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WHITEPAPER

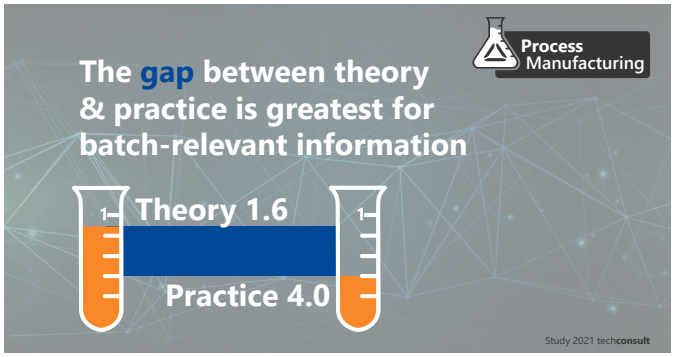
Enter the Future with Reliable Master Data

HOW TO OPTIMIZE PROCEDURES IN THE PROCESS INDUSTRY WITH MASTER DATA MANAGEMENT

Master data management has long been viewed as a laborious task that did not often appear at the top of the agenda. However, mastery of generally valid business data has become essential for anyone intending to realize the potential of digitalization. It is the key to reduced time to market, customer-specific production, and above all to increased sustainability.

INTRODUCTION

Data is often referred to as "the new oil." However, the similarity between crude oil and data lies in the fact that complex refinement processes must be applied to both to make them usable. In practice, it frequently becomes clear that knowledge can only be gained from analyses if the correct data is collected and maintained consistently. This is the basis required to make the right decisions and adhere to legal regulations. Master data management becomes a key necessity across all areas within the company – and beyond.



This is most clearly visible when serious problems occur: for example, if a consumer with allergy issues becomes ill after eating a snack that ostensibly contains no peanuts. The manufacturer should now be able to trace all ingredients used back to individual suppliers and check the product data. If an issue is discovered, all products must be recalled. A recent example: A manufacturer had to issue a complete recall for chocolate-covered raisins in January 2021. A lack of master data management can therefore lead to drastic consequences.

However, numerous factors come together in the chemicals industry, so that simple product data management (PDM) is not sufficient. Some hazards may arise due to the quantities being transported. Temperatures can also have an effect on the risk assessment. It is the logistical information and order data, normally located in the ERP system, that combine with product data to form the corresponding context.

ERP systems are predestined to act as data hubs

At best, the ERP system combines the various areas of development, procurement, warehousing, and production as well as logistics, financial accounting, and service by ensuring that they all work with the same master data. Companies need to consider the general validity of their own master data, at the very latest when implementing or updating an ERP system.

ERP as new integration hub

A position paper from industry association Bitkom frames the role of ERP systems with regard to Industrie 4.0 as follows: "While ERP systems are nowadays responsible for the integration of virtually all functions within a company, the role as the focal point for integration will only be strengthened under the paradigm of Industrie 4.0. As the integration platform, ERP will derive market data, customer information, supplier and product data from the cloud, connecting this with production and logistics data from the manufacturing level and the supply chain. The Internet of Things, where information from the world of machines is collected and aggregated, will thereby become an additional data source."

Making the ERP system the central data hub for the entire organization allows various departments and business processes to access the same data pool. This is increasing in importance as close cooperation between departments becomes ever more essential within the framework of digitalization. Master data management provides the basis for this by ensuring the uniformity, accuracy, and consistency of the pool of master data for a company, while simultaneously mapping the necessary organizational responsibilities. Unfortunately, it requires more than a one-off effort: Master data management is a continuous and strategic challenge. Long-term guarantees are required for safeguarding the reliability of master data, especially in areas dealing with compliance-relevant information.

ERP solutions can provide a uniform, company-wide data model and enable frictionless data exchange, end-to-end processes, and reliable analyses. Nonetheless, extra effort is required to ensure the general validity of the data pool. Survey and hands-on experience prove that this work pays off. There is a whole range of areas in which consistent digitalization of data management can realize considerably shorter processes, as well as improvements in quality and cost savings. These include more efficient creation and use of formulas and a shortened time to market, as well as end-to-end management of hazardous substances and product life cycle management.

