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Integrating Business Process Reengineering (BPR) and Lean in the Industry 5.0 Era: A Systematic Literature Review

Mahasena Jonatan*, Indri Hapsari
Universitas Surabaya, Indonesia
Email: s164124502@student.ubaya.ac.id*, indri@staff.ubaya.ac.id

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Abstract

Organizations face increasing pressure to enhance operational efficiency while addressing human-centricity, sustainability, and resilience. Business Process Reengineering (BPR) and Lean offer complementary approaches; however, their integration requires a clearer understanding within the emerging context of Industry 5.0. This study aims to synthesize existing evidence on BPR–Lean integration, identify implementation approaches and organizational enablers, and examine their relevance to the three foundational pillars of Industry 5.0. A systematic literature review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Literature searches were performed using the search terms "Business Process Reengineering" AND "Lean*". Of the 2,127 records initially identified, 30 publications were included following screening and eligibility assessment. The findings were synthesized thematically across methodological, technological, sectoral, and organizational dimensions. The synthesis identified sequential integration, structured improvement cycles, digital process mapping, and simulation as key approaches for combining radical process redesign with continuous improvement. Leadership commitment, employee participation, knowledge sharing, and strategic alignment were identified as important organizational enablers of successful implementation. Nevertheless, reported improvements in operational performance should be distinguished from directly measured outcomes related to human well-being, environmental sustainability, and organizational resilience. The findings suggest that BPR and Lean provide complementary capabilities for facilitating organizational transformation. However, their effective alignment with Industry 5.0 requires explicit consideration of workforce engagement, human-centric practices, and broader performance indicators. Further empirical research is needed to validate these integrated approaches across diverse industries and organizational contexts.

INTRODUCTION

Today's business environment is characterized by globalization and rapid technological advancements, which have intensified competition across various industrial sectors (Aziz, 2019). To survive and maintain a competitive advantage, organizations must continuously innovate and proactively explore new approaches to optimizing their business operations. The growing demands for reduced operational costs, greater time efficiency, and improved customer service quality have prompted management to reconsider traditional bureaucratic structures and adopt transformative performance improvement methodologies. In response to the pressures of this dynamic environment, companies can no longer rely solely on passive organizational adaptation; instead, they must redesign their operations and value chains to become more responsive to evolving customer needs.

One of the most widely recognized management approaches to addressing these challenges is Business Process Reengineering (BPR) (AbdEllatif et al., 2018; Al-Mashari et

al., 2001; Habib & Shah, 2013; Zaini & Saad, 2019). BPR is defined as the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical performance measures, such as cost, quality, service, and speed (Bhaskar, 2016; Jovanoski et al., 2017). The implementation of BPR frequently relies on information technology (IT) capabilities as key enablers of process transformation, facilitating the automation, integration, and fundamental restructuring of outdated processes and procedures. Traditionally, BPR has been associated with a top-down management approach, often directed by senior executives, with the objective of achieving substantial organizational transformation within a relatively short period.

Meanwhile, Lean Management and Total Quality Management (TQM) have emerged as influential, although conceptually distinct, approaches to operational improvement worldwide. Lean Management is a multidimensional management philosophy aimed at reducing cycle times, minimizing waste throughout the value chain, and continuously improving productivity and product quality (Chand & Mishra, 2019). Unlike the radical transformation typically associated with BPR, Lean emphasizes continuous improvement, commonly referred to as kaizen, which encourages the active participation of employees, particularly those directly involved in operational processes. Lean focuses on streamlining value streams by eliminating non-value-adding activities from the customer's perspective while fostering a culture of incremental problem-solving and organizational learning across all levels of the organization.

From theoretical and practical perspectives, BPR and Lean have often been perceived as contrasting operational management paradigms. BPR emphasizes fundamental process redesign and substantial organizational change, whereas Lean generally prioritizes continuous, incremental improvements and the systematic elimination of waste (Bhasin & Dhami, 2018). These differences in the scale, scope, and pace of organizational change have contributed to the perception that radical reengineering and incremental improvement represent competing approaches to operational transformation (Chandrayan et al., 2019). Consequently, some management practitioners have traditionally viewed these methodologies as alternative strategies, assuming that their simultaneous implementation could generate organizational tensions arising from differences in management philosophy, employee involvement, and approaches to change.

