UHASSELT

KNOWLEDGE IN ACTION

Faculty of Business Economics

Master of Management

Master's thesis

Improving business potential: an inquiry of how organisations use its business process data

Adedamola Lawal

Thesis presented in fulfillment of the requirements for the degree of Master of Management, specialization Business Process Management

SUPERVISOR :

Prof. dr. Benoit DEPAIRE

UHASSELT

KNOWLEDGE IN ACTION

www.uhasselt.be
Universiteit Hasselt
Campus Hasselt:
Martelarenlaan 42 | 3500 Hasselt
Campus Diepenbeek:
Agoralaan Gebouw D | 3590 Diepenbeek

2023
2024

UHASSELT

KNOWLEDGE IN ACTION

Faculty of Business Economics

Master of Management

Master's thesis

Improving business potential: an inquiry of how organisations use its business process data

Adedamola Lawal

Thesis presented in fulfillment of the requirements for the degree of Master of Management, specialization Business Process Management

SUPERVISOR :

Prof. dr. Benoit DEPAIRE

Acknowledgements

A common proverb is “the journey of a thousand miles begins with one step”, well,it only makes sense if you’re heading in the right direction, or you’ll end up in a very long detour. The journey of writing this paper has been filled with different highs and lows. Along the way, I've had the privilege of encountering a number of individuals who have guided and supported me.

First and foremost, I give thanks to God, the ultimate source of wisdom, strength, and inspiration.

To my parents, your words of encouragement and faith in me even when I doubted myself has been a source of strength. I would forever be grateful for your unconditional love and endless support.

I would also extend my deepest gratitude to my supervisor Dr Benoit Depaire. Your suggestions, critique and our discussion sessions have been a source of inspiration throughout the process of writing this paper, and for that I am particularly grateful.

To Toons Jouck and Stef Moons, thank you for your advice, which greatly contributed to the clarity of this research.

To every interviewee volunteer, thank you for taking the time out of your busy schedules to share your invaluable insights. Your contributions have been the lifeblood of this research.

Managerial Summary

Research Purpose And Problem Statement

In contemporary business organisations today, data plays a critical role in driving strategic decision-making, ensuring operational efficiency, and maintaining a competitive advantage. Organisations leverage different data sources, such as financial and customer data, to seek avenues for improvement and optimise resources. In recent years, analysis of business process data has become increasingly important in business process management as organisations seek information on the execution and performance of business processes to improve efficiency and effectiveness. One of the techniques developed for analysing business processes is process mining, which acts as a bridge between data mining and business process management. It provides tools and methodologies to discover and monitor real processes obtained from the insights of data generated during process executions stored in information systems. However, its implementation is challenging, particularly in its adoption and use by organisations in real-world applications.

The benchmark for this research is a literature review study that presents five different use cases for process mining in organisations. In process mining, use cases refer to scenarios where a specific process mining method addresses a business goal or objective. This research aims to evaluate the perception and relevance of process mining use cases within contemporary business environments; hence, the two research questions guiding the study are:

- "How do business organisations perceive the relevance of process mining use cases?
- "How do process mining challenges influence the implementation of its use cases in business organisations?".

Research Methodology

The study adopts a qualitative approach and conducts semi-structured interviews with professionals in business process analysis. A number of selection criteria ensure the validity of the results.

1. Minimum of 2 years working in the organisation.
2. At most, two interviewees from an industry to ensure generalizability.
3. The organisations they work for must have measures to track their business process data.

Results

This section addresses the findings from the semi-structured interviews for each use case identified from the literature study.

TRANSPARENCY

This use case aims to gain a clear and accurate understanding of the business process, which entails process discovery, repairing process models or finding out the interactions between resources in a process. The findings reveal that organisations generally perceive transparency as crucial. However, perceptions vary, with some organisations, such as consulting firms, viewing transparency as vital while others see it as dependent on specific business needs. Challenges such as insufficient data, reliance on qualitative methods like interviews and meetings to understand business process models, and concerns about data privacy by external stakeholders significantly influence the implementation of this use case.

EFFICIENCY

This use case aims to analyse the performance of a process to identify bottlenecks, inefficiencies, and opportunities for improvement. The analysis reveals that organisations prioritise improving efficiency and reducing costs by using historical data to identify workflow bottlenecks. This data-driven approach helps optimise operations, particularly in industries with multiple clients, leading to better project outcomes. Financial considerations are a key driver, with a strong focus on linking operational improvements to cost reduction. However, implementing these efficiency solutions encounters resistance due to resource limitations, outdated technology, and employee reluctance to change. Overcoming these challenges requires robust change management strategies, including modernising infrastructure and engaging employees through effective communication about the financial benefits of change.

QUALITY

This use case involves variant analysis, which focuses on identifying and comparing process variants to understand deviations and optimise process executions, and deviance mining, which involves analysing reasons for deviations in a process. The study reveals that while variant analysis uses historical data to identify deviations, deviance mining poses significant challenges. Respondents reported that their tools are adept at detecting deviations but need to improve in explaining their causes. The inability to understand the reasons for deviations highlights a gap in knowledge and available tools.

COMPLIANCE

This use case revolves around conformance checking, which compares an established process model with the process execution behaviour to ensure compliance with predefined standards, and compliance monitoring, which involves comparing an ongoing process execution with predefined rules to maintain regulatory compliance. The interviews reveal that process modelling in organisations is iterative due to dynamic business environments and frequent changes in stakeholder roles. This iterative process complicates establishing stable process

models required for effective compliance checking. Organisations struggle to maintain compliance as process models continually evolve. The challenge is exacerbated by incorrect stakeholder role definitions, necessitating frequent revisions of process models.

AGILITY

Business questions focus on predicting future process executions to anticipate potential issues for improvement which is described as predictive monitoring. It also involves describing how a process changes over time and finally the prescription of actions to achieve desired results.