Severe difficulties are a regular occurrence when trying to locate data

A survey of 342 companies conducted by the Aberdeen Group reveals that 48% of managers experience difficulties when attempting to access data stored in different departmental silos. However, more than half of the best-in-class companies reporting some steps towards the topic of master data management regard their organizational trust in data as "strong" or "highly effective."

Process manufacturers facing significant challenges

Previously, data was distributed across a number of silos within the company. Many tools are in use, particularly in the development area. Some of the greatest challenges are managing and linking innovation processes with the data in the entire product life cycle. Big data analytics and the use of artificial intelligence increase the chances of discovering substances with new or improved properties. The company-wide aim is also to collect all the information required to minimize development cycles and the time to market – and this amount of information can also be reduced drastically. This term "single source of truth" has become something of a catchphrase and is used to denote the concept of one authoritative source of truth that is the focus for all processes within the company. From the Bitkom perspective, ERP systems represent the leading authority with regard to master data and transaction data for a company, i.e., the single source of truth that combines all the information. They also add semantic context information that can be used to interpret the data.

For many companies, the path to reduced redundancy in data management can be a decisive driver of digital transformation. Dismantling redundancies goes hand-in-hand with a new way of thinking: everything that had previously been stored in independent silos is reduced to one "true" source. In a completely open and consistently digital world, all participants benefit primarily from increased clarity. Experience shows that even micro-businesses can realize major efficiency gains thanks to increasing transparency with the single source of truth.

It is difficult to implement sustainability for products without digitalization and data management. In the future, manufacturers will have to pay even closer attention to customer requirements and intensify cooperation to develop individual solutions for more sustainable products. Data will play a decisive role along this path.

Some of the important aspects:

- Optimization of data access and report creation in the entire company to enable knowledge-based decisions
- Organization of the input of, access to, and collective usage of consistent data from a central source of information for improved process and product quality
- Acceleration of compliant product and process development encompassing everything from research to quality assurance and control

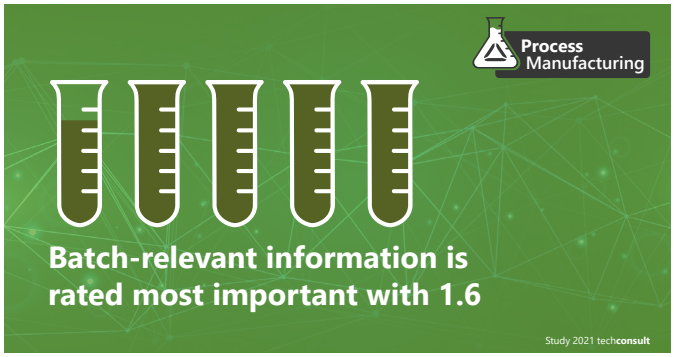
IMPROVE OPERATIONAL EXCELLENCE

Optimize formula management

Manufacturers using batch production rightly expect a high degree of flexibility in their software solutions to allow them to work with an increasingly high level of customization in manufacturing and quickly realize the level of transparency they require in production. To do so, formulators must quickly produce formulas with consistently sound documentation. In the pharma industry, GMP and Part11 directly influence formula development and management with documented change management and approval procedures, for example. The close connection between regulatory and other compliance requirements, as well as master data/formulas, contributes to lean processes.

Manufacturing products with a consistent level of quality is a daily challenge for the process industry – the composition or behavior of raw materials can change on a regular basis. The difference between this and discrete manufacturing is that numerous variable factors must be taken into account, including the quality of raw materials, shelf life and mixing ratios, or process parameters such as temperature and humidity. By-products subject to further processing and manufacture, or hazardous waste materials requiring special disposal treatment, also occur. Meeting these complex requirements demands business software that has been developed specifically for formula-based manufacturing.

In this case, master data management means ensuring that all formula-related information is integrated in formulation management. This includes quality and specification data, information about hazardous substances, manufacturing components, and complete documentation. Formula protection must also employ a comprehensive authorization concept to permit company-specific characteristics. Avoiding redundancies is a key factor.



