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Systematic Literature Review on the Convergence of Business Process Management and Process Mining

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Abstract—Although Business Process Management (BPM) and Process Mining (PM) have been extensively studied as distinct domains, limited research has systematically explored their convergence. this study presents a Systematic Literature Review (SLR) on the convergence between Business Process Management (BPM) and Process Mining (PM), focusing on journal publications indexed in SpringerLink from 2020 to 2025. The review aims to map current research trends, identify how PM techniques support the BPM lifecycle, and explore the main benefits and challenges of their integration within organizational contexts. Using the PRISMA methodology and the PICOS framework, thirteen high-quality studies were systematically analyzed. The findings reveal that BPM and PM are increasingly interdependent—BPM provides a structured lifecycle for continuous improvement, while PM introduces data-driven insights through process discovery, conformance checking, and performance monitoring. PM strengthens each phase of the BPM lifecycle by enhancing process transparency, real-time monitoring, and evidence-based decision-making. However, integration remains challenged by data quality issues, limited governance mechanisms, insufficient management support, and tool usability constraints. The study concludes that successful BPM–PM convergence requires not only technical advancements but also organizational readiness and strategic alignment. Future research should emphasize cross-organizational and longitudinal approaches to develop comprehensive frameworks for embedding process intelligence within digital transformation initiatives.

Keywords- Business Process Management, Process Mining, Digital Transformation, Systematic Literature Review, Process Optimization

I. INTRODUCTION

Organizations increasingly recognize Business Process Management (BPM) as a critical discipline for enhancing operational efficiency and achieving strategic goals. BPM encompasses a systematic approach to designing, analyzing, implementing, monitoring, and continuously improving business processes within an organization[1]. The importance of BPM has been amplified by digital transformation, which demands agile, efficient, and innovative processes to respond to the rapidly changing business environment. Digital transformation facilitates the integration of new technologies into BPM, enhancing its capabilities and effectiveness[2]. The application of BPM has been linked to improved performance, increased customer satisfaction, and the capability to pivot quickly to market demands, emphasizing its role in organizational success[1].

Complementing BPM, Process Mining (PM) has emerged as an essential tool that leverages the digital footprints left by business processes to discover, analyze, and enhance process execution. PM provides insight into the actual execution of processes as opposed to just theoretical models, which enables organizations to identify deviations and inefficiencies effectively[3]. By employing mining techniques such as event log analysis, organizations can extract knowledge from the vast amounts of process data generated daily, facilitating empirical decision-making and fostering continual process improvement[4]. The convergence of BPM and PM represents a strategic synergy where BPM establishes the framework, and PM enriches it with data-driven insights, thus evolving both fields in the context of Industry 4.0 and beyond[5].

However, BPM has faced challenges in bridging the gap between theory and practice; despite the presence of numerous BPM models and methodologies, the effective execution of processes often deviates from the designed workflow[6]. This disjointedness has prompted a growing interest in PM, which helps organizations close this gap by providing actionable insights derived directly from process execution reports. Studies have shown that integrating PM into BPM can enhance process visibility, accountability, and adaptability, leading to significant performance improvements[7]. Furthermore, the integration of these areas can lead to innovations, such as the development of self-adaptive BPM systems that can autonomously adjust process designs in response to real-time data[8].

The literature indicates multiple instances where BPM and PM have been integrated. Several studies highlight the benefits of such integration, including increased operational transparency and improved compliance with regulatory standards[9]. Challenges remain, especially regarding the quality and accuracy of data used in PM, which can directly influence BPM initiatives. The adaptability of BPM methodologies to incorporate PM insights has been identified as an essential factor in navigating these challenges[10]. Emerging trends point toward a more profound integration of artificial intelligence and machine learning within PM to enhance its capabilities further, thereby creating intelligent BPM systems that promote both automation and excellence in process execution[11].

In light of these collectively identified trends and challenges, the importance of conducting a Systematic Literature Review (SLR) becomes apparent. An SLR serves as a rigorous framework that compiles, synthesizes, and

critically analyzes existing research on the convergence of BPM and PM[12]. Previous reviews have typically been limited to specific aspects of BPM or PM; therefore, a comprehensive overview that encapsulates both domains and their interplay is not only timely but necessary. By systematically categorizing existing literature, such a review can elucidate gaps in current knowledge, identify best practices, and articulate a research agenda for future studies. Indeed, as organizations strive for agility and resilience in the digital age, reflecting on the confluence of BPM and PM offers rich avenues for both academic inquiry and practical application[13].

The forthcoming research in this paper aims to systematically synthesize the current understanding of BPM and PM integration, framing them within the context of ongoing digital transformation. By exploring this convergence, we anticipate contributing substantially to the academic literature while also providing practitioners with valuable insights that can guide them in enhancing their BPM initiatives through effective utilization of process mining techniques.

