From Automation to Autonomisation: How to Capitalise on Empowered Processes

Wasana Bandara*
School of Information Systems
Queensland University of Technology
Brisbane, Australia
Email: w.bandara@qut.edu.au

Michael Leyer
Chair of Digitisation and Process Management
University of Marburg
Marburg, Germany
School of Management
Queensland University of Technology
Brisbane, Australia

Michael Rosemann
Centre for Future Enterprise
School of Management
Queensland University of Technology
Brisbane, Australia

Abstract

Process automation has been a cornerstone of organisational success, driving competitiveness through enhanced effectiveness and efficiency. While automation remains a key focus, the rise of artificial intelligence (AI), machine learning (ML) and the Internet of Things (IoT) provides entirely new process design options and as such demands new skills and approaches in Business Process Management (BPM) to maintain relevance and competitiveness. This paper extends current BPM paradigms by introducing the concept of "process autonomisation," a new paradigm that empowers organisations to make decisions autonomously using real-time data and adaptive business contexts. By critically examining existing BPM methodologies and highlighting key innovations, we propose strategies for evolving process management frameworks - emphasising agility, data-driven decision-making, and seamless digital integration. To thrive in the digital age, we argue, organisations must rethink their BPM practices. We call on both academic and industry stakeholders to collaborate on pioneering advancements in BPM and co-develop a roadmap that will help organisations align their process management with the ongoing digital transformation reshaping industries.

Key words: Business process management, process design, process autonomisation, agile-BPM, data-driven-BPM, artificial intelligence.

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1 Introduction

Business Process Management (BPM) is integral to Information Systems (IS), bridging the gap between technology and organisational processes. Echoing socio-technical IS theory, we treat BPM not as technology deployment but as the joint design of social and technical elements, so that processes, people, and IT co-evolve toward business goals (Alter, 2008; Mumford, 2006). BPM focuses on optimising business processes to improve efficiency, agility, and innovation. However, despite the significant advances in BPM and its role in IS, traditional BPM approaches are increasingly being questioned for their continued relevance and effectiveness, especially when compared to other technological investments (Jeston & Nelis, 2008). This paper argues that to remain relevant and effective, BPM must evolve by incorporating autonomisation and leveraging emerging technologies to better align with contemporary business needs and the rapid pace of technological transformation. At the same time, despite substantial investment, many process changes don't stick. Staff create local "workarounds," exposing misfits between formal processes and real work, and with this underscore the need for BPM to pair design-time standards with the way processes are executed.

While emerging technologies such as Artificial Intelligence (AI), Machine Learning (ML), and the Internet of Things (IoT) open new possibilities, their integration needs to be guided by the organisation's strategic priorities and stakeholder needs. From a BPM perspective, the value of AI, ML, and IoT is maximised when embedded into the process lifecycle - spanning design, implementation, execution, monitoring, and continuous improvement - with governance structures that align technology use to organisational goals and stakeholder needs (Rosemann et al., 2024). Thus, rather than an 'AI-first' mantra, organisations need to follow a 'process-first' approach. Ultimately, business processes are the source of organisational value propositions, and contemporary technologies are here to serve processes in creating and sustaining value whether this relates to customer experience, operational resilience, regulatory compliance, or sustainability. Technology serves as the means to address these objectives, rather than the primary driver of change.

BPM has a long-standing tradition in organisational management, with roots extending over a century (Leyer et al., 2017; Nordsieck, 1931). Historically, BPM relied on manual methods such as pen, paper, and stopwatches, primarily for observation and time-based analysis. These early approaches were labour-intensive, requiring significant human effort for documenting and tracking processes. Methodologies such as Fordism, Total Quality Management, Six Sigma and Lean Management helped to develop structured, automated processes (Harmon, 2019). The fundamental work of Hammer and Champy (1993) in process redesign marked a turning point in rethinking process designs. van der Aalst and van Hee (1995) introduced process-aware information systems (such as workflow management) to model, execute and analyse business processes. This shift offered more accurate and efficient representations of business processes in digital environments.

