FROM PROCESS DATA TO ORGANIZATIONAL PERFORMANCE: A SAP SIGNAVIO-BASED ANALYSIS OF PRODUCTION PROCESSES

Andreea Gabriela Tănase
PhD Student
The Bucharest University of Economic Studies
Faculty of Management
Bucharest, Romania

Grigorescu (Stănescu) Andreea,
Ph.D. Student, Romanian Academy, School of Advanced Studies of the Romanian Academy, Doctoral School of Economic Sciences, National Institute for Economic Research "Costin C. Kirițescu", Institute of National Economy, Bucharest, Romania

Andreea Măldăreanu
PhD Student
The Bucharest University of Economic Studies
Faculty of Accounting and Management Information Systems, Bucharest, Romania

Crețu Raluca-Florentina
Professor PhD. habil., The Bucharest University of Economic Studies, Faculty of Accounting and Management Information Systems, Financial and Economic Analysis Department, Bucharest, Romania

Viorel - Costin Banța
Lecturer Ph.D. habil., The Bucharest University of Economic Studies, Faculty of Accounting and Management Information Systems, Management Information Systems Department,
Bucharest, Romania

Abstract: Digital transformation, a defining feature of the Industry 4.0 era, has brought to the fore the need for a deep understanding of operational processes, particularly in companies that rely on integrated production and distribution flows. In this context, the analysis of operational data becomes an important tool to be taken into account when informing managerial decisions and optimising organisational performance. In this article, the authors aimed to investigate how the SAP Signavio Process Intelligence application can be used to analyse and visualise the production process (Production Planning and Execution) within the SAP PP (Production Planning) module. In doing so, they aimed to provide a clear picture of the actual sequences of activities, deviations from the standard route, bottlenecks in the manufacturing flow, and the impact of these phenomena on financial and operational performance. Based on a set of operational data, structured according to the model of actual imports from an ECC 6.0 ERP system and analysed using process mining techniques, the study highlights the relationships between how the process currently operates within the analized company (production of double-glazed windows and fabrication of metal structures), the quality of execution and operational efficiency. The results demonstrate that the integration of process intelligence tools into the Industry 4.0 ecosystem not only increases end-to-end visibility of manufacturing processes, but also supports the development of advanced mechanisms for monitoring and continuous improvement. The paper argues for the importance of adopting intelligent tools such as SAP Signavio in assessing organisational performance and in designing robust and flexible production processes, tailored to the demands of today's digital environment.

JEL classification: M21, M31, M15, C61, M41, P41

Key words: SAP ERP, Digital accounting skills, Industry 4.0, Data-driven management decisions, Digital transformation, Economic process analysis, Operational efficiency

1. INTRODUCTION

Nowadays, the approach of integrating IT solutions to assist us in all aspects of the digital transformation of economic and operational processes is one of the fundamental directions of organizational transformation in the Industry 4.0 era. Therefore, in this new technological ecosystem, companies are challenged to rethink their internal workflows, integrate smart technologies, and develop advanced data analytics mechanisms that enable a deeper understanding of actual process performance. In other words, unlike traditional approaches based on retrospective reporting and aggregate indicators, the Industry 4.0 paradigm emphasizes end-to-end visibility, automation, connectivity, and real-time decision-making, using a range of data derived from the analyzed business process. Because of this context, the production process plays an important role, as it is one of the most significant cross-functional workflows within active companies in the manufacturing sector; for this reason, examining how these processes operate and adapt to today's digital transformations is necessary. It connects production planning with execution on the assembly line, inventory management, and quality control, directly influencing delivery times, production costs, and cash flows. Therefore, analyzing how the production process is carried out in practice is needed for those researching the phenomenon of production through the lens of technology, as this is necessary for optimizing organizational performance, especially in the small and medium-sized enterprise (SME) sector, where resources are limited and operational variations are frequent.

Using process intelligence and process mining technologies, such as SAP Signavio, provides an advanced methodological framework for investigating real-world processes, in our case manufacturing, based on data extracted directly from ERP systems. These tools enable the automatic reconstruction of workflows, the identification of deviations, the detection of bottlenecks, the comparison of operational scenarios, and the quantification of the impact on performance indicators. By combining these functionalities with the principles of Industry 4.0 - connectivity, transparency, autonomy, and digital integration - organizations can transform the way they manage their business processes in the manufacturing sector. In this scientific article, the authors aim to investigate and analyze in-depth the production process using SAP Signavio Process Intelligence and to highlight how the analysis of operational data contributes to a clearer understanding of organizational performance. The study focuses on a structured dataset of cases and events; the data was downloaded from the existing tables underlying the production process in the manufacturing company's SAP system. The analysis was conducted on a one-year dataset (2025) and focused on identifying dominant paths, deviations from the standard process, weaknesses in the workflow, and their implications for operational and financial management. Such a scientific article, through its advanced process mining analysis, contributes to the specialized literature, demonstrating the important and timely role of process mining technologies in the evolution of performance management systems—a key component of Industry 4.0.

