This document is part of the supplementary material for the paper titled 'Explaining Process Dynamics: A Process Mining Context Taxonomy for Sense-Making' by Franzoi*, S.; Hartl, S.; Grisold, T.; van der Aa, H.; Mendling, J.; vom Brocke, J. submitted for publication to the journal Process Science (https://link.springer.com/journal/44311).

Section C:

Table 1. Interview Partner Summary

Interviewee Abbreviation	Transcript Reference	Reference in Transcript	Background
I 1	B.1 Interview Researcher 1 (IR1)	A	PhD Candidate, Information Systems
I 2	B.2 Interview Researcher 2 (IR2)	A	PhD Candidate, Information Systems
I 3	B.3 Interview Researcher 3 (IR3)	A	Chair of Information Systems, PhD in Information Systems
I 4	B.4 Interview Practitioner 1 (IP1)	A	Machine Manufacturing Industry, BPM Expert
I 5	B.5 Interview Practitioner 2 (IP2)	A	Industrial Manufacturing Industry, BPM Expert
I 6	B.6 Interview Practitioner 3 (IP3)	A	Energy Industry, BPM Expert
I 7	D.1 Focus Group 1 (FG1)	A	BPM IT Consultant
I 8	D.1 Focus Group 1 (FG1)	B	BPM IT Consultant
I 9	D.1 Focus Group 1 (FG1)	C	BPM IT Consultant
I 10	D.1 Focus Group 1 (FG1)	D	BPM IT Consultant
I 11	D.1 Focus Group 1 (FG1)	E	BPM IT Consultant
I 12	D.2 Focus Group 2 (FG2)	A	BPM IT Consultant
I 13	D.2 Focus Group 2 (FG2)	B	BPM IT Consultant
I 14	D.2 Focus Group 2 (FG2)	C	BPM IT Consultant
I 15	D.2 Focus Group 2 (FG2)	D	BPM IT Consultant

Key takeaways

The exploration of the integration of LLMs for business process coherence checking has yielded significant insights through the refinement of the design specifications and their subsequent evaluation by BPM experts. The initial design objectives were well received by both researchers and practitioners, confirming their clarity and alignment with practical BPM needs, with I 2 (IR2) stating *"I think the design objectives are very good [...] And they give me the impression that they are very complete."*.

In particular, the refinement process resulted in a more precise and actionable set of design specifications, achieved through a more concise use of language. A key finding was the deliberate omission of explicit data security measures from the specifications to ensure global applicability, although stakeholders emphasised the need for robust data security practices inherent in the artifact. Practitioners appreciated the autonomous nature of the artifact, recognising its potential to provide information and guidance autonomously.

One notable finding relates to the complexity of the management summaries generated by the system. Feedback suggested that these summaries should focus on two primary options: applying or reversing the identified process changes, thereby providing clear

and practical steps for process owners with I 3 (IR3) stating *"I would always differentiate between the two options [....] in reality it's about the decision - do I want to implement this in the process model or do I not want to implement it [...]"*. The tool was characterised as a quality assurance measure, valued for its informative, autonomous and advisory nature, further underlining its perceived usefulness in improving BPM practices, as I 6 (IP3) commented *"Generally speaking, I would see the tool as a quality assurance to simply raise the quality of my work."*.

Successful implementation requires addressing several organizational aspects, with a focus on identifying the ground truth for changes to process documentation, with I 5 (IP2) questioning *"[...] whether we can reach the point, the starting point, where the model and the description are sufficiently accurate"*. For the purposes of this paper, the most recently modified document is taken as the ground truth, as suggested by I 2 (IR2) stating *"[...] perhaps the modification date could simply be the indicator, what the latest version of a process is"*. However, future research should aim to develop more sophisticated methods for dynamically determining the ground truth.

Tagging changes by priority or urgency has emerged as a critical feature. This mechanism would allow organizations to address important updates promptly, thereby increasing the practical relevance and operational efficiency of the system as discussed by the expert interviewees. Complementing this, the introduction of a traffic light indicator in artifact notifications, signalling the severity of the changes, ranging from red for critical issues requiring immediate action to green for minor adjustments that can be planned, could significantly improve user understanding and response to changes, as proposed by
I 4 (IP1) *"I would signal it with traffic lights indicators so that you know how important it is [...]"*.