II. METHODOLOGY

In this study, the formulation of research questions (RQs) was carried out systematically using the PICOS framework (Population, Intervention, Comparison, Outcome, Study type). This approach ensures that the review maintains a clear, specific, and methodologically sound focus. The Population (P) in this research refers to organizations or enterprises that implement Business Process Management (BPM) practices and adopt Process Mining (PM) techniques to support process improvement and digital transformation initiatives. The Intervention (I) concerns the integration and application of Process Mining techniques including process discovery, conformance checking, and enhancement within BPM frameworks or lifecycles to enable data-driven process optimization. The Comparison (C) is established between traditional BPM approaches that do not utilize Process Mining and manual or model-based process management practices that lack empirical, event-log-driven insights. The Outcome (O) focuses on identifying the benefits derived from the convergence of BPM and PM, such as increased process transparency, efficiency, compliance, governance, and evidence-based decision-making within digital business environments. Finally, the Study type (S) includes primary research studies such as case studies, experiments, or empirical evaluations published in reputable scientific journals between 2019 and 2024. Through this PICOS-based approach, the research questions were formulated with a structured and comprehensive focus, allowing for the inclusion of diverse methodological perspectives and findings from relevant literature. Based on this framework, three main research questions were developed to guide this study:

1. **RQ1**: What is the current state of research on the convergence between Business Process Management (BPM) and Process Mining (PM)

2. **RQ2**: How are Process Mining techniques applied to support or enhance the Business Process Management lifecycle?

3. **RQ3**: What are the main benefits and challenges of integrating BPM and Process Mining in organizational contexts?

In this study, the literature search was conducted using reputable scientific databases, with a primary focus on SpringerLink, to ensure comprehensive coverage of relevant studies. The search employed a combination of keywords: ("Business Process Management" AND "Process Mining" AND (Integration OR Convergence OR Alignment)), specifically targeting the intersection of BPM and Process Mining research. The search was restricted to journal articles published in English between 2020 and 2025, reflecting the most recent and relevant developments in the field.

The inclusion criteria encompassed primary studies that explicitly discuss the integration, convergence, or joint application of BPM and Process Mining within organizational contexts. Only articles available in full-text format were considered to ensure the credibility and scientific rigor of the reviewed materials. The exclusion criteria included studies that do not address BPM–PM convergence, purely theoretical papers without empirical contributions, non-scientific publications such as theses, books, editorials, or opinion papers, and grey literature that does not meet academic quality standards required for systematic reviews.

To ensure transparency, reproducibility, and methodological rigor, this review followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework. The PRISMA flowchart guided the sequential steps of the review process, including identification, screening, eligibility assessment, and inclusion of relevant studies. This structured approach ensured that only high-quality and thematically aligned research articles were included in the final synthesis, providing a robust foundation for analyzing the convergence of Business Process Management and Process Mining.

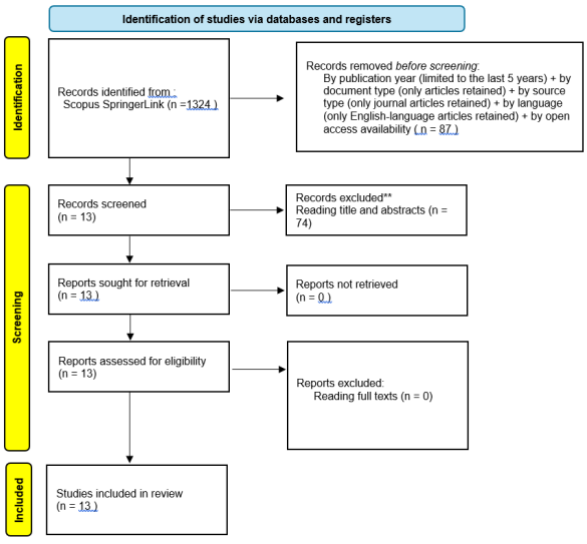

Figure 1 PRISMA Diagram

III. RESULTS AND DISCUSSIONS

This section presents the main findings obtained from a systematic review of 13 scientific articles from the SpringerLink database, published between 2020 and 2025. These articles were selected based on the inclusion and

exclusion criteria described above and underwent a rigorous selection and quality assessment process.

A. Research Question 1 (RQ1)

What is the current state of research on the convergence between Business Process Management (BPM) and Process Mining (PM)?

Recent studies demonstrate a significant convergence between Business Process Management (BPM) and Process Mining (PM), emphasizing their mutual influence and integration to enhance process understanding and optimization within organizations. BPM is defined as a discipline that employs systematic methods to discover, model, analyze, measure, and improve business processes, aligning operational behavior with strategic objectives. In contrast, PM represents a data-driven analytical approach that utilizes event logs to extract actionable insights into process execution. It merges data mining techniques with process modeling to discover underlying process structures, compare expected versus actual performance, and support conformance checking and process enhancement[14].

