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# METHODOLOGICAL APPROACHES TO BUSINESS PROCESS MANAGEMENT IMPROVEMENT: THEORY, MODERN METHODS AND DIGITAL INTEGRATION

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**Abstract.** The *purpose* of this paper is to conduct a systematic comparative analysis of TQM, BPR, and Lean methodologies in relation to the BPM lifecycle stages, and to examine the strategic role of each approach in improving business process performance. The paper traces how classical process management tools are evolving within the digital economy, where the pace of change and the sheer volume of operational data require fundamentally new implementation strategies. *Methodology*. The study draws on systemic analysis of BPM as an organisational discipline, comparative analysis of methodological frameworks, and a synthesis of classical management theory with contemporary digital transformation trends. The research rests on a comprehensive review of academic literature, international standards, and documented industry practice, which grounds the conclusions in a solid evidential base. *Results* of the survey showed that BPM functions as a cyclical, systemic approach that integrates direct and feedback control loops across six stages: analysis, modelling, execution, monitoring, improvement, and automation. Three core improvement methodologies – TQM, BPR, and Lean – were evaluated against the BPM cycle. The combination of these classical approaches with digital infrastructure substantially strengthens process management capability. TQM delivers stability and quality; BPR enables radical transformation; Lean targets waste elimination and operational efficiency – each gaining significant leverage through integration with ERP systems, BI analytics, IoT, and Process Mining. *Practical implications*. The selection of a process improvement methodology depends on the organisation's strategic objectives, available resources, and digital maturity. When each approach is aligned with appropriate IT platforms, radical process optimisation becomes achievable. The comparative framework developed in the paper allows organisations to design composite transformation programmes that draw on TQM, BPR, and Lean in proportion to their specific operational challenges and technological readiness. *Value / originality*. The contribution lies in bridging classical management concepts with contemporary digital transformation trends, offering a structured guide for selecting the optimal improvement strategy based on organisational goals and digital maturity. The paper fills a recognised gap between traditional BPM instruments and their modern digital implementations by providing a coherent framework applicable across industries and sectors.

**Keywords:** business process management, Total Quality Management, lean approach, business process reengineering, digital transformation, ERP systems, BI analytics.

**JEL Classification:** M11, L23, M15

## 1. Introduction

The growing intensity of market competition, accelerating digitalisation, and mounting pressure to reduce operational costs have placed business process management at the centre of organisational strategy. Firms that fail to adapt their processes to a shifting external environment face rising costs, declining service quality, and a steady loss of competitive position (Dumas et al., 2018).

The relevance of this research lies in the need to systematise contemporary methodological approaches to BPM improvement and to critically assess their integration potential with digital tools. Industry experience shows that applying TQM, BPR, or Lean in isolation from the broader digital transformation agenda significantly limits their effectiveness (Hammer & Champy, 1993; Womack & Jones, 1996).

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The aim of the study is to conduct a systematic comparative analysis of TQM, BPR, and Lean approaches in terms of their alignment with the BPM lifecycle stages, and to identify opportunities for integration with modern digital platforms.

To achieve this aim, the following research objectives are addressed:

– clarification of the theoretical foundations of systemic business process management;

– comparative analysis of TQM, BPR, and Lean through the lens of BPM cycle components;

– identification of digital integration opportunities (ERP, BI, IoT, Process Mining).

The methodological basis consists of systemic analysis, comparative methodology, and process modelling using BPMN 2.0. The theoretical foundation draws on Hammer and Champy (1993), Womack and Jones (1996), van der Aalst (2013, 2016), and Dumas et al. (2018); the normative basis rests on ISO 9001:2015 and ISO/IEC 33001:2015 (International Organization for Standardization, 2015a, 2015b).

The scientific novelty of the paper lies in a comprehensive, integrated comparison of three fundamental BPM improvement approaches through the prism of their digital integration with ERP systems, BI analytics, and IoT and Process Mining technologies. Where most existing work treats TQM, BPR, and Lean separately, this paper shows their complementarity within a unified BPM architecture.