The quality of raw materials is a good example of the necessity of connecting business and process data. The quality or properties of raw materials often differs from batch to batch. Successful manufacturers are the ones that overcome complex hurdles, such as variances in batch quality, to reliably meet customer specifications. In particular, natural raw materials must be standardized and homogenized in each process step – nowhere more so than in the pharma industry, where any deviation can lead to immediate recalls and official intervention. That can have wide-ranging effects as severe as suspension of the manufacturing permit or drug approval.

We all realize that Industrie 4.0 sees us entering a new era of digitalization. An example from paints and coatings manufacturing: In addition to traditional integration of colorimetry in ERP, automation in coating manufacturing can be enhanced when configuring the approach, for example. Knowledge gained from analysis of each batch can be included immediately in the manufacturing process for configuration and deliver the correction formula to ERP. This level of connectivity and automation is unthinkable without reliable data management.

Accelerate product development

Many manufacturers are increasingly reliant on innovation to stay ahead of the competition. Ever shorter life cycles characterize the market in a wide range of areas. In short: The ability to get a product to market quickly will be decisive in terms of success. The use of digital solutions in product development contributes to the connections between heightened levels of innovation and efficiency – especially when data requires management across organizations. Ultimately, information in the process industry is often much more complex than in discrete manufacturing. More detailed specifications are required in formula development. These can refer to substances, packaging materials, packaging, packaging groups – or the primary specifications in the form of the developed formulas. The various properties required are created on the next level within the specification – such as nutritional and quantitative composition or energetic values. Formula developers must also work in accordance with valid documentation and quality guidelines – all processes must be provided with information about this.

Some factors exert a particularly strong influence on the productivity of formulators: Less time required for documentation means a faster development process. Using existing, experimental data also contributes to time savings and making better decisions. Without an overall solution, time can easily be lost when searching for information that may have to be patched together from locally-stored spreadsheets. In practice, a substantial proportion of these losses could be avoided with overarching data management: It is not necessary to reinvent the wheel each time.

The availability of a larger amount of information about the entire life cycle of a product for all participants increases the potential for further digitalization correspondingly. If individual consumers or departments want to find out in advance about changes to an ingredient, the system should be able to provide this updated information immediately. The next step is the automation of routine tasks. This means that a status change in formula management leads directly to the generation of the manufacturing bill of materials, for example.

Batch-based manufacturing and optimized processes for by-products

Production in batches poses its own challenges to the ERP system. The areas where by-products occur require specific, adjustable processes based on master data. Raw milk represents a typical example from the foodstuffs industry: The processing chain results in milk for retail and pasteurized products like cream or butter, as well as whey, which can be used in the production of more valuable products, such as fitness supplements.

An ERP system aligned with process manufacturing is decisive, particularly in the by-products environment. The master data must contain a generally valid definition of which additional products can be extracted and what needs to be done in the process for these extra products. During formula development, the system checks the effects of various compositions and proportions on the product yield. Cost estimates are bolstered by current prices for raw materials from the materials management system and by initial pricing assumptions for test raw materials.

Coherent, up-to-date pricing

Transparent preliminary calculation and product cost analysis are required to provide information quickly – primarily in relation to the ideal batch size in each production process or scenario. The requirement: the first kilo from a homogeneous order quantity receives the same price as the final kilo. An end-to-end concept supports companies from the very idea as they pursue the topic of costs in parallel, allowing marketability to be defined as early as possible. Cost controlling also needs to take place as a continuous parallel process in the form of simultaneous costing. Specific offers for initial order queries are enabled on this basis. Further knowledge gained from order processing is then absorbed into the data pool, which also maps changing prices for raw materials. Cost calculation does not finish, but is continuously refined with new learning processes and experiences, such as disruptions in the production process or the availability of raw materials.

Poor data quality costs money

Poor data quality hits companies where it hurts: this is the conclusion drawn by the Data Quality Market Survey from Gartner Research. On average, data quality deficiencies cost companies 13.5 million euros each year. The market analysts also concluded that digital initiatives are undermined, competitiveness is weakened, and mistrust is engendered as a consequence of this. Income from new, digital business models can only be realized with the right level of data quality.