The study reveals that while predictive analysis is recognised for strategic purposes, its application in business processes is limited due to a lack of skilled personnel and the complexity of business process data. Most organisations prioritise predictive analytics to achieve long-term strategic goals rather than to improve business processes. The complexity of business process data, which is more challenging to analyse compared to data like financial data, which is more stable and standardised, is a crucial barrier. However, machine learning and artificial intelligence (AI) are identified as potential solutions to overcome these challenges. The findings suggest that organisations must invest in specialised expertise and advanced technologies to fully leverage predictive analytics for business process data.

Implications of the Research & Limitations

The findings from the research have significant implications for academia and industry. The goal of the literature study this paper references was to help practitioners see the benefits of process mining and the areas in which it could add value to their businesses by exploring each use case of process mining. This study provides much-needed clarity by bridging the gap between theoretical benefits outlined in the literature and real-world experiences of organisations by adding valuable insights to the relevance of the use cases and what obstacles must be overcome to leverage the potential of process mining fully. However, several limitations must be acknowledged. Even though attempts were made to generalise the results, the limited number of 7 respondents might still be a factor in limiting the generalizability of the findings. While attempts were made to ensure a broad range of perspectives were made through restrictions of only two interviewees for one industry, this study only covers some of the industries available; therefore, organisations with unique insights might have been excluded. Also, the study does not take into account the tools used by the interviewees. Therefore, the impact of resources available to the interviewees might have been overlooked. Finally, the lack of clearly defined job roles was a factor in the quality of responses from the interviewees, as the perspectives of a process manager differ from those of a business analyst.

In conclusion, a comprehensive view of the perceptions and relevance of process mining use cases in real-world scenarios has been explored. The findings offer valuable insights for practitioners offering valuable insights and guide future research.

Table of Contents

Abstract

In today's dynamic business landscape, data has become crucial for strategic decision-making, operational efficiency, and competitive advantage. Recently, the analysis of business process data has gained prominence in Business Process Management (BPM) for improving efficiency and maintaining competitiveness. Process mining, which involves analysing event logs from information systems, has emerged as a popular method for extracting insights into real processes, however its implementation comes with significant challenges. With reference to the use cases for process mining derived from an existing literature study, this thesis employs a qualitative approach where professionals engaged in business process data analysis are interviewed, with the aim of finding out their perceptions on the relevance of the use cases in practice and evaluating how the challenges impact the implementation of process mining use cases within contemporary business environments. The findings reveal the perceived importance of process mining varies based on several factors and in some cases deviates from theoretical expectations.

Keywords: Business process management(BPM), Process mining, Use Case, Business process Analysis.

1 Introduction

In the rapidly evolving landscape of today's business world, the use of data has emerged as an important asset for driving strategic decision making, operational efficiency, and competitive advantage (McAfee et al., 2012). Organisations today leverage a variety of data sources, such as data from social media, which provides real time information on trends and sentiment analysis to enhance market responsiveness (Ghani et al., 2019); customer data, which provides insights into customer preferences and behaviours (Micus et al., 2023) etc. While these data types are invaluable, in recent years, the analysis of business process data has held particular importance in the realm of business process management (BPM), which has emerged as a response to the increasing complexity of modern business environments and the need for organisations to improve efficiency and maintain a competitive advantage (Harmon, 2010; W. M. P. Van Der Aalst, 2013). Business process data refers to information on the execution, performance, and outcome of business processes, which include workflow data, cycle times, resource utilisation metrics, etc.(W. Van Der Aalst et al., 2012; W. M. P. Van Der Aalst, 2013). Analysis of process data can lead businesses to identify bottlenecks, streamline operations, and implement continuous improvements (Dumas et al., 2018) .

In recent times, process mining has gained popularity in academic literature for analysing business processes (Zerbino et al., 2021) . According to the process mining manifesto, process mining can be defined as the analysis of event data logs from information systems to extract insights and knowledge about real processes within an organisation (W. Van Der Aalst et al., 2012). Event data refers to information recorded as a result of specific occurrences within a system or process; this forms the foundation for process mining, which encompasses techniques for discovering, monitoring, and improving processes by leveraging event logs commonly available in today's information systems (Diba et al., 2020; W. Van Der Aalst et al., 2012). By analysing this event data, process mining offers several benefits, as evidenced by case studies, which includes predicting future performance, improving process performance and productivity, and identifying inefficiencies and bottlenecks (Emamjome et al., 2019; Măruşter & Van Beest, 2009; W. M. Van Der Aalst et al., 2007).

To maximize the benefits of process mining, data extraction should be driven by business questions, which ensures the analysis of data is relevant, therefore leading to valuable insights that can drive business performance and help with strategic decision making (W. Van Der Aalst et al., 2012), but there still needs to be clarity on what aspects of business process data organisations find relevant. Milani et al. (2022) conducted a systematic literature review on the use cases for process mining, focusing on value-driven business process management (VBPM) which aims to clarify how process mining can be used by practitioners to add value to their businesses. In the context of process mining, use cases refer to scenarios where a specific process mining method is applied to address a business goal or objective (Ailenei et al., 2012; Milani et al., 2022). This led to the development of 5 use case categories: transparency, efficiency, quality, compliance, and agility. These categories describe business-oriented questions that create value for organisations; for example, organisations looking to use process

mining for efficiency reasons prioritise reducing redundancies and eliminating waste in the processes, while in the compliance category, organisations are looking to reduce variability and increase standardisation of processes (Milani et al., 2022).

While Milani et al. (2022) offer a framework for process mining use cases, other literature highlights significant practical challenges. For this research, challenges related to process mining tools or algorithms would be excluded (Dakic et al., 2019). We exclude challenges related to process mining tools or algorithms because these technical issues are often specific to particular tools and are typically addressed through vendor support and ongoing software development (Loyola-González, 2023). The focus of this study is from an organisational perspective which is described as one of the frameworks for conducting process mining research (Vom Brocke et al., 2021) . In contrast, the broader challenges we are considering are more systemic and pervasive, requiring a strategic approach to manage and overcome them effectively. For example, finding and transforming event data is described as time-consuming, as organisations struggle to collect and integrate data from diverse sources, ensure data quality and accuracy, analyse large volumes of data, and translate insights into improvements (Van Der Aalst & Carmona, 2022; Kubrak et al., 2022). Process mining challenges could also be due to organisational factors which include a lack of standardised data collection methods and resistance to change initiatives as a result of process mining analysis (Stertz et al., 2021). Additionally, process analysts often lack the domain knowledge needed for effective analysis (Zimmermann et al., 2022).