This gave rise to a data-driven and automated approach to BPM. Process mining, for example, has become a key method for converting digital traces into process descriptions providing valuable insights to improve process efficiency and ensure compliance. However, despite these advancements, current BPM methods still do not fully leverage the potential of emerging technologies, particularly AI, ML and IoT and are largely used to achieve established process productivity goals - meaning they are under-utilised. This is where we propose the new notion of 'process autonomisation' to truly capture the change in technology support for business processes that is catalysed by these technologies. Autonomisation means systems (not just humans) can make decisions about how a process is executed (Rosemann et al., 2024). More specifically, this means the delegation of process decision-making to intelligent systems that can independently analyse data, adapt to business context, and determine how processes are executed in real time.

Autonomisation represents the next frontier in BPM, where decision-making and governance of business processes are delegated to intelligent, framed systems capable of analysing broader datasets and making dynamic decisions (Dumas et al., 2023). This shift allows for more agile, responsive, and self-optimising processes that can adapt in real-time to changes in the business environment. As organisations increasingly navigate the complexities of a digitised, data-intensive environment, BPM methods must evolve to integrate such autonomous capabilities (Rosemann et al., 2024). Unlike general IS approaches, BPM provides a distinctive and integrated capability set; combining end-to-end process orchestration (Dumas et al., 2018), maturity frameworks for capability assessment (e.g., Kerpedzhiev et al., 2021), and socio-technical integration patterns that align people, processes, and technology to deliver measurable, process-centric outcomes. These strengths position BPM as a discipline uniquely equipped to ensure that emerging technologies such as AI, ML, and IoT are embedded within process architectures in ways that are business-driven, outcome-focused, and adaptable to both operational and contextual dynamics (Grisold et al., 2024).

We propose a forward-looking research agenda and call upon scholars and practitioners to critically re-assess and transform BPM practices, ensuring they remain relevant and effective in the face of rapidly evolving technological advancements and shifting organisational dynamics.

2 Current State of BPM Methods and Lost Opportunities

Business Process Management (BPM) has made significant strides from its early manual approaches (Stage 1) to more digital and automated systems (Stage 2) – see Figure 1. However, despite these advancements, current BPM methods still fail to fully capitalise on emerging technologies, particularly AI, ML and IoT, which are reshaping industries today.

