

A Better Workday: Actor-Centric Business Process Management

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Abstract

Business Process Management (BPM) and process mining research have traditionally focused on improving operational efficiency and process performance, while largely overlooking the experiences of employees executing these processes. Neglecting employee work experiences may contribute to burnout and turnover and is therefore also of critical importance for organizational sustainability. This doctoral project investigates how BPM and process mining can be extended toward an actor-centric perspective aimed at improving employee work experience. The research focuses on sectors with high rates of part-time employment, such as childcare and healthcare in the Netherlands, where workforce shortages and work pressure are major challenges. The project consists of three parts: (1) introducing actor-centric predictive process monitoring methods, (2) analyzing work patterns in relation to employee work energy levels throughout the workday using event logs, and (3) developing a simulation tool to evaluate actor-centric interventions. To address these three research objectives, I use both publicly available event logs and privately collected event logs, obtained from eight childcare organizations. Overall, this doctoral project contributes to extending BPM and process mining beyond process efficiency by integrating actor-centric perspectives to enable a more comprehensive understanding of how work design affects employee work experience.

Keywords

Actor-centric, Work mining, Process mining, Business process redesign

1. Introduction

Business Process Management (BPM) and process mining research typically focus on optimizing processes in terms of efficiency, cost reduction, and performance [1]. Consequently, most studies adopt a case-centric perspective when proposing and implementing process improvements. However, one important aspect is often overlooked: *the people who execute these processes*.

Neglecting the *actor-centric* perspective, that is, *the experiences and well-being of the individuals performing the process*, may lead to burnout and turnover. For example, when employees perceive their work processes as burdensome or frustrating, this can result in burnout or increased turnover [2]. In turn, these outcomes may negatively affect organizational performance by creating staffing shortages and disrupting process execution.

Some sectors are particularly vulnerable to this issue due to their high prevalence of part-time employment. Examples include the childcare, healthcare, and primary education sectors in the Netherlands, where part-time employment rates are 84%, 66%, and 69%, respectively [3, 4]. The widespread use of part-time work contributes to staffing shortages, which increase work pressure on employees. As a result, employees become more susceptible to burnout and may experience reduced motivation, reinforcing a cycle of workforce strain and operational challenges.

The program *Meer Uren Werkt!* (*English: More Hours Works!*) aims to address this issue by enabling part-time employees to increase their working hours, should they wish to do so. Researchers from various disciplines, including economics, sociology, and organizational sciences, contribute perspectives to better understand and tackle this problem. I believe that our field—Business Process Management and Process Mining—can also offer valuable and complementary contributions to support this initiative.

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In addition, the insights derived from this doctoral project could be applied to any sector facing staffing shortages, high workloads, or workforce retention challenges.

Recent research has explored the incorporation of resource information into traditional process mining techniques. For example, Klijn et al. [5] demonstrate that resource-level waiting time features provide more interpretable performance insights than aggregate measures, while Kunkler et al. [6] show that resource-specific task duration estimates can improve allocation decisions. Similarly, resource-oriented simulation approaches have emerged that model individual resource behavior and interactions, such as Agent Simulator [7] and Agent Miner [8]. These studies demonstrate the value of incorporating resource information into process analysis and simulation.

Although these studies incorporate resource information, they continue to evaluate outcomes primarily from a process-performance perspective, such as prediction accuracy, throughput time, or simulation fidelity. The actor is treated as a source of information rather than as the primary subject of analysis. Consequently, little is known about how process mining techniques can be used to understand and improve the day-to-day experiences of employees. Understanding how process design can affect employees' work experiences may enable the development of interventions that reduce turnover and burnout, thereby contributing to a more sustainable workforce.

Motivated by the current literature in BPM and the analytical possibilities offered by process mining, I aim to answer the following Research Questions (RQs) during this doctoral project:

- RQ1: How can actor-centric next-activity prediction be formally defined and effectively modeled for predicting future work allocation across cases?
- RQ2: How can actor-centric process mining be used to design redesign interventions that improve employees' workday experiences in part-time dominated sectors?
- RQ3: How can actor-centric redesign interventions be evaluated using process simulation?

2. Method

This section presents the completed and planned studies that comprise this doctoral project in line with the mentioned RQs. For each study, I describe the research problem, relevant literature, the proposed methodology, and the expected results and contributions.

2.1. Study 1: Actor-Centric Next Activity Prediction

Research Problem Traditional predictive process monitoring (PPM) studies predominantly focus on case-centric prediction tasks, such as predicting the next activity, remaining processing time, or outcome of an ongoing process instance. While these approaches provide valuable insights into process execution, they offer limited support for resource-oriented decision making, where managers are interested in understanding and anticipating employee behaviour.