Considering the highlighted challenges of process mining, this research aims to evaluate the current perception and relevance of process mining use cases, as presented by Milani et al.(2022), within contemporary business environments. The reason is to provide clarity on the practical applicability of these use cases in real world scenarios since previous studies have suggested a gap between academic research in process mining and its real world applications which suggests limited understanding from an organisational context (Thiede et al., 2018). To achieve this, a qualitative study utilising semi-structured interviews will be conducted with professionals from organisations that already engage in business process data analysis. Consequently, the research question guiding this study is:

- "How do business organisations perceive the relevance of process mining use cases?
- "How do process mining challenges influence the implementation of its use cases in business organisations?".

The aim of this research is to validate the use cases presented by Milani et al. (2022) and also provide clarity on how existing process mining challenges affect each use case.

The subsequent sections of this paper includes related work that introduces the origins of process mining, discussions on various use cases for process mining and process data and the challenges of process mining. This is followed by a detailed methodology section outlining the approach to addressing the research question. We then present the results from the semi-structured interviews and interpret the data and suggest areas for further research.

2 Related Work

First, we start with the introduction of the basic concepts of business process intelligence and process mining. Then we review the use case of process mining derived from the literature. And finally, challenges surrounding process mining from a data organisational and personnel perspective are discussed.

2.1 Process mining As A Type of Business Process Intelligence

The use of data to support decision-making and gain a competitive advantage has been adopted by most organisations today (H. Davenport, 2014). This is a result of the various benefits that analysing big data offers, such as improved decision-making, increased efficiency, and an improved customer experience (H. Davenport, 2014). The general term used to describe the transformation of raw data into valuable insights to aid strategic, tactical, and decision-making is called business intelligence (BI), but this definition doesn't focus on processes (Aalst et al., 2015), A process focus definition is referred to as business process intelligence (BPI), which is defined as "the analytical process of identifying, defining, modelling, and improving value-creating business processes in order to support tactical and strategic management"(Linden et al., 2011, p.212). Initially, BPI focused on monitoring and analysing processes to gain performance insights and identify improvements, however, it expanded to include process discovery, conformance checking, prediction, and optimization (Castellanos et al., 2009). In recent times, process mining has gained popularity for analysis of business process data and it is described as a " bridge between data mining and business process analysis" (W. Van Der Aalst et al., 2012). Process mining is defined as a technique to discover and improve real processes by extracting knowledge from the event log of information systems (W. Van Der Aalst et al., 2012). This record consists of activities, actions, and steps taken during the execution of a process (W. Van Der Aalst et al., 2012). There are 3 main approaches to process mining discussed by W. Van Der Aalst et al., (2012) which include: process discovery, conformance checking and process enhancement. Process discovery involves extracting process models from event logs to construct a visual representation of the actual process flow; conformance checking, which focuses on comparing the predefined process model with the discovered process model to ensure that the actual process execution aligns with the original model; and finally, process extension, which deals with improving and repairing process models based on the insights gotten from event logs (W. Van Der Aalst et al., 2012). Process mining also offers different perspectives through which business processes can be analysed and understood.

2.2 Process Mining Use Cases

In Ailenei et al.(2012), process mining use cases were classified into 5 categories: discovery, conformance checking, enhancement from an organisational perspective, enhancement from a time perspective and enhancement from a case perspective. These categories were identified from a literature study based on the functionality of a process mining tool called ProM, and then validated by conducting a semi-structured interview and survey with process mining users to gather relevance for the identified use cases. In a similar study, Milani et al.(2022) categorised process mining use cases into 5 main categories: transparency, efficiency, quality, compliance, and agility. These categories were derived from value driven business process management, which states organisations derive value by realising one of the categories listed. Although the use cases derived in the latter study weren't validated through surveys and interviews like in Ailenei et al.(2012), both papers share a common objective: to identify process mining use cases and their applications in real-world scenarios. The key difference is that Milani et al.(2022) established a clear link between process mining use cases and specific business oriented questions that they can address.This business oriented approach ensures potential practitioners could link their everyday process issues with available use cases of process mining. Another similarity is that both papers are domain agnostic which implies that the use cases can be applied in any type of industry. The table below shows a comparison of use cases identified by both papers where we match similar use cases and highlight differences by representing the use case as a standalone segment with a brief description of what they entail.

Aielenei et al, (2012)	Milani et al, (2022)	Description Of Use Case
DIscovery Organisational Enhancement	Transparency	This use case identifies the structure and flow of processes., discovering how resources interact in a process model.
Conformance checking	Compliance checking	Ensuring processes adhere to predefined models or rules.
Enhancement from a Time Perspective	Efficiency	Evaluating performance metrics like throughput time and resource utilisation.
Enhancement from a Case Perspective		Analysing specific cases to enhance individual process instances.
	Quality	Identifying process variants, and the reasons for the variation.
	Agility	Focuses on predictive monitoring which analyses how processes would unfold in the future and prescriptive

Aielenei et al, (2012)	Milani et al, (2022)	Description Of Use Case
DIscovery Organisational Enhancement	Transparency	This use case identifies the structure and flow of processes., discovering how resources interact in a process model.
		monitoring which prescribes actions to take to achieve a desired outcome.

Table 1: Description of Use Cases

For the purpose of this research, we would be focusing on the use cases identified by Milani et al. (2022) due to its business-oriented approach since the research question aims to investigate the use cases in business organisations. Below is a detailed description of the use cases by Milani et al.(2022) and the description of business questions they address.

