

Process Mining in SAP Extended Warehouse Management (EWM)

Boost your warehouse process performance by identifying the root cause of bottlenecks and rework rates based on SAP warehousing solutions and process mining.

Warehouse management systems like SAP Extended Warehouse Management (EWM) and Warehouse Management (WM) support companies with all warehouse processes around inventory management and the movement of goods.

Every day, your SAP software gathers tons of new and very useful information about your processes. You can show most of the transactional data generated by your warehouse processes on the

Warehouse Management Monitor in EWM, a powerful tool for steering operations in daily business. However, if you need analysis across warehouses or insight into performance issues, bottlenecks, or rework activities within your warehouse/s, process mining offers the perfect as-is comparison. This can serve as a basis for optimizing existing processes and lay a fact-based foundation for business transformation projects and SAP S/4HANA implementations.

In this paper, we will give you an overview over how process mining is structured and how our ready-to-use process mining data model, which includes pre-defined dashboards, can generate benefits for you immediately. ➤

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Warehouse management

The primary function of a warehouse is stock management. In any business, the stock overview helps to analyze and keep track of demand and supply. A warehouse management system (WMS) therefore supports resource planning and efficient material requirement planning for both simple and complex processes. To deal with the challenges presented by these processes, along with process digitalization and a better overview of warehouse activities, SAP launched SAP ERP Warehouse Management (WM) in 1993. SAP then developed and released a new WMS in 2005, SAP Extended Warehouse Management (EWM), to provide more flexibility within warehouse structures and processes and to manage more complex warehouses, e.g. those with automated material handling equipment. SAP’s EWM is currently one of the market leaders in warehouse management software, according to Gartner’s 2020 Magic Quadrant¹. With the launch of SAP S/4HANA, SAP has also announced that support for SAP EWM’s predecessor,

SAP WM, will end in 2027². This provides existing SAP WM and new SAP customers with a strong incentive to deploy SAP EWM as their one and only WMS in the coming years. SAP EWM has the ability to run both embedded in SAP S/4HANA and as a stand-alone instance, providing more flexibility to its customers.

The digitalization of all business processes, including those around warehouses, and the general trend towards Industry 4.0, has given companies an enormous database of valuable information with which to analyze processes and businesses. SAP offers a wide range of tools for this as standard. Nevertheless, in the area of warehouse management, their focus is primarily on daily order handling and warehouse processes. Actual process flows are not included, nor how these differ from expected or designed processes. In times when logistics constitute an essential part of the business, costs can be saved by avoiding rework and making logistics execution processes more efficient.

Fig. 1 - Business benefits



Transparency about warehouse processes and their flows



Reduce rework activities up to 30% and avoid losing time and money



Cross-warehouse process analysis, increase productivity up to 10%



Identify internal best practice based on benchmarking



Analyze bottlenecks within your warehouse

¹ Klappich, C., & Tunstall, S. (2020). Magic Quadrant for Warehouse Management Systems. Gartner Inc.

² SAP Support, „Extended Innovation Commitment for SAP S/4HANA“ (2020) <https://support.sap.com/en/release-upgrade-maintenance/maintenance-information/maintenance-strategy/s4hana-business-suite7.html>

Process Mining

The ever-growing complexity of business operations poses tremendous challenges for process transparency. Anxious for a competitive edge in the digital age, many companies conduct process optimization and transformation without even having a clear picture of the current state. This often leads to the wrong strategies and high costs of failure. Process mining is a new analytics discipline that uses the digital footprints of IT systems (e.g. activity timestamps) to reconstruct end-to-end business processes.

The Deloitte Center for Process Bionics uses process mining technologies to help clients create full transparency of their business processes. This includes process visualizations, conformity checks, and root-cause analyses. Furthermore, transactional data and master data is brought together with process data to create a 360-degree view for monitoring business operations from every angle. This enables the identification of potential problems before they cause damage and increases productivity by up to 10 percent, ultimately establishing a higher level of process excellence.

Extracting process data

Process reconstruction is based on three key data components:

- Case identifiers
- Events
- Timestamps

The case identifier represents a single instance of a process, which could be the sales order number that is the basis for an SAP EWM outbound process, for example. The identifier connects all relevant activities as well as master data to the process. Every case consists of a number of events that show what is happening within the process. These events can be read from the log files of IT systems like SAP EWM, where all case-related activities are saved, and used to recreate the process on a very detailed level. Examples of activities in the outbound process are "Outbound Delivery Created" or "Loading Started".