However, a review of the existing literature indicates that implementing BPR independently presents several significant challenges. Previous research has reported that more than 70% of BPR implementation projects fail to achieve their intended objectives, although such estimates should be interpreted in relation to the contexts and criteria used to define implementation failure (Bhaskar, 2018). These challenges have been associated with inadequate planning and insufficient organizational preparation (Musa & Othman, 2016), as well as difficulties in managing the human dimensions of organizational transformation. When radical process redesign is undertaken without effective communication, employee participation, and appropriate change management strategies, it may generate resistance to change, reduce employee morale, and disrupt established organizational relationships. Such consequences can become particularly pronounced when employees perceive restructuring initiatives as threats to job security, professional identity, or established working arrangements.

Conversely, implementing Lean independently also presents challenges and limitations. When Lean initiatives are introduced without sufficient structural transformation or

technological modernization, organizations may encounter diminishing returns from incremental improvements, particularly when existing operational systems are unable to respond effectively to substantial market disruptions. Furthermore, excessive emphasis on waste elimination and productivity improvement, without adequate consideration of employee well-being, may intensify workloads and contribute to occupational stress (Rane et al., 2016). These challenges suggest that although Lean can strengthen operational consistency, process efficiency, and continuous improvement capabilities, certain organizational circumstances may require more fundamental process redesign to address structural inefficiencies and obsolete operational systems.

Recognizing the limitations of implementing each methodology independently, contemporary literature increasingly challenges the assumption that BPR and Lean are inherently incompatible. Existing studies suggest that radical process transformation may benefit from continuous improvement practices that support organizational learning, employee engagement, and the long-term sustainability of operational changes. Accordingly, BPR and Lean can be understood as potentially complementary approaches to organizational transformation, with BPR providing mechanisms for fundamental process redesign and Lean supporting continuous refinement and operational stabilization (Bhasin & Dhami, 2018). From this perspective, integrating the two methodologies may enable organizations to combine transformative change with sustained improvement, although the effectiveness of such integration depends on organizational conditions, implementation strategies, and the alignment of managerial and operational practices.

The relevance of integrating these methodologies has become increasingly significant with the emergence of Industry 5.0. Building upon the technological foundations of Industry 4.0, which emphasizes automation, interconnectivity, cyber-physical systems, and data-driven operational efficiency, the European Commission's Industry 5.0 framework places greater emphasis on the societal and environmental dimensions of industrial development. Specifically, Industry 5.0 positions technology as an enabler of three interconnected principles: human-centricity, sustainability, and resilience. This shift suggests that organizational transformation strategies, including those based on BPR and Lean, should be evaluated not only in terms of operational efficiency but also according to their implications for employee well-being, workforce participation, environmental sustainability, and organizational adaptability. Consequently, the central issue extends beyond determining whether BPR and Lean can be integrated to examining how their integration may be designed and implemented in ways that support the human-centric, sustainable, and resilient objectives of Industry 5.0.

The intended novelty of this research lies in examining BPR–Lean integration through an explicit Industry 5.0 analytical framework rather than claiming originality in combining the two methodologies. Specifically, this systematic literature review investigates how radical process redesign, continuous improvement practices, digital technologies, and organizational participation are interconnected within existing research. The study aims to synthesize available evidence and clarify the conditions under which these relationships may contribute to human-centric, sustainable, and resilient organizational operations. Its specific objectives are to identify the principal approaches to BPR–Lean integration, compare their applications across different organizational and industrial contexts, examine reported implementation enablers and barriers, and assess the extent to which documented outcomes correspond to the

three foundational pillars of Industry 5.0. Furthermore, the review seeks to distinguish empirically supported findings from conceptual propositions, thereby identifying unresolved questions and areas requiring further empirical investigation.