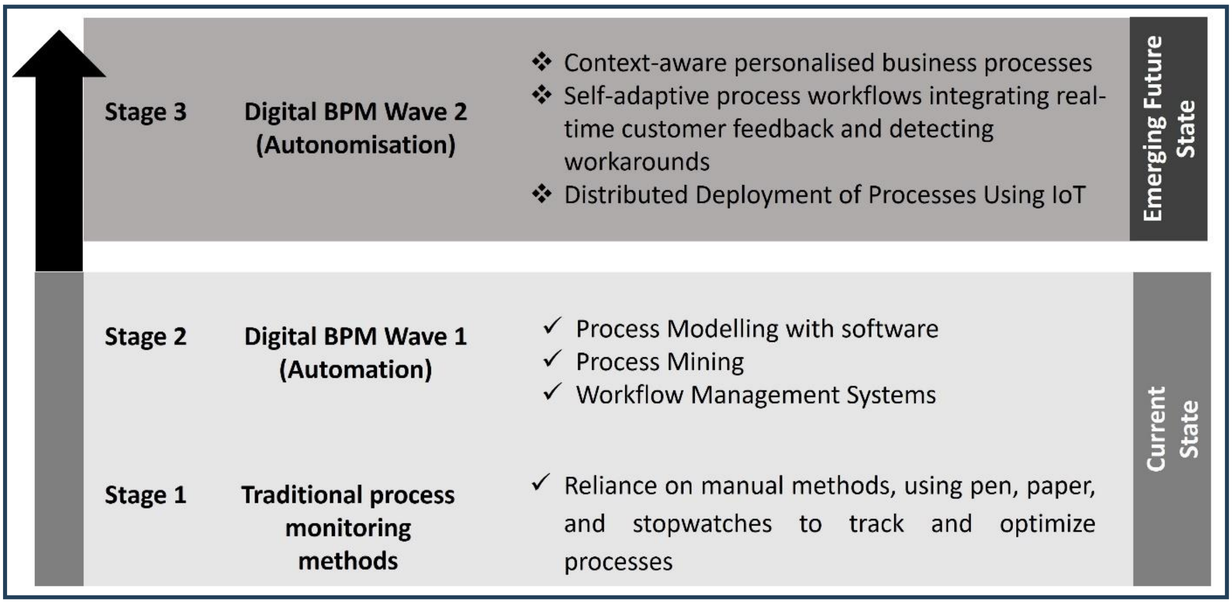

Figure 1: Emerging paradigms for BPM methods in the digital age

Historically, Business Process Management (BPM) relied on manual methods like pen, paper, and stopwatches to track and optimise processes (Barker, 1994; Nordsieck, 1931, 1961). Companies documented workflows through written instructions or flowcharts, while stopwatches measured task durations and identified delays. Audits were performed manually to spot inefficiencies, and decision-making was based on limited, often outdated data. This approach made process optimisation slow, inconsistent, and labour-intensive, with businesses only able to make incremental improvements through trial and error. This basic method, which spanned roughly from the 1930s to the 1980s - referred to here as Stage 1: Traditional BPM, focused on observation and time-based analysis, relying heavily on human effort for documentation and lacking integration or automation. While it provided some insight into operational efficiencies, it struggled to keep up with the growing complexity of modern organisations. This stage was marked by limited technology use beyond simple record-keeping and manual adjustments, making it a resource-intensive, less scalable approach.

With the rise of digital technologies, Business Process Management (BPM) underwent a profound transformation from the 1990s into the early 2020s, marking the emergence of Stage 2: The First Wave of Digital BPM. Digital tools became central to BPM, transitioning from manual methods to efficient, data-driven systems - further advancing the process redesign mindset laid out by Hammer and Champy (1993). Software environments enabled processes to be modelled and automated, providing an accurate representation of workflows (García-Borgoñón et al., 2014; van der Aalst & van Hee, 1995). The integration of workflow management systems further advanced BPM by capturing real-time data, which allowed for performance analysis and optimisation (Dumas et al., 2005). This shift to digital BPM marked the beginning of an automated, data-driven approach, where tools like process mining provided insights into process performance and conformance, enabling organisations to continuously refine and optimise their operations.

Currently, organisational BPM practices often combine both Stage 1 and Stage 2 approaches, with the specific blend depending on factors such as the organisation's BPM maturity, automation levels, data quality, and available expertise. While these approaches can yield successful outcomes, they also have inherent limitations. Key gaps persist within both traditional BPM (Stage 1) and digital BPM (Stage 2) practices, preventing organisations from fully realising the potential of a truly process-centric organisation— the foundational principle upon which BPM is built. Notably, these gaps are not just technological, but strategic - with many initiatives failing to start from clearly articulated business priorities and stakeholder needs. The failure to integrate AI and advanced technologies into BPM represents a significant missed opportunity, hindering organisations from optimising processes in real-time, driving innovation, and staying competitive in today's rapidly evolving business landscape. A visible symptom of these gaps is the proliferation of workarounds, local adaptations people use when processes or systems don't fit (Alter, 2014). From a socio-technical perspective, these gaps reflect misfits between formal process designs and situated work systems—misfits long recognised as a root cause of IS shortfalls (Alter, 2008).

Despite the advances of Stage 2 BPM, which incorporates data-driven approaches and workflow automation, several key gaps remain that prevent organisations from fully optimising their processes. While Stage 2 BPM enables retrospective analysis and optimisation, it lacks the ability to anticipate future process behaviour or proactively optimise workflows through predictive insights. This absence of AI integration limits real-time decision-making, as businesses continue to rely on human interpretation of data rather than leveraging AI to provide intelligent, automated recommendations. Additionally, without the capacity for real-time learning and adaptation, organisations are left dependent on static process models and periodic reviews, which are often too slow to respond to rapid changes in the digital landscape. Furthermore, Stage 2 BPM misses the opportunity for AI-driven personalisation, especially in customer-facing processes like sales and support, where tailored experiences could significantly improve engagement. Finally, the process intelligence offered by Stage 2 BPM tools, such as process mining, falls short of the deeper insights AI could provide, such as simulating and predicting process behaviour, offering a more comprehensive view of process health and optimisation potential.

A recurring limitation in both Stage 1 and Stage 2 BPM practice is the tendency to adopt new technologies in search of problems to solve. This technology-first mindset risks producing automation without purpose or alignment to organisational strategy. We contend that future BPM advancements should begin with a rigorous diagnosis of business challenges and stakeholder needs, and then identifying the appropriate technology mix to address them. In other words, business context, strategic priorities, and value-creation goals must set the agenda, with technology serving as an enabler rather than the driver. This business-first approach ensures that integration of AI, ML, and IoT delivers tangible, context-specific value, rather than generic efficiency gains.