MASTER DATA MANAGEMENT FOR COMPLIANCE AND SUSTAINABILITY

Automated compliance for hazardous materials and substances

In all areas that focus on data for hazardous materials and substances, the need for end-to-end, transparent, and easily available information is at the crux of the matter. The limitations of data silos or Excel files quickly become clear and represent a commercial risk. Particularly in the chemical industry, there are many substances that count as hazardous: Their contents must be declared and information must be provided about how to handle them. Different regulations also apply in different countries – for example, it can be illegal to use specific substances in some countries. In this respect, the customer is totally reliant on the reliability of the manufacturer: Correct information alone allows the customer to assess which notes to take into account during processing and which health and safety regulations must be selected – such as respiratory masks or gloves. This data is also essential for appropriate disposal.

A spirits producer must also comply with statutory regulations when shipping alcohol, as larger quantities of this are viewed as hazardous. The hazardous nature of many substances is measured by quantity, mode of transport, or temperature.

Process manufacturers must contend with a variety of legal regulations in this regard. That is why integrated management of hazardous materials is essential. For example, it can also be possible to generate the data for the safety data sheet automatically for a sales order or transport processing as well. This data allows transport options consisting partly or fully of hazardous materials to be structured efficiently. Starting from the sales order, for example, you can determine whether a transport must be categorized as 'transport of hazardous materials' or whether minimum-quantity exceptions or exempt quantities (the '1000 point rule') allow normal, cheaper transportation. A uniform data basis and end-to-end processes for (hazardous) materials management are also useful when exchanging test results and analysis certificates, and when ensuring that suppliers of raw materials adhere to agreed quality levels.

Driven by sustainability

Commercial and economic fluctuations, which are themselves caused by the often severe fluctuations in the prices of raw materials, are just some of the challenges posed in product planning and pricing. The costs for energy and water are also rising all the time – with an increased focus on sustainability, the issue will only become more acute in years to come.

Legal requirements mean that the concept of the circular economy is set to prevail in more and more areas, which will involve increased effort and costs but will also bring competitive advantages for companies that have set their systems up to deal with these topics. An end-to-end platform is the best way to meet all these challenges. It must combine all areas from procurement, warehousing, and production processing to shipping, covering the complete product life cycle.

Particularly in the plastics sector, many providers take increasing care to ensure that products can be recycled or are even biodegradable. We are seeing a clear trend towards manufacturers assuming more responsibility and structuring their products to ensure that they have no negative effect on the environment. Within plastic production, the regranulation process generates waste that is still suitable for further processing. Waste or sprue is often ground, then "fresh" plastic is added before returning it to the manufacturing process. The need to achieve a consistent level of quality is a hurdle that is particularly complex to overcome when using natural raw materials such as polymers. Master data also plays a part here, as it can specify in advance which prerequisites apply to allow recyclates to be incorporated in a product – if only 5% of recyclate is permitted in the overall composition, for example. This requires a large amount of master data, which determines the context of a product and the associated specifications. That also applies for each customer-related article and all suppliers.

Product life cycle management and product stewardship

Product responsibility for manufacturers now extends beyond value creation in the procurement of raw materials to delivery to the customer and covers the entire life cycle – an approach that is known as product stewardship. All information about handling products and dealing with their disposal is publicly available. This includes safety data sheets and technical bulletins in multiple languages on the manufacturer website. It is not uncommon for companies to advise their customers at all levels within the life cycle. This covers the selection of raw materials, dealing with potential toxicological, ecotoxicological, or physical-chemical hazards and the resulting risks, taking expansion into account. Consulting services cover regulatory requirements for planned usage, as well as transport and disposal. Specific usage patterns can be restricted as necessary, and bans on usage can be issued for individual products under extreme circumstances. What this means with regard to digitalization: All information published – on the Web portal, specialist forums, in digital form for public bodies, customers and, with increasing frequency, for consumers as well – must always be up-to-date and correct. A reliable, generally valid data pool is the basis for this, the single source of truth that is used to distribute the organized information to the appropriate channels.

At a regulatory level, the REACH directive from the EU applies here. This requires the registration of all chemical substances manufactured in the EU, imported into the EU, or brought to market there at one tonne or more per year. To allow early determination of whether substances may be subject to restrictions, manufacturers continually compare their portfolios with official published lists of substances. If this is the case, suitable measures must be agreed upon and next steps must be coordinated with the customer.

