

Process Mining for Business Process Standardization in ERP Implementation Projects – An SAP S/4 HANA Case Study from Manufacturing

Industry Paper

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Abstract. Organizations increasingly build operations on enterprise resource planning (ERP) systems. However, ERP implementation projects require significant process transformation and standardization to successfully use ERP systems. This article presents a case study in a manufacturing corporation to demonstrate how process mining can be used for process decision-making in an SAP S/4 HANA implementation project. In particular, the corporation implements process mining for the analysis of the SAP purchase-to-pay (“Purchasing”) and the order-to-cash (“Sales”) processes to determine whether the future to-be process should be standardized according to ERP standards, or to be individualized in a corporate-specific template. Further, process mining can be used to select suitable standard process specifications from the SAP Best Practices Explorer, as well as to analyze the required process changes before the launch of the new ERP system and process implementations.

Keywords: Process Mining, Process Standardization, ERP Implementation Projects, SAP S/4 HANA

1 Introduction

Organizations increasingly utilize information systems such as Enterprise Resource Planning (ERP) to support operations [1], and abundant practical experiences and academic contributions reveal significant potential of ERP systems for business process improvement and reengineering [2]–[4].

ERP systems are commercial information systems for the automation and integration of organizational business processes [5] to obtain a holistic overview of the companies [6]. Organizations implement ERP systems to integrate and consolidate information, geographically [7] or functionally separate units [8], [9]. ERP systems enable companies to streamline business processes and exchange information efficiently and effectively both within and across company boundaries [10]. Implementation goals range from reducing costs [9], increasing the overall organizational performance [11],

enabling new business models [11] to reengineering business processes in response to environmental changes [12]. Further, ERP systems enable the integration and standardization of business processes by implementing them in a common underlying architecture [7].

However, implementation projects of ERP systems are frequently considered as failures (e.g., [13]). Although the figures vary considerably, practitioners classify implementation projects in twenty-one [14] to seventy-five percent of cases [15] as failed. Even though both practitioners and academics have focused on researching ERP implementation projects, the overall success rate of ERP implementation projects remains considerably low [16] due to the inherent complexity, resource intensity in terms of required financial investment, time, management challenges, risks or number of employees involved (e.g., [8], [9]).

In particular, research finds business process transformation and reengineering activities as necessary prerequisites before the actual ERP implementation [17]–[20]. To contribute to the outlined problems in ERP implementations, this industry paper therefore proposes to use process mining for transformation decision-making. Process mining is a technique for the discovery, monitoring, and the improvement of business processes through the extraction of process knowledge from event log data in information systems [21]. Meanwhile, process mining reached a state of maturity with numerous different solutions such as Celonis, Fluxicon, Lana Labs, QPR, or Signavio available in the market [22], the “post-mining” phase which is concerned with translating findings from process mining into actual decisions remains both a research gap as well as a significant challenge for organizations. In particular, process mining supports decision-making by allowing data-driven analyses of business processes, and to reduce the resources required for projects.

Thus, this paper demonstrates in the context of a large-scale SAP S/4 HANA ERP implementation project in a manufacturing corporation how process mining can be utilized to standardize business process across several companies. In particular, by applying process mining in the SAP S/4 HANA project to select suitable standard processes and to discover business-essential process variants which need to be implemented in the future process design in the new ERP system, this paper delivers an example of how process mining can effectively support process decision-making.

2 Project Background

To explore how process mining can be used in ERP implementation projects, an industry cooperation with the IT service provider of a German small to medium-sized manufacturing corporation was formed to conduct the research in a real-life ERP implementation project. In 2017, the manufacturing corporation consisted of five companies operating globally with more than 8.200 employees and about 1,2bn Euro in turnover in 22 countries.