Transparency in process mining involves gaining a clear understanding of business processes through various subsections, including process model discovery to understand execution, process model enhancement to repair and improve models, and social network mining to discover resource interactions. Efficiency focuses on analysing process performance to identify bottlenecks and inefficiencies, while Quality encompasses variant analysis to compare process deviations and deviance mining to understand the reasons for these deviations. Compliance involves conformance checking to ensure processes align with predefined standards and compliance monitoring to maintain regulatory adherence. Agility addresses predicting future process executions through predictive monitoring, understanding process changes over time, and prescribing actions to achieve desired outcomes. In summary, while one document (Ailenei et al., 2012) categorises use cases based on specific process mining tools and their capabilities, the other (Milani et al., 2022) adopts a broader perspective focused on business outcomes and value creation aligned with organisational objectives.

2.3 Case Studies of Process Mining

Process mining has been used in a wide range of industries such as healthcare, manufacturing, finance, and information technology (Dakic et al., 2018). Most of these industries use process mining to improve their process efficiency by identifying bottlenecks, inefficiencies and deviations in their business process (Dakic et al., 2018). For example (Cho et al., 2017) presents evidence of how process mining techniques can be utilised for business process redesign. This was achieved by conducting case studies in a hospital and tour agency. In these case studies, process mining was used to collect data stored in event logs, discover process models, visualise the process flows and facilitate performance analysis by examining the time and frequency of events in the process. The researchers were able to quantitatively evaluate the impact of their prescribed solutions by comparing key performance metrics before and after the implementation of the best practices. This aligns with Milani et al. (2022) transparency, efficiency and quality use cases which shows the

process mining can be used to improve process flows and performance metrics in both the hospital and tour agency.

Similarly (Măruşter & Van Beest, 2009) proposed a methodology which involves combining process mining with simulation techniques as a systematic approach for organisations to redesign their business processes and predict the future performances of those processes. This methodology was applied in three different domains which are the gas industry, government institutions and agriculture. The methodology was successfully used to reduce average time to book gas transport, it was also used to reduce the number of days spent in processing fines in the government institution. The results from the case studies illustrate the practical application of the methodology in real world scenarios and also demonstrates its versatility and effectiveness in various industries showcasing its ability to address specific performance issues and support data driven decision making in process redesign effort. It also aligns with the agility use case which focuses on prediction of processes and efficiency use case which aims to improve process performance (Milani et al., 2022).

The case studies highlight the practical application of the use cases by Milani et al. (2022) across diverse sectors. By aligning the use cases to how process mining is used in the case studies, we can observe that the integration of process mining in various industries has been effective in facilitating data driven decision making in addressing performance issues with processes.

2.4 Challenges Associated with Process Mining

The literature on the challenges of utilising process mining ranges across many facets which could be data challenges, organisational or personnel challenges. For this part of the related work, we would present challenges that aren't a direct result of process mining tools.

2.4.1 Data Challenges

Challenges related to data that organisations face can be broadly categorised into data complexity, quality issues, time consuming extraction processes and privacy concerns.

1. Data Complexity: Large volumes of data are generated by various systems, appearing in different formats, structures etc therefore organisations need to have a robust data management capability in order to derive meaningful insights for process improvements (Thiede et al., 2018).
2. Data Quality Issues: Event logs may be incomplete due to missing timestamps or values therefore analysts must address these issues through data cleansing to ensure accuracy and reliability of the results (Dakic et al., 2018).
3. Time Consuming Data Extraction: Data extraction could be a time-consuming step in process mining projects which is detrimental to the speed and efficiency of obtaining valuable insights (W. M. P. Van Der Aalst & Carmona, 2022).
4. Data Privacy Concerns: Concerns about maintaining data privacy from analysing sensitive data are also discussed in the literature; therefore, organisations must implement data protection measures to safeguard sensitive information during process

mining analysis and ensure compliance with regulations or industry standards (W. M. Van Der Aalst et al., 2007).

Addressing these challenges is crucial for organisations to leverage process mining initiatives effectively.

2.4.2 Organisational Challenges

Process mining initiatives must align with the strategic objectives and values of the organisation, which can evolve in response to market dynamics, competitive pressures, or internal changes. Effective communication with stakeholders is essential to address this alignment issue (Badakhshan et al., 2022; Zuidema-Tempel et al., 2022). Implementing process mining-driven changes within the organisation might face resistance from stakeholders who are already used to existing processes or systems of working (Grisold et al., 2020); for example, in a study conducted on small and medium-sized manufacturing companies, workers were reluctant to share tacit knowledge due to concern of feeling observed (Stertz et al., 2021). Organisations also need to ensure seamless integration of their existing IT infrastructure and process mining tools to be able to extract the relevant data, perform analysis, and visualise the results effectively. This challenge can be overcome by ensuring collaboration with IT personnel within the organisation to establish data connections, data pipelines, and data governance frameworks (Stertz et al., 2021).

Process managers have also noted that organisational barriers rather than technical ones might lead to delays in process mining projects because of issues around obtaining permissions to access data (Grisold et al., 2020).

Summary of the challenges is presented in the table below:

Challenge	Description	Key reference
Strategic Alignment	Need for process mining to align with organisational goals and values through effective stakeholder communication.	Badakshan et al. (2022)
Stakeholder Resistance	Resistance of stakeholders used to existing processes can impede implementation.	Grisold et al. 2020; Stertz et al. 2021.
IT Integration	Seamless integration of IT infrastructure and processes mining tools is essential for effective data extraction and analysis	Stertz et al. 2021
Organisational Barriers	Delay due to obtaining data access permissions highlight the importance of organisational readiness.	Grisold et al. 2020.

Table 2: Summary of Organisational Challenges

2.4.3 Challenges Faced By Process Analysts

Process analysts face various challenges when conducting process mining projects which can directly impact the effectiveness and efficiency of their analyses. They might also lack domain specific knowledge about the process they are analysing which involves understanding the context of the process for accurate process interpretation (Zimmermann et al., 2022).

3. Methodology

3.1 Research Design

This section of this paper outlines the approach adopted to answer the research question which are:

- "How do business organisations perceive the relevance of process mining use cases?
- "How do process mining challenges influence the implementation of its use cases in business organisations?".