Through these objectives, the study seeks to contribute to operations management research by systematically organizing fragmented evidence and providing a clearer understanding of the relationship between radical process transformation and continuous improvement. Its theoretical contribution lies in clarifying the mechanisms, organizational conditions, and contextual factors that may connect BPR–Lean integration with the objectives of Industry 5.0. From a practical perspective, the study provides an evidence-informed foundation for managers seeking to select appropriate process improvement strategies, strengthen employee participation, coordinate digital transformation initiatives, and establish comprehensive organizational performance indicators. The findings may also support researchers in developing more focused agendas for longitudinal, comparative, and sector-specific investigations, particularly those examining the long-term implications of integrated process improvement methodologies. Ultimately, this study aims to inform organizational transformation strategies that balance operational performance with human well-being, environmental responsibility, and adaptive capacity, thereby supporting more sustainable and resilient industrial development in the Industry 5.0 era

METHOD

This study employed a Systematic Literature Review (SLR) approach to identify, evaluate, and synthesize existing research on the integration of Business Process Reengineering (BPR) and Lean Management within the context of Industry 5.0. The review followed the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) reporting guidelines to support transparency and reproducibility in the literature selection process.

The literature search covered Google Scholar, Scopus, PubMed, and Web of Science, with Harzing's Publish or Perish software used to facilitate bibliographic data retrieval. The search employed the Boolean expression "Business Process Reengineering" AND "Lean*" and focused on publications from 2015 to 2026. The search initially identified 2,127 records. Following the removal of 199 duplicates and 1,828 records based on predefined administrative criteria, including publication year, citation count, incomplete Digital Object Identifier (DOI) information, and unidentified publication sources, 100 records remained for title and abstract screening.

During the screening stage, 20 records were excluded because they did not sufficiently address BPR, Lean, or their integration. The remaining 80 reports underwent full-text eligibility assessment, during which 50 were excluded because their full texts were inaccessible or they did not meet the required publication criteria. Consequently, 30 peer-reviewed journal articles were included in the final review. The selected articles were examined and synthesized thematically to identify integration approaches, implementation enablers and barriers, technological applications, and their relevance to the human-centricity, sustainability, and resilience principles of Industry 5.0. The literature identification, screening, eligibility assessment, and inclusion processes are presented in the PRISMA 2020 flow diagram in Figure 1.