In the course of the standardization project, the group of companies wants to harmonize the existing, diversified SAP R/3 landscape to a uniform landscape under SAP S/4 HANA in order to support the goal of process standardization with an ERP plat-

form. The aim of the project is to develop a holistic approach for the introduction and use of the new SAP software for the entire group of companies, which standardizes as many processes as possible, provided this is economically and organizationally possible. At the same time, the project also regards the trade-off between standardization and business-critical individualization for the individual companies, and allows for individual non-standard process designs if these are decisive for business success.

Fig. 1 illustrates the standardization-individualization framework. At the one end of the spectrum, processes suitable for corporate-wide standardization such as administrative, support or service functions are located in a “shared services” sphere without any deviations from the corporate standard. At the other end, business-essential processes such as the production of individual products or sales processes which are part of the individual “DNA” of a company and which may not be standardized are located in the individualization sphere. In between, processes which are neither suitable for full standardization, but which offer the potential for some degree of harmonization are located in the mid between standardization and individualization.

In particular, when making transformation decisions on standardization or individualization, the question arises as to where this makes economic sense and does not jeopardize competitiveness. Process Mining helps the process owners to identify necessary process variants and to consider them as an allowed deviation from the standard process specification when designing the future process design.

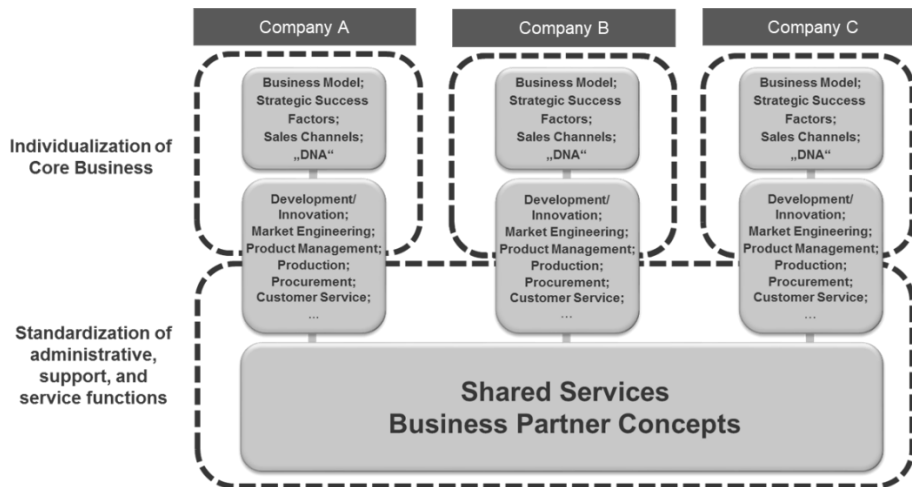


Fig. 1. Process Standardization vs. Individualization across Companies in the new ERP System

Thus, the process mining approach supports the corporation in the endeavor as it provides an analysis of whether business processes contain variants critical for business success which need to be reflected in the future standard process specification in the S/4 HANA Business Suite. Further, process mining needs to provide detailed comparisons of the individual process specifications between the different companies, as well as to provide performance indicators to compare which process specifications achieves the best result and should be taken as the future corporate standard in the

SAP S/4 HANA landscape. In addition, the ERP vendor provides different possible standard specifications for the S/4 HANA system.

Therefore, the process mining solution further needs to allow to compare business processes and their variants against the different standard specifications to decide which standard is a candidate for implementation, to implement required deviations from the standard, and to estimate changes and impacts on the organizations.

However, due to limited IT budgets and the inability to implement all business processes in a process mining solution, the question of which business processes are suitable candidate processes for implementation becomes crucial. Thus, we implemented the decision support system “KeyPro” in the SAP ERP systems of the corporation. “KeyPro” provides analyses of log data and matches ERP transactions to business processes to automatically discover important processes along several importance dimensions such as the number of executions, process stakeholders, the involvement of customers or suppliers in the process, or the process being classified as a primary or secondary business process [23]. As a result of the KeyPro analysis, the SAP order-to-cash (“Sales”) and the purchase-to-pay (“Purchasing”) process were selected for implementation in a process mining solution, as these are the business processes with the highest number of executions, a high number of employees involved in the processes, and a high degree of external partners involved.

