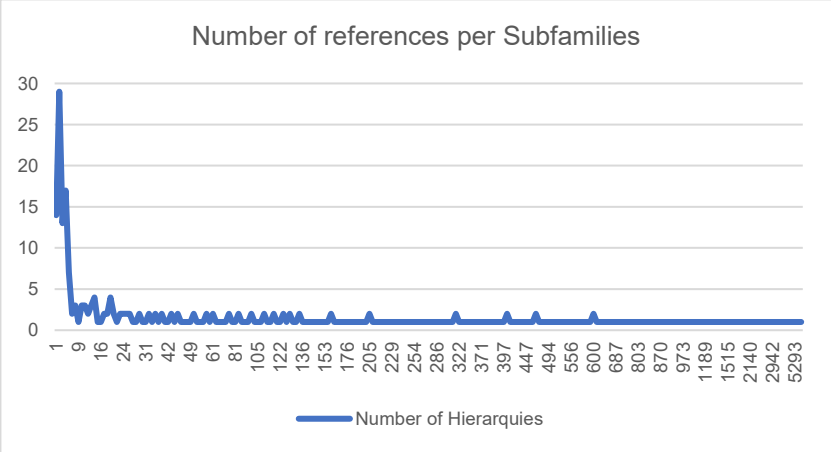


Figure 2: Distribution of materials across areas, families, and subfamilies in product hierarchy

In addition, brands were frequently used as hierarchical levels, particularly at the subfamily level. This practice contradicts recommended governance standards, as hierarchies should reflect intrinsic product characteristics rather than external commercial identifiers (Dama International, 2017). Moreover, brand-based classification created duplication across different families, where the same brand appeared multiple times, undermining consistency.

The analysis also showed a high recurrence of generic categories such as “Outros” or “Obras & Kits”, which were applied repeatedly across multiple families. These generic groupings reduce the analytical value of the hierarchy, since they fail to distinguish between product characteristics and instead aggregate diverse materials into poorly defined categories.

The effective granularity of the brand-based subfamilies and the overuse of generic categories employed demonstrate the current hierarchy is not fit for strategic reporting as well as operational processes. It is evident that such inconsistencies within the operational warehousing domain hamper the execution of more discrete strategies (i.e., storage, demand forecasting) at the family or subfamily level. From an organizational perspective, the situation illustrates the lack of clear rules and definitional standards needed to ensure SAP S/4HANA migration and attribute-based referencing needed for SAP EWM governance.

As outlined by (Dama International, 2017) the material hierarchies need to be framed in such a manner that operational and analytic efficiencies are balanced and the arrangement of product groupings is coherent and rational.

Material Groups

Lastly, the auditing also revealed significant issues in the definition and use of Material Groups within SAP. Material Groups are designed to serve as a simple classifier to support administrative functions, pricing policies, and reporting. However, the current classification at ROLEAR MAIS was found to be excessively detailed, inconsistent, and strongly influenced by suppliers and brands rather than by product characteristics.

At the time of analysis, the database contained one thousand six hundred and twenty-five distinct Material Groups. Approximately fifty percent of these groups had fewer than sixteen materials associated, and one hundred and thirty-six groups contained only a single reference, as shown in the figure below (Figure 3).

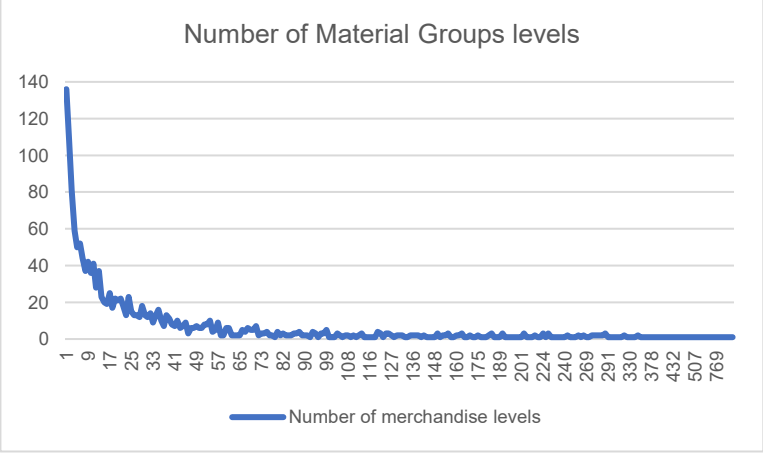


Figure 3: Distribution of Material Groups in the Material Master Data table

Such fragmentation results in an unnecessarily complex classification system, which makes reporting, comparison, and decision-making more difficult. Instead of serving as a simplification tool, Material Groups have become a source of additional complexity.

Furthermore, the auditing identified that many group names were repeated across different Material Groups, and that several groups were defined explicitly by supplier or brand. While this approach may reflect procurement practices, it conflicts with best practices in Master Data governance, where Material Groups should be based on intrinsic product characteristics and not on external commercial references (Dama International, 2017). This supplier-based logic leads to unnecessary duplication, as similar materials sourced from different suppliers are placed in separate groups.

Moreover, the inconsistent and repetitive application of group definitions diminishes the value of the reports from an analytical standpoint. Rather than providing a clear overview of material types for pricing or policy purposes, the current arrangement results in an abundance of overlapping classifications and a lack of product comparability. This creates problems in reporting, inventory control, and purchasing because group-based governance cannot be uniformly applied.

Overall, the Material Groups in ROLEAR MAIS are excessively fine, duplicative, and out of step with industry standards. Inefficiently designed data frameworks result in pervasive inefficiencies in workflows. Dama International (2017) emphasizes the importance of having a coherent, uniform, and expandable grading system. It is for these reasons that in reshaping Material Groups as defined by attributes of the product, in preference to the supplier, is vital to streamlining the Master Data structure for effective reporting and seamless operational integration in SAP S/4HANA and EWM.

Summary of auditing finding

The previous analyses of material codes, descriptions, units of measure, logistics fields, Product Hierarchy, and Material Groups reveal that the challenges affecting ROLEAR MAIS's MMD are multidimensional and interconnected. To synthesize these findings, Table 6 presents a summary of the key problems, examples, and their consequences for warehouse operations and SAP EWM. This consolidated view reinforces the diagnosis that poor data governance is at the root of many inefficiencies and forms the basis for the planning of corrective measures.

Problem	Example	Impact on operations / SAP EWM	Governance implication
Material codes	Codes with 1 to 6 characters; some numeric, others alphanumeric	Difficulties in searches and reporting; higher risk of duplicates	Lack of a standardized, unique, and sequential coding policy
Material descriptions	Duplicate entries; special characters (*, +, _); supplier codes in description; obsolete status marked as “Z”	Confusion in material identification; errors in procurement and logistics; poor searchability	Absence of description standards; misuse of SAP fields for purposes other than intended
Units of Measure (UMB/UMA)	Conversion factors hidden in description (“1cx=10un”); UMA fields not filled	Incorrect stock movements; difficulties in picking, packing, and conversion	No enforcement of UM governance rules; lack of control over completeness
Logistics fields	Less than 1% of SKUs with complete EAN, dimensions, and weight	Prevents system from calculating storage allocation, load optimization, and barcode scanning	Missing critical data elements; absence of mandatory completeness checks
Product Hierarchy	Brands as subfamilies; overuse of “outros” and “obras & kits”; redundant levels	Hinders reporting and demand forecasting; duplication of product categories	Classification not based on product characteristics; no governance standards for hierarchy
Material Groups	1,625 groups; half with less than 16 SKUs; some groups defined by suppliers	Excessive granularity; difficult reporting and comparison; duplicate groups by supplier	Misalignment with best practices; groups reflect commercial logic rather than product logic

Table 6: Summary of auditing findings: problems, examples, operational impacts, and governance implications

The findings demonstrate that the current state of MMD is fragmented, inconsistent, and misaligned with best governance practices. The current As-Is scenario at ROLEAR MAIS represents a significant barrier to achieving these objectives, underscoring the need to redesign the MMD reference process in accordance with best practices.

These issues provide the foundation for the Planning phase of the Action Research cycle, where targeted corrective actions will be designed to ensure reliable, standardized, and scalable Master Data in preparation for SAP S/4HANA migration.

4.3. Action Planning

Following the auditing and diagnosis, the next step in the Action Research cycle is to define targeted interventions to address the identified weaknesses. In this case, the action plan is customized and built around the Gantt chart below, which outlines all tasks along with their planned completion durations.

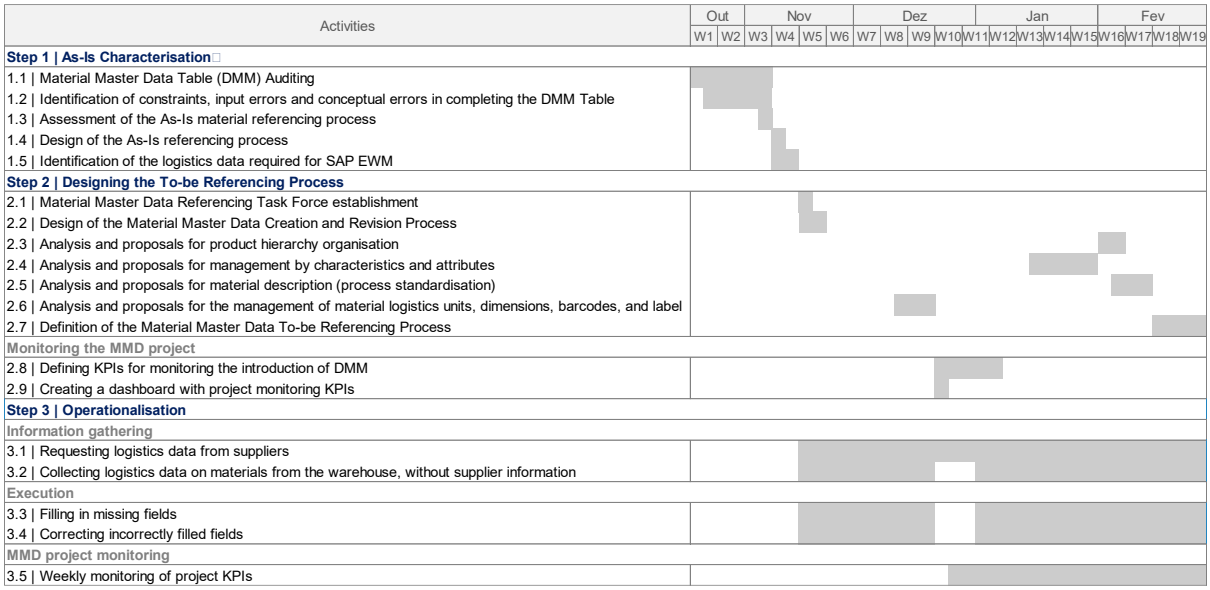


Figure 4: Gantt chart of the action plan for the implementation of Material Master Data improvements

The Gantt chart (Figure 4) provides an overview of the designed project schedule, sequenced and delineated into a series of defined steps consisting of three core phases plus a peripheral continuous evaluation. Each of these is designed to enable a smooth and logical transition, with adequate evidence, from the diagnosis of a problem to the design and implementation of changes, as outlined in the Action Research procedure.

Step 1 – As-Is Characterization

This first phase was carried out during the initial months of the project and provided the empirical foundation for the Diagnosis phase. This stage included the comprehensive auditing of the MMD table, which involved extracting data from SAP and performing automated analyses in R to evaluate the completeness of critical fields, detect duplicate codes, verify the correctness of descriptions, and assess the population of logistics attributes such as EAN, weights, and dimensions.

This activity generated a series of quantitative deliverables, including field completeness reports, duplication metrics, and data quality dashboards, which enabled the measurement of the scale and distribution of errors across the database.

In parallel, the current process for creating material codes was mapped through document analysis, interviews with procurement and logistics stakeholders, and the observation of real transactions in SAP. This process-mapping activity resulted in the development of a flowchart representing the As-Is process, supported by explanatory documentation that describes the sequence of tasks, decision points, and roles involved. Together, these deliverables created a detailed and validated picture of the current state of MMD governance at ROLEAR MAIS, highlighting the weaknesses that compromise data reliability and system integration.

Step 2 – Designing the To-Be Referencing Process

Marks the transition from diagnosis to planning and focuses on the development of a future referencing framework aligned with best practices in data governance and SAP S/4HANA requirements. Several key activities are planned for this stage, starting with the establishment of a dedicated task force responsible for defining, validating, and documenting the standards that will govern the referencing of MMD. This team was given the name “Material Master Data (MMD) Referencing Task Force” and played a crucial role in ensuring that the process was consistent, scalable, and adaptable to the organization's operational needs.

During this phase, a standardized process for creating and revising MMD was established to guide the completion, cleaning, and correction of the database. This workflow, illustrated in Figure 5, ensures that each material record follows a precise sequence of validation steps before being saved in SAP. The process begins with the reception of a purchase order and the opening of the technical data sheet, from which basic fields are filled. Missing logistical data, such as dimensions, weight, EAN, and units of measure, are then retrieved from auxiliary tables provided by suppliers or, when necessary, through the export and comparison of supplier information with the SAP master table. If gaps persist, materials available in stock are physically measured in the warehouse, ensuring that conversion factors between different units of measure are captured accurately. When neither supplier data nor stock is available, the supplier is contacted directly, or the process is postponed until stock arrives. Once all mandatory fields are verified and completed, the material record is validated and saved.

This referencing procedure is crucial since it specifies a standard procedure that ensures the quality, completeness, and certainty of Master Data, and leaves product-specific facts to the Product Managers responsible.

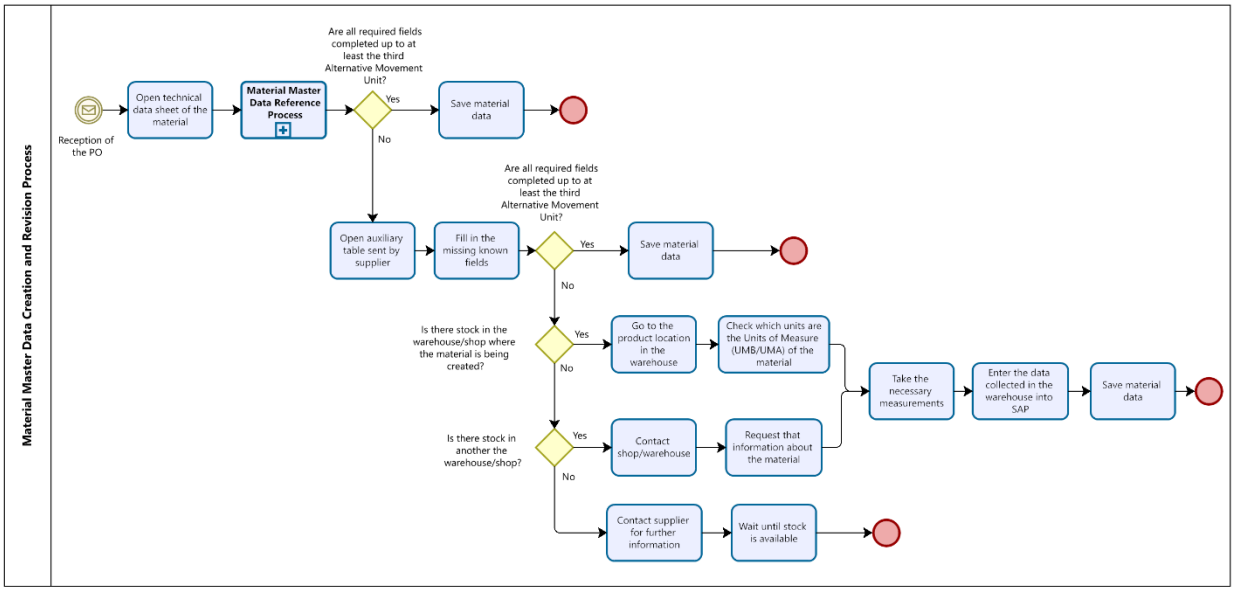


Figure 5: Design of the Material Master Data Creation and Revision Process

The expected deliverable from this activity is guidelines, based on best practices, for creating new material codes and description standards, designed to ensure consistency, clarity, and semantic value. The definition of coding rules will establish a fixed-length, uniform structure for material codes, supported by automated validation rules to prevent non-conforming entries.