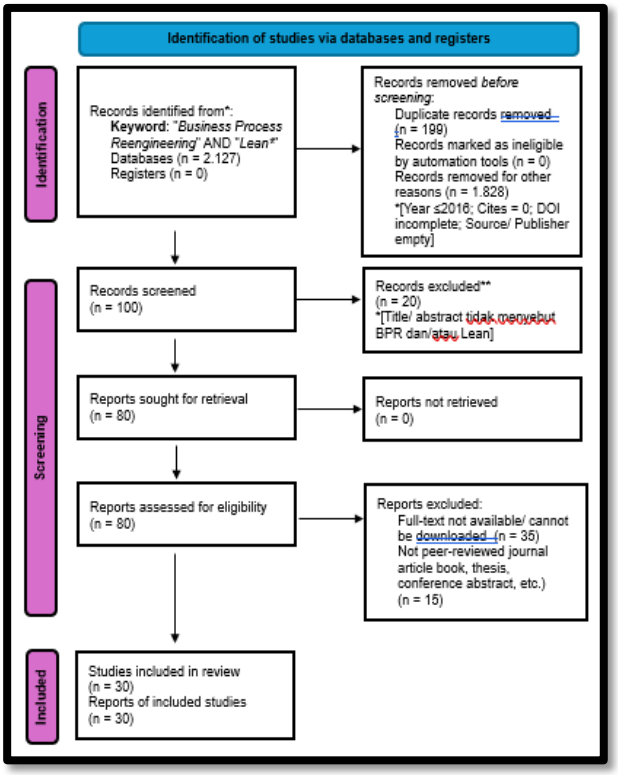


Figure 1. PRISMA Flowchart



Figure 2. Research Roadmap

RESULTS AND DISCUSSION

This section presents a synthesis and critical analysis of various literature studies on strategies for improving organizational operational performance, with a primary focus on the intersection between Business Process Reengineering (BPR) and Lean Management (including Total Quality Management or TQM). Historically, the literature in the field of operations management has often dichotomized BPR and Lean as two separate approaches. BPR is generally associated with radical change, initiated from the top down, and heavily reliant on information technology (IT) to overhaul business architecture. On the other hand, Lean and TQM are better known as philosophies of continuous improvement centered on optimizing workflows, eliminating waste, and engaging human resources through a bottom-up approach.

However, the demands of a dynamic global market and the evolution of the digital age are forcing organizations—ranging from manufacturing and small and medium-sized enterprises (SMEs) to healthcare—to adopt more holistic strategies. A comprehensive review of various modern literature in this section demonstrates a paradigm shift: BPR and Lean are no longer viewed as mutually exclusive concepts but must be integrated. The discussion in this section will outline various frameworks, hybrid methodologies, and evaluation tools that demonstrate that the synergy between the radical breakthroughs of BPR and the culture of stability in Lean is an absolute prerequisite for reducing transformation failure rates and creating sustainable operational excellence.

To facilitate systematic tracing of the relationship between BPR, Lean, and Industry 5.0 as the overarching outcome of this review, the 30 selected articles are organized into six thematic clusters. The first cluster, comprising studies by Bhaskar (2016, 2018), Jovanoski et al. (2017), Bhasin and Dhami (2018), Musa and Othman (2016), Vishvakarma et al. (2021), and Aziz (2019), focuses on BPR methodology and frameworks, exploring the foundational architecture, failure factors, and strategic conditions under which radical process redesign operates. The second cluster from Chandrayan et al. (2019), Chand and Mishra (2019), Varadaraj and Ananth (2020), Rane et al. (2016), Maciąg (2019), and Noto and Cosenz (2021) examines Lean and TQM tools in applied settings, with particular attention to shop-floor implementation, worker engagement, and dynamic modeling. The third cluster groups hybrid methodological convergences, specifically Lean Six Sigma and DMAIC-based approaches, as documented by Zwetsloot et al. (2018), Patel et al. (2019), Lameijer et al. (2017), Indrawati et al. (2020), Sohal et al. (2022), and Nasrollahzadeh et al. (2016). The fourth cluster consolidates sector-specific applications in healthcare, drawing on the works of Ruffin (2016), Nabelsi and Gagnon (2017), Pérez-Benito et al. (2019), Srinivas et al. (2021), and Bharsakade et al. (2021), all of which demonstrate how BPR–Lean integration addresses resilience imperatives in high-stakes service environments. The fifth cluster captures the digital and Industry 4.0 dimension, through the lenses of Leyh et al. (2017), Leyh et al. (2018), Salvadorinho and Teixeira (2021), and Atari and Prause (2019), which collectively trace how Lean diagnostic tools and BPR principles are being restructured within smart manufacturing ecosystems, laying the structural groundwork for the transition toward Industry 5.0. Finally, the sixth cluster addresses the organizational and knowledge management dimension, represented by Nkurunziza et al. (2023), which highlights how knowledge creation and human

capital development moderate BPR outcomes in alignment with Industry 5.0's human-centric imperatives. This thematic organization reflects the progressive trajectory from operational methodology (Clusters 1–3), through sectoral and digital application (Clusters 4–5), toward the human-centric and resilience-oriented principles of Industry 5.0 (Cluster 6)—thereby making the BPR–Lean–Industry 5.0 relationship structurally visible throughout this review.