However, to be able to compare business processes from different companies, the landscape of ERP-systems, related systems and addons, as well as individual applications implemented in the processes needs to be taken into account before implementing the process mining solution.

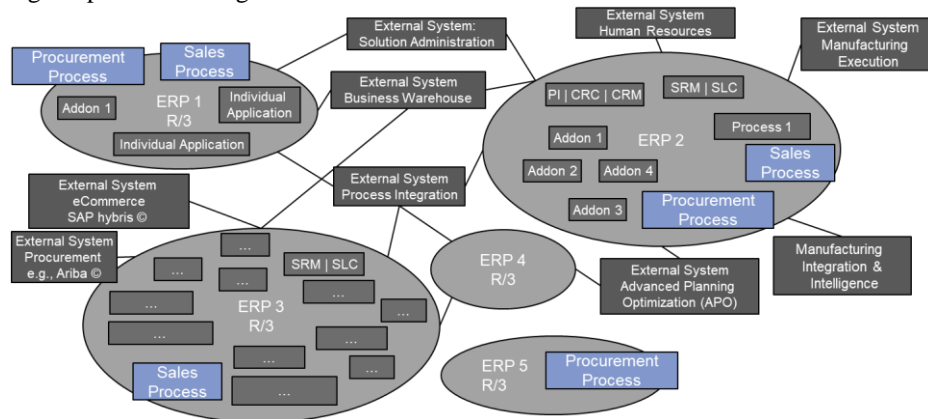


Fig. 2. ERP Systems Landscape as Boundary Conditions for Process Mining

3 Process Mining Application in the SAP S/4 HANA Implementation Project

To mine and compare business processes and their variants, the manufacturing corporation implemented a process mining solution in a proof of concept project for the SAP Purchase-to-Pay (“Purchasing”) and the Order-to-Cash (“Sales”) processes.

Table 1 provides an overview over the two processes. Due to space restrictions, the following section describes the application for the procurement process. Process mining application for the sales process is performed analogously.

Process	Purchase-to-Pay ("Purchasing")			Order-to-Cash ("Sales")		
	Company A	Company B	Company C	Company A	Company B	Company C
Start of Period	01.01.2016					
End of Period	31.07.2017					
Number of cases	998,80 Thsd.	432,21 Thsd.	108,54 Thsd.	15,8 Mil.	65.377	155.125
Number of process variants	20,67 Thsd.	10,47 Thsd.	2,54 Thsd.	35,32 Thsd.	39,815 Thsd.	20,87 Thsd.
Total number of process steps [Millions]	4,13	2,15	0,34774.	106,52	50,49	6,07
Avg. number of process steps	4,13	4,98	4,42	6,74	6,02	8,37
Distinct process steps	30	154	54	21	21	22

Table 1. Overview over Process Mining Processes

To determine whether the procurement process should be standardized or individualized, two process mining analyses are performed. First, procurement responsables design an individual corporate-specific to-be procurement process (right hand-side of Fig. 3), which is to be compared against the individual as-is process variants of the different companies in the corporation.

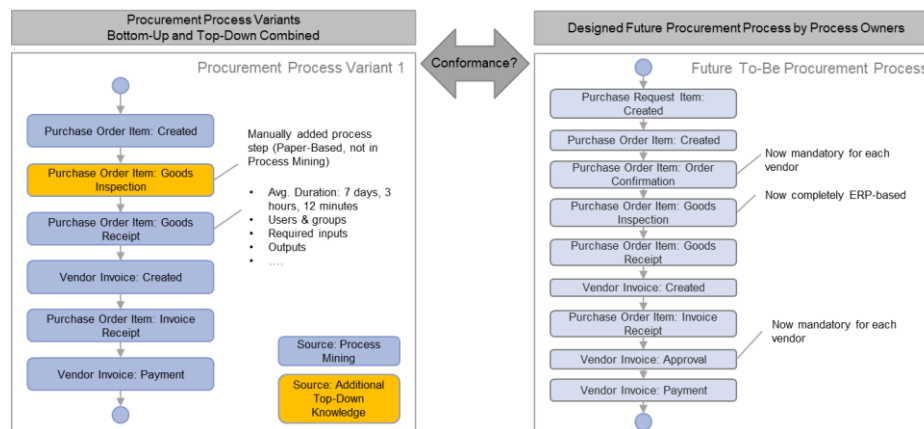


Fig. 3. Example for Variant-Level Comparison of As-Is Process against Individual To-Be Process Design for the Future Procurement Process