## 2. A Systemic Approach to Business Process Management

Business Process Management (BPM) is a systematic approach to the organisation, analysis, modelling, execution, monitoring, and improvement of an enterprise's operational processes, directed at enhancing their effectiveness, quality, and strategic alignment (Dumas et al., 2018). In the academic literature, BPM is characterised as a discipline encompassing the methods, techniques, and software tools used to design, implement, manage, and analyse operational processes (van der Aalst, 2013).

ISO 9001:2015 establishes that effective management must be grounded in a process approach, systems thinking, and the principle of continual improvement (International Organization for Standardization, 2015a). BPM is realised through a cyclical sequence of interlinked stages, summarised in Table 1.

These stages form a closed improvement cycle that constitutes the methodological core of BPM. Digital technologies – particularly Process Mining platforms such as Celonis and Disco – extend this cycle by providing automated detection of deviations based on event log analysis from information systems (van der Aalst, 2016), effectively turning the BPM cycle into a self-correcting management mechanism.

Three principal improvement methodologies are recognised in contemporary management science:

– Total Quality Management (TQM) – a quality-oriented approach;

– Business Process Reengineering (BPR) – a reengineering approach;

– Lean – a waste-elimination approach.

Each fits naturally into the overarching BPM architecture, supplementing its stages in accordance with the organisation's strategic priorities (Dumas et al., 2018; Kravchenko & Zhuchenko, 2020).

## 3. Total Quality Management (TQM) and Its Digital Dimension

Total Quality Management (TQM) is a comprehensive management concept directed at improving the quality of products and services through the systematic enhancement of business processes and the engagement of all personnel in meeting performance targets (Harrington & Harrington,

Table 1
**Key components of the BPM cycle**

| Component | Description |
|---|---|
| Analysis | Detailed examination of current processes to identify bottlenecks, sources of inefficiency, and latent improvement opportunities. |
| Modelling | Construction of graphical or formalised process models – including BPMN 2.0 notation – to understand their structure and the logic of interactions between elements. |
| Execution | Implementation of designed processes in day-to-day operations, encompassing task allocation among participants and configuration of automated workflows. |
| Monitoring | Real-time tracking of key performance indicators (KPIs) to assess effectiveness and detect deviations from target parameters before they escalate. |
| Improvement | Optimisation of processes based on monitoring and analysis data: elimination of redundant steps, reduction of cycle times, and enhancement of output quality. |
| Automation | Introduction of software (BPMS, ERP, RPA) to execute routine operations, increasing process speed and accuracy while reducing dependence on manual intervention. |

*Source: compiled by the author based on (Dumas et al., 2018; van der Aalst, 2016; International Organization for Standardization, 2015a)*

1995). The conceptual foundations were established by W.E. Deming (1986) and developed by J.M. Juran (Juran & Godfrey, 1999); K. Ishikawa (1986) contributed the core analytical toolkit for root-cause analysis. At the normative level, TQM principles are enshrined in ISO 9001:2015 as the mandatory basis for certified quality management systems (International Organization for Standardization, 2015a).

Within BPM, TQM is applied to reduce defects and stabilise processes. A practical illustration: TQM tools can be used to cut the rate of incorrect orders from 10% to below 1% through structured defect analysis and targeted control measures, building the quality culture that customer-oriented organisations depend on.

The principal TQM tools include:

– the Plan-Do-Check-Act (PDCA) cycle – the basis of continual improvement, starting with planning a change, implementing it, checking the results, and adjusting before the next cycle (Deming, 1986);

– Six Sigma – a methodology using statistical analysis, including DPMO (Defects Per Million Opportunities) calculation, to drive down defect rates;

– Shewhart control charts – graphical tools for tracking process stability over time, for instance monitoring the defect percentage at each stage;

– Pareto diagrams – used to identify the dominant causes of problems, such as finding that 80% of errors stem from 20% of causes (Ishikawa, 1986; Juran & Godfrey, 1999).

TQM integrates with the BPM cycle while orienting each stage towards quality. Table 2 shows how each BPM component – analysis, modelling, execution, monitoring, improvement, and automation – is applied within TQM.