Another activity will focus on redesigning the unit-of-measure structure, setting correct base units (UMB), and configuring alternative units (UMA) within SAP rather than embedding conversion factors in text fields. The deliverable will be a unit-of-measure matrix, which will serve as the model for materials created in the future, along with an updated configuration in SAP. Additionally, rules will be developed for the systematic completion of logistics fields, as it will be mandatory to fill them out.

To conclude the second phase, a restructured Product Hierarchy will be presented to reduce fragmentation, eliminate brand-based or supplier-based categories, and categorize materials according to product characteristics. This activity will deliver a model of how the Product Hierarchy should be structured. Collectively, the deliverables from the second step will constitute a complete To-Be model of the material referencing process, ready for operational implementation.

Step 3 – Operationalization

The last main step of the action plan is Operationalization, which involves implementing the To-Be model and is divided into two key activities: information gathering and execution.

The first activity will focus on collecting all missing data necessary to complete the fields identified as incomplete during the audit. This will include obtaining technical product data and packaging information from suppliers, extracting archived documentation, and performing physical measurements in the warehouse when necessary. Furthermore, it will be necessary to clean and correct incomplete records, complete missing logistics records, and reconfigure the units of measure. At the same time, new governance mechanisms will be implemented, including approval workflows and validation rules, to ensure that all newly created materials adhere to the standards set in step 2.

The deliverables from this execution phase will include an updated and standardized MMD table, a report on the data cleansing results, and activated governance rules embedded in SAP.

Monitoring

The Material Mater Data project is being monitored simultaneously with Step 2 and Step 3, which involves monitoring whether all planned tasks are on schedule, reviewing tasks to check if they are being completed on time, and routinely reviewing and evaluating these data quality indicators, such as field completeness, or any of which may indicate possible data quality problems. Progress reports and updated project dashboards are essential delivery modules that will be presented in the Microsoft Power BI tool. These reports will provide the evidence needed to evaluate the effectiveness of the interventions and to ensure the long-term sustainability of data quality improvements.

This activity is vital for assuring the alignment between the Diagnosis and the forthcoming Evaluation phases of the Action Research cycle, ensuring that the improvements made are both measurable and sustainable over time.

4.4. Taking action, evaluating, and monitoring

Following the definition of the action plan, the next step in the Action Research cycle involved taking action, which entailed the concrete implementation of the planned interventions, while simultaneously evaluating their effectiveness and monitoring progress.

This phase constructed a bridge between the conceptual design of the To-Be referencing process and its practical use within ROLEAR MAIS's operational setting. In contrast to the earlier phases, which were primarily analytical and diagnostic, this stage was naturally iterative and flexible, necessitating continuous adjustments based on the observed outcomes.

4.4.1. The To-be referencing macro process

Throughout the planning stage, a harmonized process of Material Master Data Referencing, as illustrated in Figure 6, emerged to replace the current decentralized and heterogeneous approach. The To-Be process defines the procedure for inputting a new material within SAP, ensuring that all important data fields are consistently filled, and the new material is coded based on harmonized standards. Through the enforcement of a rule-based and formal procedure, the operation strives to ensure data quality, traceability, and scalability, thereby responding to the operational and analytical requirements of SAP EWM.

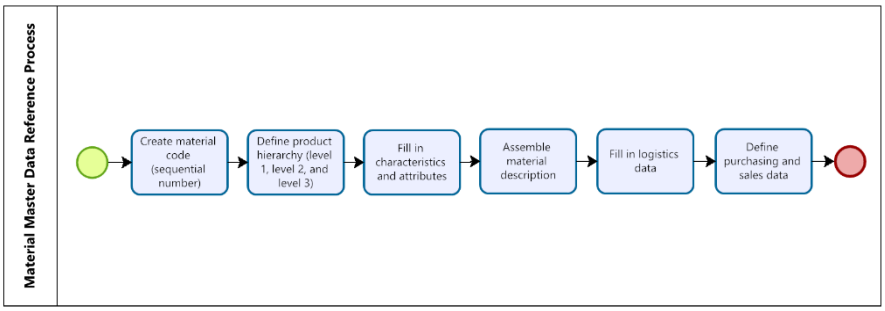


Figure 6: Design of the Material Master Data Referencing Process

The initial step of the process involves generating the material code, following the agreed-upon rules of standardization. After establishing the code, the product hierarchy needs to be assigned, which is organized into three levels, the area, its family, and the subfamily. This classification organizes the material within the firm's structure, facilitates hierarchical reporting, and enables differentiated inventory practices. Having been sorted out, the stage proceeds to defining attributes and characteristics. These are the factoid points that represent the inherent nature of the material. In the new procedure, these fields must be completed and are directly connected to the automated build-up of the material's description.

Once the features are logged, the system will automatically populate the material description to a pre-defined template for semantic correctness and uniformity. This eliminates the earlier reliance on manual and frequently incorrect text input, ensuring that all descriptions contain useful and searchable product information. The next step involves completing the logistics data fields, including EAN codes, gross weight, and dimensional data (length, width, height). These details are necessary to support warehouse automation, deposit assignment, and determine the optimal storage location based on the material’s characteristics.

Lastly, the process involves assigning purchasing and sales information, including minimum orders, replenishment requirements, and prices.

Together, this macro process provides a formalized series of descriptive referencing material through the help of automatic field population, validation rules, and governance checks. It ensures that all new materials are created with fully populated and accurate Master Data from

the outset, thereby removing the root causes of inconsistency issues identified in the Diagnosis phase and laying the foundation for an extended Master Data governance model at ROLEAR MAIS.

4.4.2. Implementation of the To-Be referencing process

The implementation activities were guided by the principles and governance rules developed during the planning stage. A central objective was to transform the MMD from a fragmented and inconsistent repository into a structured, accurate, and scalable system capable of supporting the requirements of SAP S/4HANA and SAP EWM.

Material codes

At the implementation level, the optimal solution, as per the agreement with the firm, is that at the time of migration readiness for SAP S/4HANA, non-standard material codes will follow a phase-out/phase-in strategy based on the migration workstream. Instead of changing the old legacy identifiers in the location, all incorrect or non-standard code was replaced with a newly created, standard one, ensuring that the target S/4HANA data model consisted of proper identifiers only.

To preserve business continuity and traceability, each legacy material code will give rise to a new standardized code. A correspondence between the old and new identifiers will be maintained, but more importantly, all historical records — including sales, stock movements, and other transactional data — will be migrated and mirrored into the new material code. This ensures that past information remains visible and reportable under the replacement identifier, thereby safeguarding traceability while enabling the organization to adopt the new coding structure without loss of historical data. The convention established that it must be a unique and sequential code, with a fixed length and a numeric structure, thereby eliminating the previous heterogeneity in format (numeric, alphabetic, and alphanumeric) and length (1 to 6 characters). The code cannot have intelligence, i.e., it cannot be created in reference to the material type or product hierarchy, for example.

Practically, this will involve four steps. The first step is to create a new material record in accordance with the agreed-upon standard. Afterwards, the legacy code needs to be blocked for further use, and then the active stock needs to be transferred. Lastly, configuring reporting so that historical movements and commercial figures could be consolidated under the new code without losing the audit trail of the original documents.

This migration-led correction will ensure that legacy inconsistencies do not propagate into the future landscape while maintaining end-to-end traceability. From an operational

standpoint, users continue to access the full material history through the new identifier. On the other hand, from a governance standpoint, the approach ensures that, post-migration, only codes that comply with the standard remain active for transactional use.

Product Hierarchy and Material Groups

Another fundamental component of the MMD referencing project was the definition of a clear and standardized product categorization model, supported by two complementary structures: the Product Hierarchy and the Material Groups.

The Product Hierarchy is intended to serve as the company's main classification structure for materials, allowing them to be organized logically and consistently within SAP. Following best practices, a model was designed as a multi-level hierarchical tree that groups materials by increasing levels of specificity (Table 7).

Hierarchy level	Characterization	Examples
Level 1 - Product area	Broad categories that group materials of the same general nature	• "Iluminação"; • "Componentes Elétricos"; • "AVAC"; • "Solar Térmico"; • "Fotovoltaico"; • Etc.

Level 2 - Families	Subdivisions within each area with similar functions or technical characteristics	• Level 1 – "Iluminação":
		  • "Lâmpadas";
		  • "Iluminação técnica";
		  • Etc.

Level 3 - Subfamilies	Grouping by homogeneity	• Level 2 – "Lâmpadas":
		  • "Linear";
		  • "Tubular";
		  • Etc.

Table 7: Product Hierarchy characterization and examples

This organization enables in-depth material analysis and treatment, standardizes the description, and allows storage rules and slotting typologies to be defined in SAP EWM. With the step-by-step refinement of the detail level from Level 1 to Level 3, it is possible to manage the complexity of the assortment in an orderly manner while improving flexibility and precision in reporting.

In parallel, the concept of Material Groups was also reviewed. Unlike the product hierarchy, this structure is a flat, non-hierarchical classifier used primarily for administrative and commercial purposes, such as price policies, procurement strategies, and reporting. Each

material is associated with precisely one material group, which classifies it in broad commercial terms, such as ‘Fios e Cabos’. Within these groups, items can be analyzed for pricing or promotional purposes. For example, ‘Fios e Cabos’ would include items such as ‘Cabos de Cobre’ and ‘Cabos de Fibra Ótica’, among others. It should be noted, however, that this redesign was not implemented during the project; instead, the task force discussed and presented it only as a proposal of best practices to guide future structuring of material groups.

The Product Hierarchy provides a detailed, product-oriented view, while the material groups offer a transversal, administrative view, which together support both operational and commercial processes. Following best practices, it was defined that each material must be assigned to one material group and positioned within the product hierarchy, ensuring that every item is consistently classified in both dimensions. Apart from this, the MMD Referencing Taskforce also decided that the Product Managers of each category will carry out detailed design and maintenance, as they possess the technical and commercial knowledge necessary to define these structures precisely. Their involvement ensures both the operational context and long-term management of the classification system.

Such a double structure will enable ROLEAR MAIS to structure its portfolio in a logical and standardized manner, further enhancing transparency, data quality, and analysis potential, and facilitating accurate SAP S/4HANA and SAP EWM processes based on reliable product classification.

Filling characteristics and attributes

One of the most significant steps in the implementation was the development of a structured model for characteristics and attributes, designed to replace the previous fragmented and non-standardized approach to material data creation. The model provides a template for documenting all commercial and technical data on every material in a structured and controlled manner, ensuring completeness, comparability, and usability in the future within SAP S/4HANA.

To ensure that the attribute framework is scalable and aligned with the company’s product structure, it was defined that each Level 1 of the Material Hierarchy, such as “Iluminação” and “Componentes Elétricos”, must have its own tailored set of attributes and characteristics. This means that all materials within the same Level 1 category will share the same structure of mandatory and optional fields; however, each Level 1 will have different attribute sets that reflect the nature of its products.

In the proposed model, attributes represent general properties common to materials within a category, such as “Composto”, “Índice de Proteção”, “Temperatura de Cor”, “Marca

Comercial", among others. In contrast, characteristics are the particular and quantifiable information in common to all individual materials, like "Potência [W]", "Fluxo Luminoso [Lm]", "Peso", "Tensão", "N.º de Série", "Lote", among others. This separation enables the data model to capture both the general classification rule and the product-specific information required to describe a material fully.

During this phase, a framework of best practices and reference examples was developed to support the future population of these fields. This included the definition of example attribute sets for selected product families, such as "Iluminação", "Componentes Elétricos", "AVAC", and "Eletromecânica", and the creation of prototypes showing how the fields can be structured, which ones should be mandatory, and how controlled lists of allowed values can be used to avoid free text and ensure semantic consistency. The model created for this purpose is represented in Annex B.

Nonetheless, because technical details are at a high level, it was determined to reserve the determination of the precise definition of what attributes and characteristics should be used in any particular family of products to Product Managers. They possess the necessary operating and technical expertise to ensure that the fields chosen are both accurate and complete. Their participation will also involve ownership and responsibility for the data, which is imperative to the long-term viability of the model.

This approach ensures that the final model will be robust, scalable, and aligned with operational realities, while integrating the process of filling attributes and characteristics into the material creation workflow in the future SAP environment.

Material description

Based on the attribute and characteristic concept, material description was re-engineered for automation, standardization, and consistency. Rather than relying on manually typed free-text descriptions, which are likely to contain inconsistencies, abbreviations, or irrelevant details, the new approach enables the automated generation of both long and short descriptions from completed attribute values.

A template for description was designed (Annex C) to specify the sequence and structure in which values for the chosen attribute are to be merged. Only attributes marked as relevant for description ("Description?" = "S") are used to build the material's name, ensuring that the description contains only the most important and distinctive properties.

To support this mechanism, a controlled vocabulary and abbreviation table was also proposed, ensuring that all terms used in the descriptions are standardized and that the text remains within SAP's character limits without losing clarity or meaning (Figure 7). For example,

a material that was previously listed as “LUM EST LED KYOS 40W/740 1200 IP65 7H832” would now be generated as “LUMINÁRIA ARM EST LED IP65 70 NAVIGATOR 40W”, by combining the attribute values.