The convergence of BPM and PM is increasingly evident in both research and practice. From the BPM perspective, PM provides real-time analytical capabilities that enable organizations to monitor process execution and detect deviations dynamically, facilitating evidence-based decision-making and continuous improvement[15],[16]. Conversely, from the PM perspective, BPM offers a structured framework for embedding mining insights into the broader process lifecycle, thereby linking operational data with strategic business management. Organizations that adopt PM within BPM frameworks benefit from enhanced process transparency, operational efficiency, and overall business value[15].

Research evolution in this domain reveals two dominant directions. First, technical research continues to advance PM algorithms for process discovery, conformance checking, and predictive analysis, although challenges remain in incorporating data and contextual perspectives effectively[16],[17]. Second, a growing body of literature emphasizes managerial and organizational implications, highlighting how PM adoption influences decision-making, governance, and cultural transformation within organizations[17]. Empirical investigations often focus on case studies of PM implementations in specific organizational contexts—such as healthcare and logistics—revealing both benefits and contextual limitations[17].

Finally, recent holistic analyses suggest that BPM and PM should not be treated as isolated research domains but as complementary components of a unified process improvement ecosystem, often examined alongside Project Portfolio Management (PPM) and other managerial frameworks[16]. Overall, the literature indicates a strong symbiotic relationship where Process Mining provides the data-driven intelligence that strengthens BPM's capacity for evidence-based decision-making and continuous process optimization.

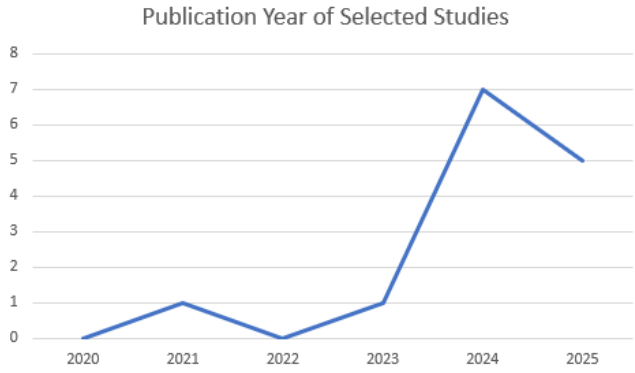

Figure 2 Publication year of selected studies

B. Research Question 2 (RQ2)

How are Process Mining techniques applied to support or enhance the Business Process Management lifecycle?

Process Mining (PM) techniques play a crucial role in supporting and enhancing multiple phases of the Business Process Management (BPM) lifecycle by leveraging event logs to extract actionable insights into business processes[17],[18],[19]. As a data-driven process analysis method, PM operates at the intersection of process science and data science, utilizing digital footprints recorded in information systems to reveal how processes are actually executed in organizational environments[15],[18],[16]. Through its analytical capabilities, PM enables organizations to better understand, monitor, and improve their processes, thereby reinforcing BPM as a continuous and evidence-based discipline[16],[18].

Within the BPM lifecycle, PM provides distinct contributions across key phases such as modeling, execution, monitoring, and improvement[17],[20]. In the modeling phase, PM supports process discovery by analyzing event logs to expose real process behaviors, which inform the creation or refinement of process models[15]. This allows organizations to maintain up-to-date "to-be" models that accurately reflect operational realities. Moreover, recent developments such as object-centric process mining and event abstraction techniques help manage model complexity and ensure interpretability[17].

During the execution phase, PM offers real-time data processing and analysis capabilities that generate live insights into process execution, enabling evidence-based decision-making and timely detection of process drift or anomalies[15],[21], [22]. This real-time alignment between process design and operational performance strengthens the adaptability of BPM systems[20].

In the monitoring phase, PM is widely used for conformance checking and performance assessment, comparing actual execution traces against predefined process models to evaluate compliance and efficiency[16],[21],[23]. By systematically analyzing historical and real-time event data, PM provides an empirical foundation for understanding deviations, bottlenecks, and performance variations within business processes.

Finally, in the improvement phase, PM functions as a central enabler of data-driven process optimization[16], [24]. It is frequently integrated into structured methodologies such

as the DMAIC model of Six Sigma, facilitating systematic analysis and continuous improvement[16]. PM projects typically include a dedicated improvement phase following initialization and analysis, during which identified inefficiencies are addressed to streamline operations and enhance overall process performance[16],[17].

In summary, Process Mining strengthens the BPM lifecycle by embedding data-driven intelligence into each of its phases—from design and execution to monitoring and improvement. Through its ability to extract and interpret knowledge from event logs, PM enables organizations to achieve greater process transparency, operational agility, and continuous optimization grounded in empirical evidence.