2. LITERATURE REVIEW

In the era of Industry 4.0, the use of advanced digital technologies and tools in production processes enables their continuous monitoring, allowing for a dynamic response to changes that may affect production at any stage (Monti et al., 2024). With technological advances of Industry 4.0, management science has evolved, and business processes have become complex, relying increasingly on information systems and mathematical models for analyzing and improving processes. (Ackoff, 1956) asserts that operational analysis is not merely a set of techniques but has become a scientific discipline. This has led to the emergence of information systems that control the execution of business processes, namely the development of SAP-ERP systems, founded in 1972, which have become the world leader in business and production management software.

The ability to respond to changes of the external environment depends on how companies manage and analyze the data extracted from business processes (Bicocchi et al., 2019). To survive and innovate in a highly competitive business environment , companies seek to optimize their business processes using information collected from operational processes (Janvrin et al., 2017). The production process within the SAP system represents a critical workflow from a business process perspective, as it integrates multiple departments - planning, procurement, production line execution , quality control, and inventory management - into a single database, making it one of the most visible processes for the company's overall performance, which is why its management and improvement are so important (Kääriä & Shamsuzzoha, 2023). Operational data generated throughout the life cycle of the production process can provide valuable insights into the organization's efficiency. This data may include transactional information such as production orders, material consumption, operation confirmations, and finished product receipts, or time-related information such as production cycle time or waiting time between operations (Taipaleenmäki & Ikäheimo, 2013). Operational data generated by IT systems as a result of the execution of processes is leveraged through advanced analysis, transforming raw data into organizational knowledge (Kagermann & Wahlster, 2022).

Many organizations face challenges in leveraging large volumes of data and transforming them into relevant information for strategic decision-making (Chen et al., 2012). Process Mining (PM) - a form of data mining - is currently the most widely used and effective method for extracting information from business operational process data. It collects information about the process model during actual execution, based on the event log recorded in an IT system. PM combines techniques based on machine learning (ML) and business process management (BPM) to improve a company's processes. Recent studies conducted by (Shen et al., 2024) have shown that advanced analysis of operational data contributes to reducing costs and improving the efficiency of production processes.

3. METHODOLOGY AND DATASET – PERSPECTIVES

The methodology used in this study is based on the integration of two complementary approaches: business process analysis (using process mining techniques) and the investigation of operational performance in the context of the digital transformation specific to Industry 4.0. Within this methodological framework, the central analytical tool is SAP Signavio Process Intelligence, a platform that enables the extraction, modeling, and interpretation of the real behavior of the production process , based on real-data recorded in the ERP system. Due to confidentiallity of organizational data and to preserve the analytical structure of the original paper on which this adaptation is based, the dataset used in the following sections has been adapted/modified as if it were for a fictitious company; in reality, the data belongs to a company that manufactures double-pane windows, although, of course, the dataset was constructed based on actual extracts from an SAP ECC 6.0, PP (Production Planning) module. The numerical values presented are for scientific purposes, as is describetd in the Table 1, and to demonstrate how SAP Signavio interprets and visualizes a production flow, and are derived from a data extraction tables related to the production process at the company mentioned above - specifically, the tables from which we can construct the event log: ID, activity, timestamp, resource/user, plant, material, order, work center, quantity, status (AUFK - Order Master Data, AFKO - Order Header Data PP Orders, etc.), as shown in the table below:

Table no. 1 SAP PP Data Sources for Event Log Reconstruction in SAP Signavio

Area in PP	SAP Table	Content	Usage in Signavio
Order master	**AUFK**	General order data	Order identification, order type, general status, controlling object
Production order header	**AFKO**	Production order header	Planned dates, material, routing, basic dates
Production order item	**AFPO**	Production order items	Produced material, ordered quantity, delivered quantity
Operations	**AFVC**	Order operations	Operations, process sequence, internal work center
Operation values/dates	**AFVV**	Operation quantities, times, and dates	Analysis of planned vs. actual durations
Confirmations	**AFRU**	Production confirmations	Real execution events: operation

			confirmation, quantities, times
Reservations	**RESB**	Components reserved for the order	Required materials, planned consumption, material shortages
Status	**JEST**	Current SAP object statuses	Order status: created, released, confirmed, delivered, closed
Status history	**JCDS**	Status change history	Very useful for building an event log based on status changes