Material Code	Long Description	Control
123456789	LUMINARIA ARM EST LED IP65 70 NAVIGATOR 40W	43

Attributes	Active	# Characters	Description?	Value	Control
FAMILIA	S	10	N	ILUMINACAO	
TIPO ILUMINAÇÃO	S	12	S	LUMINARIA	
CATEGORIA	S	18	S	ARM EST	
CARACTERISTICA ESPECIFICIDADE	S	3	N	EXT	
COMPOSTO	S	10	S	LED	
INDICE PROTECAO	S	4	S	IP65	
INDICE PROTECO MECANICA	S	4	N	IK08	
INDICE RESTITUICAO COR	N	2	S	70	
REGULÁVEL	S	3	N	NAO	
DALI	N	3	N	-	
TEMPERATURA COR	N	8	N	4000	
VERSÃO SENSOR	N	6	N	-	
ABERTURA TETO	S	6	N	-	
MARCA COMERCIAL	S	12	S	NAVIGATOR	
CLASSE ISOLAMENTO	S	8	N		
SUPORTE	S	6	S		
FATOR POTENCIA	S	6	N	>0,9	
CONECTIVIDADE	S	7	S		
FREQUENCIA	S	8	S		
AUTONOMIA	N	9	N		
ACESSORIOS	N	10	N		
OPACIDADE	S	11	S		
FLUXO LUMINOSO	S	6	N		
POTENCIA	S	6	S	40W	
PESO LIQUIDO	N	6	N		
QUANTIDADE EMBALAGEM	N	6	N	-	
LOTE	S	8	N	Activar	
N SERIE	S	8	N	Activar	
TENSAO	S	8	N	Activar	

Figure 7: Example of attribute-driven short material description configuration template

Therefore, material descriptions are semantically configured, normalized, and generated equally from features and characteristics, rather than being manually keyed in. Redundancy elimination, increased data validity, and improved reporting, analytics, and warehouse functioning in SAP S/4HANA and SAP EWM are facilitated by this new approach, a leap forward towards ROLEAR MAIS's green data stewardship.

Logistics data - Units of Measure and Logistics fields

One of the most important aspects of the rollout was the completion and correction of logistics-related fields in the material master, specifically units of measure (UMB and UMA) and physical identification data (EAN, weight, and dimensions). They are required to ensure proper stock management, facilitate automated goods movements, and support warehouse operations in SAP EWM.

The initial diagnosis revealed serious gaps and inconsistencies. The majority of the material had the base unit of measure (UMB) established but lacked supplementation with other units of measure (UMA), such as boxes, packages, or pallets, which were either missing or improperly configured. Conversion factors were more likely to be loosely mentioned in the description field rather than being correctly set. Likewise, the product dimensions (length, width, height), gross weight, and EAN fields were usually left blank, which detriments warehouse slotting, picking, packing, and barcode identification.

To correct this, a systematic procedure was implemented to help fill in these fields. The process began by contacting all suppliers to request official conversion tables for their products, including the quantities associated with each packaging level (UMB, UMA [1], UMA [2], etc.), as well as the corresponding physical dimensions and weights. This approach sought to ensure the use of accurate and standardized information directly from the source.

Once the supplier information was received, the Master Data of the respective materials was exported from SAP into an Excel file. Furthermore, a query was developed to transform this dataset into a comparison table, where the supplier's data was matched to a copy of the Master table based on the supplier material. This enabled a side-by-side comparison between the existing data in SAP, if any, and the data provided by the supplier.

Each record was then validated to identify discrepancies or inconsistencies. When the supplier data was confirmed as correct, the comparison columns were removed, leaving only the validated fields to be imported back into SAP. This ensured data integrity while significantly accelerating the population of missing fields. However, for a considerable number of materials, suppliers either did not provide the requested information or provided incomplete data. In these cases, the missing information was collected through direct physical measurement in the warehouse, where quantities per packaging level, such as units per box and boxes per pallet, were measured. Moreover, the dimensions and weights of their respective items were measured and recorded. This information was then consolidated into initial conversion tables that linked UMB to each UMA level.

While this project established the framework, methodology, and initial data population, the complete definition and validation of these fields for all materials will be the responsibility of the Product Managers and operational teams of each product family. These teams possess the detailed knowledge of packaging structures, handling units, and product specifications necessary to ensure the accuracy and operational relevance of the data.

This 2-step approach ensures technical accuracy and operational control while enabling the company to continue filling in the missing fields incrementally as part of the material master cleansing processes. By arranging this structure and partially pre-completing the missing data, the project ensured that, at the time of migration to SAP S/4HANA, all materials would have complete logistics data, allowing for automated conversions, accurate stock movements, and optimized picking and packing procedures in SAP EWM.

4.4.3. Monitoring and Evaluation

Monitoring the Material Master Data Management process was an important aspect of the project's success and sustainability. To maintain ongoing supervision, two types of dashboards were created, each fulfilling distinct but complementary roles.

To this end, two different R scripts were created (Annex D and Annex E) to assess the Master Data tables for each week. The script generated intermediate files in the XLSX format, where the verification of the completeness of the MMD tables was clearly highlighted. This organized file was then transferred to Microsoft Power BI, where it was converted into a dynamic dashboard that visually displays week-on-week improvements in data quality.

The first dashboard focused on the overall completeness of the MMD table, providing a global view of data quality and identifying areas where critical information, such as EAN codes, dimensions, gross weight, and alternative units of measure, remained incomplete. This high-level monitoring tool enabled the identification of persistent gaps and guided the prioritization of corrective actions by the MMD Referencing Task Force.

In practice, the global dashboard included indicators such as the total number of SKUs, the number of active versus inactive items, and the share of records with complete logistic data. It also detailed completeness by hierarchy level and by material group, enabling the task force to quickly identify which product areas required the most significant effort. For instance, some families, such as “Iluminação”, had a higher number of SKUs with completed logistic attributes, whereas others displayed more critical gaps. By combining absolute numbers with percentages, the dashboard offered both a detailed and comparative view across product lines (Figure 8 and Annex F).

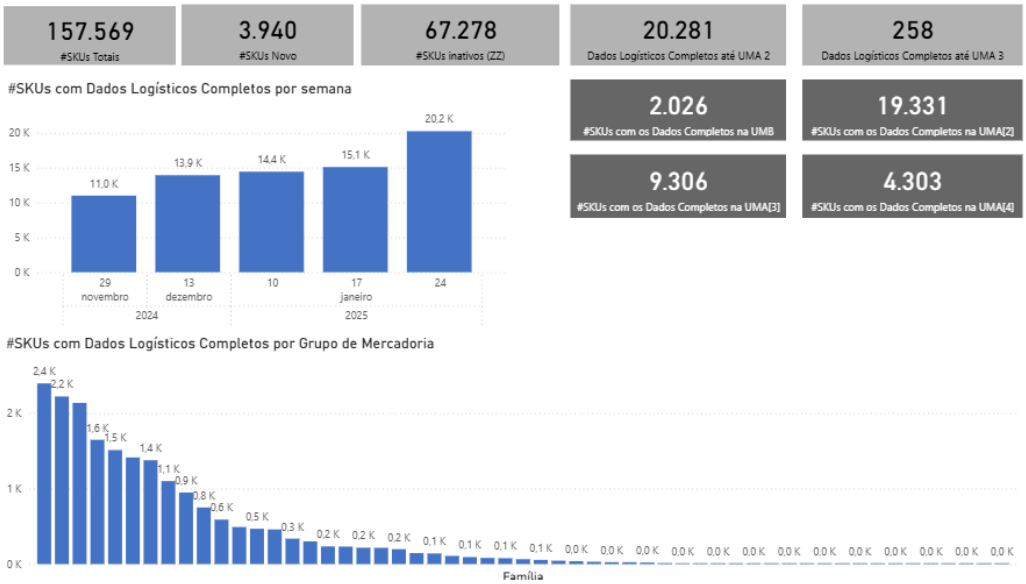


Figure 8: General dashboard of Material Master Data completeness

The second monitoring approach focused on tracking weekly progress in updating the MMD table. This was important for assessing the effectiveness of the remediation actions as well as the speed of the data enrichment activities. The second dashboard not only provided an account of the general completeness of the data, but also an open breakdown of the progress made on the four key UMA levels, as well as the completeness of logistic attributes such as weight and dimensions per unit of measure. By showing these metrics across consecutive weeks, the dashboard allowed the project team to quantify incremental improvements and provided both a performance measure and an accountability mechanism.

Moreover, the weekly dashboards were designed to align with company expectations by allowing a clear visualization of how many records were completed each week and in which product families progress was most significant. They acted as an internal management tool and a communication instrument with stakeholders, ensuring transparency in the implementation phase (Figure 9 and Annex G).

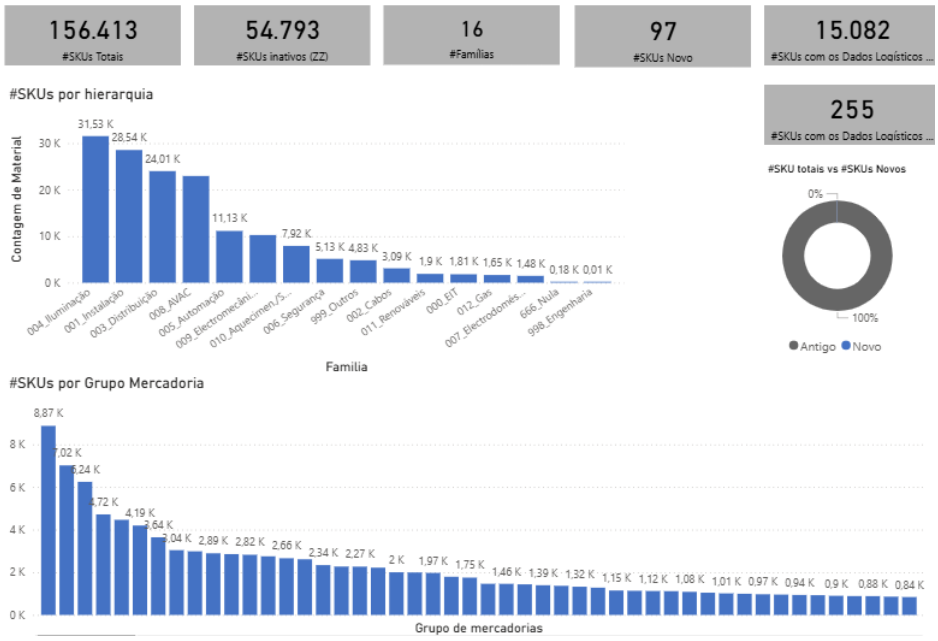


Figure 9: Weekly dashboard of Material Master Data completeness progress

The monitoring activities produced results that indicated a steady but persistent progress toward increasing the completeness of the MMD. The global dashboard reported a decrease in missing values in key logistics fields, and the weekly monitoring dashboard ensured the ongoing incorporation of information received from providers and the incremental validation of information read directly from the warehouse. Collectively, these tools enabled the actions taken during enforcement to be effectively translated into quantifiable improvements, creating a lasting infrastructure that further enhances Master Data quality monitoring.

5. Conclusion

This in-company project focused on MMD quality management at ROLEAR MAIS in the context of preparing for its SAP Extended Warehouse Management (EWM) migration. The research employed the Action Research approach, wherein diagnosis, action planning, taking action, monitoring, and evaluation were integrated into a non-stop and circular process. In doing so, the project not only addressed the immediate organizational requirements but also established a governance platform that could support long-term enhancements.

During the diagnostic phase, certain critical deficiencies were identified in the MMD, particularly in key logistics areas such as EAN codes, weight, and dimensions, as well as missing or inconsistent units of measure. These not only compromised data integrity but also compromised inventory accuracy and warehouse efficiency. The discovery of these loopholes formed the foundation for future intervention, and it was agreed that there could be no successful migration to SAP S/4HANA without a great effort to clean, organize, and control the MMD.

In response, the action planning stage designed a structured roadmap that aligned the project's objectives with best practices in data governance. A dedicated referencing framework was created to standardize coding rules, enforce description templates, and define mandatory fields. Additionally, a governance mechanism was established through the creation of a Material Master Data Taskforce, which is responsible for overseeing compliance and continuous improvement. This planning phase thus provided the organizational and methodological foundation for the subsequent interventions.

The first implementation phase focused on completing the previously audited missing fields, such as EAN codes, weights, and dimensions. This was a joint effort, where the task force reached out to suppliers to request technical data sheets and packaging specifications. At the same time, measurements of the products in the warehouses were being taken to verify or complete the information provided. In parallel, incorrect data entries were being corrected, including the redefinition of base units of measure (UMB) and the configuration of alternative units of measure (UMA) to replace manual conversions embedded in description fields. Another central task during the redesign of the Product Hierarchy. This activity involved merging fragmented or redundant subfamilies, eliminating brand-based categories, and consolidating groups around product attributes and characteristics, rather than suppliers.

Monitoring and Evaluation were integrated into the implementation to determine if the measures were being implemented effectively and in areas that needed improvement. The evaluation was conducted using both quantitative and qualitative measures. The first audit

was conducted as a baseline, and improvements were tracked by analyzing the completion of fields such as EAN codes, units of measurement, and dimensions across consecutive database versions.

Monitoring constituted the final and ongoing component of the project. Two dashboards were developed to ensure continuous oversight: a global dashboard that tracks the overall completeness of Master Data fields, and a weekly dashboard that compares progress between subsequent periods. These tools, built by combining R scripts with Microsoft Power BI, allowed for both high-level transparency and detailed monitoring of incremental progress. The dashboards not only measured data quality improvement but also served as a communications device among the task force and upper management. Visibility was crucial for maintaining momentum, aligning expectations, and holding each stakeholder accountable.

The integration of implementation, evaluation, and monitoring, iteratively and cumulatively, institutionalized the operational aspects of the Action Research cycle. It proved that solutions created in planning are not only theoretically sound but also operable and could deliver quantifiable gain. Furthermore, in establishing a governance and monitoring structure, the project ensured that data quality would be preserved beyond the project timeframe, thereby ensuring organizational preparedness for the SAP S/4HANA transition, as well as for innovative warehouse technologies.

Academically, this project contributes to the research base by demonstrating the real-world application of Action Research within the realm of Master Data management, specifically in logistics and ERP. It records the nexus between technical data quality interventions, organizational governance controls, and monitoring tools that interact with operational and strategic decision-making. The ROLEAR MAIS example demonstrates that data quality treatment is not a technical process but a systems issue that involves coordination, governance, and culture change.

Naturally, some limitations remain, as it is challenging to gather information about the products, and certain suppliers were unable or unwilling to provide the necessary information to support the project. Additionally, although monitoring tools were rightly deployed, their effectiveness will depend on the ongoing organizational commitment and the adaptability of governance structures to future business and technological developments.

Future work to be developed includes broadening the governance processes outlined here to additional Master Data domains, such as suppliers or clients, which would provide a more comprehensive data management plan, thereby maintaining the integrity of the overall ERP system. Furthermore, the implications of future research on how emerging technologies, such

as machine learning, can be utilized to automate data quality checks and anomaly detection require exploration.

In summary, this project has established that controlled and regulated MMD Management is a requirement to address any WMS migration challenges and to leverage its potential. Having incorporated governance, ensured evaluation, and identified monitoring tools, ROLEAR MAIS can now more effectively address its challenges and leverage the potential of the software. Aside from its organizational benefits, the project showcases the capability of data governance to act as a game-changer in streamlining supply chain processes for efficiency, accuracy, and sustainability.