What BPM uniquely brings, and where it differs from broader IS or automation initiatives is its disciplined, end-to-end view of organisational work that integrates operational detail with a broader contextual understanding. BPM unites modelling, analysis, implementation, execution, and continuous improvement within a socio-technical frame, aligning processes to strategy and evolving stakeholder needs. It also offers tested methods for managing both operational and contextual dynamics (Grisold et al., 2024), including the ability to conceptualise potential futures and to deliberately discard superseded practices that no longer serve organisational goals.

This dual capability; operational control and contextual foresight, enables BPM not only to optimise current processes but also to shape and reshape them in response to both closed-ended and open-ended futures. By embedding AI and other advanced technologies within this business-anchored BPM framework, organisations can anticipate change, proactively adapt, and sustain competitiveness in turbulent environments.

We provoke the status quo of current BPM approaches by questioning the focus on merely enhancing process efficiency with increasingly sophisticated tools. It is time to rethink BPM, identify untapped opportunities, and challenge the discipline to evolve beyond its current boundaries, unlocking new ways to drive impactful, transformative change. This marks the third stage of BPM and the second wave of Digital BPM, where we explore how BPM methods will integrate with dominant technological trends, particularly AI, ML and IoT.

3 Unveiling New Opportunities for Process Autonomisation

We present three key opportunities to enhance BPM tools and methods through the integration of AI, ML, and IoT, challenging the conventional BPM practices. While we do not claim to provide an exhaustive overview, we identify these areas as the primary avenues for advancing BPM in the digital era. Additionally, we outline future research directions to advance each of these opportunities. These opportunities are framed around persistent and well-documented business challenges, with technology serving as the means to address them effectively through BPM frameworks.

3.1 Context-aware Personalised Business Processes

While personalisation is a common theme in IS, *BPM provides the methodological scaffolding* to embed personalisation into the governance and orchestration of end-to-end processes. This ensures that AI-driven recommendations or IoT-enabled triggers are not isolated features, but *explicit decision points within adaptive workflows*, guided by *clear goal models*, *macro-level resourcing*, and *constraint-based governance* so that outcomes remain aligned with strategy and compliance (Rosemann et al., 2024).

This opportunity is motivated by persistent business challenges, experienced across multiple sectors, in delivering relevant, timely, and seamless customer experiences across channels. AI, ML, and IoT offer powerful enablers to address these needs when embedded in BPM frameworks. In IS, personalisation has been theorised and tested across lenses that are directly useful for BPM; spanning foundational conceptualisations (Fan & Poole, 2006), recommender design (Adomavicius & Tuzhilin, 2005), and the personalization–privacy paradox (Xu et al., 2011), with recent advances on ethical personalisation (Greene et al., 2023). These insights help ensure process personalisation is contextually relevant yet governed, privacy-aware, and strategically aligned.

Personalisation has long been recognised as a key differentiator for businesses across industries (Wurm et al., 2019). Historically, many deployed approaches combined explicit input with *implicit* behaviour signals (e.g., on-site clicks, co-views), as seen in early Amazon-style "customers who bought X also bought Y" recommendations. While this provides a level of personalisation, it still depends on customers actively engaging with the platform. Similarly, in banking, personalisation is often driven by customers explicitly sharing their financial goals with a representative or through systems like robo-advisors (e.g., Betterment), which require customers to input their data upfront.

While effective, these tactics generally personalise content within the current channel. They are typically triggered only *after* a user action and focus on *what to show*, not *how the end-to-end process should respond* - for example, which channel to hand off to next, when to intervene, or how to prioritise fulfilment and service routing under explicit governance. This narrow scope limits real-time anticipation and cross-channel adaptation. Furthermore, these systems assume that customers can clearly articulate their preferences or are willing to engage in potentially lengthy interaction. As a result, valuable opportunities for fluid, real-time, and context-aware personalisation are often missed. Recent IS work pushes beyond this reactivity: showing that real-time recommendations, tailored to a user's immediate context (e.g., current activity, time, device), exponentially increase engagement (Shi et al., 2025).