ERP systems (SAP S/4HANA Quality Management, Oracle ERP Cloud) automate quality data collection and processing across production and service processes, shortening the deviation analysis cycle. Business intelligence tools – Power BI, Tableau, QlikSense – enable interactive control charts and quality dashboards in real time, transforming the PDCA cycle from a periodic review into a continuous digital process (Honchar & Chorna, 2023). This confirms the position of Harrington and Harrington (1995) that the future of quality management is tied to the automation of data collection and analysis.

## 4. Business Process Reengineering (BPR) and Digital Transformation

Business Process Reengineering (BPR) involves the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in key metrics: productivity, quality, speed, and cost (Hammer & Champy, 1993). Its authors held that BPR questions the purpose of existing procedures and seeks wholly new solutions, eliminating obsolete processes rather than refining them.

The principal BPR tools are:

– BPMS (Business Process Management Systems) – software platforms that enable radical process automation, for instance replacing all manual data-handling steps with a digital processing system, thereby optimising information and resource flow;

– RPA (Robotic Process Automation) – technology for automating repetitive tasks, such as automatically validating documents against defined criteria, reducing errors and increasing throughput;

– before/after comparative analysis – used to quantify the effect of reengineering interventions (Hammer & Champy, 1993).

BPR integrates with the BPM cycle but is applied where fundamental change is needed – full automation or complete process redesign. Unlike incremental approaches, BPR rethinks processes from scratch, challenging their rationale and introducing radical solutions that replace outdated procedures. Table 3 shows how each BPM stage is engaged within BPR.

BPR is widely regarded as the methodology that most fully realises the potential of digital transformation (Arefieva & Poberezhna, 2020; Hrechko & Zakharov,

Table 2
**Alignment of TQM with BPM stages**

| BPM Stage | TQM Application (with Digital Integration) |
|---|---|
| Analysis | Root-cause analysis of defects using Ishikawa and Pareto diagrams; BI dashboards (Power BI, Tableau) for automated deviation monitoring. |
| Modelling | Modelling aligned with ISO 9001 quality standards; construction of reference models within ERP quality management modules (SAP QM). |
| Execution | Embedding a quality culture across all functions; automated real-time compliance monitoring through ERP platforms. |
| Monitoring | Statistical monitoring via Shewhart control charts; BI analytics for interactive quality dashboards, replacing static reports. |
| Improvement | Continual improvement (Kaizen) through PDCA cycles targeting zero-defect performance; integration with ERP quality analysis modules. |
| Automation | Automated quality checks to reduce human error; digital audit trails maintained through ERP systems. |

*Source: compiled by the author based on (Deming, 1986; Ishikawa, 1986; International Organization for Standardization, 2015a; Juran & Godfrey, 1999)*

Table 3
**Alignment of BPR with BPM stages**

| BPM Stage | BPR Application (with Digital Integration) |
|---|---|
| Analysis | Analysis aimed not only at problem identification but at evaluating the feasibility of full process redesign from scratch. |
| Modelling | Development of fundamentally new process models; BPMS platforms used to design target-state (to-be) processes rather than optimise existing ones. |
| Execution | Deployment of radically redesigned processes, typically requiring organisational restructuring, large-scale training, and ERP platform migration. |
| Monitoring | Before/after comparative assessment of transformation outcomes; BI tools for quantifying productivity gains and reengineering ROI. |
| Improvement | Rebuilding the entire process to achieve breakthrough results rather than incrementally refining individual steps. |
| Automation | Automation is the centrepiece: RPA replaces manual operations; ERP provides end-to-end digital integration across functions (Order-to-Cash, Procure-to-Pay). |

*Source: compiled by the author based on (Arefieva & Poberezhna, 2020; Hrechko & Zakharov, 2024; Hammer & Champy, 1993)*

2024). BPMS platforms (Camunda, Pega, IBM BPM) orchestrate complex end-to-end processes, while RPA solutions (UiPath, BluePrism, Automation Anywhere) replace manual operations with software bots without modifying underlying systems. ERP platforms unify previously fragmented functional subsystems into a single digital environment, enabling material reductions in the number of operational steps across core processes.