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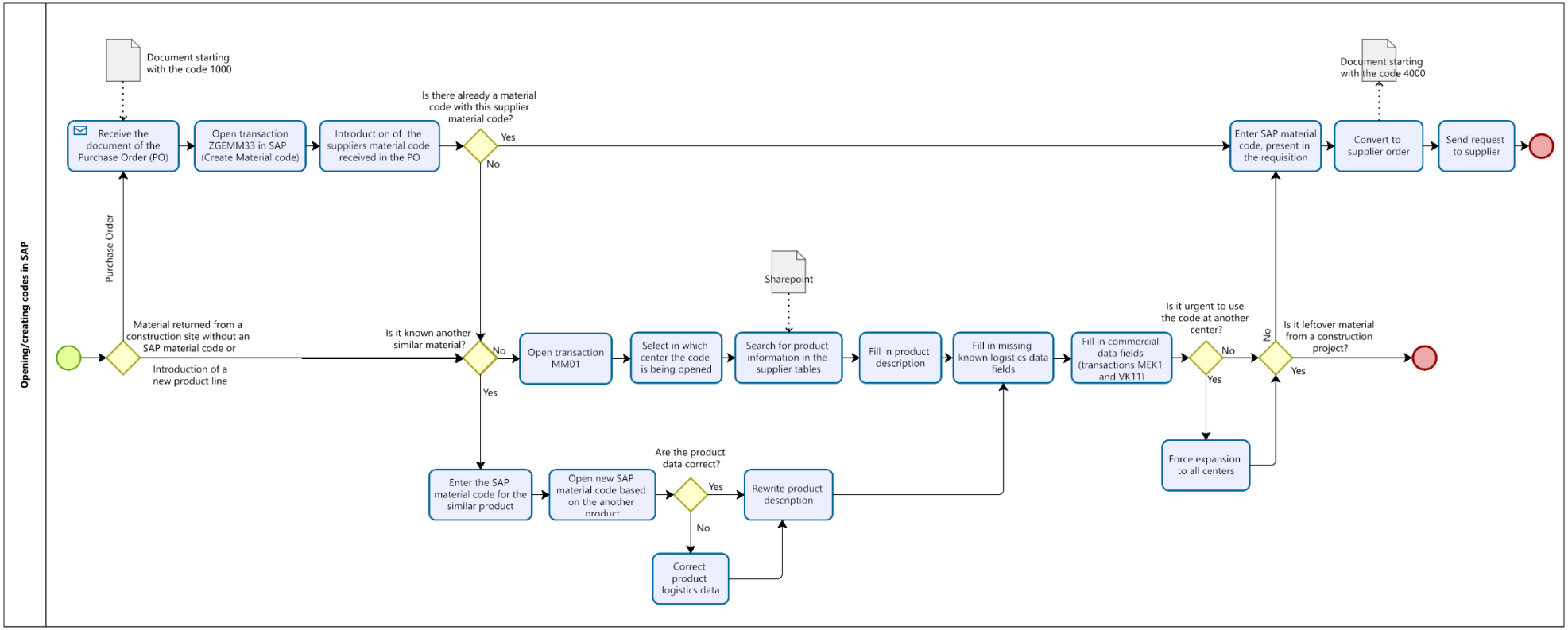
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Annexes

Annex A - Opening/creating material codes in SAP



Annex A: Opening/creating material codes in SAP Flowchart

Annex B – Product hierarchy characteristics and attributes – "Iluminação"

ILUMINAÇÃO - CARACTERISTICAS E ATRIBUTOS

CR#1 Familia Atributo
FAMILIA
004 - ILUMINAÇÃO

CR#2 Tipo_Iluminação Atributo
TIPO DE IUMINAÇÃO
TIPO DE IUMINAÇÃO 1
TIPO DE IUMINAÇÃO 2
TIPO DE IUMINAÇÃO 3
TIPO DE IUMINAÇÃO 4
TIPO DE IUMINAÇÃO 5

CR#3 Categoria Atributo
CATEGORIA
CATEGORIA 1
CATEGORIA 2
CATEGORIA 3
CATEGORIA 4
CATEGORIA 5
CATEGORIA 6
CATEGORIA 7
CATEGORIA 8
CATEGORIA 9
CATEGORIA 10
CATEGORIA 11
CATEGORIA 12
CATEGORIA 13
CATEGORIA 14
CATEGORIA 15
CATEGORIA 16
CATEGORIA 17
CATEGORIA 18
CATEGORIA 19
CATEGORIA 20
CATEGORIA 21
CATEGORIA 22
CATEGORIA 23

CR#4 Caracteristica_Especificidade Atributo
ESPECIFIDADE
ESPECIFIDADE 1
ESPECIFIDADE 2

CR#5 Composto Atributo
COMPOSTO
COMPOSTO 1
COMPOSTO 2
COMPOSTO 3
COMPOSTO 4
COMPOSTO 5
COMPOSTO 6
COMPOSTO 7

CR#6 Indice_Protecao Atributo
INDICE DE PROTECAO
INDICE DE PROTECAO 1
INDICE DE PROTECAO 2
INDICE DE PROTECAO 3
INDICE DE PROTECAO 4
INDICE DE PROTECAO 5
INDICE DE PROTECAO 6
INDICE DE PROTECAO 7
INDICE DE PROTECAO 8
INDICE DE PROTECAO 9
INDICE DE PROTECAO 10
INDICE DE PROTECAO 11
INDICE DE PROTECAO 12
INDICE DE PROTECAO 13
INDICE DE PROTECAO 14
INDICE DE PROTECAO 15
INDICE DE PROTECAO 16
INDICE DE PROTECAO 17
INDICE DE PROTECAO 18
INDICE DE PROTECAO 19
INDICE DE PROTECAO 20
INDICE DE PROTECAO 21
INDICE DE PROTECAO 22
INDICE DE PROTECAO 23

CR#7 Indice_Proteco_Mecanica Atributo
INDICE PROTEÇÃO MECÂNICA
INDICE PROTEÇÃO MECÂNICA 1
INDICE PROTEÇÃO MECÂNICA 2
INDICE PROTEÇÃO MECÂNICA 3
INDICE PROTEÇÃO MECÂNICA 4
INDICE PROTEÇÃO MECÂNICA 5
INDICE PROTEÇÃO MECÂNICA 6
INDICE PROTEÇÃO MECÂNICA 7
INDICE PROTEÇÃO MECÂNICA 8
INDICE PROTEÇÃO MECÂNICA 9
INDICE PROTEÇÃO MECÂNICA 10
INDICE PROTEÇÃO MECÂNICA 11

CR#8 CRI Atributo
CRI
CRI 1
CRI 2
CRI 3

CR#9 Regulável Atributo
REGULÁVEL
REGULÁVEL 1
REGULÁVEL 2

CR#12 DALI Atributo
DALI
DALI 1
DALI 2

CR#13 Temperatura_Cor Atributo
TEMPERATURA COR [K]
TEMPERATURA COR [K] 1
TEMPERATURA COR [K] 2
TEMPERATURA COR [K] 3
TEMPERATURA COR [K] 4
TEMPERATURA COR [K] 5
TEMPERATURA COR [K] 6
TEMPERATURA COR [K] 7
TEMPERATURA COR [K] 8
TEMPERATURA COR [K] 9
TEMPERATURA COR [K] 10
TEMPERATURA COR [K] 11
TEMPERATURA COR [K] 12
TEMPERATURA COR [K] 13
TEMPERATURA COR [K] 14
TEMPERATURA COR [K] 15
TEMPERATURA COR [K] 16
TEMPERATURA COR [K] 17
TEMPERATURA COR [K] 18
TEMPERATURA COR [K] 19
TEMPERATURA COR [K] 20
TEMPERATURA COR [K] 21
TEMPERATURA COR [K] 22
TEMPERATURA COR [K] 23

CR#14 Versão_Sensor Atributo
SENSOR
SIM
NÃO

CR#15 Abertura_teto Atributo
ABERTURA DE TETO
SIM
NÃO

CR#16 Marca_Comercial Atributo
MARCA COMERCIAL
MARCA COMERCIAL 1
MARCA COMERCIAL 2
MARCA COMERCIAL 3
MARCA COMERCIAL 4
MARCA COMERCIAL 5
MARCA COMERCIAL 6
MARCA COMERCIAL 7
MARCA COMERCIAL 8
MARCA COMERCIAL 9
MARCA COMERCIAL 10
MARCA COMERCIAL 11
MARCA COMERCIAL 12
MARCA COMERCIAL 13
MARCA COMERCIAL 14
MARCA COMERCIAL 15
MARCA COMERCIAL 16
MARCA COMERCIAL 17
MARCA COMERCIAL 18
MARCA COMERCIAL 19
MARCA COMERCIAL 20
MARCA COMERCIAL 21
MARCA COMERCIAL 22
MARCA COMERCIAL 23

CR#17 Classe_Isolamento Atributo
CLASSES DE ISOLAMENTO
CLASSES DE ISOLAMENTO 1
CLASSES DE ISOLAMENTO 2
CLASSES DE ISOLAMENTO 3

CR#18 Suporte Atributo
SUPORTE
SUPORTE 1
SUPORTE 2
SUPORTE 3
SUPORTE 4
SUPORTE 5
SUPORTE 6
SUPORTE 7
SUPORTE 8
SUPORTE 9
SUPORTE 10
SUPORTE 11
SUPORTE 12
SUPORTE 13
SUPORTE 14
SUPORTE 15
SUPORTE 16
SUPORTE 17
SUPORTE 18
SUPORTE 19
SUPORTE 20
SUPORTE 21
SUPORTE 22
SUPORTE 23

CR#19 Fator_Potencia Atributo
FATOR DE POTÊNCIA
FATOR DE POTÊNCIA 1
FATOR DE POTÊNCIA 2
FATOR DE POTÊNCIA 3
FATOR DE POTÊNCIA 4
FATOR DE POTÊNCIA 5
FATOR DE POTÊNCIA 6
FATOR DE POTÊNCIA 7
FATOR DE POTÊNCIA 8
FATOR DE POTÊNCIA 9

CR#20 Conectividade Atributo
CONECTIVIDADE
CONECTIVIDADE 1
CONECTIVIDADE 2

CR#21 Frequencia Atributo
FREQUENCIA
FREQUENCIA 1
FREQUENCIA 2
FREQUENCIA 3

CR#22 Autonomia Atributo
AUTONOMIA
AUTONOMIA 1
AUTONOMIA 2
AUTONOMIA 3
AUTONOMIA 4
AUTONOMIA 5

CR#23 Acessorios Atributo
ACESSORIOS
ACESSORIOS 1
ACESSORIOS 2
ACESSORIOS 3
ACESSORIOS 4
ACESSORIOS 5
ACESSORIOS 6
ACESSORIOS 7
ACESSORIOS 8
ACESSORIOS 9
ACESSORIOS 10
ACESSORIOS 11
ACESSORIOS 12
ACESSORIOS 13
ACESSORIOS 14
ACESSORIOS 15
ACESSORIOS 16
ACESSORIOS 17
ACESSORIOS 18
ACESSORIOS 19
ACESSORIOS 20
ACESSORIOS 21
ACESSORIOS 22
ACESSORIOS 23

CR#24 Opacidade Atributo
OPACIDADE
OPACIDADE 1
OPACIDADE 2
OPACIDADE 3

CC#25 Fluxo_Luminoso Característica
LM

CC#26 Potencia Característica
W

CC#27 Peso_Liquido Característica
PESO LIQUIDO

CC#28 Quantidade_Embalagem Característica
QUANTIDADE POR EMBALAGEM

CC#29 Lote Característica
LOTE

CC#30 N_Serie Característica
NÚMERO DE SÉRIE

CC#31 Tensao Característica
TENSÃO

Annex B: Product hierarchy characteristics and attributes – "Iluminção"

Annex C - Example of attribute-driven long material description configuration template

Material Code	Long Description	Control
123456789	LUMINARIA ARMADURA ESTANQUE LED IP65 70 NAVIGATOR 40W	53

Attributes	Active	# Characters	Description?	Value	Control
FAMILIA	S	10	N	ILUMINACAO	
TIPO ILUMINAÇÃO	S	12	S	LUMINARIA	
CATEGORIA	S	18	S	ARMADURA ESTANQUE	
CARACTERISTICA ESPECIFICIDADE	S	3	N	EXT	
COMPOSTO	S	10	S	LED	
INDICE PROTECAO	S	4	S	IP65	
INDICE PROTECO MECANICA	S	4	N	IK08	
INDICE RESTITUICAO COR	N	2	S	70	
REGULÁVEL	S	3	N	NAO	
DALI	N	3	N	-	
TEMPERATURA COR	N	8	N	4000	
VERSÃO SENSOR	N	6	N	-	
ABERTURA TETO	S	6	N	-	
MARCA COMERCIAL	S	12	S	NAVIGATOR	
CLASSE ISOLAMENTO	S	8	N		
SUPORTE	S	6	S		
FATOR POTENCIA	S	6	N	>0,9	
CONECTIVIDADE	S	7	S		
FREQUENCIA	S	8	S	60	
AUTONOMIA	N	9	N		
ACESSORIOS	N	10	N		
OPACIDADE	S	11	S		
FLUXO LUMINOSO	S	6	N		
POTENCIA	S	6	S	40W	
PESO LIQUIDO	N	6	N		
QUANTIDADE EMBALAGEM	N	6	N	-	
LOTE	S	8	N	Activar	
N SERIE	S	8	N	Activar	
TENSAO	S	8	N	Activar	

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Annex C: Example of attribute-driven long material description configuration template