Given the exploratory nature of the research questions, a qualitative research design leveraging semi-structured interviews would be employed (Creswell & Poth, 2016). The choice of a qualitative approach lies in its ability to capture diverse perspectives among stakeholders. By engaging the interviewees about how they use their process data, we aim to uncover the different use cases for process data in real-world scenarios and the challenges associated with each use case.

3.1.1 Sampling Strategy

Sample Characteristics

Population: The target population includes individuals from various industries who are actively involved in the analysis of process data within their organisations. Dakic et al. (2018) identified 12 different types of industries where process mining has been applied, which include healthcare, Information technology, finance, manufacturing, education, government, energy (oil, gas, and nuclear industry), agriculture, logistics, telecommunication, news media, and tourism. This would be used as a guide to ensure the relevant industries are selected.

Sample size: The study aims to conduct interviews with 5-10 participants.

Sampling method: This study will adopt a mix of purposive and snowballing sampling strategies. Purposive sampling is done to ensure the validity of results and ensure individuals selected meet a certain number of criteria (Palinkas et al., 2015). Snowballing sampling leverages the network of initial participants to identify additional relevant individuals that might not be easily accessible (Biernacki & Waldorf, 1981).

Selection criteria: The criteria for eligible interviewees include the following:

1. Participants chosen for the interview need to possess relevant expertise in process data analysis within their organisations positions and actively managing their organisation's business processes. The relevant expertise includes expertise in collecting, cleaning, and analysing process-related data.
2. Minimum of 2 years of working experience in that organisation.

3. These organisations must have measures in place for tracking its processes and identifying areas for improvement as it is one of the criteria for process orientation of an organisation (Willaert et al., 2007).

3.2 Data Collection

A semi-structured interview would be conducted to gain insights from the selected participants. It would also be important that not more than 2 individuals from an industry are interviewed to ensure the generalizability of the results. (Kubrak et al., 2022) also implemented this interview approach where participants were selected from different domains . All interviews would be audio recorded with a duration of approximately 30-45 minutes.

3.3 Data Analysis

The data analysis for this research would involve the application of deductive coding and inductive coding to the responses obtained from the semi-structured interviews. Deductive coding is a type of qualitative data analysis that starts with predefined codes derived from the existing literature, while inductive coding involves identifying and labelling new themes or patterns that emerge from the data (Fereday & Muir-Cochrane, 2006). Given that the interview questions were formulated from the use cases by (Milani et al., 2022), and the challenges related to process mining, a deductive approach would be appropriate to categorise and analyse the data initially before the inductive coding process is initiated.

Steps taken for the deductive and inductive coding process include:

1. Development of initial codes which are derived from the use cases identified in (Milani et al., 2022) which were organised into five main categories: transparency, efficiency, quality, compliance and agility. And also codes on challenges were categorized under data organisational and personnel challenges for each section of the use case where it is applicable from the interview data.
2. The interview transcripts were read to gain a thorough understanding of the responses.
3. Using the predetermined codes, each response was categorised under one or more predefined code categories. For example, responses that involved gaining insights to processes were coded under transparency, while those focused on reducing cost and optimizing processes were coded under efficiency.
4. And finally, inductive coding is conducted to identify new themes from the data.

3.4 Ethical Considerations

Participants will be provided with information about the thesis and their role in the interview study. Consent would be obtained before the interview commenced. They would also be assured of the confidentiality of their answers to the interview questions and their anonymity.

4 Results, Discussions & Recommendations

4.1 Overview

In this section, the results and discussion segments would be combined to provide an integrated analysis of the qualitative data derived from the semi-structured interviews which aims to answer the following research questions: "How do business organisations perceive the relevance of process mining use cases? and "How do process mining challenges influence the implementation of its use cases in business organisations?".

By referencing the use cases presented by Milani et al.(2022), insights from the participants are presented on their perception of the relevance of the use cases, and the challenges associated with the use cases. This is followed by a discussion segment that interprets the findings in relation to the research questions and contributions to the literature.

4.2 Interviewee Profiles

The table below presents the profile of the interviewees.

INITIALS	*INDUSTRY*	*OCCUPATION*	*YEARS OF EXPERIENCE*
JF	Consulting firm	Business Analyst	5
PO	Aviation	Process Manager	7
SV	Consulting firm	IT Auditor/Analyst	3
DO	Aviation	Data Analyst	2
VD	Finance	Data Analyst	3
TM	Information technology	Process manager	6
TC	Information technology	Process manager	4

Table 3: Interviewees

4.3 Relevance of Use Cases And Challenges

4.3.1 TRANSPARENCY

This use case aims to gain a clear and accurate understanding of the business process, which entails process discovery, repairing process models or finding out the interactions between resources in a process (Milani et al., 2022).

Relevance of Transparency Use Case

When the interviewees were asked about this use case, the insights are generally from a business needs perspective, and it's also influenced largely by organisational approach to transparency.

One of the interviewees describes gaining full transparency of the business process as already an essential part of the organisation, for reasons such as discovering the business process and finding out the relationships between stakeholders in the organisation.

> *"So the end goal is to build a model that connects all stakeholders, where they can pick the process we are defining and find exactly what their responsibilities are, who their direct and indirect stakeholders are, and what part they are to play in ensuring the overall achievement of the strategy we are trying to put in place"- (PO, Process Manager, Aviation Industry).*

For other interviewees it's an essential part of the services they deliver; for example, the consultants emphasize the importance of understanding how business processes are carried out initially, before they can provide services to the organisation they are consulting for. It's also used for making budgetary decisions.

> *" Actually the very step, in a risk assessment, you have to set the context, and have an understanding of the organisation"- (SV, IT auditor/Analyst, Consulting firm).*

> *"To be able to make a proper budgetary estimate, you have to be able to tell what relationships between different functional areas are required, so yes we do see relationships not just between employees but also functional areas or departments" -(JF, Business Analyst, Consulting firm).*

Another form of response stems from organisational culture which doesn't consider gaining full transparency of business processes as really important.