To effectively address the different stakeholders within BPM, it is essential to provide tailored outputs based on specific Business Process Change Dimensions. These dimensions, introduced in Section C, ensure that the system addresses the different interests of stakeholders, as proposed by I 3 (IR3) *"[...] the process owner is primarily interested in all changes to the control flow, but the production planner may be more interested in the resource dimension"*. In addition, notifications can be tailored to highlight the Business Process Change Dimensions relevant to each recipient. For example, experts indicated that not all stakeholders may find the data dimension relevant, so tailoring messages to highlight only the suited relevant changes ensures that recipients receive the most relevant information. This level of personalised communication could increase the efficiency and overall effectiveness of the system by ensuring clarity and focus in each notification, and should be a priority for further research.

The feedback suggested several areas for further research. Expanding the types of data the system can handle to include event logs, UI logs, images and video, for example, would greatly enhance its usefulness and capabilities. Another promising direction is to develop capabilities for direct implementation of changes, allowing users to accept and apply changes efficiently, moving beyond mere recommendations to actionable implementations, with I 6 (IP3) envisioning *"I would even go one step further. So if the entire software, the AI,*

has understood the process, the process documentation it could maybe even make changes automatically".

Discussions on the triggering mechanism for the system considered change-based, interval-based, on-demand and hybrid approaches. Each offers unique advantages: immediate response, consistent monitoring, flexibility, and comprehensive coverage. Although only the on-demand triggering mechanism is demonstrated in this paper, the modular design of the system allows for future extensions to incorporate other triggering options. Further research is recommended to explore the different triggering mechanisms in practical implementations.

Emphasising the autonomous nature of the system, the potential for significant efficiency gains is highlighted by its ability to reduce the need for manual work. This is particularly important as staff time is one of an organization's most valuable resources, with I 6 (IP3) stating *"No matter in which project for us, resources, FTE, are the be-all and end-all."*.

The combination of design objectives derived from the literature, refined specifications and extensive expert feedback has resulted in a clear and practical set of requirements and guidelines for the integration of an effective process coherence checking mechanism based on changes to process-related documentation. The refined design specifications ensure that the system can accurately detect incoherencies, provide actionable insights and operate in a way that supports both operational efficiency and strategic business improvement.

Business Process Change Dimensions

For the effective implementation of business process coherence checking, it is crucial to systematically detect and categorise changes in BPM-related documentation. The Business Process Change Dimensions have been derived from foundational work and adapted to meet contemporary business process requirements. In particular, the perspectives outlined by Jablonski and Bussler (1996) provide the basis for understanding different aspects of workflows. Jablonski and Bussler identified key perspectives such as Function, Operation, Behavior, Information and Organization to comprehensively describe workflows. van der Aalst and Jablonski (2000) adapted these perspectives into a framework for categorising workflow change. Later, Bose et al. (2014), in "Dealing With Concept Drifts in Process Mining", further developed these categories into three perspectives of business process change: Control Flow, Data and Resource, emphasising their relevance in tracking dynamic changes over time.

Based on the synthesis of these works, the following Business Process Change Dimensions have been derived to categorise changes and check for incoherencies:
Task Dimension, Control Flow Dimension, Data Dimension, Organization Dimension.

Task Dimension focuses on changes to the fundamental activities and events within processes, including the introduction of new activities, the modification of existing activities or the deletion of obsolete activities. These changes have a direct impact on the execution and

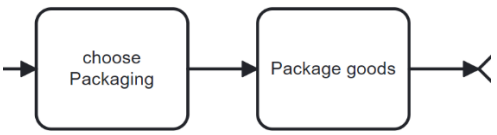
functionality of the process. For example, in the context of BPMN, this could be the addition of a new task element, the modification of a task type, the deletion of redundant task elements or a change to a start or end event.