Overview of the Basic Characteristics of BPR and Lean

Industry 5.0 represents a deliberate conceptual evolution beyond the productivity-first logic of Industry 4.0. While Industry 4.0 prioritized the deployment of technologies such as the Internet of Things (IoT), artificial intelligence (AI), and cyber-physical systems to maximize automation and operational speed, Industry 5.0 introduces three foundational pillars that reorient industrial strategy: (1) human-centricity placing worker well-being and cognitive agency at the center of production system design, rather than treating labor as a variable to be optimized away; (2) resilience building organizations capable of withstanding and adapting to crises, disruptions, and systemic volatility; and (3) sustainability ensuring that industrial activity operates within ecological and social boundaries. Critically, Industry 5.0 does not reject the technological achievements of Industry 4.0; rather, it subordinates them to humanistic and ecological governance principles. This distinction is crucial for understanding why the integration of BPR and Lean must be reconceptualized: both methodologies were originally designed in an era where efficiency maximization was the dominant logic, and neither was explicitly constructed to operate under the human-centric and sustainability constraints that Industry 5.0 imposes.

Understanding the integration of these two concepts requires mapping their basic characteristics. BPR is fundamentally defined as the radical rethinking and redesigning of business processes to achieve dramatic improvements in critical performance metrics such as cost, quality, efficiency, and speed (Chandrayan et al., 2019). BPR acts as a catalyst for structural transformation, where IT innovation serves as the primary enabler to facilitate new processes that transcend the limitations of traditional systems (Bhaskar, 2018).

On the other hand, Lean is a production and management philosophy rooted in optimizing customer value by eliminating all forms of non-value-added activities or waste (Varadaraj & Ananth, 2020). The Lean approach executes this vision through the implementation of analytical and operational tools on the shop floor, such as Value Stream Mapping (VSM), Just-In-Time (JIT), the Kanban system, and 5S (Seiri, Seiton, Seiso, Seiketsu, Shitsuke), all of which rely on employee autonomy and daily motivation (Chandrayan et al., 2019).

Various Methodologies for Integrating BPR and Lean

Historical data indicates that the failure rate of traditional BPR initiatives is extremely high, reaching 70% to 80%, largely due to the lack of an appropriate methodological framework and the neglect of the human and organizational cultural dimensions (Bhasin & Dhami, 2018). Therefore, recent literature has developed various cutting-edge methodologies that explicitly integrate BPR with Lean/ TQM to ensure the success of the transformation.

1. **Sequential Integration Methodology (TQM BPR-TQM) and Holistic Framework**

   In the early stages of their development, many management teams viewed TQM/ Lean and BPR as mutually exclusive. However, the literature emphasizes that TQM and business process reengineering must be integrated to deliver robust results, with

both approaches aligned with the organization's strategic objectives. This synergy can be achieved through a sequential methodological approach. An organization can begin with TQM or Lean to stabilize processes and reduce variability, then proceed with BPR for a radical leap in change and return to using TQM/ Lean for sustaining the results (Bhaskar, 2018). This concept is supported by the Holistic Framework, which states that a culture of continuous improvement is a mandatory final phase following BPR implementation to secure the new performance.

2. **Methodological Convergence through the DMAIC Cycle (Lean Six Sigma)**

   The most established evidence of methodological integration between Lean rationalization and BPR engineering is evident in the Lean Six Sigma (LSS) framework. LSS employs the structured Define, Measure, Analyze, Improve, Control (DMAIC) cycle, which unites Lean-style waste elimination diagnostics with statistically based process redesign (Zwetsloot et al., 2018). This methodology operates as a roadmap for transformation:

   - The Measure and Analyze phases adopt Lean tools such as VSM to diagnose existing inefficiencies.
   - The Improve phase implements radical process reengineering (BPR) (Patel et al., 2019).
   - The Control phase uses Lean practices such as 5S to standardize the reengineered processes, ensuring the system does not revert to old work patterns (Chandrayan et al., 2019).

3. **Methodological Process Reengineering Ontology-based Knowledge Map Methodology (PROM)**

   In addition to LSS, recent literature introduces the Process Reengineering Ontology-based Knowledge Map Methodology (PROM). This methodology is specifically designed to reduce the failure rate of BPR by integrating Lean-style knowledge creation. PROM uses an organizational ontology to depict the structure of the process environment, then employs knowledge maps to identify the causes of contradictions and inefficiencies in BPR (Bhasin & Dhami, 2018). Through the PROM methodology, the knowledge integration typically championed by Lean culture is mapped out in a structured manner before the BPR overhaul process is executed.