In SAP Signavio, production process analysis is not based exclusively on the tables specific to the Production Planning module, but rather on the reconstruction of an integrated event log, starting from production orders, operations, confirmations, inventory movements, statuses, and master data. By combining the AUFK, AFKO, AFPO, AFVC, AFRU, RESB, JEST/JCDS, and MATDOC (S/4HANA) or MKPF/MSEG (SAP ECC 6.0) tables, the complete production order cycle can be modeled, from creation and release through consumption, confirmation, receipt, and closure.

4. SAP SIGNAVIO IN THE CONTEXT OF INDUSTRY 4.0: IMPLEMENTATION, PROCESS ANALYSIS, AND RESULTS

The digital transformation associated with the Industry 4.0 concept is pushing organizations to pay increasing attention to data integration, process automation, and the use of analytical tools to improve operational performance. In this context, ERP systems, such as SAP, are no longer viewed merely as transactional platforms, but as essential sources of data for analyzing, monitoring, and optimizing business processes. The data generated in SAP modules can be used to reconstruct actual workflows and to identify discrepancies between the designed process and the process actually executed. SAP Signavio provides a modern framework for business process analysis, enabling their visualization, evaluation, and improvement based on data extracted from operational systems. In the case of production processes, the analysis is not limited to observing isolated transactions but involves reconstructing a complete workflow, from planning and creating a production order through material consumption, confirmation of operations, receipt of the finished product, and order closure.

In the SAP PP module, such an analysis requires the integration of multiple data sources. Tables such as AUFK, AFKO, AFPO, AFVC, AFRU, RESB, JEST/JCDS, and MATDOC or MKPF/MSEG enable the creation of a relevant event log for SAP Signavio. Based on this event log, the production order can be treated as primary for analysis, and the activities associated with it can be ordered chronologically to reflect how the process actually unfolds in the system. Therefore, the purpose of this chapter is to present how SAP Signavio can be used in the context of Industry 4.0 to analyze the production process in SAP PP. The chapter focuses on three main areas: implementing the analysis approach, describing the workflow required to build the event log, and interpreting the results obtained. This approach makes it possible to identify bottlenecks, delays, execution variations, and control points in the production order cycle, contributing to a better understanding and optimization of the process.

Between January 1, 2025, and December 31, 2025, the use of records from SAP tables which create the analyzed scenario, as follows: AUFK – 7,107 records, AFKO – 10,443 records, AFPO – 10,339 records, AFVC – 93,736 records, AFRU – 10,816 records, RESB – 48,373, JEST/JCDS – 133,236 records, MKPF – 92,027, and MSEG – 299,602 records.