## 5. The Lean Approach and "Digital Lean"

The Lean approach originated in the Toyota Production System, theoretically grounded by Ohno (1988) and given broad elaboration by Womack and Jones (1996). It is directed at the systematic identification and elimination of seven types of waste: overproduction, waiting, unnecessary transportation, excess inventory, over-processing, defects, and underutilised human potential.

The principal Lean tools include:

– VSM (Value Stream Mapping) – a technique for creating current and future state process maps that captures every step, identifies waste, and emphasises continuous flow rather than functional efficiency;

– 5S (Sort, Set in Order, Shine, Standardise, Sustain) – a workplace organisation system covering the removal of unnecessary items, tool organisation, cleanliness maintenance, standard-setting, and ongoing compliance;

– Kaizen (continuous improvement) – a methodology of sustained process improvement through small changes proposed and implemented by employees;

– Just-In-Time (JIT) – completing tasks only when required, for example receiving materials daily in needed quantities without holding excess stock;

– Kanban – a visual task management system using boards or cards to signal when replenishment is needed;

– Poka-Yoke (error-proofing) – mechanisms that prevent mistakes, for example automated order verification in BPMS to prevent missing components (Womack & Jones, 1996; Ohno, 1988).

Lean integrates with the BPM cycle while directing each stage towards waste elimination, as shown in Table 4.

The defining development of the past decade is the digital transformation of Lean – "Digital Lean" or "Lean 4.0". Digital VSM tools (Miro, Lucidspark, SAP VSM Module) replace paper-based value stream maps and enable automated cycle time calculation; IoT sensors convert traditional Kanban into digital Kanban with automatic replenishment signals; BI analytics (Power BI, Tableau) provide real-time visualisation of Lean metrics – OEE, FTT, and takt time – replacing static spreadsheets; and Process Mining platforms (Celonis, Disco) detect waste automatically in the ERP digital

Table 4
**Alignment of Lean with BPM stages**

| BPM Stage | Role in the General BPM Cycle |
|---|---|
| Analysis | Examination of current processes to identify bottlenecks and sources of inefficiency. |
| Modelling | Creation of process models (BPMN) to represent structure and interrelationships. |
| Execution | Implementation of designed processes with task allocation among participants. |
| Monitoring | KPI tracking for deviation detection. |
| Improvement | Process optimisation based on monitoring data. |
| Automation | Software implementation for routine operations. |

*Source: compiled by the author based on (Arutiunian & Zhytkevych, 2024; Ohno, 1988; Womack & Jones, 1996; Zaverbny & Ilnytsky, 2022)*

footprint, removing the need for manual mapping (van der Aalst, 2016).

## 6. Conclusions

The findings of this study lead to the following conclusions.

Business process management is a complex, systemic discipline implemented as a closed six-stage cycle – analysis, modelling, execution, monitoring, improvement, and automation – in which each stage feeds back into the next.

An examination of the three improvement approaches confirms that TQM, BPR, and Lean are complementary rather than competing tools within the BPM architecture:

– TQM – grounded in Deming (1986), Juran and Godfrey (1999), and Ishikawa (1986) – delivers quality and process stability through statistical control and a culture of continual improvement;

– BPR (Hammer & Champy, 1993) drives transformational change through radical process redesign and comprehensive automation;

– Lean (Ohno, 1988; Womack & Jones, 1996) systematically eliminates waste, improving efficiency at low implementation cost.

The integration of these classical BPM approaches with modern digital tools is a critical determinant of their real-world effectiveness:

– ERP systems provide a unified information platform for real-time process management;

– BI analytics transforms conventional monitoring into dynamic, data-driven management;

– IoT and Process Mining technologies enable automated deviation detection and proactive process improvement (van der Aalst, 2016).

Disregarding the digital dimension substantially limits the potential of any of the approaches examined.

Future research directions include developing specific KPI frameworks for assessing the effectiveness of BPM digitalisation, and exploring the application of artificial intelligence and machine learning – including predictive process analytics and automated scheduling – within the context of digital BPM.

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