The final component that is necessary for process mining is timestamps of the events. They place process events in the correct order and allow an analysis of throughput time between certain activities. With this information, process bottlenecks which are a major root cause of inefficiency, can be identified easily.

To establish process mining, it is necessary to have these process traces in the form of data in your systems. The first step in any process mining project is therefore to identify all relevant data records from one or more source systems. In the second step, these are transferred from the source systems to an analysis environment, such as a data warehouse or data lake.

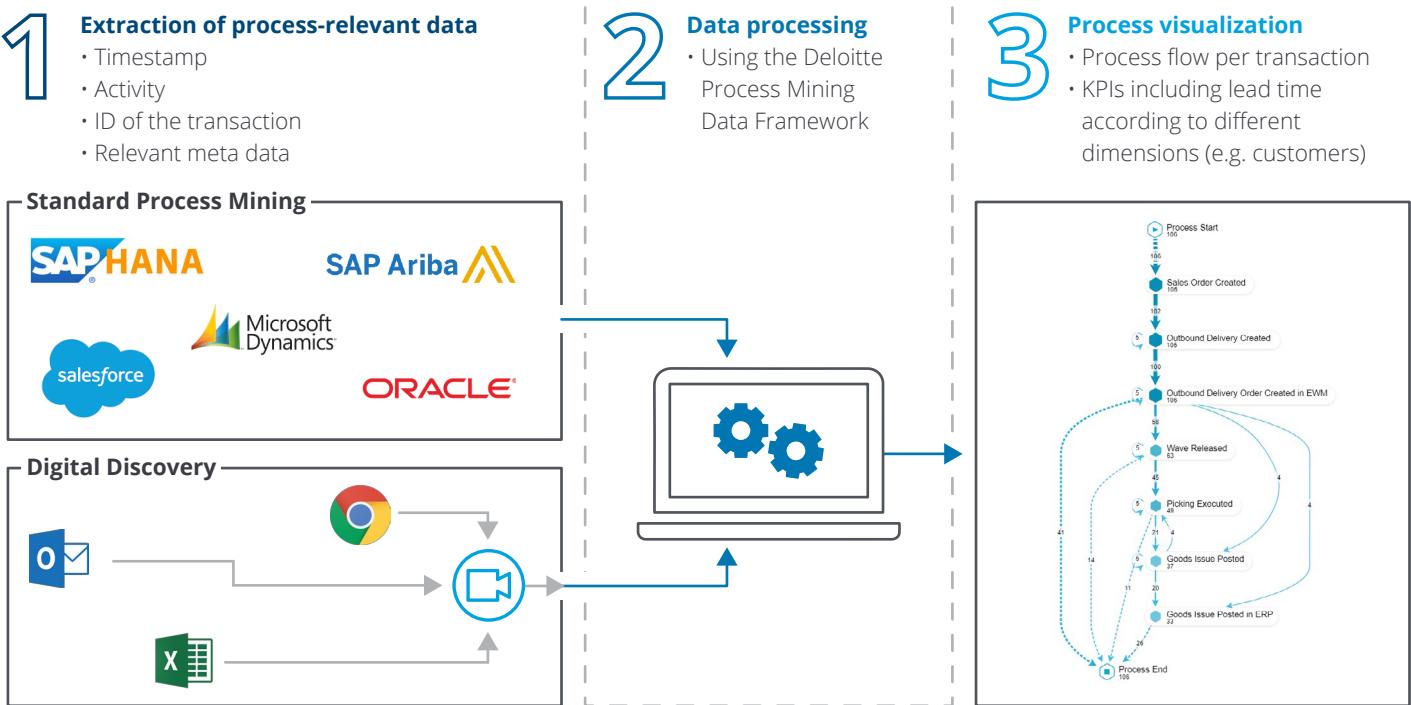
Once all raw data is available for analysis, project cases and events can be extracted into the new process mining data model. This is done by querying event-related tables for timestamps that are connected to the case identifier. For example, the event "Outbound Delivery Order Quantity Changed" can be retrieved from the changelog by querying records where the corresponding field in the order item table has changed. The timestamp of the change activity is then used as the timestamp for the process event. Furthermore, BI (Business Intelligence) tables are integrated into the data model as well; these consist of master data and transactions and are mapped to process instances. This allows analysis of the process in all its related dimensions and Key Process Indicators (KPIs), such as packaging material or order volume. This end-to-end data processing pipeline is managed by the Deloitte Process Mining Framework.