Avoid these typical mistakes with master data management:

- Duplicate or incomplete master data from various sources/silos
- Faulty data due to incorrect manual entry
- Use of inconsistent, bad data in a range of processes

REACH A HIGH LEVEL OF DATA QUALITY

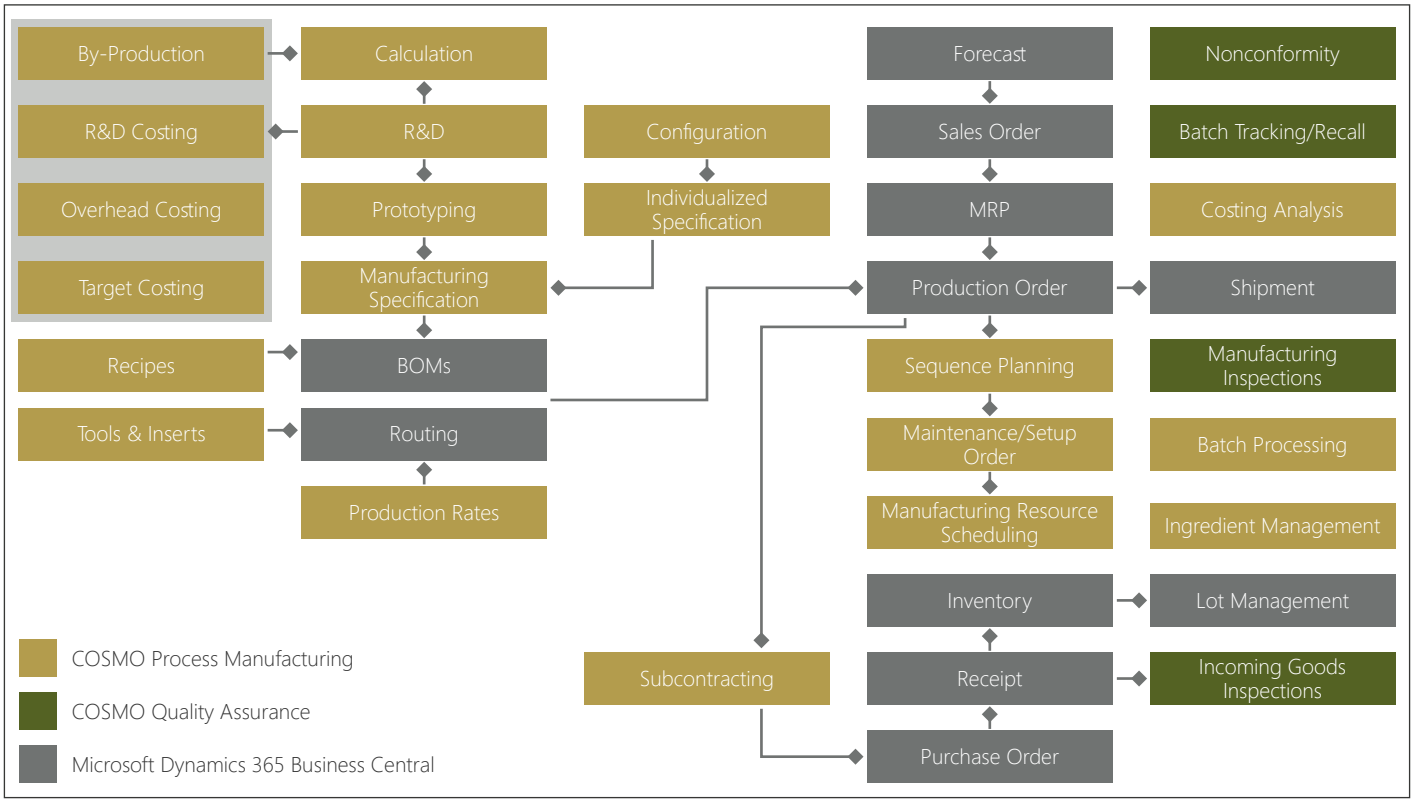
All for nothing without master data quality

Master data management focuses on defining and maintaining generally valid data. However, that alone is not sufficient, as shown time and again by many SMEs. Confusing structures often build up over time, with people entering data although they can sometimes no longer interpret the meaning of the data fields. For example, fields may have been added for a workaround years ago. These are still being maintained even though new features or processes have rendered them redundant. The fundamental conclusion: master data shares many properties with volatile address data. Many things happen around master data that are not spotted at first glance.