4. **Continuous Transformation Methodologies: BPR-LC and PRISM**

   To address the criticism that traditional BPR proceeds in a rigid and disjointed manner, academics have developed adaptive and cyclical methodologies. One such methodology is the Process Reengineering Integrated Spiral Model (PRISM), which is an agile approach to BPR that combines process management flexibility with continuous iteration (Bhaskar, 2018).

   On the other hand, (Bhaskar, 2018) proposed the BPR Life Cycle (BPR-LC) meta-model methodology, which divides a project into seven phases: Visioning, Identifying, Analyzing, Redesigning, Evaluating, Implementing, and Improving. In this BPR-LC methodology, the seventh phase (Improving) mandates that process owners continuously monitor performance indicators using Continuous Process Improvement (CPI), an essential element of Lean Management to organically transform and adapt

processes.

5. **The Evolution of Lean Tools in BPR: Dynamic and Sustainable VSM**

   In the Industry 4.0 era, Lean diagnostic tools evolved into vital digital instruments to facilitate BPR. Traditional Value Stream Mapping (VSM) has now been developed into Sustainable Value Stream Mapping (SVSM) and Dynamic Value Stream Mapping (DVSM). By leveraging Internet of Things (IoT) technology and cyber-physical systems, DVSM can track product flow, detect discrepancies in real-time, and prevent production schedule bottlenecks (Salvadorinho & Teixeira, 2021). The integration of these digital-based Lean tools ensures that planned BPR interventions are always based on accurate, rational, and streamlined operational data.

6. **Evaluation of BPR-Lean Using Mixed Methodology and Fuzzy AHP**

   To ensure the successful integration of BPR and Lean, researchers and practitioners strongly recommend the use of an evaluation methodology that combines qualitative and quantitative approaches (mixed methodology) as well as multi-criteria decision-making techniques. For example, in the healthcare sector, success factors for Lean Six Sigma/ BPR projects are first identified using grounded theory (qualitative) before being tested quantitatively, making it a highly applicable validation method for complex operations (Sohal et al., 2022).

   Additionally, the Fuzzy Analytical Hierarchy Process (Fuzzy AHP) is extensively used to prioritize and weigh Critical Success Factors (CSFs) when implementing Lean protocols (such as JIT, concurrent engineering, and pull systems) in industrial development processes or service BPR (Nasrollahzadeh et al., 2016). The combination of these analytical tools enables organizations to measure employees' cultural perceptions while precisely calculating BPR efficiency.

7. **The Vital Role of Human Resource Management (HRM) in Synergy**

   Regardless of the sophistication of methodologies and technologies (such as ERP implementation), the success of BPR and Lean integration ultimately hinges on the readiness of the human dimension. The literature confirms that Lean Management provides a socio-cultural foundation capable of neutralizing employee resistance caused by the disruptions of BPR. Organizations that implement collaborative knowledge-sharing practices have been shown to positively moderate the relationship between innovation creation and the final outcomes of business process reengineering, particularly in the financial services sector (Nkurunziza et al., 2023). By positioning the workforce as empowered process owners in the Lean style (not merely machines reprogrammed by BPR), organizations will be able to transform fear of radical change into productive participation.

Sectoral Applications of BPR and Lean Integration: From Manufacturing, Healthcare, to Education

The need to synergize the radical leap of BPR with the stability of Lean manifests differently across industrial sectors. In the manufacturing sector, which is moving toward the era of Industry 4.0 and Industry 5.0, BPR is classified as one of the central principles of Lean Production alongside Kaizen and TQM (Leyh et al., 2017). Within the smart factory model, this integration has been validated as capable of creating operational synergy that bridges a

company's radical innovations with a leaner production network (Atari & Prause, 2019). In fact, mutual classification explicitly juxtaposes the continuous improvement of Kaizen and the radical interventions of BPR as complementary components in adopting disruptive technologies (Leyh et al., 2018).