> *" I think for some processes, it is easy to construct the process models being executed, which is as a result of what's stored in the information systems, such as having enough timestamps, or defining the number of steps in the process; do we capture the whole process?, we don't do that immediately, and it's purely based on business requirements whether we need to do that or not"- (TM, Process Manager, Information Technology).*

Milani et al. (2022) asserts that process discovery is the most common use case, but insights from the interviewees show varying perceptions about its relevance, where some organisations value it more than others. This conflicting perspective highlights a gap between theoretical importance of this use case and organisational approach.

Challenges Associated With Transparency Use Case

Despite the conflicting importance of business process transparency, several challenges were identified particularly related to data availability and quality.

As discussed by some of the interviewees, insufficient data and the absence of system logged changes can affect the ability to fully capture and model business processes from the data.

> *"We always take into consideration what the limitations are, if the system does not lock a state change, it would be impossible to do, you would need to do some customizations if you would need to record extra time stamps and sometimes it's not possible" - (TM, Process Manager, Information Technology).*

This confirms existing literature that identifies data quality and availability as significant barriers to process mining (Eggers & Hein, 2020).

To navigate this problem, one method used by most interviewees is through meetings and interviews and it's particularly evident with the consultants since it's a necessary part of their work procedure.

> *"We collect data from digital platforms. We also collect data via inquiry, because sometimes the business processes are not always well documented. So a department may tell you, we don't have any documented procedure process, So we conduct interviews with various stakeholders, and it's also from those interviews and inquiries that you are able to identify which type of data sets you need from that process to be able to identify the trends"- (SV, IT auditor/Analyst, Consulting firm).*

This reliance on qualitative data suggests this use case can be inconsistent with the actual goal of process mining in documenting real processes and not assumed processes as stated in the process mining manifesto (W. Van Der Aalst et al., 2012). This reliance on interviews and meetings to supplement incomplete and undocumented processes, could introduce subjectivity and potential bias in the data collection process.

For some of the respondents, retrieving internal data is a seamless procedure, however getting data from an external source could be problematic due to regulations.

> *"Because of the sensitivity of the kind of data that we collect, there's a lot of regulatory oversight on what we're doing and the data that we collect. So when we work with an external stakeholder, essentially all they do is to verify and put a stamp of approval on the data that we collect. The good thing is internally, the organisation has a fairly decent functional process for retrieving internal data. However, sometimes you need data from external bodies, and that's where the challenge is" (PO Process Manager, Aviation Industry).*

Previous studies have also confirmed that most process mining studies only focus on single organisations and limited attention given to cross-organisational process mining (Thiede et al., 2018). The regulatory oversight that governs data collection from external stakeholders can limit the scope of transparency hence the need for more studies to address this problem.

4.3.2 EFFICIENCY

This category of use case aims to analyse the performance of a process to identify

bottlenecks, inefficiencies, and opportunities for improvement (Milani et al., 2022).

Relevance of Efficiency Use Case

The emphasis on improving the efficiency of business processes is a recurring theme in the responses of the interviewees. This is particularly evident with the consultants that engage with multiple clients where there's a constant accumulation of industry specific data that allows for more nuanced understanding and common challenges, enabling them to have tailored solutions and better meet client needs.

Majority of the respondents described the use of historical data to make improvements and identify bottlenecks in the workflow process.

> *"We use historical data of business processes to streamline operations so we can make better decisions in terms of project layout for the next client, also, having multiple clients within the same industry ensures we have enough historical data that allows us to be better for the next client"- (JF, Business Analyst, Consulting firm).*

Furthermore, financial optimization emerges as a primary concern for organisations when evaluating business processes.

> *"When we present the project requirements to the clients, the first thing they look out for is the areas of the business process that concern actual financial costs"- (SV, IT auditor/Analyst, Consulting firm) .*

> *"We analyse operational data that is directly tied to financial data"- (TC, Project Manager, Information Technology).*

This raises questions about whether financial cost is the only reason for improving business process data.

Challenges Associated With Efficiency Use Case

Despite the recognised benefits of process optimisation, implementation of the solutions is often met with resistance. Several interviewees highlighted various factors that contribute to this resistance which include, resource limitations and employee reluctance to change.

> *" I would say most of the time, there's a resistance, there are a lot of internal factors that go into the implementation of those solutions, that we are not aware of, or that when they try to implement it, could lead to budgetary concerns. Sometimes it's because they don't have enough resources, or maybe the nature of the technology some organisations use, like very old and outdated technology, and it's too expensive to replace them, and nobody has the technical know-how to change the current one, because it's outdated"- (SV, IT auditor/Analyst, Consulting firm).*

This suggests organisations might be forced to balance the cost of upgrading outdated systems with potential benefits of improved efficiency. Also lack of technical expertise to transition from

legacy systems might be problematic for organisations.

Furthermore, the employee resistance to change is also significant, as one interviewee noted ,

> *"No one likes change. People are often stuck in their ways.... (PO Process Manager, Aviation Industry).*

This resistance is often rooted in lack of understanding of the proposed changes (Jans et al., 2011); therefore the implementation of stakeholder management cannot be overstated as organisations need to have an effective change management plan (Kipping et al., 2022). An effective method for this approach as suggested by one interviewee is to show how the change translates in monetary terms. This could further motivate employees to take ownership of the change process.

> *but give them an understanding of why the change is happening and how much it translates to in monetary terms. And this is why stakeholder management is super, super important. You have to help them understand that not only are you improving their process, but also in the long run, somehow helping them" (PO Process Manager, Aviation Industry).*

4.3.3 QUALITY

This category of use case involves variant analysis, which focuses on identifying and comparing process variants to understand deviations and optimise process executions; and deviance mining which involves analysing reasons for deviations in a process (Milani et al., 2022).

Relevance and Challenges of Quality Use Case

Just as in the efficiency use case the respondents also highlighted the use of historical data in identifying and comparing process variants; however, deviance mining which focuses on uncovering the reasons behind process deviations is a significant challenge.

> *"…for example, if you want to measure the incident resolution process while it's documented in that process you could see who or which role needs to do which task. And I think you could measure deviations from that process, if you want, from the data"(VN, Data Analyst, Finance Industry).*

But for deviance mining which describes the reasons why there's deviations in the process, a majority of the respondents highlighted the problem of not understanding the reasons for deviations directly from the data as a common problem.