The resulting process data model can be integrated into a large number of process mining applications to visualize the process. Use cases range from the usual savings of working materials and time, to reductions in wait times, waste and rework, a decrease in tied-up capital, the identification and prevention of compliance violations, the harmonization and simplification of process flows, and continuous reporting of processes. A distinction is typically made between explorative and hypothesis-based analysis dashboards.

"The Deloitte Center for Process Bionics uses process mining technologies to help clients create full transparency of their business processes."

Process Mining in SAP Extended Warehouse Management (EWM)

Fig. 2 – Process mining pipeline



Our service offering

The transactional data in SAP EWM is used for monitoring and analyzing historic and ongoing warehouse activities. It therefore represents a valuable basis for decision-making in day-to-day warehousing operations. Nevertheless, some valuable insights regarding performance issues, bottlenecks, and rework activities are not directly visible in the system. It is possible, with some add-ons, to introduce new monitoring ‘nodes’ for looking at existing data from new points of view. Unfortunately, this can be a time-consuming and frustrating RFC (SAP interface for communication) process for the business. This is why the idea of applying process mining based on SAP S/4HANA and SAP EWM transactional data was born.

Data Processing

Based on SAP transactional data, we have generated data models for the three core processes of SAP EWM: inbound, outbound, and internal production processes. These predefined data models serve as foundation for client-specific projects and provide immediate benefits. Transactional data originating from SAP

modules as well as non-SAP systems can easily be integrated in existing data models. Examples of other data sources include transportation management, yard management and production planning and execution software.

Implementing cross-system process models and feeding them from several sources requires global keys that link different systems; this prevents overlaps and associated conflicts during processing and subsequent analysis. We use the Deloitte Process Mining framework to meet this challenge. This platform provides many mechanisms in a modular design to manage and structure process-related data across system boundaries. As an integral component, it successively establishes a naming structure that spans all processes and systems, so that new process mining models can be integrated faster and with greater stability.

For SAP EWM, our team of experts has already realized the foundation for an easily implemented service. It uses warehouse process-related building blocks based on the most common SAP LE and SAP EWM activities and uses these to immediately

generate added value for our clients. The extent of the enhancements is based on the system set-up and any deviations from standard fields and tables.

Event data

As explained in the process mining section, events are used to track the activities of a business object in the system as they happen at a certain point in time. For this purpose, we extract a combination of case identifiers, warehouse-related events, and timestamps from the source system to build up process flows and provide insights into the duration, sequence, and regularity of these activities.

To speed up future implementation processes, we predefined a large number of events for different warehouse processes, based on SAP standard and best practice processes from several industries. In cooperation with clients, we can include additional events and metadata that describes the entities belonging to the process in detail. It is also possible to take customer specific (Z-) tables and fields into account.

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Process visualization

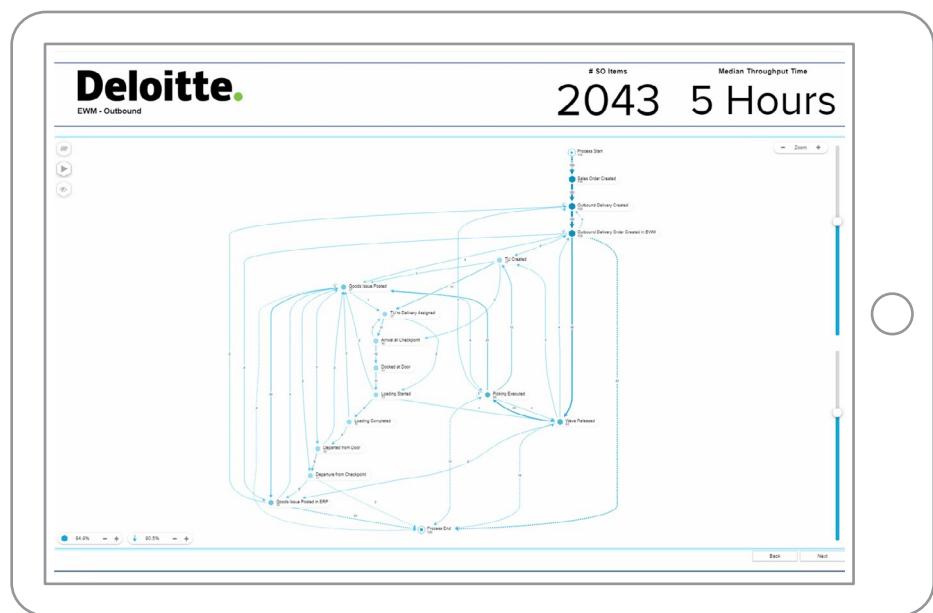
The event data gathered from the system is combined with metadata from order documents and displayed in customizable dashboards. We are then able to monitor end-to-end-processes, identify critical deviations, and tackle future risks in logistics processes. Each dashboard focusses on a specific KPI and has its own focus, which can be further narrowed down with selection criteria such as time windows, warehouse numbers, or material groups.