Table 1. Relationship Between the BPM Lifecycle and Process Mining Contributions

BPM Phase	PM Contribution
Modeling	Process discovery from event logs to create accurate "as-is" and "to-be" models
Execution	Real-time analysis and anomaly detection to align operations with models
Monitoring	Conformance checking and performance evaluation against reference models
Improvement	Data-driven process optimization and enhancement

C. Research Question 3 (RQ3)

What are the main benefits and challenges of integrating BPM and Process Mining in organizational contexts?

The integration of Business Process Management (BPM) and Process Mining (PM) within organizational contexts represents both a strategic opportunity and a complex challenge. Several studies have identified data-related, organizational, managerial, and technical barriers that hinder the effective implementation of PM initiatives in BPM environments[15],[17]. One of the most frequently cited issues concerns data quality, encompassing incomplete, inconsistent, or inaccessible data that limit the reliability of process insights[17]. Additionally, data access and preparation remain resource-intensive tasks, often requiring significant effort before meaningful analysis can occur[15]

From an organizational perspective, the absence of adequate governance structures and misalignment between PM efforts and business strategy pose substantial barriers to integration[19]. The disconnect between design teams and end-users further complicates the adoption process, as the practical value of PM outputs may not align with operational realities[19]. Lack of managerial support and the organizational discomfort with increased transparency also impede adoption and trust in PM outcomes[19]

On the technical side, PM tools are often criticized for limited intuitiveness and insufficient guidance, which restrict user understanding and confidence in analysis results[16]. Moreover, while PM can generate measurable business value, organizations frequently struggle to quantify this value and to identify suitable processes for PM implementation[16],[19].

Despite these challenges, numerous success factors for PM adoption have been reported in the literature. These include strong management support, effective project management, the presence of domain and technical expertise, a structured implementation approach, and high-quality data[17], [18]. When these factors are met, organizations can achieve significant process improvements and evidence-based decision-making through PM integration.

Methodologically, research on BPM–PM convergence has largely relied on case studies and empirical investigations, which provide deep insights into real-world implementations but often lack generalizability[19]. Most studies focus on single-system or single-organization contexts, underscoring the need for cross-system and cross-organizational research to understand broader adoption patterns[19]. Focus group studies have further highlighted the importance of managerial, governance, and leadership dimensions in PM adoption[19]. However, existing literature remains fragmented, with a lack of holistic frameworks addressing PM's organizational, managerial, and technical integration challenges[17], [19].

In conclusion, while Process Mining holds substantial promise for enhancing Business Process Management, its effective integration is contingent upon overcoming barriers related to data quality, governance, organizational alignment, and value realization. Future research should emphasize multi-organizational and longitudinal studies to develop comprehensive frameworks that guide BPM–PM convergence across diverse industries.

IV. CONCLUSION

The convergence between Business Process Management (BPM) and Process Mining (PM) represents a transformative shift in how organizations manage, monitor, and optimize their processes. Based on the synthesis of the three research questions, it is evident that BPM and PM are increasingly intertwined—mutually reinforcing each other to create data-driven, adaptive, and evidence-based process management ecosystems.

First, the analysis of current research (RQ1) reveals a growing academic and practical recognition of BPM–PM convergence. BPM provides a structured lifecycle framework for continuous improvement, while PM contributes analytical rigor through data-driven process discovery, conformance checking, and performance monitoring. This symbiotic relationship bridges the gap between process design and real-world execution, enabling organizations to align operational performance with strategic objectives.

Second, regarding the role of PM across the BPM lifecycle (RQ2), findings demonstrate that PM enhances every phase—from modeling and execution to monitoring and improvement. Through the use of event logs and advanced analytics, PM ensures that process models remain reflective of actual operations, facilitates real-time performance evaluation, and drives systematic improvement initiatives. By embedding PM techniques into BPM practices, organizations gain the capability to adapt dynamically and sustain continuous optimization based on empirical evidence.

Third, the exploration of benefits and challenges in integrating BPM and PM (RQ3) indicates that while integration offers substantial value in terms of transparency, efficiency, and strategic alignment, several barriers persist. These include issues of data quality and accessibility, lack of governance and management support, limited tool usability, and challenges in quantifying business value. Overcoming these barriers requires not only technical advancement but also strong managerial commitment, structured implementation approaches, and organizational readiness.

Overall, the convergence of BPM and PM signifies the evolution of process management from a model-driven to a data-driven paradigm. Successful integration demands a balanced approach that combines robust analytical methods with sound governance and organizational alignment. Future research should move toward holistic and cross-organizational studies to establish frameworks that operationalize BPM–PM integration, enabling organizations to fully realize the strategic potential of process intelligence in the digital era.

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