In addition to the manufacturing sector, this paradigm shift has also been aggressively implemented in the healthcare sector and hospitals. The adoption of Health Information Technology (HIT) often requires a restructuring of BPR processes in alignment with the fundamental principles of Lean to optimize the outcomes of hospital management design (Ruffin, 2016). The integration of BPR and Lean in hospitals has been shown to enhance the agility of pharmaceutical and medical equipment supply chain management, particularly when integrated with centralized tracking technology (Nabelsi & Gagnon, 2017). Furthermore, the impact of these BPR interventions significantly affects the stability of patients' electronic medical records; therefore, the evaluation of medical records resulting from radical changes must be continuously monitored on a regular basis (Pérez-Benito et al., 2019). To minimize the risk of restructuring failures in critical areas such as emergency departments, computerized BPR simulations are used to analyze efficiency strategies before they are implemented in practice (Srinivas et al., 2021). Furthermore, the effectiveness of Lean initiatives in healthcare management is precisely evaluated using Multi-Criteria Decision Making (MCDM) methods such as the Analytical Hierarchy Process (Bharsakade et al., 2021).

In other service sectors, such as the fast-food industry, the Six Sigma framework serves as the primary bridge enabling the implementation of process management, continuous improvement (Lean), and BPR reforms to be carried out in an integrated manner alongside the innovative TRIZ method (Indrawati et al., 2020). However, the adoption of BPR is not always well-received across all sectors. By comparison, in the higher education sector, the top-down approach of BPR is often viewed as a structural threat to academic principles and traditions, leading universities to prioritize the Lean Management concept, which fosters bottom-up cultural participation (Maciąg, 2019).

Dynamic Modeling Approaches and the Impact of Organizational Strategy

To strengthen the analytical foundation of BPR and Lean integration, recent literature has begun to introduce dynamic computational modeling tools. One of the limitations of traditional Value Stream Mapping (VSM) in Lean is its static nature. To address this, the System Dynamics (SD) approach is used to create a dynamic Value Stream Map (dynamic VSM), which enables organizations to strategically simulate various process engineering scenarios (Noto & Cosenz, 2021). From a managerial perspective, the identification of BPR's Critical Success Factors (CSFs) is heavily influenced by the organization's strategy itself. Through empirical cluster analysis, it has been proven that organizational strategy has a direct correlation with the success of BPR scope implementation and the direction of communication flow, which ultimately minimizes the level of resistance from employees (Vishvakarma et al., 2021).

CONCLUSION

Based on a critical synthesis of the existing literature, this study concludes that Business Process Reengineering (BPR) and Lean Management are not mutually exclusive paradigms but complementary approaches that can be strategically integrated to support organizational

transformation. BPR emphasizes fundamental process redesign and technology-enabled structural change, whereas Lean provides a systematic framework for continuous improvement, waste elimination, and employee participation. Their integration offers opportunities to balance radical transformation with sustained operational improvement, although its effectiveness depends on organizational readiness, implementation strategies, and contextual conditions.

The emergence of Industry 5.0 has introduced additional considerations for integrating BPR and Lean within contemporary organizations. Building upon the technological foundations of Industry 4.0, Industry 5.0 emphasizes human-centricity, sustainability, and resilience as interconnected principles of industrial development. Within this context, technology-driven process redesign must consider employee well-being, workforce participation, and environmental responsibility alongside operational efficiency. Although BPR can facilitate fundamental organizational restructuring, its implementation may encounter challenges when human and organizational dimensions are insufficiently addressed. Conversely, Lean supports employee involvement and continuous improvement but may require complementary structural transformation when incremental changes are insufficient to address complex organizational challenges.

The findings suggest that integrating BPR and Lean may provide a coordinated approach to organizational transformation. BPR can facilitate substantial process restructuring, while Lean can support the continuous refinement, stabilization, and sustainability of redesigned processes. This complementary relationship may strengthen organizational adaptability, encourage employee engagement, and improve operational performance. However, the extent to which these integrated approaches contribute to the human-centricity, sustainability, and resilience objectives of Industry 5.0 requires further empirical investigation.