The limitations of these traditional personalisation methods highlight a critical gap: they are overly reliant on active customer input or staff engagement, which hinders the delivery of seamless, proactive, and adaptive experiences. This reliance creates missed opportunities for dynamic, context-aware personalisation that adapts in real-time to a customer's needs. However, recent technology advancements provide a powerful solution to bridge this gap. By integrating technologies such as AI, ML and IoT including data analytics, BPM systems can automate processes like data collection, real-time analysis, and decision-making, reducing the need for direct customer or staff intervention. This shift enables organisations to offer personalised services that are not only relevant and timely, but also adaptive to the customer's needs as they evolve.

Our vision for personalisation goes beyond simply suggesting products or services based on past behaviour or explicit customer input. We advocate for **data-driven, context-aware systems that dynamically adapt to an individual's situation in real time**. These systems anticipate needs and adjust their offerings automatically, without requiring explicit customer input. This proactive approach integrates seamlessly into business processes, responding to real-time customer behaviour and external factors to offer tailored experiences, without the customer having to "opt in" or actively engage. We introduce four critical areas that can drive this transformation:

AI-Driven Customer Insights: A key limitation of traditional personalisation is its reliance on customers to actively declare preferences. Methods like simple data mining analyse past behaviours, such as purchase history or browsing patterns, but still require explicit customer input or clear preferences. In contrast, AI-enabled BPM goes beyond basic data analysis by enabling systems to continuously monitor and analyse customer interactions across various touchpoints - whether through digital platforms, transaction data, or behavioural signals, without requiring any explicit input from the customer (Davenport, 2023). For example, AI can not only analyse browsing history or past purchases but also integrate additional data sources, such as social media activity, to predict customer preferences and anticipate needs in real time. This capability allows e-commerce platforms, for instance, to offer a more proactive approach to personalisation by automatically suggesting products that align with a customer's implied preferences, even before they actively search for them. Unlike traditional methods, AI-driven insights leverage ML algorithms to uncover deeper, more nuanced patterns, enabling a level of personalisation that adapts dynamically as customer behaviour evolves. This enables business processes to be more dynamic, allowing real-time adjustments and continuous learning from data. It enhances automation, streamlines decision-making, optimizes resource allocation, and improves demand forecasting. Moreover, when insights are state-dependent (e.g., mood, context, session intent), BPM can orchestrate *when* to diversify vs. assimilate recommendations to improve outcomes (Shi et al., 2025). To sustain trust, these pipelines should include explicit privacy boundary rules (Zhu & Kanjanamekanant, 2021) and governance for algorithms that continuously test and adjust their choices, including human oversight, auditability, and fairness checks (Greene et al., 2023).

Real-Time Personalisation through Data Integration: Traditional methods also rely on staff to engage with customers to understand their needs. Modern BPM innovations can integrate data from multiple touchpoints (e.g., website interactions, mobile apps, customer service interactions, and past purchases) to build a holistic customer profile. This real-time data can then be processed by AI algorithms to create tailored offerings or recommendations without waiting for direct customer input. For instance, in the banking sector, BPM systems can use customer transaction data and behavioural insights to automatically offer personalised loan options, savings plans, or investment advice based on a customer's financial habits, without needing an initial consultation with a bank representative.

Automated, Adaptive Workflows: BPM workflows can be designed to automatically adapt in real-time based on customer behaviour and data. For example, when a customer browses specific products or services, CRM systems can trigger personalised content, offers, or notifications, which are seamlessly integrated into business processes. The workflow system then uses these triggers to adapt the process dynamically - adjusting the next steps, such as sending tailored promotions, updating customer profiles, or prioritising certain actions based on the customer's preferences or previous interaction history. This adaptability ensures that customers receive a personalised experience without requiring them to manually communicate their needs. This approach is far more dynamic than traditional methods, which often require customers to proactively express their preferences. In industries like retail or banking, adaptive BPM workflows can continuously adjust product or service offerings, delivering the most relevant options based on real-time data and evolving customer needs. Where adaptivity relies on learning-by-feedback methods, such as *bandit algorithms* that continuously test different offers and shift toward the best-performing one, or *reinforcement learning* that chooses the next step based on rewards from prior actions—BPM should include socio-technical safeguards (human oversight, audit trails, fairness checks) in line with ethical IS guidance (Greene et al., 2023).

Machine Learning for Continuous Improvement: ML algorithms can continuously refine personalisation models by learning from ongoing interactions, enabling BPM systems to improve over time without requiring manual updates. For instance, in customer support, BPM systems can use ML to analyse past service requests and automatically suggest solutions based on similar customer issues. This approach can greatly enhance efficiency and customer satisfaction, as the system learns to predict the most relevant solutions without waiting for the customer to explicitly state their needs.