This must therefore be dealt with to reach a continual level of general validity within master data. The data must be reliable over a period of time and provide information that is expected of it later in the process. That is especially easy to understand in the area of formulas: It is not possible to work with an ambiguous formula. The overview of master data goes beyond the limits of the ERP system. There are other data pools within the company that must also be involved.

A clear view: Well-structured master data

Some factors can significantly simplify the topic of master data management for small and mid-size businesses. Of course, it is helpful if the initial data model has not already been inflated to a huge size to allow all conceivable situations to be covered: this leaves users unable to see the wood for the trees. Instead, lean models such as the ones in Microsoft Dynamics 365 Business Central help you to stay on top of things. Extensions to the standard are covered by extra software packages suited to each task, which can be integrated into the ERP system as industry solutions.



SMEs derive greater benefits from lean systems, enhanced with the relevant required components, than from solutions boasting endless parameterization options. They add agility to process automation and enable useful, individual processes.

How the ideal real-life scenario could look

A modular structure like the one in the example is especially important to maximize agility at various points in the process. Wherever people work with formulas, it is worth taking into account customer requirements and all relevant topics subject to statutory regulation, as well as formula-related data for quality assurance. Right from the beginning in the laboratory, when creating samples and tiny amounts, all the data about the correct quantities, components, compositions, or the ideal mixing speed or temperature, must be recorded. Calculation must take place in parallel: from the initial design to release and then during operation.

This is the only way to continually verify the formula from the cost perspective: Costs are an accompanying aspect, alongside specification, feasibility, or compliance. Any missing information can be provided later for pilot runs and sample manufacturing in the production facility. The software saves the entered formulas in the background and uses these to generate bills of material and work plans for batch-based processes as well as for process steps. Employees often perform multiple steps within a production order. However, mid-size companies often want to avoid the time-consuming task of registering each step individually: therefore, it is vital not to have to separate the batches from the subsequent discrete manufacturing steps.

Once something has been defined, there is no reason to repeat that step

Complete documentation of the product history is created implicitly in this way, from the first laboratory task to series production maturity. Integrated management of hazardous materials is applied to all processes in parallel, meaning that it is possible to assess in the laboratory which parameters and associated legal areas the product will entail – such as impacts on the water table or effects on the mucous membrane. During development, it is possible to estimate the potential consequences of road transport, or relevant sustainability-related aspects, from the laboratory. Data and forms also need to be automatically available in the local languages to allow their use in approval processes and for transportation.

Master data management must be simplified

Master data management succeeds when digital support facilitates and simplifies the master data management process. In modern business solutions, the term "intelligent assistants" refers to the increasing use of machine learning algorithms that relieve the user of laborious data management tasks and increase data quality. An example of this is an intelligent assistant that checks manual input in the ERP system and then examines numerical values to see whether the data input corresponds to the usual range of values for this field. Intelligent duplicate matching and semantic search solutions play a useful role here. An assistant like this can also prepopulate fields based on its own "knowledge" – users simply have to approve proposals that they agree with. A template can be used and adjusted when creating certain raw materials, for example. Templates requiring additions or corrections can also be employed in formula management.

AI supports innovation

The combination of master data and AI also supports innovation processes. Intelligent comparison with the history of all formulas that have been developed, and the experience gained from these, lays the foundation for the derivation of new formulas. AI can predict optimal formulas, based on neural networks and deep learning. In the case of a new, customer-specific requirement for product properties, it would then be possible to search the history intelligently for a similar or comparable formula and make a recommendation, which is then submitted to experts for further qualification.

CONCLUSION

The process industry can benefit from digitalization and new technology, especially with a view to increasing resource efficiency at all levels in the value chain, or prolonging the service life of products and components. However, this is predicated upon a willingness to face up to the topics of master data management and the single source of truth. This requires people to challenge cultural aspects, such as the traditional way of thinking in silos, and to streamline, standardize, and connect data models and sources.

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Torsten Harnack is the industry manager responsible for process manufacturing and the further development of our solutions.

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