From a theoretical perspective, this study contributes to operations management literature by synthesizing existing evidence on the relationship between radical process redesign and continuous improvement. The reviewed studies identified several potential integration approaches, including sequential improvement models, Total Quality Management–Business Process Reengineering–Total Quality Management (TQM–BPR–TQM), the Define–Measure–Analyze–Improve–Control (DMAIC) cycle associated with Lean Six Sigma, and technology-supported approaches such as Dynamic Value Stream Mapping (DVSM). These approaches illustrate how structured improvement practices and digital technologies may support process transformation. However, their effectiveness should be interpreted according to the methodological characteristics and organizational contexts of the reviewed studies rather than regarded as universally established outcomes.

The synthesis also highlighted the importance of leadership commitment, employee participation, knowledge sharing, and strategic alignment as potential organizational enablers of successful BPR–Lean integration. Previous research has associated BPR implementation difficulties with inadequate organizational preparation and insufficient consideration of human factors. Accordingly, integrating Lean principles into process redesign initiatives may help address employee resistance, strengthen organizational learning, and support the continuity of improvement activities. Nevertheless, the available evidence does not establish that BPR–Lean integration consistently reduces implementation failure rates or produces superior outcomes across all organizational settings.

From a managerial perspective, the findings suggest that organizational leaders should align information technology investments, including Enterprise Resource Planning (ERP) systems, with process improvement objectives and employee engagement strategies. Rather than approaching BPR exclusively as a cost-reduction initiative, management should consider collaborative implementation practices that involve employees in identifying inefficiencies, redesigning workflows, and evaluating operational changes. Lean tools may assist organizations in identifying non-value-adding activities before implementing technological solutions, although the appropriate sequence of process simplification and automation should be determined by organizational requirements and operational conditions.

This study was limited by its reliance on secondary evidence from the selected publications, which varied in methodological approaches, organizational settings, and reported performance indicators. Furthermore, the available literature provided limited direct empirical evidence regarding the contributions of BPR–Lean integration to human-centricity, environmental sustainability, and organizational resilience. The potential influence of contextual factors, including organizational size, digital maturity, industry characteristics, and market turbulence, also remained insufficiently established. Consequently, the findings should be interpreted as an evidence-based synthesis of existing approaches rather than definitive validation of an integrated Industry 5.0 transformation model.

Future research should employ longitudinal, comparative, and mixed-methods designs to examine the implementation processes and outcomes of BPR–Lean integration across different industries and organizational contexts. Particular attention should be given to identifying critical success factors (CSFs), evaluating employee participation and organizational learning, and developing performance indicators that capture operational, human, environmental, and resilience-related outcomes. Further investigations could also examine the potential contributions of artificial intelligence (AI), machine learning, big data analytics, and digital process mapping to waste identification, process redesign, and continuous improvement. Such research would provide stronger empirical foundations for determining how integrated BPR–Lean approaches can support sustainable, human-centric, and resilient organizational transformation in the Industry 5.0 era.

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CONFLICT OF INTEREST

The authors declare that this study was conducted without any commercial or financial relationships that could be interpreted as a potential conflict of interest.

AUTHORS CONTRIBUTIONS

Mahasena Jonatan: research conceptualization, methodology design, experiment execution, data collection, data analysis, manuscript drafting, and manuscript revision. Indri Hapsari: research supervision, validation of research results, provision of scientific input, and manuscript review and revision. All authors have read and approved the final version of the manuscript.

STATEMENT ON THE USE OF GENERATIVE ARTIFICIAL INTELLIGENCE

The authors declare that generative artificial intelligence (AI) was used in the preparation

of this manuscript to help improve linguistic clarity, correct grammar, and refine the writing structure. Generative AI was not used to generate, manipulate, or analyze research data. The entire content of the manuscript has been reviewed and verified by the author(s). The author(s) are fully responsible for the accuracy, integrity, and final content of the manuscript.

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