When shifting the prediction target from process cases to individual resources, a fundamentally different prediction problem emerges. Instead of predicting the next activity within a single case, the objective becomes predicting the next activity performed by a specific employee across multiple cases. From this point onward, I refer to this task as *actor-centric next activity prediction*. This change alters the structure of the prediction data and the underlying behavioural patterns that must be learned. Furthermore, issues commonly observed in case-centric prediction, such as majority-class dominance and example leakage through overlapping case prefixes [9], are less prevalent in the resource-centric setting.

Despite its practical relevance for workforce planning, workload balancing, and resource management, actor-centric next activity prediction remains largely unexplored in the PPM literature. Consequently, it is unclear to what extent employee behaviour can be predicted and which modelling approaches and feature representations are most effective for this task.

Related Work Research on next activity prediction has predominantly adopted a case-centric perspective, where machine learning and deep learning models are trained to predict the subsequent activity of an ongoing process instance based on its execution history. Existing approaches employ a variety of encoding techniques and predictive models, including decision trees, random forests, gradient boosting methods, recurrent neural networks, and transformer-based architectures [10, 11, 12, 13, 14, 15, 16]. While these studies have demonstrated strong predictive performance, they largely focus on process behaviour rather than resource behaviour.

Only limited attention has been given to actor-centric predictive tasks. Understanding the future actions of individual employees could support workforce management, workload balancing, and the identification of potentially overloaded resources. Actor-centric next activity prediction therefore extends the scope of predictive process monitoring by shifting the focus from process execution to human behaviour within business processes. Despite its practical relevance, empirical evidence on effective modelling approaches for this task remains scarce.

Methodology Event logs are transformed into sequences by grouping events according to the resource responsible for their execution. I evaluate four machine learning models—Random Forest, LightGBM, LSTM, and a Transformer-based model—across four BPIC datasets (BPIC 2013 Incidents, BPIC 2017, BPIC 2018, and BPIC 2019) and compare their predictive accuracy when using three behavioural encodings against a baseline based on sequence encoding.

The behavioural encodings capture resource-specific work patterns. The first encoding uses binary feature encoding to represent whether a resource has ever performed a particular activity in the event log. The second encoding uses a 2-gram representation to capture activity-switching tendencies. The third encoding extends the second by computing the number of activity runs observed in a sequence and the average length of these runs. A run is defined as a sequence of identical consecutive activities. The number of runs reflects how frequently a resource switches between tasks, while the average run length captures how long a resource typically continues performing the same activity before switching.

I compare different model–encoding combinations to identify the configurations that achieve the highest predictive accuracy.

Results and Contribution The results demonstrate that next-activity prediction from an actor-centric perspective is feasible across multiple real-life event logs. Furthermore, feature encodings that explicitly capture resource behaviour, such as 2-gram and run-length encodings, improve predictive accuracy by up to 0.55 points compared to the sequence-encoding baseline.

This study contributes to the predictive process monitoring literature in three ways. First, it formalizes and evaluates the actor-centric next activity prediction problem, extending the predominantly case-centric focus of prior work. Second, it provides an empirical comparison of machine learning approaches across multiple benchmark datasets. Third, it identifies behavioural resource features as important predictors of future employee actions, establishing a baseline for future research on actor-centric predictive process monitoring.

2.2. Study 2: Process Redesign for Work Energy

Research problem Employee-centered insights have not yet been translated into concrete process redesign patterns that process analysts can readily apply in practice. As a result, process redesign efforts often focus on organizational performance indicators while overlooking the impact of process changes on employees. To address this gap, I use *work energy* as an employee-centered indicator for evaluating and comparing work processes. Work energy is a multidimensional construct comprising emotional energy (positive mood and excitement), cognitive energy (alertness and focus), and physical-behavioral energy (the investment of physical effort into purposeful action) [17]. Higher energy levels are associated with improved creativity, concentration, problem-solving, and performance, benefiting both employees and organizations [18].

Related Work Redesigning a business process aims to improve an existing workflow, for example by increasing efficiency, reducing costs, or enhancing organizational performance. Prior research in BPM

has proposed numerous redesign principles and best practices to support such improvements [19, 20]. Existing research on process improvement predominantly focuses on either developing frameworks for identifying improvement opportunities, examining process improvement within specific industries, or proposing methods for process redesign [21]. These approaches typically focus on organizational or operational outcomes, such as performance optimization and cost efficiency, but pay little attention to improving work processes at the individual employee level.

Methodology I identified six recurring patterns in eight real-life datasets obtained from childcare organizations. A pattern is defined as a recurring activity with specific characteristics that indicate potential opportunities for improvement from an employee-centred perspective. Each pattern captures a distinct phenomenon related to work energy, task execution, or workday structure. Work energy is measured using a 10-working-day survey in which childcare employees record the tasks they perform and rate how draining or energizing they find each task on a Likert scale ranging from -5 (very draining) to +5 (very energizing).