Annex D - General dashboard auxiliar R script

```
library(DT)
library(stringr)
library(RODBC)
library(bizdays)
library(tictoc)
library(sqldf)
library(odbc)
library(dplyr)

library(tidyverse)
library(magrittr)
library(dplyr)

library(readxl)
library(lubridate)
library(DBI)
library(rebus)

library(openxlsx)
```

```
library(writexl)
library(arrow)

left <- function(text, n) {
  substr(text, 1, n)
}
'%!in%' <- function(x,y)!('%in%'(x,y))

Tabela_20241129 <- read_excel("Comparacao_basedados_20241129_v3.xlsx")
Tabela_20241129 <- Tabela_20241129%>%
  select(-`Grp. Mercad. Ext.`, -`[1] Demonidor`, -`[1] UM alternativa`, -
`[1] Contador`, -`[1] Código EAN/UPC`, -`[1] Ctg.EAN`, -`[1] Comprimento`,
-`[1] Largura`, -`[1] Altura`, -`[1] Unidade de medida`, -`[1] Peso bruto`,
-`[1] Unidade de peso`, -`[2] Demonidor`, -`[2] UM alternativa`,  -`[2]
Contador`, -`[2] Código EAN/UPC`, -`[2] Ctg.EAN`, -`[2] Comprimento`, -`[2]
Largura`, -`[2] Altura`, -`[2] Unidade de medida`, -`[2] Peso bruto`, -`[2]
Unidade de peso`, -`[3] Demonidor`, -`[3] UM alternativa`, -`[3] Contador`,
-`[3] Código EAN/UPC`, -`[3] Ctg.EAN`, -`[3] Comprimento`, -`[3] Largura`,
-`[3] Altura`, -`[3] Unidade de medida`, -`[3] Peso bruto`, -`[3] Unidade
de peso`, -`[4] Demonidor`, -`[4] UM alternativa`, -`[4] Contador`, -`[4]
Código EAN/UPC`, -`[4] Ctg.EAN`, -`[4] Comprimento`, -`[4] Largura`, -`[4]
Altura`, -`[4] Unidade de medida`, -`[4] Peso bruto`, -`[4] Unidade de
peso`)
Tabela_20241129 <- Tabela_20241129%>%
  mutate(data = "29-11-2024")

Tabela_20241206 <- read_excel("Comparacao_basedados_20241206.xlsx")
Tabela_20241206 <- Tabela_20241206%>%
  select(-`Grp. Mercad. Ext.`, -`[1] Demonidor`, -`[1] UM alternativa`, -
`[1] Contador`, -`[1] Código EAN/UPC`, -`[1] Ctg.EAN`, -`[1] Comprimento`,
-`[1] Largura`, -`[1] Altura`, -`[1] Unidade de medida`, -`[1] Peso bruto`,
-`[1] Unidade de peso`, -`[2] Demonidor`, -`[2] UM alternativa`,  -`[2]
Contador`, -`[2] Código EAN/UPC`, -`[2] Ctg.EAN`, -`[2] Comprimento`, -`[2]
Largura`, -`[2] Altura`, -`[2] Unidade de medida`, -`[2] Peso bruto`, -`[2]
Unidade de peso`, -`[3] Demonidor`, -`[3] UM alternativa`, -`[3] Contador`,
-`[3] Código EAN/UPC`, -`[3] Ctg.EAN`, -`[3] Comprimento`, -`[3] Largura`,
-`[3] Altura`, -`[3] Unidade de medida`, -`[3] Peso bruto`, -`[3] Unidade
de peso`, -`[4] Demonidor`, -`[4] UM alternativa`, -`[4] Contador`, -`[4]
Código EAN/UPC`, -`[4] Ctg.EAN`, -`[4] Comprimento`, -`[4] Largura`, -`[4]
Altura`, -`[4] Unidade de medida`, -`[4] Peso bruto`, -`[4] Unidade de
peso`, -`SA_descricao`, -`SA_peso_liq`,  -`SA_UM_básica`, -
```

```
`SA_1_Demonidor`,  -`SA_1_UMA`, -`SA_1_Contador`, -`SA_1_Código_EAN_UPC`, -
`SA_1_Ctg_EAN`,  -`SA_1_Comprimento`, -`SA_1_Largura`, -`SA_1_Altura`, -
`SA_1_Unidade_medida`, -`SA_1_Peso_bruto`, -`SA_1_Unidade_peso`, -
`SA_2_Demonidor`, -`SA_2_UMA`, -`SA_2_Contador`, -`SA_2_Código_EAN_UPC`, -
`SA_2_Ctg_EAN`, -`SA_2_Comprimento`, -`SA_2_Largura`, -`SA_2_Altura`, -
`SA_2_Unidade_medida`, -`SA_2_Peso_bruto`, -`SA_2_Unidade_peso`, -
`SA_3_Demonidor`, -`SA_3_UMA`, -`SA_3_Contador`, -`SA_3_Código_EAN_UPC`, -
`SA_3_Ctg_EAN`,  -`SA_3_Comprimento`, -`SA_3_Largura`, -`SA_3_Altura`, -
`SA_3_Unidade_medida`, -`SA_3_Peso_bruto`, -`SA_3_Unidade_peso`, -
`SA_4_Demonidor`, -`SA_4_UMA`, -`SA_4_Contador`, -`SA_4_Código_EAN_UPC`, -
`SA_4_Ctg_EAN`, -`SA_4_Comprimento`, -`SA_4_Largura`, -`SA_4_Altura`, -
`SA_4_Unidade_medida`, -`SA_4_Peso_bruto`, -`SA_4_Unidade_peso`)
Tabela_20241206 <- Tabela_20241206%>%
  mutate(data = "06-12-2024")

Tabela_20241213 <- read_excel("Comparacao_basedados_20241213.xlsx")
Tabela_20241213 <- Tabela_20241213%>%
  select(-`Grp. Mercad. Ext.`, -`[1] Demonidor`, -`[1] UM alternativa`, -
`[1] Contador`, -`[1] Código EAN/UPC`, -`[1] Ctg.EAN`, -`[1] Comprimento`,
-`[1] Largura`, -`[1] Altura`, -`[1] Unidade de medida`, -`[1] Peso bruto`,
-`[1] Unidade de peso`, -`[2] Demonidor`, -`[2] UM alternativa`,  -`[2]
Contador`, -`[2] Código EAN/UPC`, -`[2] Ctg.EAN`, -`[2] Comprimento`, -`[2]
Largura`, -`[2] Altura`, -`[2] Unidade de medida`, -`[2] Peso bruto`, -`[2]
Unidade de peso`, -`[3] Demonidor`, -`[3] UM alternativa`, -`[3] Contador`,
-`[3] Código EAN/UPC`, -`[3] Ctg.EAN`, -`[3] Comprimento`, -`[3] Largura`,
-`[3] Altura`, -`[3] Unidade de medida`, -`[3] Peso bruto`, -`[3] Unidade
de peso`, -`[4] Demonidor`, -`[4] UM alternativa`, -`[4] Contador`, -`[4]
Código EAN/UPC`, -`[4] Ctg.EAN`, -`[4] Comprimento`, -`[4] Largura`, -`[4]
Altura`, -`[4] Unidade de medida`, -`[4] Peso bruto`, -`[4] Unidade de
peso`)
Tabela_20241213 <- Tabela_20241213%>%
  mutate(data = "13-12-2024")

Tabela_20241219 <- read_excel("Comparacao_basedados_20241219.xlsx")
Tabela_20241219 <- Tabela_20241219%>%
  select(-`Grp. Mercad. Ext.`, -`[1] Demonidor`, -`[1] UM alternativa`, -
`[1] Contador`, -`[1] Código EAN/UPC`, -`[1] Ctg.EAN`, -`[1] Comprimento`,
-`[1] Largura`, -`[1] Altura`, -`[1] Unidade de medida`, -`[1] Peso bruto`,
-`[1] Unidade de peso`, -`[2] Demonidor`, -`[2] UM alternativa`,  -`[2]
Contador`, -`[2] Código EAN/UPC`, -`[2] Ctg.EAN`, -`[2] Comprimento`, -`[2]
Largura`, -`[2] Altura`, -`[2] Unidade de medida`, -`[2] Peso bruto`, -`[2]
```

```
Unidade de peso`, -`[3] Demonidor`, -`[3] UM alternativa`, -`[3] Contador`,
-`[3] Código EAN/UPC`, -`[3] Ctg.EAN`, -`[3] Comprimento`, -`[3] Largura`,
-`[3] Altura`, -`[3] Unidade de medida`, -`[3] Peso bruto`, -`[3] Unidade
de peso`, -`[4] Demonidor`, -`[4] UM alternativa`, -`[4] Contador`, -`[4]
Código EAN/UPC`, -`[4] Ctg.EAN`, -`[4] Comprimento`, -`[4] Largura`, -`[4]
Altura`, -`[4] Unidade de medida`, -`[4] Peso bruto`, -`[4] Unidade de
peso`, -`SA_descricao`, -`SA_peso_liq`,  -`SA_UM_básica`, -
`SA_1_Demonidor`,  -`SA_1_UMA`, -`SA_1_Contador`, -`SA_1_Código_EAN_UPC`, -
`SA_1_Ctg_EAN`,  -`SA_1_Comprimento`, -`SA_1_Largura`, -`SA_1_Altura`, -
`SA_1_Unidade_medida`, -`SA_1_Peso_bruto`, -`SA_1_Unidade_peso`, -
`SA_2_Demonidor`, -`SA_2_UMA`, -`SA_2_Contador`, -`SA_2_Código_EAN_UPC`, -
`SA_2_Ctg_EAN`, -`SA_2_Comprimento`, -`SA_2_Largura`, -`SA_2_Altura`, -
`SA_2_Unidade_medida`, -`SA_2_Peso_bruto`, -`SA_2_Unidade_peso`, -
`SA_3_Demonidor`, -`SA_3_UMA`, -`SA_3_Contador`, -`SA_3_Código_EAN_UPC`, -
`SA_3_Ctg_EAN`,  -`SA_3_Comprimento`, -`SA_3_Largura`, -`SA_3_Altura`, -
`SA_3_Unidade_medida`, -`SA_3_Peso_bruto`, -`SA_3_Unidade_peso`, -
`SA_4_Demonidor`, -`SA_4_UMA`, -`SA_4_Contador`, -`SA_4_Código_EAN_UPC`, -
`SA_4_Ctg_EAN`, -`SA_4_Comprimento`, -`SA_4_Largura`, -`SA_4_Altura`, -
`SA_4_Unidade_medida`, -`SA_4_Peso_bruto`, -`SA_4_Unidade_peso`)
Tabela_20241219 <- Tabela_20241219%>%
  mutate(data = "19-12-2024")

Tabela_20241231 <- read_excel("Comparacao_basedados_20241231.xlsx")
Tabela_20241231 <- Tabela_20241231%>%
  select(-`Grp. Mercad. Ext.`, -`[1] Demonidor`, -`[1] UM alternativa`, -
`[1] Contador`, -`[1] Código EAN/UPC`, -`[1] Ctg.EAN`, -`[1] Comprimento`,
-`[1] Largura`, -`[1] Altura`, -`[1] Unidade de medida`, -`[1] Peso bruto`,
-`[1] Unidade de peso`, -`[2] Demonidor`, -`[2] UM alternativa`,  -`[2]
Contador`, -`[2] Código EAN/UPC`, -`[2] Ctg.EAN`, -`[2] Comprimento`, -`[2]
Largura`, -`[2] Altura`, -`[2] Unidade de medida`, -`[2] Peso bruto`, -`[2]
Unidade de peso`, -`[3] Demonidor`, -`[3] UM alternativa`, -`[3] Contador`,
-`[3] Código EAN/UPC`, -`[3] Ctg.EAN`, -`[3] Comprimento`, -`[3] Largura`,
-`[3] Altura`, -`[3] Unidade de medida`, -`[3] Peso bruto`, -`[3] Unidade
de peso`, -`[4] Demonidor`, -`[4] UM alternativa`, -`[4] Contador`, -`[4]
Código EAN/UPC`, -`[4] Ctg.EAN`, -`[4] Comprimento`, -`[4] Largura`, -`[4]
Altura`, -`[4] Unidade de medida`, -`[4] Peso bruto`, -`[4] Unidade de
peso`, -`SA_descricao`, -`SA_peso_liq`,  -`SA_UM_básica`, -
`SA_1_Demonidor`,  -`SA_1_UMA`, -`SA_1_Contador`, -`SA_1_Código_EAN_UPC`, -
`SA_1_Ctg_EAN`,  -`SA_1_Comprimento`, -`SA_1_Largura`, -`SA_1_Altura`, -
`SA_1_Unidade_medida`, -`SA_1_Peso_bruto`, -`SA_1_Unidade_peso`, -
`SA_2_Demonidor`, -`SA_2_UMA`, -`SA_2_Contador`, -`SA_2_Código_EAN_UPC`, -
```

```
`SA_2_Ctg_EAN`, -`SA_2_Comprimento`, -`SA_2_Largura`, -`SA_2_Altura`, -
`SA_2_Unidade_medida`, -`SA_2_Peso_bruto`, -`SA_2_Unidade_peso`, -
`SA_3_Demonidor`, -`SA_3_UMA`, -`SA_3_Contador`, -`SA_3_Código_EAN_UPC`, -
`SA_3_Ctg_EAN`,  -`SA_3_Comprimento`, -`SA_3_Largura`, -`SA_3_Altura`, -
`SA_3_Unidade_medida`, -`SA_3_Peso_bruto`, -`SA_3_Unidade_peso`, -
`SA_4_Demonidor`, -`SA_4_UMA`, -`SA_4_Contador`, -`SA_4_Código_EAN_UPC`, -
`SA_4_Ctg_EAN`, -`SA_4_Comprimento`, -`SA_4_Largura`, -`SA_4_Altura`, -
`SA_4_Unidade_medida`, -`SA_4_Peso_bruto`, -`SA_4_Unidade_peso`)
Tabela_20241231 <- Tabela_20241231%>%
  mutate(data = "31-12-2024")

Tabela_20250103 <- read_excel("Comparacao_basedados_20250103.xlsx")
Tabela_20250103 <- Tabela_20250103%>%
  select(-`Grp. Mercad. Ext.`, -`[1] Demonidor`, -`[1] UM alternativa`, -
`[1] Contador`, -`[1] Código EAN/UPC`, -`[1] Ctg.EAN`, -`[1] Comprimento`,
-`[1] Largura`, -`[1] Altura`, -`[1] Unidade de medida`, -`[1] Peso bruto`,
-`[1] Unidade de peso`, -`[2] Demonidor`, -`[2] UM alternativa`,  -`[2]
Contador`, -`[2] Código EAN/UPC`, -`[2] Ctg.EAN`, -`[2] Comprimento`, -`[2]
Largura`, -`[2] Altura`, -`[2] Unidade de medida`, -`[2] Peso bruto`, -`[2]
Unidade de peso`, -`[3] Demonidor`, -`[3] UM alternativa`, -`[3] Contador`,
-`[3] Código EAN/UPC`, -`[3] Ctg.EAN`, -`[3] Comprimento`, -`[3] Largura`,
-`[3] Altura`, -`[3] Unidade de medida`, -`[3] Peso bruto`, -`[3] Unidade
de peso`, -`[4] Demonidor`, -`[4] UM alternativa`, -`[4] Contador`, -`[4]
Código EAN/UPC`, -`[4] Ctg.EAN`, -`[4] Comprimento`, -`[4] Largura`, -`[4]
Altura`, -`[4] Unidade de medida`, -`[4] Peso bruto`, -`[4] Unidade de
peso`, -`SA_descricao`, -`SA_peso_liq`,  -`SA_UM_básica`, -
`SA_1_Demonidor`,  -`SA_1_UMA`, -`SA_1_Contador`, -`SA_1_Código_EAN_UPC`, -
`SA_1_Ctg_EAN`,  -`SA_1_Comprimento`, -`SA_1_Largura`, -`SA_1_Altura`, -
`SA_1_Unidade_medida`, -`SA_1_Peso_bruto`, -`SA_1_Unidade_peso`, -
`SA_2_Demonidor`, -`SA_2_UMA`, -`SA_2_Contador`, -`SA_2_Código_EAN_UPC`, -
`SA_2_Ctg_EAN`, -`SA_2_Comprimento`, -`SA_2_Largura`, -`SA_2_Altura`, -
`SA_2_Unidade_medida`, -`SA_2_Peso_bruto`, -`SA_2_Unidade_peso`, -
`SA_3_Demonidor`, -`SA_3_UMA`, -`SA_3_Contador`, -`SA_3_Código_EAN_UPC`, -
`SA_3_Ctg_EAN`,  -`SA_3_Comprimento`, -`SA_3_Largura`, -`SA_3_Altura`, -
`SA_3_Unidade_medida`, -`SA_3_Peso_bruto`, -`SA_3_Unidade_peso`, -
`SA_4_Demonidor`, -`SA_4_UMA`, -`SA_4_Contador`, -`SA_4_Código_EAN_UPC`, -
`SA_4_Ctg_EAN`, -`SA_4_Comprimento`, -`SA_4_Largura`, -`SA_4_Altura`, -
`SA_4_Unidade_medida`, -`SA_4_Peso_bruto`, -`SA_4_Unidade_peso`)
Tabela_20250103 <- Tabela_20250103%>%
  mutate(data = "03-01-2025")
```

```
Tabela_20250110 <- read_excel("Comparacao_basedados_20250110.xlsx")
Tabela_20250110 <- Tabela_20250110%>%
  select(-`Grp. Mercad. Ext.`, -`[1] Demonidor`, -`[1] UM alternativa`, -
`[1] Contador`, -`[1] Código EAN/UPC`, -`[1] Ctg.EAN`, -`[1] Comprimento`,
-`[1] Largura`, -`[1] Altura`, -`[1] Unidade de medida`, -`[1] Peso bruto`,
-`[1] Unidade de peso`, -`[2] Demonidor`, -`[2] UM alternativa`,  -`[2]
Contador`, -`[2] Código EAN/UPC`, -`[2] Ctg.EAN`, -`[2] Comprimento`, -`[2]
Largura`, -`[2] Altura`, -`[2] Unidade de medida`, -`[2] Peso bruto`, -`[2]
Unidade de peso`, -`[3] Demonidor`, -`[3] UM alternativa`, -`[3] Contador`,
-`[3] Código EAN/UPC`, -`[3] Ctg.EAN`, -`[3] Comprimento`, -`[3] Largura`,
-`[3] Altura`, -`[3] Unidade de medida`, -`[3] Peso bruto`, -`[3] Unidade
de peso`, -`[4] Demonidor`, -`[4] UM alternativa`, -`[4] Contador`, -`[4]
Código EAN/UPC`, -`[4] Ctg.EAN`, -`[4] Comprimento`, -`[4] Largura`, -`[4]
Altura`, -`[4] Unidade de medida`, -`[4] Peso bruto`, -`[4] Unidade de
peso`)
Tabela_20250110 <- Tabela_20250110%>%
  mutate(data = "10-01-2025")

Tabela_20250117 <- read_excel("Comparacao_basedados_20250117.xlsx")
Tabela_20250117 <- Tabela_20250117%>%
  select(-`Grp. Mercad. Ext.`, -`[1] Demonidor`, -`[1] UM alternativa`, -
`[1] Contador`, -`[1] Código EAN/UPC`, -`[1] Ctg.EAN`, -`[1] Comprimento`,
-`[1] Largura`, -`[1] Altura`, -`[1] Unidade de medida`, -`[1] Peso bruto`,
-`[1] Unidade de peso`, -`[2] Demonidor`, -`[2] UM alternativa`,  -`[2]
Contador`, -`[2] Código EAN/UPC`, -`[2] Ctg.EAN`, -`[2] Comprimento`, -`[2]
Largura`, -`[2] Altura`, -`[2] Unidade de medida`, -`[2] Peso bruto`, -`[2]
Unidade de peso`, -`[3] Demonidor`, -`[3] UM alternativa`, -`[3] Contador`,
-`[3] Código EAN/UPC`, -`[3] Ctg.EAN`, -`[3] Comprimento`, -`[3] Largura`,
-`[3] Altura`, -`[3] Unidade de medida`, -`[3] Peso bruto`, -`[3] Unidade
de peso`, -`[4] Demonidor`, -`[4] UM alternativa`, -`[4] Contador`, -`[4]
Código EAN/UPC`, -`[4] Ctg.EAN`, -`[4] Comprimento`, -`[4] Largura`, -`[4]
Altura`, -`[4] Unidade de medida`, -`[4] Peso bruto`, -`[4] Unidade de
peso`)
Tabela_20250117 <- Tabela_20250117%>%
  mutate(data = "17-01-2025")

Tabela_20250124 <- read_excel("Comparacao_basedados_20250124.xlsx")
Tabela_20250124 <- Tabela_20250124%>%
  select(-`Grp. Mercad. Ext.`, -`[1] Demonidor`, -`[1] UM alternativa`, -
`[1] Contador`, -`[1] Código EAN/UPC`, -`[1] Ctg.EAN`, -`[1] Comprimento`,
-`[1] Largura`, -`[1] Altura`, -`[1] Unidade de medida`, -`[1] Peso bruto`,
```

```
-`[1] Unidade de peso`, -`[2] Demonidor`, -`[2] UM alternativa`,  -`[2]
Contador`, -`[2] Código EAN/UPC`, -`[2] Ctg.EAN`, -`[2] Comprimento`, -`[2]
Largura`, -`[2] Altura`, -`[2] Unidade de medida`, -`[2] Peso bruto`, -`[2]
Unidade de peso`, -`[3] Demonidor`, -`[3] UM alternativa`, -`[3] Contador`,
-`[3] Código EAN/UPC`, -`[3] Ctg.EAN`, -`[3] Comprimento`, -`[3] Largura`,
-`[3] Altura`, -`[3] Unidade de medida`, -`[3] Peso bruto`, -`[3] Unidade
de peso`, -`[4] Demonidor`, -`[4] UM alternativa`, -`[4] Contador`, -`[4]
Código EAN/UPC`, -`[4] Ctg.EAN`, -`[4] Comprimento`, -`[4] Largura`, -`[4]
Altura`, -`[4] Unidade de medida`, -`[4] Peso bruto`, -`[4] Unidade de
peso`)
Tabela_20250124 <- Tabela_20250124%>%
  mutate(data = "24-01-2025")

Tabela_Total <- bind_rows(Tabela_20241129, Tabela_20241206,
Tabela_20241213, Tabela_20241219, Tabela_20241231, Tabela_20250103,
Tabela_20250110, Tabela_20250117, Tabela_20250124)

write.xlsx(Tabela_Total)
```