AI-powered BPM workflows can revolutionise personalisation across a wide range of industries by leveraging data-driven insights to proactively anticipate and meet customer needs. In **healthcare**, AI can analyse a patient's medical history, appointment data, and wearable health tracker information to predict potential health issues or recommend preventive measures, providing care providers with the ability to guide patients toward better health outcomes without waiting for explicit requests. In **banking**, AI and ML models can help automate personalised financial advice by analysing customers' spending habits, savings, and income data to recommend savings plans or loan options without customers needing to explicitly declare their goals. Platforms like Monzo and Cleo exemplify this by providing tailored financial recommendations based on customers' actual financial activity. In **retail**, contextual digital trace data allows retailers to proactively deliver personalised products and services by analysing customer behaviours and situational factors. For example, retailers can send tailored product recommendations, location-based offers, or time-sensitive promotions based on browsing history, cart abandonment, or in-store behaviour. Integrating this data with BPM systems enables retailers to adapt processes in real-time, offering predictive discounts, seasonal deals, and loyalty rewards that align with evolving customer needs and enhance the shopping experience.

These sectorial examples underscore how integrating AI and ML into BPM systems not only enhances the customer experience through proactive personalisation but also improves operational efficiency and scalability, allowing businesses to stay competitive in an increasingly dynamic digital world. While some of these practices are already in use, we propose the following avenues for future research, aimed at providing evidence-based, contextually relevant guidelines that can inform and enhance practical applications in the field.

- How can AI and/or ML be seamlessly integrated into BPM systems to analyse customer data in real time - to proactively uncover implied preferences and anticipate needs before customers explicitly search for products or services?
- How can BPM systems effectively integrate data from diverse touchpoints and systems (such as website interactions, mobile apps, customer service engagements, and past purchases) to create a comprehensive, real-time customer profile that drives personalised decision-making and enhances service delivery - while respecting privacy boundaries?
- How can BPM workflows be designed to automatically adapt to changing customer needs in real-time, leveraging in-the-moment data and customer behaviour to dynamically adjust service or product offerings (including when to introduce new options versus reinforce known preferences)?
- How can machine learning be integrated into BPM systems to automatically optimise service delivery, by predicting relevant solutions based on historical interactions, with continuous learning and monitoring for model drift, without requiring manual updates or explicit customer input?
- In what ways can AI-driven personalisation models in BPM systems account for customer emotions and sentiment in real-time, enhancing the relevance and empathy of service delivery?
- How can BPM systems ensure ethical and transparent personalisation practices when utilising AI and data analytics, particularly in terms of privacy, security, explainability, human oversight, and fairness, to sustain customer trust?

3.2 Self-Adaptive Process Workflows: Integrating Real-Time Customer Feedback and Identifying Workarounds

In many organisations, feedback loops remain too slow or fragmented to meaningfully influence day-to-day process performance. Addressing this gap requires BPM approaches that are grounded in real operational and stakeholder challenges, with technology applied to enable responsive, data-informed adaptation.

ML has the potential to significantly transform BPM systems by enabling them to evolve continuously through real-time insights from various sources. We propose **a self-evolving BPM system**, powered by ML, that **allows organisations to dynamically refine their workflows in (a) response to customer feedback, and (b) internal work patterns and process workarounds**. By observing interactions such as complaints, positive feedback, or inefficiencies, BPM systems can automatically react and adapt in real-time, creating a new "as-is" process that reflects these insights. This approach fosters an agile, responsive process environment that stays aligned with actual customer and/or user needs and behaviours, enhancing operational efficiency and improving stakeholder satisfaction while ensuring that workflows remain relevant and effective.

3.2.1 Autonomous Reaction to Customer Feedback

Integrating autonomous reactions to customer feedback through ML in BPM systems can significantly transform various industries. For example, in e-commerce, BPM systems could automatically adjust processes based on customer dissatisfaction highlighted on platforms like Reddit, improving aspects like checkout and delivery. In telecommunications, social media complaints could trigger automatic reviews and enhancements in billing processes or customer service workflows. In healthcare, feedback on wait times or booking issues could prompt scheduling adjustments to improve patient experience, while in banking, insights into loan application frustrations could streamline workflows. Similarly, retail and hospitality businesses could refine ordering systems or service levels in response to customer reviews. By enabling BPM systems to autonomously adapt to real-time feedback, businesses can enhance operational efficiency, proactively address issues, and continuously improve customer satisfaction.