The patterns include tasks that are (1) consistently rated as low-energy across all employees; (2) characterized by high variation in energy ratings between employees; (3) associated with higher energy levels in the morning than in the afternoon, and vice versa; (4) performed at the start of the workday, short in duration, and exhibiting a phenomenon referred to as the “start-of-the-day trap” [22]; (5) consistently rated as low-energy and long in duration; and (6) rated as low-energy and frequently repeated throughout the day. These patterns form the basis of our redesign method and are used to derive interventions aimed at improving employee energy throughout the workday. Accordingly, the redesign interventions associated with these patterns fall into one of three categories: (1) removing the activity, (2) reallocating the activity to other employees, or (3) rescheduling the activity within the workday.

Finally, I will evaluate these interventions by conducting simulations on the event logs and measuring the average energy score across the entire log. In addition, I will conduct interviews with HR personnel and location managers within the participating organizations to assess whether the interventions are feasible and relevant in practice.

(Preliminary) Results and Contribution I simulated the proposed interventions on three event logs and are currently analyzing data from the remaining five organizations. The initial results indicate that applying all interventions to the top three activities identified for each pattern on three event logs can improve overall work energy by up to 27%. Furthermore, interviews revealed that participants perceived the interventions as requiring relatively little effort while offering potentially substantial benefits for the organization. However, not all interventions are applicable to every activity. For example, activities involving specific mentor–child relationships could not be redistributed to other employees because they were tied to particular individuals. Additionally, interviewees indicated that some of the resulting insights were unexpected and provided valuable discussion points for the team.

I make the following contributions: (1) I introduce six employee-centered process redesign patterns aimed at improving employee energy in business processes, offering actionable redesign guidance for process analysts; (2) I propose a method for detecting and applying these patterns using real-life event logs, allowing analysts to identify and implement employee-centered improvements in practice.

2.3. Study 3: Evaluating Actor-Centric Process Redesign

Research Problem The research problem addressed in this study is the absence of a method for evaluating process redesign interventions from an individual employee perspective. The study investigates how simulation-based techniques can be used to assess the impact of process redesign alternatives on employees and provide actor-centric evaluation metrics instead of the traditional process performance indicators. Using a simulation-based approach, organizations can evaluate the potential effects of interventions on employees before implementing them in practice.

Related work While numerous approaches exist for evaluating the success of process redesign initiatives at the process level, considerably less attention has been paid to whether employees themselves

benefit from these redesigns and to what extent. Existing studies primarily focus on process-oriented performance metrics. For example, Trottier et al. evaluate interventions based on process execution times and employee involvement, measured through participation in briefing sessions and the associated time investment [23]. Similarly, Cho et al. assesses the effects of process redesign using indicators related to time, cost, quality, and flexibility, comparing performance before and after the redesign [24]. Although such measures provide valuable insights into organizational and process performance, they offer limited understanding of how redesign interventions affect employees. To address this gap, I propose a tool that adopts a resource-oriented perspective by using simulation techniques to evaluate the impact of interventions on employees and their work.

Methodology This study aims to develop a simulation tool that enables the evaluation of the concrete gains or improvements experienced by individual employees following process redesign interventions. The study could build upon existing simulation models, such as AgentMiner, although developing a new model from scratch is also a possibility [8]. For instance, the insights derived from Study 1, in which we predict an employee's next activity, can serve as input to the simulation tool. Furthermore, the tool should incorporate the work energy construct introduced in Study 2 to evaluate the impact of redesign interventions on individual employees.

(Expected) Results and Contribution I expect to contribute to the Business Process Simulation field and to post-intervention analysis at the actor-centric level. The simulation tool would use new performance indicators tailored to the individual employee level. Such an evaluation approach would enable organizations to explore whether specific redesign interventions benefit employees without needing to immediately implement them in practice.

3. Research Progress and Expected Feedback

Study 1 has been completed and is currently under review. Study 2 is in progress and is expected to result in a journal paper. Study 3 has not yet been started. During the Doctoral Consortium, I hope to receive feedback on the design and methodology of the proposed simulation tool, as well as on how the individual studies can be integrated into a coherent dissertation. In addition, I would appreciate feedback on how the findings of Study 2 can be generalized beyond the childcare domain to increase their broader applicability.

4. Conclusion

To conclude, this doctoral project aims to contribute to a shift within BPM and process mining toward a stronger actor-centric perspective, in which employees and their work experiences become a central focus of process analysis and redesign. By drawing on established BPM and process mining subfields, such as PPM, process redesign and business process simulation, this research explores how work processes can be analyzed and improved from the perspective of the employee. In doing so, the research seeks to contribute to sectors affected by labor shortages, burnout, and employee turnover, while also examining whether BPM and process mining techniques can play a meaningful role in improving employees' work experiences and supporting more sustainable ways of working. By focusing on the actor-centric perspective, organizations may be better able to monitor and preserve positive employee work experiences, which could contribute to employee retention and, consequently, more stable process execution.

Declaration on Generative AI

During the preparation of this work, the author used ChatGPT (OpenAI GPT-5.5) for grammar and spelling checking. After using this tool, the author reviewed and edited the content as needed and takes full responsibility for the publication's content.

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