Annex D: General dashboard auxiliar R script

Annex E - Weekly dashboard auxiliar R script

```
library(DT)
library(stringr)
library(RODBC)
library(bizdays)
library(tictoc)
library(sqldf)
library(odbc)
library(dplyr)

library(tidyverse)
library(magrittr)
library(dplyr)

library(readxl)
library(lubridate)
library(DBI)
library(rebus)
library(openxlsx)
library(writexl)
```

```
left <- function(text, n) {
  substr(text, 1, n)
}
'%!in%' <- function(x,y)!('%in%'(x,y))


Tabela_anterior <- read_excel("00_Base_2025-01-10.xlsx")

Tabela_anterior <- Tabela_anterior%>%
  filter(`Hierarq.produtos` != is.na(`Hierarq.produtos`))

Tabela_nova <- read_excel("00_Base_2025-01-17.xlsx")

Tabela_nova <- Tabela_nova%>%
  filter(`Hierarq.produtos` != is.na(`Hierarq.produtos`))

Novos_materiais <- Tabela_nova%>%
  anti_join(Tabela_anterior, by="Material")
Novos_materiais <- Novos_materiais%>%
  mutate(Material_novo = "Novo")

Tabela_anterior <- Tabela_anterior %>%
  mutate(Material_novo = "Antigo")

Tabela_anterior<-rbind(Tabela_anterior,Novos_materiais)

Tabela_anterior <- Tabela_anterior%>%
  select(-`Material antigo`,-`Material novo`,-`Texto descritivo`,-"N° peça
fabricante",-"N° material antigo","Grp. Mercad. Ext.",-"[1] Volume",-"[1]
Unidade volume",-"[2] Volume",-"[2] Unidade volume",-"[3] Volume",-"[3]
Unidade volume",-"[4] Volume",-"[4] Unidade volume")

Tabela_nova <- Tabela_nova%>%
  select(-`Material antigo`,-`Material novo`,-`Texto descritivo`,-"N° peça
fabricante",-"N° material antigo","Grp. Mercad. Ext.",-"[1] Volume",-"[1]
Unidade volume",-"[2] Volume",-"[2] Unidade volume",-"[3] Volume",-"[3]
Unidade volume",-"[4] Volume",-"[4] Unidade volume",-"Grupo de
mercadorias",-"Descr.grupo mercad.",-"Hierarq.produtos",-"Denominação",-
"Grp. Mercad. Ext.",- "Stat.mat.todos cent.")
```

```
Tabela_nova <- Tabela_nova%>%
  rename(SA_material = 'Material',
         SA_descricao = 'Texto breve de material',
         SA_peso_liq = 'Peso líquido',
         SA_UM_básica = 'UM básica',
         SA_1_Demonidor = '[1] Demonidor',
         SA_1_UMA = '[1] UM alternativa',
         SA_1_Contador = '[1] Contador',
         SA_1_Código_EAN_UPC = '[1] Código EAN/UPC',
         SA_1_Ctg_EAN = '[1] Ctg.EAN',
         SA_1_Comprimento = '[1] Comprimento',
         SA_1_Largura = '[1] Largura',
         SA_1_Altura = '[1] Altura',
         SA_1_Unidade_medida = '[1] Unidade de medida',
         SA_1_Peso_bruto = '[1] Peso bruto',
         SA_1_Unidade_peso = '[1] Unidade de peso',
         SA_2_Demonidor = '[2] Demonidor',
         SA_2_UMA = '[2] UM alternativa',
         SA_2_Contador = '[2] Contador',
         SA_2_Código_EAN_UPC = '[2] Código EAN/UPC',
         SA_2_Ctg_EAN = '[2] Ctg.EAN',
         SA_2_Comprimento = '[2] Comprimento',
         SA_2_Largura = '[2] Largura',
         SA_2_Altura = '[2] Altura',
         SA_2_Unidade_medida = '[2] Unidade de medida',
         SA_2_Peso_bruto = '[2] Peso bruto',
         SA_2_Unidade_peso = '[2] Unidade de peso',
         SA_3_Demonidor = '[3] Demonidor',
         SA_3_UMA = '[3] UM alternativa',
         SA_3_Contador = '[3] Contador',
         SA_3_Código_EAN_UPC = '[3] Código EAN/UPC',
         SA_3_Ctg_EAN = '[3] Ctg.EAN',
         SA_3_Comprimento = '[3] Comprimento',
         SA_3_Largura = '[3] Largura',
         SA_3_Altura = '[3] Altura',
         SA_3_Unidade_medida = '[3] Unidade de medida',
         SA_3_Peso_bruto = '[3] Peso bruto',
         SA_3_Unidade_peso = '[3] Unidade de peso',
         SA_4_Demonidor = '[4] Demonidor',
         SA_4_UMA = '[4] UM alternativa',
         SA_4_Contador = '[4] Contador',
```

```
         SA_4_Código_EAN_UPC = '[4] Código EAN/UPC',
         SA_4_Ctg_EAN = '[4] Ctg.EAN',
         SA_4_Comprimento = '[4] Comprimento',
         SA_4_Largura = '[4] Largura',
         SA_4_Altura = '[4] Altura',
         SA_4_Unidade_medida = '[4] Unidade de medida',
         SA_4_Peso_bruto = '[4] Peso bruto',
         SA_4_Unidade_peso = '[4] Unidade de peso')

Comparacao_semana <- Tabela_anterior%>%
  left_join(.,Tabela_nova,by = c("Material"="SA_material"))

Comparacao_semana<- Comparacao_semana%>%
  mutate(Verificar_descricao = if_else(`Texto breve de material` ==
SA_descricao, TRUE, FALSE, missing = FALSE),
         Verificar_peso_liq = if_else(is.na(as.numeric(`Peso líquido`)) &
is.na(as.numeric(SA_peso_liq)),TRUE,if_else(is.na(as.numeric(`Peso
líquido`)) | is.na(as.numeric(SA_peso_liq)),FALSE, as.numeric(`Peso
líquido`) == as.numeric(SA_peso_liq))),
         Verificar_UM_básica = if_else(is.na(`UM básica`) &
is.na(SA_UM_básica), TRUE, if_else(is.na( `UM básica`) |
is.na(SA_UM_básica), FALSE,  `UM básica` == SA_UM_básica)),
         Verificar_1_Demonidor = if_else(is.na( `[1] Demonidor`) &
is.na(SA_1_Demonidor), TRUE, if_else(is.na( `[1] Demonidor`) |
is.na(SA_1_Demonidor), FALSE,  `[1] Demonidor` == SA_1_Demonidor)),
         Verificar_1_UMA = if_else(is.na( `[1] UM alternativa`) &
is.na(SA_1_UMA), TRUE, if_else(is.na( `[1] UM alternativa`) |
is.na(SA_1_UMA), FALSE,  `[1] UM alternativa` == SA_1_UMA)),
         Verificar_1_Contador = if_else(is.na( `[1] Contador`) &
is.na(SA_1_Contador), TRUE, if_else(is.na( `[1] Contador`) |
is.na(SA_1_Contador), FALSE,  `[1] Contador` == SA_1_Contador)),
         Verificar_1_Código_EAN_UPC = if_else(is.na(`[1] Código EAN/UPC`) &
is.na(SA_1_Código_EAN_UPC),TRUE,if_else(is.na(`[1] Código EAN/UPC`) |
is.na(SA_1_Código_EAN_UPC), FALSE,`[1] Código EAN/UPC` ==
SA_1_Código_EAN_UPC)),
         Verificar_1_Ctg_EAN  = if_else(is.na( `[1] Ctg.EAN`) &
is.na(SA_1_Ctg_EAN), TRUE, if_else(is.na( `[1] Ctg.EAN`) |
is.na(SA_1_Ctg_EAN), FALSE,  `[1] Ctg.EAN` == SA_1_Ctg_EAN)),
         Verificar_1_Comprimento  = if_else(is.na( `[1] Comprimento`) &
is.na(SA_1_Comprimento ), TRUE, if_else(is.na( `[1] Comprimento`) |
is.na(SA_1_Comprimento) , FALSE,  `[1] Comprimento` == SA_1_Comprimento )),
```

```
        Verificar_1_Largura  = if_else(is.na( `[1] Largura`) &
is.na(SA_1_Largura ), TRUE, if_else(is.na( `[1] Largura`) |
is.na(SA_1_Largura) , FALSE,  `[1] Largura` == SA_1_Largura )),
        Verificar_1_Altura  = if_else(is.na( `[1] Altura`) &
is.na(SA_1_Altura ), TRUE, if_else(is.na( `[1] Altura`) |
is.na(SA_1_Altura) , FALSE,  `[1] Altura` == SA_1_Altura )),
        Verificar_1_Unidade_medida  = if_else(is.na( `[1] Unidade de
medida`) & is.na(SA_1_Unidade_medida ), TRUE, if_else(is.na( `[1] Unidade
de medida`) | is.na(SA_1_Unidade_medida) , FALSE,  `[1] Unidade de medida`
== SA_1_Unidade_medida )),
        Verificar_1_Peso_bruto  = if_else(is.na( `[1] Peso bruto`) &
is.na(SA_1_Peso_bruto ), TRUE, if_else(is.na( `[1] Peso bruto`) |
is.na(SA_1_Peso_bruto) , FALSE,  `[1] Peso bruto` == SA_1_Peso_bruto )),
        Verificar_1_Unidade_peso  = if_else(is.na( `[1] Unidade de peso`)
& is.na(SA_1_Unidade_peso ), TRUE, if_else(is.na( `[1] Unidade de peso`) |
is.na(SA_1_Unidade_peso) , FALSE,  `[1] Unidade de peso` ==
SA_1_Unidade_peso )),
        Verificar_2_Demonidor  = if_else(is.na( `[2] Demonidor`) &
is.na(SA_2_Demonidor), TRUE, if_else(is.na( `[2] Demonidor`) |
is.na(SA_2_Demonidor), FALSE,  `[2] Demonidor` == SA_2_Demonidor)),
        Verificar_2_UMA  = if_else(is.na( `[2] UM alternativa`) &
is.na(SA_2_UMA), TRUE, if_else(is.na( `[2] UM alternativa`) |
is.na(SA_2_UMA), FALSE,  `[2] UM alternativa` == SA_2_UMA)),
        Verificar_2_Contador  = if_else(is.na( `[2] Contador`) &
is.na(SA_2_Contador), TRUE, if_else(is.na( `[2] Contador`) |
is.na(SA_2_Contador), FALSE,  `[2] Contador` == SA_2_Contador)),
        Verificar_2_Código_EAN_UPC  = if_else(is.na( `[2] Código EAN/UPC`)
& is.na(SA_2_Código_EAN_UPC), TRUE, if_else(is.na( `[2] Código EAN/UPC`) |
is.na(SA_2_Código_EAN_UPC), FALSE,  `[2] Código EAN/UPC` ==
SA_2_Código_EAN_UPC)),
        Verificar_2_Ctg_EAN  = if_else(is.na( `[2] Ctg.EAN`) &
is.na(SA_2_Ctg_EAN), TRUE, if_else(is.na( `[2] Ctg.EAN`) |
is.na(SA_2_Ctg_EAN), FALSE,  `[2] Ctg.EAN` == SA_2_Ctg_EAN)),
        Verificar_2_Comprimento  = if_else(is.na( `[2] Comprimento`) &
is.na(SA_2_Comprimento), TRUE, if_else(is.na( `[2] Comprimento`) |
is.na(SA_2_Comprimento), FALSE,  `[2] Comprimento` == SA_2_Comprimento)),
        Verificar_2_Largura  = if_else(is.na( `[2] Largura`) &
is.na(SA_2_Largura), TRUE, if_else(is.na( `[2] Largura`) |
is.na(SA_2_Largura), FALSE,  `[2] Largura` == SA_2_Largura)),
```

```
        Verificar_2_Altura  = if_else(is.na( `[2] Altura`) &
is.na(SA_2_Altura), TRUE, if_else(is.na( `[2] Altura`) |
is.na(SA_2_Altura), FALSE,  `[2] Altura` == SA_2_Altura)),
        Verificar_2_Unidade_medida  = if_else(is.na( `[2] Unidade de
medida`) & is.na(SA_2_Unidade_medida), TRUE, if_else(is.na( `[2] Unidade de
medida`) | is.na(SA_2_Unidade_medida), FALSE,  `[2] Unidade de medida` ==
SA_2_Unidade_medida)),
        Verificar_2_Peso_bruto  = if_else(is.na( `[2] Peso bruto`) &
is.na(SA_2_Peso_bruto), TRUE, if_else(is.na( `[2] Peso bruto`) |
is.na(SA_2_Peso_bruto), FALSE,  `[2] Peso bruto` == SA_2_Peso_bruto)),
        Verificar_2_Unidade_peso  = if_else(is.na( `[2] Unidade de peso`)
& is.na(SA_2_Unidade_peso), TRUE, if_else(is.na( `[2] Unidade de peso`) |
is.na(SA_2_Unidade_peso), FALSE,  `[2] Unidade de peso` ==
SA_2_Unidade_peso)),
        Verificar_3_Demonidor  = if_else(is.na( `[3] Demonidor`) &
is.na(SA_3_Demonidor), TRUE, if_else(is.na( `[3] Demonidor`) |
is.na(SA_3_Demonidor), FALSE,  `[3] Demonidor` == SA_3_Demonidor)),
        Verificar_3_UMA  = if_else(is.na( `[3] UM alternativa`) &
is.na(SA_3_UMA), TRUE, if_else(is.na( `[3] UM alternativa`) |
is.na(SA_3_UMA), FALSE,  `[3] UM alternativa` == SA_3_UMA)),
        Verificar_3_Contador  = if_else(is.na( `[3] Contador`) &
is.na(SA_3_Contador), TRUE, if_else(is.na( `[3] Contador`) |
is.na(SA_3_Contador), FALSE,  `[3] Contador` == SA_3_Contador)),
        Verificar_3_Código_EAN_UPC  = if_else(is.na( `[3] Código EAN/UPC`)
& is.na(SA_3_Código_EAN_UPC), TRUE, if_else(is.na( `[3] Código EAN/UPC`) |
is.na(SA_3_Código_EAN_UPC), FALSE,  `[3] Código EAN/UPC` ==
SA_3_Código_EAN_UPC)),
        Verificar_3_Ctg_EAN  = if_else(is.na( `[3] Ctg.EAN`) &
is.na(SA_3_Ctg_EAN), TRUE, if_else(is.na( `[3] Ctg.EAN`) |
is.na(SA_3_Ctg_EAN), FALSE,  `[3] Ctg.EAN` == SA_3_Ctg_EAN)),
        Verificar_3_Comprimento  = if_else(is.na( `[3] Comprimento`) &
is.na(SA_3_Comprimento), TRUE, if_else(is.na( `[3] Comprimento`) |
is.na(SA_3_Comprimento), FALSE,  `[3] Comprimento` == SA_3_Comprimento)),
        Verificar_3_Largura  = if_else(is.na( `[3] Largura`) &
is.na(SA_3_Largura), TRUE, if_else(is.na( `[3] Largura`) |
is.na(SA_3_Largura), FALSE,  `[3] Largura` == SA_3_Largura)),
        Verificar_3_Altura  = if_else(is.na( `[3] Altura`) &
is.na(SA_3_Altura), TRUE, if_else(is.na( `[3] Altura`) |
is.na(SA_3_Altura), FALSE,  `[3] Altura` == SA_3_Altura)),
        Verificar_3_Unidade_medida  = if_else(is.na( `[3] Unidade de
medida`) & is.na(SA_3_Unidade_medida), TRUE, if_else(is.na( `[3] Unidade de
```