> *" …so on some of our tools, it is not always easy to tell because the tools were only designed to show you deviations without telling you the reason why there was a deviation" (JF, Business Analyst, Consulting firm).*

This confirms studies that have suggested the need for improving process mining tools to address challenges with variations in processes (Zimmermann et al., 2022). Therefore the need for more advanced tools and methodology in exploring causal relationships between data and process variations is of significant importance. This challenge could also be as a result of the complexity of business processes and a multitude of factors that can cause deviations. Studies on challenges faced by process analysts has also highlighted the challenges of dealing with complex business processes (Zimmermann et al., 2023).

4.3.4 COMPLIANCE

This use case category revolves around conformance checking which compares an established process model with the process execution behaviour to ensure compliance with predefined standards; and compliance monitoring which involves comparing an ongoing process execution with predefined rules to maintain regulatory compliance (Milani et al., 2022).

Relevance And Challenges Of Compliance Use Case

One of the key insights from the interview is the recognition that process modelling is inherently an iterative process. One of the responses highlights the complexity involved in creating and maintaining accurate process models.

> *"I think because it's a very complex model, we're not building one complex process. So it's a number of processes that we're building to map a much larger process. And so the idea is to make sure that all of the stakeholders have been carried along. Sometimes it happens that you wrongly define the role of a specific stakeholder, and it's really up to them to correct that, and then we have to go back to the drawing board and adjust the process, so it's really an iterative process, and we're learning from our mistakes" (PO Process Manager, Aviation Industry).*

This iterative nature is due to the dynamic nature of business environments and the element of defining stakeholder roles. Also, the culture of flexible work procedures suggest the limitations of compliance as a use case for business processes.

Given the challenges identified from the responses, this suggests that static process models may not be suitable for organisations working in dynamic environments, therefore flexibility and adaptability could conflict with the rigid structures required for compliance.

4.3.5 AGILITY

Business questions focus on predicting future process executions to anticipate potential issues for improvement which is described as predictive monitoring (Milani et al., 2022). It also involves describing how a process changes over time and finally the prescription of actions to achieve desired results (Milani et al., 2022).

Relevance And Challenges of Agility Use Case

The insights gathered from the interviews indicate the application of predictive analysis is often confined to attaining strategic goals rather than granular analysis of business processes.

> *"…. for instance, based on the current strategy, we have said that by 2030 we want to reduce our total emissions by 24% so that's a long term goal, and it's also my job to to*

prepare a model that predicts how much emissions we have today, how much emissions we will have next year up until 2030 and this model should be able to look at all of the data and say, okay, based on this data, this is how much CO2 you would have by next year" (PO Process Manager, Aviation Industry).

The reason given for this is the difficulty of having to deal with the business process data as one interviewee described the complexity of process data makes prediction difficult.

"So it's easier to run predictive analysis on costs and profits, what is more difficult is to run predictive analysis on whether a business process would still be efficient, due to the nature of how process data is"- (JF, Business Analyst, Consulting firm).

One of the interviewees highlighted the lack of necessary skills for performing predictive analysis on business processes.

"... so we only work with the data that we have, and then we just look at what you've done in the past, but we don't have anyone that predicts what will happen in the future with business processes" (DU, Data Analyst, Aviation).

This statement points to the broader issue of lack of specialised personnel who possess technical skills required to leverage business processes for predictive purposes as confirmed by previous studies (Zimmermann et al., 2022).

One method suggested for tackling this issue is the use of machine learning and artificial intelligence.

"...one of the things that we explore is machine learning and artificial intelligence, and so by looking at the data, yes, in fact, it's something we have to do now with the improvement of artificial intelligence, we have to run some scripting and some code to see if, based on what we know from the past, we can predict outcome for the future. And in fact, this is what sets the standards for new projects. The predictive analysis becomes the new benchmark for the project" (JF, Business Analyst, Consulting firm).

This opens up avenues for future research where the use of AI and machine learning can be used to enhance predictive monitoring in business processes.

A summary of the results is presented in the table below:

USE CASE	PERCEPTION	CHALLENGES
TRANSPARENCY	• Organisational culture plays a significant role in valuing transparency of business processes. • Very essential for consulting firms. • Not important for organisations that value flexibility in business processes.	• Insufficient data in realising full transparency of business processes. • Use of qualitative data generated from interviews and meetings is used by most organisations in understanding business process data. • Working with external data for process mining is a challenge due to data privacy concerns.
EFFICIENCY	• Top priority for most organisations. • Historical data plays an important role in this use case. • Most organisations optimise business processes mainly for financial reasons.	• Lack of resources could influence the improvement of business processes. • Interpretation of data to identify bottlenecks is a major issue. • Resistance to change initiatives by employees. •
COMPLIANCE	• Organisations need to value having a standardised business process for this use case to be relevant.	• Dynamic business environment makes compliance a difficult problem. • Lack of standardised processes in organisations.
QUALITY	• Process variant analysis and deviance mining is done mainly for efficiency reasons.	• Interpreting data for deviations is a difficult problem.
AGILITY	• Most organisations don’t value predicting business processes due to complexity of business process data. • Artificial intelligence and machine learning could be used for this use case	• Complexity of business process data makes prescriptive and predictive analysis difficult. • Lack of skills by analysts in utilising this use case.

Table 4 : Summary of the Results

5 Implications of the Study, Conclusions & Limitations

The findings from the research have significant implications for academia and industry. The goal of the literature study this paper references was to help practitioners see the benefits of process mining and the areas in which it could add value to their businesses by exploring each use case of process mining. This study provides much-needed clarity by bridging the gap between theoretical benefits outlined in the literature and real-world experiences of organisations by adding valuable insights to the relevance of the use cases, and what obstacles must be overcome to leverage the potential of process mining fully.

Despite process discovery being the top use case for process mining, responses from interviewees shows this isn't the case in most organisations. Challenges of insufficient data and data privacy concerns hinder the effective implementation of transparency as a use case.