To fully explore the cutting-edge potential of integrating ML, real-time feedback, and BPM systems, several key areas require further research. These areas will help unlock the ability to create self-evolving, adaptive processes that are more responsive to customer needs and aligned with business objectives. These research avenues include:

- How can ML algorithms be trained to autonomously prioritise and translate diverse customer feedback (e.g., from Reddit, reviews, or social media) into actionable process changes within BPM systems, ensuring that only high-impact issues trigger workflow adjustments?
- In what ways can BPM systems integrate real-time feedback from customer sentiment analysis (such as social media discussions) to autonomously adapt workflows and processes, and how can these adaptations be tested for effectiveness without human intervention?
- How can BPM systems leverage ML to identify and incorporate unspoken customer needs, detected through patterns in feedback and behavioural data, into process improvements that align with both business goals and customer satisfaction?

3.2.2 Detect and Autonomously Respond to Process Workarounds

In addition to customer-driven insights, ML can also track how employees or other stakeholders are working around established processes. These workarounds often arise when individuals perceive the existing processes as inefficient or unable to meet specific demands in real-time. Workarounds are local, goal-driven adaptations people use when standard procedures or systems get in the way of getting the job done (Alter, 2014). Rather than viewing them simply as “unauthorised” deviations, they can be read as signals of misfit between process design and operational reality. For example, retail agents may skip low-value verification to speed resolution for high-value customers; in healthcare, staff may streamline intake steps to expedite treatment. Analysing these patterns helps pinpoint where workflows create friction and whether the informal change actually improves outcomes (e.g., resolution time, patient flow, resource use). The BPM implication is to convert beneficial workarounds into governed process changes—and redesign or reinforce controls where workarounds introduce risk. In socio-technical terms, workarounds surface where designed technical routines and the social organisation of work lack fit; robust BPM can sense these signals and adjust the joint design (Strong & Volkoff, 2010).

If workarounds consistently lead to improved outcomes, a BPM system should, under governance, promote them into standard operating procedures as “positive deviance” (Setiawan & Sadiq, 2013), so successful local practices are scaled safely. At run time, the BPM system can detect recurring patterns and their effects, formalise beneficial ones, and flag harmful ones for review (Alter, 2014). Institutionalising validated workarounds makes processes more agile and resilient, reduces manual intervention, and recognises frontline improvement efforts. It also streamlines operations and builds a culture of continuous improvement, aligning workflows with actual user needs and boosting customer satisfaction and employee morale. The result is improved day-to-day performance and a more durable capability - turning informal problem-solving into formal, scalable solutions.

We propose several research questions aimed at advancing the understanding of how BPM systems can autonomously evolve by analysing workarounds:

- How can ML algorithms identify and evaluate workarounds in BPM systems to determine which should be formalised into standard operating procedures, and how can these insights trigger autonomous system adaptations to enhance process performance?
- What patterns in employee-driven workarounds can inform BPM systems to autonomously adapt workflows in real-time, improving operational efficiency and responsiveness to customer needs without manual intervention?
- What metrics and success indicators should BPM systems use to assess the effectiveness of workarounds?
  - How can these insights be leveraged to continuously optimise workflows and enhance customer satisfaction?
  - How can BPM systems differentiate between temporary workarounds and systemic process changes, ensuring that only beneficial adaptations are formalised while maintaining alignment with organisational goals and compliance standards?

3.3 Distributed Deployment of Processes Using IoT

The motivation for exploring IoT-enabled process deployment comes from long-standing challenges in achieving real-time responsiveness and operational agility across distributed environments. IoT technologies become high-value enablers when harnessed to address these specific challenges through BPM designs.

The idea of distributed deployment of processes using IoT is an emerging and increasingly important area of innovation in business process management (BPM). The combination of IoT devices, edge computing, and smart process automation is reshaping the way organisations approach operational efficiency, agility, and real-time decision-making. Traditionally, BPM systems have been centralised and dependent on human intervention or static, pre-defined workflows. However, as the IoT landscape evolves, the capability to deploy and manage business processes across a vast network of interconnected devices introduces an entirely new dimension to BPM. This shift towards distributed and autonomous processes is poised to revolutionise industries by enabling smarter, more efficient, and highly responsive operations.