Control Flow Dimension deals with changes to the sequence and logic of processes. This includes changes to the order of activities, the logic of sequence flows, and decision points. Such changes redefine the path and logic by which processes are executed, affecting the overall coherence of the process. In BPMN terms, this could involve reordering tasks, changing gateway configurations, or adjusting conditional flows.

Data Dimension relates to changes in the consumption and production of data within processes. This includes updates to data elements and data handling procedures to ensure that input and output data flows are consistent and aligned with process requirements. In BPMN diagrams, for example, this may involve changes to data objects and data associations.

Organization Dimension involves changes to roles, responsibilities and resource allocations within a process. These changes affect who performs certain tasks and how resources are allocated within workflow executions. Monitoring these changes is critical to understanding their impact on organizational efficiency and maintaining coherence. In BPMN, this could include reassigning tasks to different roles, updating swim lane assignments, or changing resource distributions.

The following table provides examples for each of these Business Process Change Dimensions, taken from the dataset introduced in Section D. These examples will illustrate how the dimensions are applied in practice, ensuring a robust understanding of the categorisation framework through the use of BPMN diagrams as specific examples.

Name of Business Process Change Dimension	**Examplary Change Types (adopted from van der Aalst and Jablonski (2000))**	**Example from the Dataset (see Section E.)**
Task Dimension	Changes to Events or Activities (Flow Objects)	Addition of Task in Dispatching Process:  v0:  v1:

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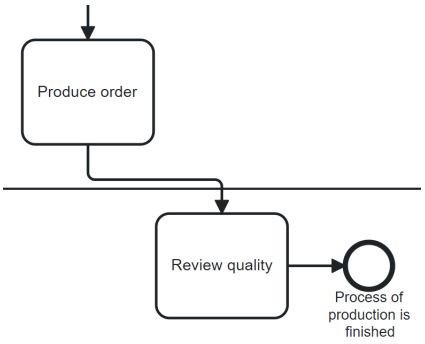
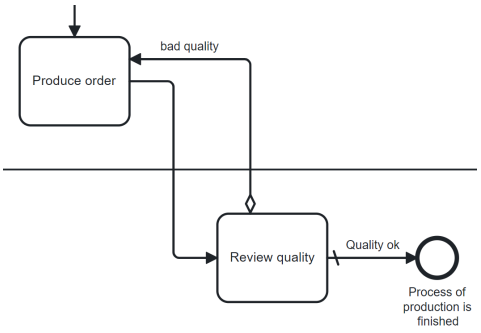
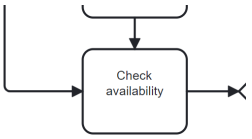
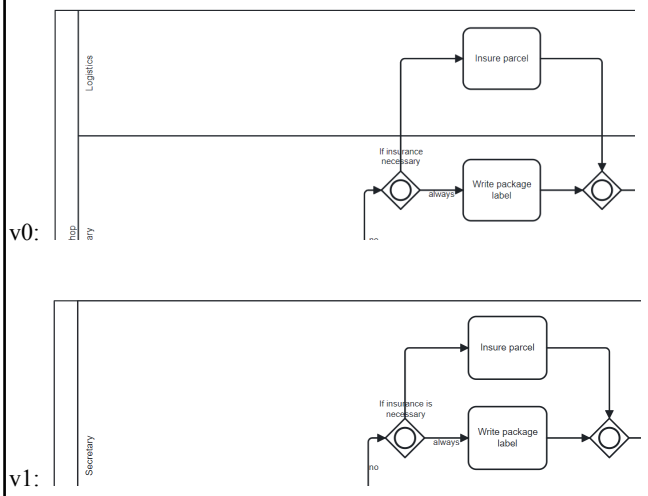
Control flow Dimension	Changes to Order or Logic (Sequence Flow and Gateways)	Change of Sequence Flow Logic for Part Production:  v0:  v1:
Data Dimension	Changes to Data that is Consumed or Produced (Data Objects)	Addition of Database for Replacement Parts Process:  v0:  v1:

Organization Dimension	Changes to Roles that are Executing Process Steps (Swim lanes, Pools)	Deletion of Logistics Lane for Dispatching Process: 

Tab. 1 BPM Dimensions and Exemplary Changes from the Dataset.