Understanding processes

The process overview (see figure 3) helps analyze processes and gain insight into rework activities such as repacking, as well as other deviating process sequences in inbound or outbound processes. In the case of SAP EWM, it is particularly beneficial to analyze process flows from multiple orders over a certain period in time in one overview. This helps identify irregularities and deviations from the expected process sequence.

“We are able to monitor end-to-end-processes, identify critical deviations, and tackle future risks in logistics processes.”

Fig. 3 – Process overview dashboard



Identifying internal best practices

The benchmarking dashboard (see figure 4) provides detailed insights into all processes and variants with extensive customization options for benchmarking comparisons. It allows users to compare process performance and throughput time, e.g. broken down by customer, material number, or carrier on a cross-warehouse basis.

Fig. 4 – Benchmarking dashboard

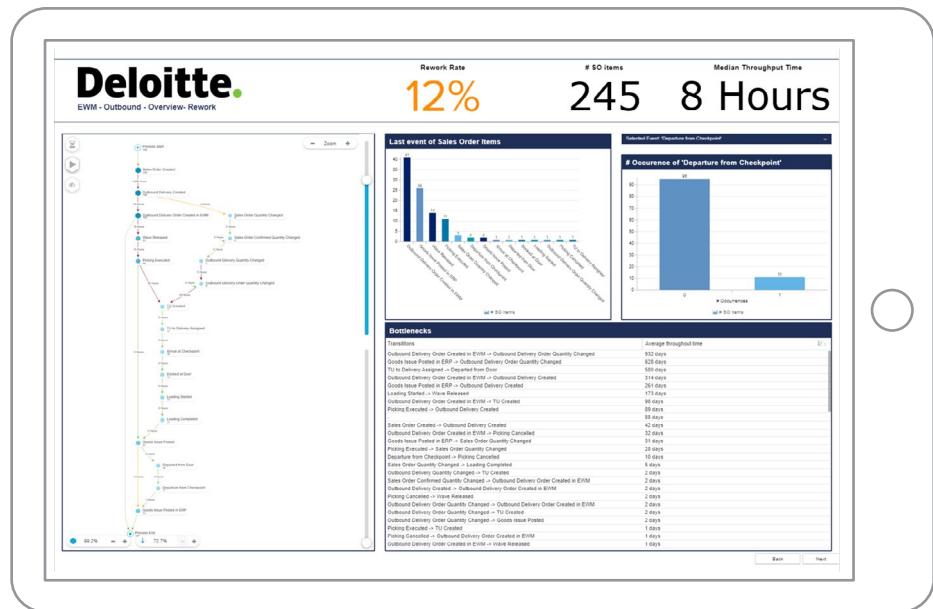


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Avoiding rework

The rework dashboard (see figure 5) analyzes processes and supports warehouses with insight into the rate of activity occurrence or rework, e.g. in picking, packing, and staging activities. Different selection criteria allow users to focus on specific tasks or task sequences. Every time a warehouse activity is repeated, it costs time and therefore money; identifying avoidable rework thus unlocks cost saving opportunities.