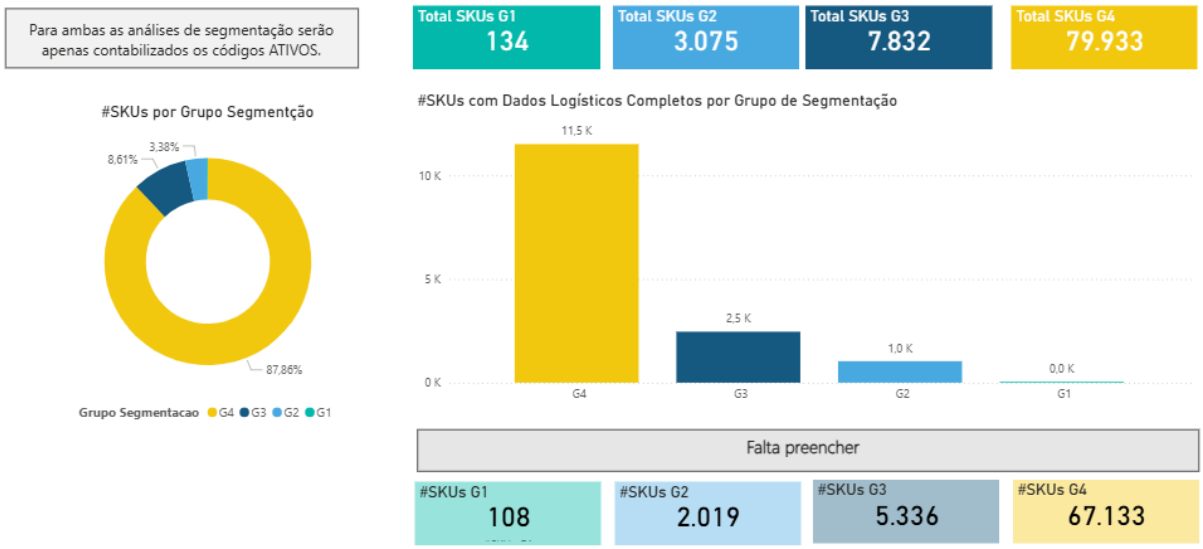
```
medida`) | is.na(SA_3_Unidade_medida), FALSE,  `[3] Unidade de medida` ==
SA_3_Unidade_medida)),
        Verificar_3_Peso_bruto  = if_else(is.na(`[3] Peso bruto`) &
is.na(SA_3_Peso_bruto), TRUE, if_else(is.na( `[3] Peso bruto`) |
is.na(SA_3_Peso_bruto), FALSE,  `[3] Peso bruto` == SA_3_Peso_bruto)),
        Verificar_3_Unidade_peso  = if_else(is.na( `[3] Unidade de peso`)
& is.na(SA_3_Unidade_peso), TRUE, if_else(is.na( `[3] Unidade de peso`) |
is.na(SA_3_Unidade_peso), FALSE,  `[3] Unidade de peso` ==
SA_3_Unidade_peso)),
        Verificar_4_Demonidor  = if_else(is.na( `[4] Demonidor`) &
is.na(SA_4_Demonidor), TRUE, if_else(is.na( `[4] Demonidor`) |
is.na(SA_4_Demonidor), FALSE,  `[4] Demonidor` == SA_4_Demonidor)),
        Verificar_4_UMA  = if_else(is.na( `[4] UM alternativa`) &
is.na(SA_4_UMA), TRUE, if_else(is.na( `[4] UM alternativa`) |
is.na(SA_4_UMA), FALSE,  `[4] UM alternativa` == SA_4_UMA)),
        Verificar_4_Contador  = if_else(is.na( `[4] Contador`) &
is.na(SA_4_Contador), TRUE, if_else(is.na( `[4] Contador`) |
is.na(SA_4_Contador), FALSE,  `[4] Contador` == SA_4_Contador)),
        Verificar_4_Código_EAN_UPC  = if_else(is.na( `[4] Código EAN/UPC`)
& is.na(SA_4_Código_EAN_UPC), TRUE, if_else(is.na( `[4] Código EAN/UPC`) |
is.na(SA_4_Código_EAN_UPC), FALSE,  `[4] Código EAN/UPC` ==
SA_4_Código_EAN_UPC)),
        Verificar_4_Ctg_EAN  = if_else(is.na( `[4] Ctg.EAN`) &
is.na(SA_4_Ctg_EAN), TRUE, if_else(is.na( `[4] Ctg.EAN`) |
is.na(SA_4_Ctg_EAN), FALSE,  `[4] Ctg.EAN` == SA_4_Ctg_EAN)),
        Verificar_4_Comprimento  = if_else(is.na( `[4] Comprimento`) &
is.na(SA_4_Comprimento), TRUE, if_else(is.na( `[4] Comprimento`) |
is.na(SA_4_Comprimento), FALSE,  `[4] Comprimento` == SA_4_Comprimento)),
        Verificar_4_Largura  = if_else(is.na( `[4] Largura`) &
is.na(SA_4_Largura), TRUE, if_else(is.na( `[4] Largura`) |
is.na(SA_4_Largura), FALSE,  `[4] Largura` == SA_4_Largura)),
        Verificar_4_Altura  = if_else(is.na( `[4] Altura`) &
is.na(SA_4_Altura), TRUE, if_else(is.na( `[4] Altura`) |
is.na(SA_4_Altura), FALSE,  `[4] Altura` == SA_4_Altura)),
        Verificar_4_Unidade_medida  = if_else(is.na( `[4] Unidade de
medida`) & is.na(SA_4_Unidade_medida), TRUE, if_else(is.na( `[4] Unidade de
medida`) | is.na(SA_4_Unidade_medida), FALSE,  `[4] Unidade de medida` ==
SA_4_Unidade_medida)),
        Verificar_4_Peso_bruto  = if_else(is.na( `[4] Peso bruto`) &
is.na(SA_4_Peso_bruto), TRUE, if_else(is.na( `[4] Peso bruto`) |
is.na(SA_4_Peso_bruto), FALSE,  `[4] Peso bruto` == SA_4_Peso_bruto)),
```