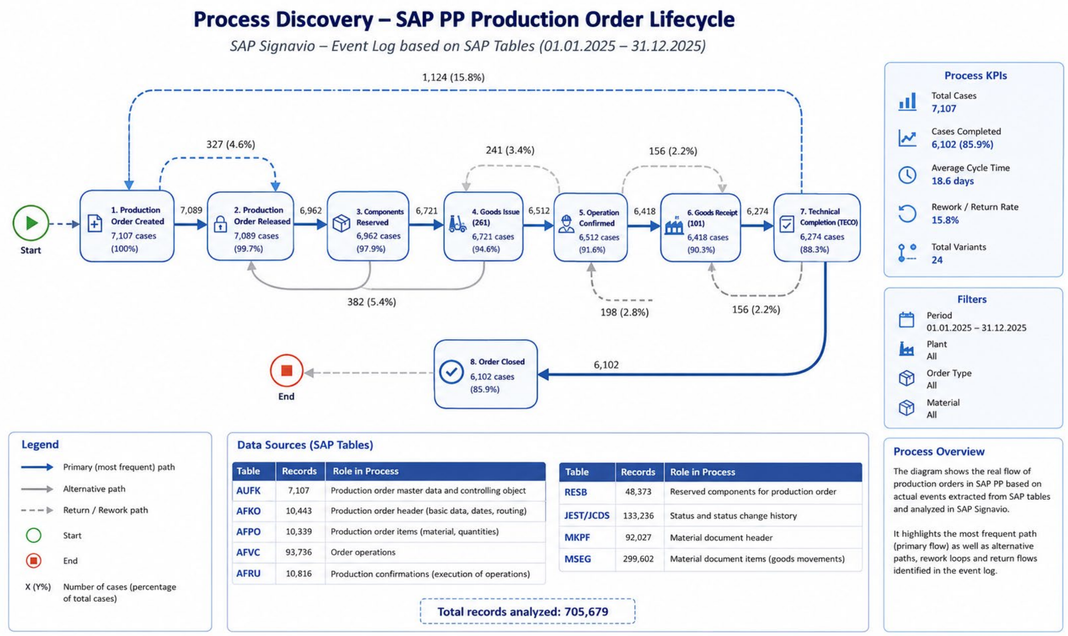

Figure no. 1 Process discovery for SAP PP production order lifecycle based on event log reconstructed from AUFK, AFKO, AFPO, AFVC, AFRU, RESB, JEST/JCDS, MKPF and MSEG tables.

Figure 1 shows a Process Discovery representation of the production order cycle in SAP PP, built based on an event log derived from relevant SAP tables for the period January 1, 2025 – December 31, 2025. The purpose of this representation is to highlight how transactional data from SAP can be transformed into a visual process model, usable in SAP Signavio for analyzing the actual production flow.

To reconstruct the process, records from the AUFK, AFKO, AFPO, AFVC, AFRU, RESB, JEST/JCDS, MKPF, and MSEG tables were used, totaling 705,679 records. These tables cover the main components of the SAP PP process: general production order data, order headers and line items, production operations, confirmations, component reservations, order statuses, and inventory movements associated with material consumption and finished goods receipt.

In the proposed model, the production order is used as the primary unit of analysis, and the standard flow being tracked is as follows: creation of the production order, release of the order, reservation of components, consumption of materials, confirmation of operations, receipt of the finished product, technical closure, and final closure of the order. This sequence allows for observing the main flow of the process, as well as identifying alternative paths, rework loops, and any deviations from the standard process.

The high volume of records in MSEG and JEST/JCDS highlights the importance of inventory movements and status changes in reconstructing the actual process. In particular, material documents allow for the identification of consumption and receipts, while the status history enables tracking of the moments when an order is created, released, confirmed, technically completed, or closed. Consequently, the figure highlights that the SAP Signavio analysis is not based on a single data source, but rather on the integration of multiple SAP tables to construct a coherent event log.

From a process analysis perspective, the figure allows for the identification of key stages, event frequency, completed cases, and process variants. At the same time, it provides a basis for analyzing performance indicators such as production cycle time, order completion rate, the number of process variants, and the frequency of rework or return flows. Thus, SAP Signavio can support relevant operational analysis for improving the production process in the context of Industry 4.0.

In conclusion, the figure demonstrates how data extracted from SAP PP can be used to create a clear picture of the actual execution of the production process. By transforming SAP records into an analyzable event log, the organization can identify bottlenecks, delays, process deviations, and opportunities for optimization, thereby increasing transparency and operational efficiency.

5. CONCLUSIONS

The analysis conducted highlights the fact that SAP Signavio can be used as a valuable tool for reconstructing, visualizing, and evaluating the production process in SAP PP. By using an event log built on the basis of the AUFK, AFKO, AFPO, AFVC, AFRU, RESB, JEST/JCDS, MKPF, and MSEG tables, the production process can be analyzed not only theoretically but also based on actual events recorded in the SAP system. The data analyzed for the period January 1, 2025 – December 31, 2025 reveals a significant volume of transactional information, totaling 705,679 records. This volume confirms the complexity of the production process and the need for advanced process analysis tools.

Without a tool such as SAP Signavio, manually correlating this data would be difficult, time-consuming, and prone to incomplete interpretations. Figure 1, a Process Discovery diagram, demonstrates that the production process can be reconstructed around the production order, which is used as the primary unit of analysis. The standard workflow tracked—from order creation, release, component reservation, material consumption, operation confirmation, finished product receipt, to order closure—allows us to observe how the process is actually executed in the system. An important aspect highlighted by the analysis is that the actual process does not always follow a linear path. Alternative paths, rework, corrections, delays, or discrepancies between the designed process and the executed process may occur.