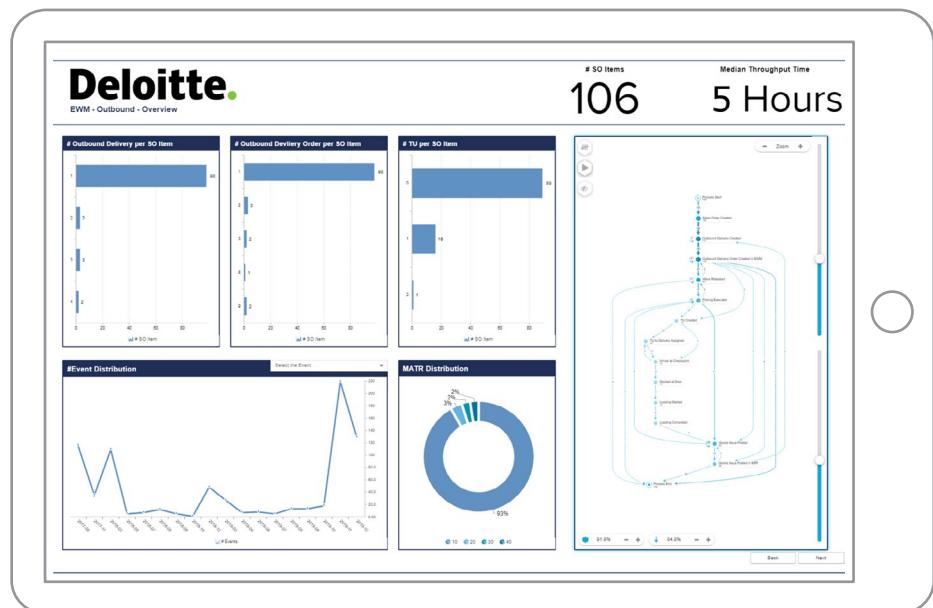
Fig. 5 – Rework dashboard



Analyzing bottlenecks

The bottleneck dashboard (see figure 6) allows users to explore areas where work is delayed and identify the causes of bottlenecks. The aim of this dashboard is to get work flowing through every workstation at a steadier pace. For example, if some trucks occupy loading docks for longer than expected, this information can be cross-referenced with available metadata to identify correlations with certain carriers or material groups.

Fig. 6 – Bottleneck dashboard



Infrastructure

As an alternative to installing the ready-made process mining solution on-premise, you can benefit from process mining as a Service (PMaaS). The Deloitte Process Bionics Platform is a fully managed cloud solution for process mining that gives access from a worldwide repository of proven process mining dashboards and data models, as well as different process mining software solutions. As a fully managed service, the Process Bionics platform allows you to focus on creating value rather than on technical details. It is instantly available for use, and due to its flexible and scalable cloud approach, it fits perfectly for your organization's needs. It can also be adapted along your process mining journey. By only paying for the components you actually use, the transparent licensing model gives you full control over costs.

Process Excellence

Using data- and fact-based insights from top-down and bottom-up perspectives on your SAP EWM processes, we can help you define the right process optimization measures to tackle process bottlenecks or support your digitalization strategy. Together with our business and industry experts, we help you realize the impact in terms of operational efficiency, cost savings and compliance.

Alongside implementing optimization measures, we train your functional teams to use the process analyses and control dashboards to track your process optimization results. In that way, we help your organization to continuously challenge and improve daily business operations.

Our agile service offering provides you with an easy start on your process excellence journey, step by step:

- **Proof of Value**

provides a thorough understanding of the vast potential of process mining based on your own data. Quick prototyping of one process by leveraging standardized building blocks and hands-on workshops with our process mining and logistics process experts offer first insights into hidden optimization potentials.

- **Process Diagnostics**

yields highly quantified and actionable improvement measures targeted at substantial impact and a rapid return. This is achieved with deep-dive analytics on processes and associated behaviors across system boundaries. Combined with our lean and industry expertise, we create best-in-class process landscapes.

- **Continuous Evolution**

embeds process mining into the DNA of your organization to ensure holistic and continuous process optimization. The integration of process mining analysis blueprints into the corporate core and a dedicated governance structure for process excellence preserve competitive advantages. A comprehensive training strategy for key practitioners and lean experts results in sustainable impact.

Conclusion

Process mining is a state-of-the-art analytical discipline that uses process data from IT systems to reconstruct actual processes on a transactional level. It offers the perfect as-is comparison to serve as a basis for optimizing existing processes and lays a fact-based foundation for business transformation projects and SAP S/4HANA implementations. Process mining offers companies full transparency of their SAP logistics execution processes, generating knowledge that feeds into warehouse process optimization measures and is the starting point for continuous operational excellence.

It provides a real-time insight into the warehouse activities and how these are influenced by rework activities and process bottlenecks such as repacking activities, picking changes and door occupation. By identifying bottlenecks and rework, users are able to eliminate risks and unnecessary costs, thereby improving their processes and making them more efficient.

Our team of experienced data scientists, SAP logistics execution experts, and business process consultants will seamlessly implement the process mining tools for analyzing processes in SAP warehousing solutions. The ready-to-use process mining data model includes pre-defined dashboards and is the foundation for kick-starting implementation projects and immediately generating benefits for you as our client.

We want to help you boost your warehouse process performance by identifying the root cause of bottlenecks and rework rates based on SAP warehousing solutions and process mining. Please feel free to contact our team if you have any questions or are interested in a showcase of our service offering for your company.

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