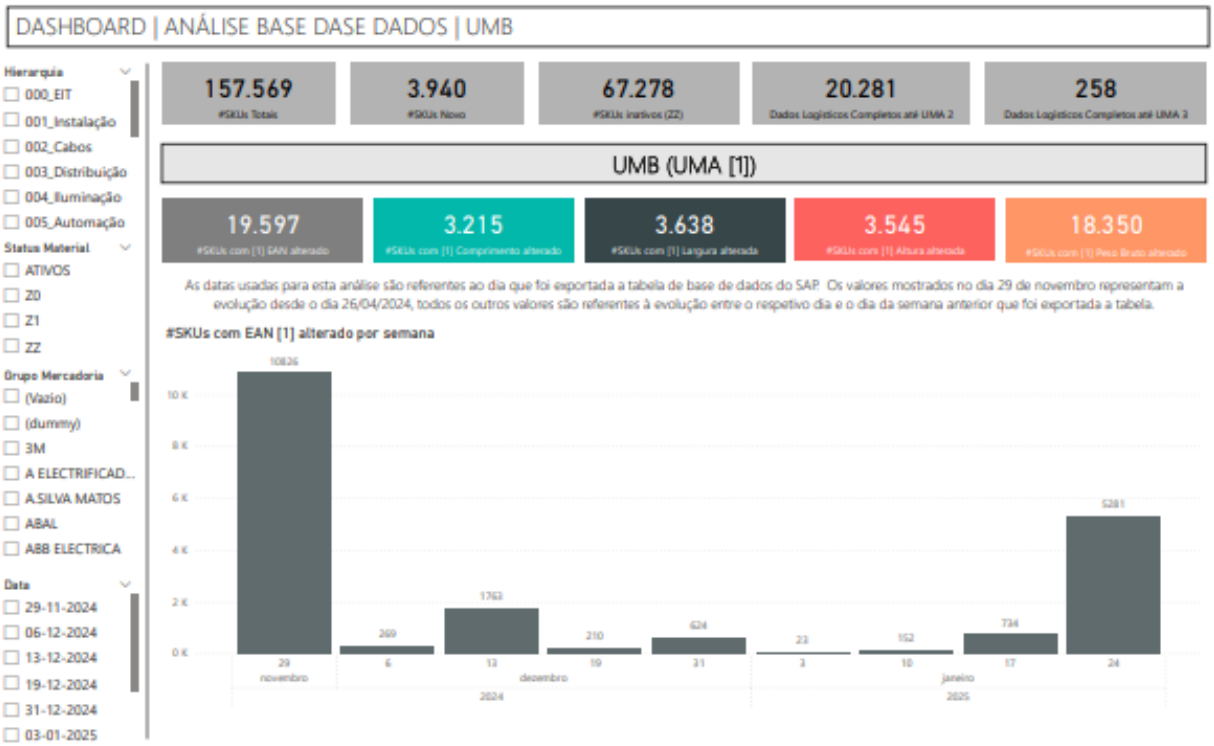
```
        Verificar_4_Unidade_peso  = if_else(is.na( `[4] Unidade de peso`)
& is.na(SA_4_Unidade_peso), TRUE, if_else(is.na( `[4] Unidade de peso`) |
is.na(SA_4_Unidade_peso), FALSE,  `[4] Unidade de peso` ==
SA_4_Unidade_peso)),
  )

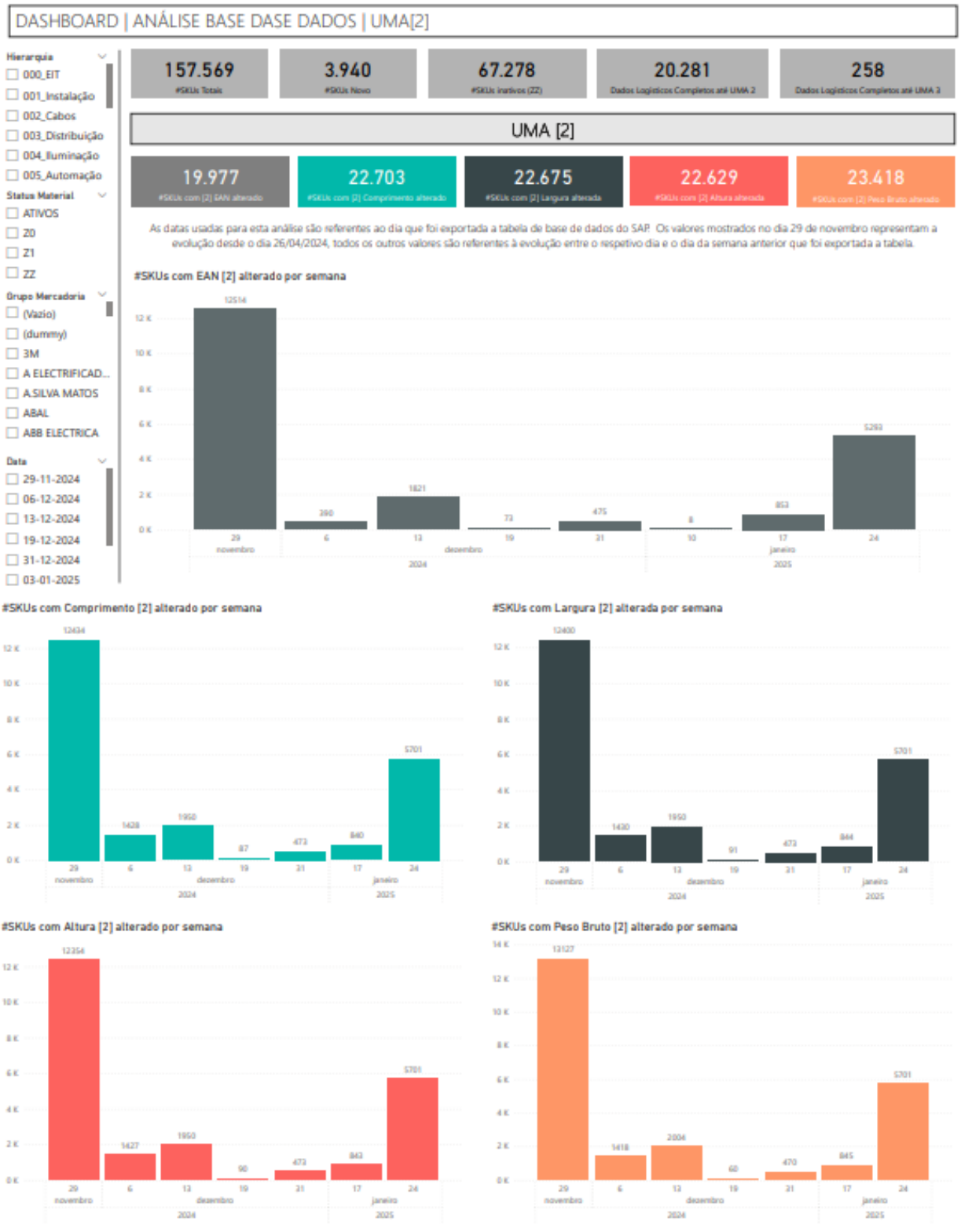
write_xlsx(Comparacao_semana)
```

Annex E: Weekly dashboard auxiliar R script

Annex F - General dashboard of Material Master Data completeness (continuation)




DASHBOARD | ANÁLISE BASE DASE DADOS | UMB
Hierarquia
000_EIT
001_Instalação
002_Cabos
003_Distribuição
004_Iluminação
005_Automação
Status Material
ATIVOS
Z0
Z1
ZZ
Grupo Mercadoria
(Vazio)
(dummy)
3M
A ELECTRIFICAD...
A.SILVA MATOS
ABAL
ABB ELECTRICA
Data
29-11-2024
06-12-2024
13-12-2024
19-12-2024
31-12-2024
03-01-2025
157.569
#SKUs Totais
3.940
#SKUs Novo
67.278
#SKUs inativos (ZZ)
20.281
Dados Logísticos Completos até UMA 2
258
Dados Logísticos Completos até UMA 3
UMB (UMA [1])
19.597
#SKUs com [1] EAN alterado
3.215
#SKUs com [1] Comprimento alterado
3.638
#SKUs com [1] Largura alterada
3.545
#SKUs com [1] Altura alterada
18.350
#SKUs com [1] Peso Bruto alterado
As datas usadas para esta análise são referentes ao dia que foi exportada a tabela de base de dados do SAP. Os valores mostrados no dia 29 de novembro representam a evolução desde o dia 26/04/2024, todos os outros valores são referentes à evolução entre o respetivo dia e o dia da semana anterior que foi exportada a tabela.
#SKUs com EAN [1] alterado por semana
10826
269
1763
210
624
23
152
734
5281
29 novembro
6
13
19
31
3
10
17
24
dezembro
janeiro
2024
2025
#SKUs com Comprimento [1] alterado por semana
1369
17
995
114
6
137
756
#SKUs com Largura [1] alterada por semana
1370
16
1617
116
13
134
761
#SKUs com Altura [1] alterado por semana
1356
16
1345
115
13
128
760
#SKUs com Peso Bruto [1] alterado por semana
11336
851
1261
95
5
243
4585


DASHBOARD | ANÁLISE BASE DASE DADOS | UMA[2]
Hierarquia
000_EIT
001_Instalação
002_Cabos
003_Distribuição
004_Iluminação
005_Automação
Status Material
ATIVOS
Z0
Z1
ZZ
Grupo Mercadoria
(Vazio)
(dummy)
3M
A ELECTRIFICAD...
A.SILVA MATOS
ABAL
ABB ELECTRICA
Data
29-11-2024
06-12-2024
13-12-2024
19-12-2024
31-12-2024
03-01-2025
157.569
#SKUs Totais
3.940
#SKUs Novo
67.278
#SKUs inativos (ZZ)
20.281
Dados Logísticos Completos até UMA 2
258
Dados Logísticos Completos até UMA 3
UMA [2]
19.977
#SKUs com [2] EAN alterado
22.703
#SKUs com [2] Comprimento alterado
22.675
#SKUs com [2] Largura alterada
22.629
#SKUs com [2] Altura alterada
23.418
#SKUs com [2] Peso Bruto alterado
As datas usadas para esta análise são referentes ao dia que foi exportada a tabela de base de dados do SAP. Os valores mostrados no dia 29 de novembro representam a evolução desde o dia 26/04/2024, todos os outros valores são referentes à evolução entre o respetivo dia e o dia da semana anterior que foi exportada a tabela.
#SKUs com EAN [2] alterado por semana
#SKUs com Comprimento [2] alterado por semana
#SKUs com Largura [2] alterada por semana
#SKUs com Altura [2] alterado por semana
#SKUs com Peso Bruto [2] alterado por semana


DASHBOARD | ANÁLISE BASE DASE DADOS | UMA [3]
Hierarquia
000_EIT
001_Instalação
002_Cabos
003_Distribuição
004_Iluminação
005_Automação
Status Material
ATIVOS
Z0
Z1
ZZ
Grupo Mercadoria
(Vazio)
(dummy)
3M
A ELECTRIFICAD...
A.SILVA MATOS
ABAL
ABB ELECTRICA
Data
29-11-2024
06-12-2024
13-12-2024
19-12-2024
31-12-2024
03-01-2025
157.569
#SKUs Totais
3.940
#SKUs Novo
67.278
#SKUs inativos (ZZ)
20.281
Dados Logísticos Completos até UMA 2
258
Dados Logísticos Completos até UMA 3
UMA [3]
10.366
#SKUs com [3] EAN alterado
15.459
#SKUs com [3] Comprimento alterado
15.472
#SKUs com [3] Largura alterada
15.388
#SKUs com [3] Altura alterada
15.654
#SKUs com [3] Peso Bruto alterado
As datas usadas para esta análise são referentes ao dia que foi exportada a tabela de base de dados do SAP. Os valores mostrados no dia 29 de novembro representam a evolução desde o dia 26/04/2024, todos os outros valores são referentes à evolução entre o respetivo dia e o dia da semana anterior que foi exportada a tabela.
#SKUs com EAN [3] alterado por semana
#SKUs com Comprimento [3] alterado por semana
#SKUs com Largura [3] alterada por semana
#SKUs com Altura [3] alterado por semana
#SKUs com Peso Bruto [3] alterado por semana



Annex F: General dashboard of Material Master Data completeness (continuation)

Annex G - Weekly dashboard of Material Master Data completeness progress (Continuation)




DASHBOARD | ANÁLISE BASE DADOS | UMA [2]
Hierarquia
000_EIT
001_Instalação
002_Cabos
003_Distribuição
004_Iluminação
005_Automação
006_Segurança
007_Electrodomésti...
008_AVAC
009_Electromecânica
010_Aquecimen./So...
Status Material
ATIVO
Z0
Z1
ZZ
Grupo de mercadoria
(Vazio)
(dummy)
3M
A ELECTRIFICADORA
A.SILVA MATOS
ABAL
ABB ELECTRICA
156.413
#SKUs Totais
97
#SKUs Novo
853
#SKUs com EAN (UMA 2) alterado
16.956
#SKUs com o EAN preenchido
27.561
#SKUs com [2] UMA preenchida
#SKUs com EAN UMA[2] alterado por hierarquia
515
202
71
30
28
3
2
1
1
005_Automação
008_AVAC
003_Distribuição
010_Aquetiwm./Solar
001_Instalação
002_Cabos
004_Iluminação
006_Segurança
007_Electrodomésti...
#SKUs por UMA[2]
CX
UN
M
SAC
CXT
PAC
KG
CXC
ROL
Material
Texto breve de material
[2] UMA
100001 Z ARMADURA 450 IPC 70W/I VS
100002 Z ARMADURA 450 IPC 70W/I VS
100003 Z ARMADURA 450 IPC 70W/I VS
100004 Z ** ARMADURA 450 IPC 70W/I VS
100005 Z ** ARMADURA 450 IPC 70W/I VS
100006 Z ** ARMADURA 450 IPC 70W/I VS
100007 Z ** ARMADURA 450 IPC 70W/I VS
100008 ABRACADEIRA 101 IRO 11 CR --> 127676
100009 Z ABRACADEIRA 102 CR --> 127677
100011 Z ABRACADEIRA 104 CR --> 127679
100013 Z ABRACADEIRA 106 CR --> 127681
100014 Z ABRACADEIRA 107 CR --> 127682
100015 ABRACADEIRA CLIC 108 M50 CZ
840
#SKUs com [1] Comprimento alterado
844
#SKUs com [1] Largura alterada
843
#SKUs com [1] Altura alterada
845
#SKUs com [1] Peso Bruto alterado
13.887
#SKUs com Dados da UMA [2] completo
#SKUs com Comprimento alterado por família
528
201
65
30
16
005_Automação
008_AVAC
003_Distribuição
010_Aquetiwm./Solar
001_Instalação
#SKUs com Largura alterada por família
532
201
65
30
16
005_Automação
008_AVAC
003_Distribuição
010_Aquetiwm./Solar
001_Instalação
#SKUs com Altura alterada por família
531
201
65
30
16
005_Automação
008_AVAC
003_Distribuição
010_Aquetiwm./Solar
001_Instalação
#SKUs com Peso Bruto alterado por família
533
201
65
30
16
005_Automação
008_AVAC
003_Distribuição
010_Aquetiwm./Solar
001_Instalação


DASHBOARD | ANÁLISE BASE DADOS | UMA [3]
Hierarquia
000_EIT
001_Instalação
002_Cabos
003_Distribuição
004_Iluminação
005_Automação
006_Segurança
007_Electrodomésti...
008_AVAC
009_Electromecânica
010_Aquecimen./So...
Status Material
ATIVO
Z0
Z1
ZZ
Grupo de mercadoria
(Vazio)
(dummy)
3M
A ELECTRIFICADORA
A.SILVA MATOS
ABAL
ABB ELECTRICA
156.413
#SKUs Totais
97
#SKUs Novo
190
#SKUs com EAN (UMA 3) alterado
7.167
#SKUs com o EAN preenchido
15.000
#SKUs com [3] UMA preenchida
#SKUs com EAN UMA[3] alterado por hierarquia
101
51
38
003_Distribuição
005_Automação
001_Instalação
#SKUs por UMA[3]
CXC
PAL
CXT
CX
ROL
PAC
Material
Texto breve de material
[3] UMA
100001 Z ARMADURA 450 IPC 70W/1 VS
100002 Z ARMADURA 450 IPC 70W/1 VS
100003 Z ARMADURA 450 IPC 70W/1 VS
100004 Z ** ARMADURA 450 IPC 70W/1 VS
100005 Z ** ARMADURA 450 IPC 70W/1 VS
100006 Z ** ARMADURA 450 IPC 70W/1 VS
100007 Z ** ARMADURA 450 IPC 70W/1 VS
100008 ABRACADEIRA 101 IRD 11 CR --> 127676
100009 Z ABRACADEIRA 102 CR --> 127677
100010 Z ABRACADEIRA 103 CR --> 127678
100011 Z ABRACADEIRA 104 CR --> 127679
100012 Z ABRACADEIRA 105 CR --> 127680
100013 Z ABRACADEIRA 106 CR --> 127681
189
#SKUs com [1] Comprimento alterado
194
#SKUs com [1] Largura alterada
188
#SKUs com [1] Altura alterada
195
#SKUs com [1] Peso Bruto alterado
5.391
#SKUs com Dados da UMA [3] completo
#SKUs com Comprimento alterado por família
91
67
31
003_Distribuição
005_Automação
001_Instalação
#SKUs com Largura alterada por família
91
72
31
003_Distribuição
005_Automação
001_Instalação
#SKUs com Altura alterada por família
91
66
31
003_Distribuição
005_Automação
001_Instalação
#SKUs com Peso Bruto alterado por família
533
201
65
30
16
005_Automação
008_AVAC
003_Distribuição
010_Aquecimen./Solar
001_Instalação



Annex G: Weekly dashboard of Material Master Data completeness progress (Continuation)