By identifying these variants, SAP Signavio helps users understand operational deviations and pinpoint areas where bottlenecks or inefficiencies may occur. The MSEG and MKPF tables play a key role in analyzing inventory movements, as they enable the tracking of raw material consumption and finished goods receipts. At the same time, the JEST/JCDS tables are important for tracking changes in the status of production orders, providing a chronological overview of their progress. Integrating these data sources provides a comprehensive view of the production cycle. From a managerial perspective, this analysis offers a solid foundation for monitoring process performance metrics. It is possible to evaluate the production cycle time, the frequency of process variations, the order completion rate, the occurrence of rework flows, and the intervals in which delays occur. This information can support decisions regarding process optimization, reducing lead times, improving material availability, and increasing operational efficiency.

In the context of Industry 4.0, the primary value of such an analysis lies in transforming operational data from SAP into useful information for decision-making. SAP Signavio enables the transition from simple data reporting to an understanding of actual process behavior. Thus, the organization can identify not only what happened, but also where, when, and why deviations from the standard workflow occur. In conclusion, analyzing the production process with SAP Signavio demonstrates the importance of integrating ERP data into digital transformation initiatives. By reconstructing the event log and visualizing the actual process, organizations can achieve operational transparency, identify opportunities for optimization, and support a continuous improvement approach to production processes. This perspective confirms SAP Signavio's role as a strategic tool for process analysis within modern ERP systems.

REFERENCES

1.	Ackoff, R. L.	The Development of Operations Research as a Science. Operations Research, 4(3), 265-295. https://doi.org/10.1287/opre.4.3.265, 1956
2.	Bicocchi, N., Cabri, G., Mandreoli, F., & Mecella, M.	Dynamic digital factories for agile supply chains: An architectural approach. Journal of Industrial Information Integration, 15, 111-121. https://doi.org/10.1016/j.jii.2019.02.001, 2019
3.	Chen B, Wan J, Shu L, Li P, Mukherjee M, Yin B	Smart factory of Industry 4.0: key technologies, application case, and challenges. IEEE Access 6:6506–6519, 2017
4.	Chen, H., Chiang, R. H. L., & Storey, V. C.	Business Intelligence and Analytics: From Big Data to Big Impact. MIS Quarterly, 36(4), 1165-1188. https://doi.org/10.2307/41703503, 2012
5.	Ghasemi M., Shafeiepour V., Aslani M., et al.,	The impact of Information Technology (IT) on modern accounting systems, Procedia - Social and Behavioral Sciences 28: 112-116, 2011
6.	Janvrin D.J., Weidenmier Watson M.	Big Data: A new twist to accounting", Journal of Accounting Education 38: 3-8, 2017
7.	Kääriä, E., & Shamsuzzoha, A.	Improvement of an order-to-cash business process by deploying lean six sigma tools: A case study. International Journal of Productivity and Performance Management, 73(11), 161-189. https://doi.org/10.1108/IJPPM-01-2022-0050, 2023
8.	Kagermann, H., & Wahlster, W.	Ten Years of Industrie 4.0. Sci, 4(3), 26. https://doi.org/10.3390/sci4030026, 2022
9.	Monti, F.,	On the application of process management and process mining to

Mathew, J. G., Leotta, F., Koschmider, A., & Mecella, M. Industry 4.0. Software and Systems Modeling, 23(6), 1407-1419. https://doi.org/10.1007/s10270-024-01175-z, 2024

10. Posada J, Toro C, Barandiaran I, Oyarzun D, Stricker D, de Amicis R, Vallarino I Visual computing as a key enabling technology for Industry 4.0 and industrial internet". IEEE Comput Graph Appl 35(2):26–40, 2015

11. Shen, L., Wang, F., Zhou, Z., & Xu, R. Research on the Difficulty Mining Algorithm for the Integration of Multiple Sets of Data Platforms Based on Big Data Analysis in Smart Factories. 2024 IEEE 3rd International Conference on Electrical Engineering, Big Data and Algorithms (EEBDA), 1444-1448. https://doi.org/10.1109/EEBDA60612.2024.10485802, 2024

12. Taipaleenmäki J., Ikäheimo S., On the convergence of management accounting and financial accounting – the role of information technology in accounting change, International Journal of Accounting Information Systems 14: 321-348, 2013

13. van der Aalst, W. Data Science in Action. În W. van der Aalst (Ed.), Process Mining: Data Science in Action (pp. 3-23). Springer. https://doi.org/10.1007/978-3-662-49851-4_1, 2016

14. Zhong RY, Xu X, Klotz E, Newman ST „Intelligent manufacturing in the context of Industry 4.0: a review." Engineering 3:616–630, 2017