The convergence of IoT and BPM has recently gained significant attention because of its potential to transform traditional process management. As IoT devices become more pervasive, collecting data and enabling real-time interactions across various points of operation, organisations are looking for ways to integrate this data into their existing BPM frameworks. By leveraging the intelligence of IoT devices, businesses can create processes that react, adapt, and evolve based on real-time insights from across the network. This is a natural progression from static processes to more dynamic, distributed systems that can execute decisions autonomously, enabling faster and more effective responses to customer needs, operational inefficiencies, or environmental changes.

This represents a paradigm shift where workflows no longer rely on centralised decision-making but instead are distributed and automated in response to real-time data feeds. For example, in manufacturing, IoT sensors can monitor machine conditions and trigger maintenance actions before breakdowns occur. In logistics, GPS and RFID sensors can track the movement of goods and initiate re-routing decisions without human intervention. In healthcare, patient monitoring devices can trigger workflows to adjust treatment plans based on real-time health data. IoT in smart cities can transform public services by automating traffic management, waste collection, and energy use, with BPM systems leveraging real-time sensor data to optimise urban operations, improving efficiency and quality of life for residents.

Several critical areas require further exploration to fully integrate IoT into BPM systems, ensuring seamless scalability, robust security, and appropriate human oversight while addressing the complexities of real-time data processing and decision-making across diverse industries.

- How can BPM systems be redesigned to integrate real-time, distributed IoT data while ensuring scalability and flexibility across diverse industries?
- What methodologies and AI/ML models can be developed to enable autonomous decision-making and process adaptation within BPM systems driven by IoT sensor data?
- What frameworks or protocols are needed to ensure seamless interoperability between IoT devices, sensors, and existing BPM tools, particularly in large-scale, multi-device environments?
- How can BPM systems balance automation with human oversight when integrating IoT-driven decision-making, particularly in mission-critical sectors like healthcare or finance?
- What security and privacy measures must be integrated into BPM tools to safeguard real-time data from IoT devices, especially in sensitive industries like healthcare or smart cities?

4 Conclusion

As organisations accelerate their digital transformation journeys, BPM must evolve from adapting to technological change to actively shaping how technology delivers business value. The integration of AI, ML and IoT offers unprecedented opportunities for agility, personalisation, and real-time adaptability. Yet these technologies must be deployed in response to clearly articulated business challenges, not pursued for their novelty. BPM's enduring strength lies in its ability to align operational processes with strategic priorities, ensuring that technological investments generate context-specific value and measurable outcomes.

A central advancement in this evolution is process autonomisation - enabling BPM systems to make decisions autonomously and adapt to real-time data and contextual shifts. The three opportunities explored in this paper; context-aware personalised processes, real-time feedback-driven workflows, and distributed IoT-based process management, demonstrate how autonomisation can transform both operational efficiency and customer engagement. By anchoring these innovations in business needs, organisations can ensure that automation enhances - not replaces - strategic intent.

Drawing on Grisold et al. (2024), we stress that BPM is uniquely positioned to manage both operational and contextual dynamics. It can conceptualise potential futures, design for flexibility, and deliberately discard superseded practices that no longer serve organisational goals. This dual capability allows BPM not only to optimise processes in predictable, closed-ended scenarios but also to navigate uncertainty in open-ended futures.

The proposed research agenda calls on academics and practitioners to seize these opportunities while addressing the accompanying challenges; scalability, security, governance, and balancing automation with human oversight. Future work must focus on integrating AI, ML, and IoT seamlessly into socio-technical BPM systems, guided by capability frameworks and grounded in goal specification, macro-level resourcing, and constraint governance.

Ultimately, BPM must not only adapt to the rapidly evolving technological landscape but also lead the way in reimagining business processes for a smarter, more efficient future. As emerging technologies often lack seamless integration within individual workflows, the strategic integration of technology into BPM is no longer optional—it is mission-critical. Embracing process autonomisation as the next pivotal stage will enable organisations to unlock new levels of performance, enhance operational agility, and foster deep alignment between process management and business strategy. This will not only drive efficiency but also position businesses to thrive in an increasingly dynamic and competitive environment, a future where BPM is the discipline that ensures technology serves strategy, not the other way around.

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