Change Relevance Categories. In the course of investigating the coherence of business processes, a crucial issue that emerged from expert interviews is the necessity to filter out changes that are not relevant in order to maintain focus on meaningful deviations, with I 3 (IR3) stating *"[...] you would probably have to differentiate by prioritising, because I want to be informed immediately about really critical changes."*. Regarding changes that are not relevant, I 3 (IR3) continued *"you can say exactly: does it affect control flow, resources, on this or that and if on none of the dimensions are affected, then you can ignore it*. This demonstrates the importance of an effective categorisation of changes, ensuring that only significant alterations in process documentation trigger user notifications. Consequently, three primary Change Relevance Categories have been proposed: Relevant, Unrelated, and Negligible.

Relevant Changes are defined as modifications that directly impact at least one of the Business Process Change Dimensions in the related documentation, as outlined in Section C. To illustrate, a semantic alteration to a task described in both the original and the related document, encompassing changes in task execution or its associated data, constitutes a relevant change. Relevant changes have the potential to affect task functionality, control flow, data handling, or organizational roles within the process, potentially necessitating urgent attention and potential rectification to maintain process coherence, as suggested in the expert interviews. Conversely, relevant changes may also encompass modifications that deviate from the original process positively, implying potential improvement opportunities for the process.

Unrelated changes in contrast are defined as changes whose context in the original document does not intersect with the content of the related document. To illustrate,

modifications to the backend database schemas that do not exert any direct influence on a related practical training document used by assembly line workers may be regarded as unrelated changes in that context. Such modifications are not encompassed by the business process dimensions described in the related document, and thus do not impact the coherence of the process as observed in the context of the related documentation, as proposed by expert interviews.

Negligible changes are those that do not affect the semantics of any business process dimension. They include minor amendments such as spelling corrections or visual modifications to diagrams. While such changes may enhance readability or presentation, they do not alter the fundamental content or execution of the process. This adheres to the notion of I 4 (IR1) stating *"I can also imagine that in the case of insignificant changes, an email might not need to be sent […]"*.

The categorisation system was developed in response to the need identified during the expert interviews to filter out irrelevant and insignificant changes. The objective was to concentrate on relevant changes, thereby reducing the number of notifications and enhancing the clarity of those that are issued. By focusing on alterations that are pertinent to the process and documentation in question, users are only informed of deviations that have a relevant impact on process coherence. This focus is aligned with the objective of maintaining operational efficiency and eliminating distractions caused by irrelevant or insignificant changes. However, the process of categorising the changes is inherently complex and subjective. The boundaries between these categories can be fluid, and the impact of changes can vary significantly depending on contextual nuances that are not immediately apparent. For example, a minor modification in a document that appears insignificant could influence the interpretation or execution described in related documentation. This inherent subjectivity necessitates a sophisticated approach to change categorisation.

The deployment of the capabilities of LLMs presents a potential solution to this complexity. State-of-the-Art LLMs are highly proficient in the processing and interpretation of textual data and can understand the contextual and semantic relationships inherent in such data (Mcintosh et al., 2024). The deployment of LLMs enables the dynamic evaluation and classification of changes in a manner that is specifically aligned with the characteristics of the process document under comparison. This capability represents a notable advancement over traditional process comparison techniques, which frequently depend on more inflexible frameworks such as extraction techniques involving text and document mining (Martin-Toral et al., 2008). While the traditional techniques provide valuable insights, they typically require structured data like event logs rather than textual documents, which limits their ability to fully capture the subtle and subjective nuances of document changes (Delias, 2017).

The deployment of LLMs facilitates the attainment of a high degree of precision in change categorisation by the process coherence checking artifact, effectively filtering out irrelevant modifications and maintaining user focus on critical updates. This focused approach ensures that only significant changes are highlighted, thereby streamlining the process of identifying and addressing deviations efficiently.