For the most important variants which cover at least 80% of cases, each variant of the as-is process is enriched with additional top-down process information such as shadow process steps and then compared against the to-be process to determine whether the variant is compatible with the to-be process in terms of completeness and desirability. In case the variant contains a critical characteristic which needs to be reflected in the template of the to-be process, the future to-be process design is

amended. As a result of this first step, an individual “corporate procurement process template” is created.

Second, process mining results from the different companies are compared on the variant-level against a database of various possible standard processes by the ERP system vendor in the “SAP Best Practices Explorer”. For the procurement process, the ERP provider delivers 12 different standard process specifications in BPMN notation in the “Operational Purchasing” domain for the on-premise version of SAP S/4 HANA [24]. As a result of the process mining analysis of the procurement process variants and the comparison against the standard process specifications in the SAP Best Practices Explorer, eight out of the twelve processes from the database are considered as necessary and as compatible with the requirements of the different companies and thus selected for implementation. The comparison of the process mining results against the SAP Best Practices Explorer revealed that the corporation requires the “Batch Management”, “Central Processing of Purchase Requisitions”, “Consumable Purchasing”, “Procurement of Direct Materials”, “Procurement of Services”, “Requisitioning”, “Scheduling Agreements in Procurement”, and “Serial Number Management” processes. Furthermore, the analysis revealed that “Central Processing of Purchase Requisitions”, “Consumable Purchasing”, “Procurement of Direct Materials”, and the “Procurement of Services” processes do not contain company-specific variants. Thus, these particular processes are candidates for standardization across the different companies in Fig. 1. The other processes for which there are local adaptations from the standard required are to be harmonized, but implemented individually for each company.

As a final step, the two solutions should be compared in the future course of the project and evaluated in terms of whether the individual corporate-level template should be implemented, or whether the corporation should implement the SAP standard processes with local adaptations.

4 Conclusion and Lessons Learned

This paper presents a business case from the application of process mining in an SAP S/4 HANA implementation project to standardize business processes across multiple companies of a manufacturing corporation. Data-driven process analyses offer the potential to significantly improve process decision-making. While typical top-down process documentation in companies is usually limited to the most common variants and the ideal flow of the process, the use of process mining allows all variants to be included in the decision to decide whether a process should be individualized or standardized. Traditional top-down transformation decisions unrelated to data in the ERP systems which usually neglect a high number of these variants are therefore highly likely to lead to a decision that is detrimental to the company. For example, ignoring vital process variants which the company needs to provide its competitive processes and products might lead to the “killing” of a competitive advantage.

In sum, although the implementation of the process mining solution required considerable monetary and managerial resources, managers reported confidence in the

data-driven decision-making. In particular, managers highlighted the ability of process mining to support the selection of a suitable standard process and to allow for analyses of the required changes to the process before the implementation of the new standard process. Also, managers valued the identification of the most occurring variants and the determination of business-essential process variants such as customer- or supplier-specific process flows. Besides, process mining allows organizations to improve ERP implementation projects with the ability to perform a root cause analysis of deviations from to-be processes and to analyze process improvement potentials such as manual efforts or data issues. The assessment of these variants in terms of performance KPIs allows for improvement activities during the ERP project when the new to-be process is designed or selected. Finally, managers stated the process mining project helped them in advancing BPM as a core capability of the organization, and to increase the “process-oriented thinking” of their employees and themselves.

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