Cost reduction seems to be the reason for efficiency as a use case, but despite this realisation organisations face significant challenges due to resistance from both resources and human factors. Overcoming these barriers requires strong change management strategies and transparency with stakeholders on the financial benefits of efficiency improvements.

Gaps in knowledge and limitations of tools affect quality as a use case, especially in deviance mining.

The dynamic nature of business environments affect compliance as a use case. This is also not relevant for organisations that prioritise flexibility in their business processes.

Finally, to effectively implement predictive monitoring, organisations must invest in its employees to realise value from this use case. Integrating AI and machine learning into predictive monitoring can enhance predictive and prescriptive solutions for business processes.

In this study, several limitations must be acknowledged. Even though attempts were made to generalise the results, the limited number of seven respondents might still be a factor in limiting the generalizability of the findings. While attempts were made to ensure a broad range of perspectives were made through restrictions of only two interviewees for one industry, this study only covers some of the industries available; therefore, organisations with unique insights might have been excluded. Also, the study does not take into account the tools used by the interviewees. Therefore, the impact of resources available to the interviewees might have been overlooked. Finally, the lack of clearly defined job roles was a factor in the quality of responses from the interviewees, as the perspectives of a process manager differ from those of a business analyst.

In conclusion, a comprehensive view of the perceptions and relevance of process mining use cases in real-world scenarios has been explored. The findings offer valuable insights for practitioners offering valuable insights and guide future research.

Bibliography

1. Aalst, W. V. D., Zhao, J. L., & Wang, H. J. (Eds.). (2015). Editorial: "Business Process Intelligence: Connecting Data and Processes." *ACM Transactions on Management Information Systems*, *5*(4), 1–7. https://doi.org/10.1145/2685352
2. Ailenei, I., Rozinat, A., Eckert, A., & van der Aalst, W. M. (2012). *Definition and validation of process mining use cases*. 75–86.
3. Biernacki, P., & Waldorf, D. (1981). Snowball sampling: Problems and techniques of chain referral sampling. *Sociological Methods & Research*, *10*(2), 141–163.
4. Cho, M., Song, M., Comuzzi, M., & Yoo, S. (2017). Evaluating the effect of best practices for business process redesign: An evidence-based approach based on process mining techniques. *Decision Support Systems*, *104*, 92–103.
5. Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.
6. Dakic, D., Stefanovic, D., Cosic, I., Lolic, T., & Medojevic, M. (2018). Business Process Mining Application: A Literature Review. In B. Katalinic (Ed.), *DAAAM Proceedings* (1st ed., Vol. 1, pp. 0866–0875). DAAAM International Vienna. https://doi.org/10.2507/29th.daaam.proceedings.125
7. Diba, K., Batoulis, K., Weidlich, M., & Weske, M. (2020). Extraction, correlation, and abstraction of event data for process mining. *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery*, *10*(3), e1346.
8. Dumas, M., La Rosa, M., Mendling, J., & Reijers, H. A. (2018). *Fundamentals of Business Process Management*. Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-662-56509-4
9. Eggers, J., & Hein, A. (2020). Turning Big Data into Value: A Literature Review on Business Value Realization from Process Mining. *ECIS*.
10. Fereday, J., & Muir-Cochrane, E. (2006). Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *International Journal of Qualitative Methods*, *5*(1), 80–92.
11. Froger, M., Benaben, F., Truptil, S., & Boissel-Dallier, N. (2019). A non-linear business process management maturity framework to apprehend future challenges. *International Journal of Information Management*, *49*, 290–300.
12. Ghani, N. A., Hamid, S., Hashem, I. A. T., & Ahmed, E. (2019). Social media big data analytics: A survey. *Computers in Human Behavior*, *101*, 417–428.
13. Grisold, T., Mendling, J., Otto, M., & Vom Brocke, J. (2020). Adoption, use and management of process mining in practice. *Business Process Management Journal*, *27*(2), 369–387. https://doi.org/10.1108/BPMJ-03-2020-0112
14. H. Davenport, T. (2014). How strategists use "big data" to support internal business decisions, discovery and production. *Strategy & Leadership*, *42*(4), 45–50.
15. Harmon, P. (2010). The scope and evolution of business process management. *Handbook on Business Process Management 1: Introduction, Methods, and Information Systems*, 37–81.
16. Jans, M., Alles, M. G., & Vasarhelyi, M. A. (2014). A field study on the use of process

mining of event logs as an analytical procedure in auditing. *The Accounting Review*, *89*(5), 1751–1773.

17. Jans, M., Van Der Werf, J. M., Lybaert, N., & Vanhoof, K. (2011). A business process mining application for internal transaction fraud mitigation. *Expert Systems with Applications*, *38*(10), 13351–13359. https://doi.org/10.1016/j.eswa.2011.04.159
18. Kipping, G., Djurica, D., Franzoi, S., Grisold, T., Marcus, L., Schmid, S., Brocke, J. V., Mendling, J., & Röglinger, M. (2022). How to Leverage Process Mining in Organizations—Towards Process Mining Capabilities. In C. Di Ciccio, R. Dijkman, A. Del Río Ortega, & S. Rinderle-Ma (Eds.), *Business Process Management* (Vol. 13420, pp. 40–46). Springer International Publishing. https://doi.org/10.1007/978-3-031-16103-2_5
19. Kubrak, K., Milani, F., & Nolte, A. (2022). Process Mining for Process Improvement—An Evaluation of Analysis Practices. In R. Guizzardi, J. Ralyté, & X. Franch (Eds.), *Research Challenges in Information Science* (Vol. 446, pp. 214–230). Springer International Publishing. https://doi.org/10.1007/978-3-031-05760-1_13
20. Linden, M., Felden, C., & Chamoni, P. (2011). Dimensions of Business Process Intelligence. In M. Zur Muehlen & J. Su (Eds.), *Business Process Management Workshops* (Vol. 66, pp. 208–213). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-20511-8_19
21. Loyola-González, O. (2023). Process mining: Software comparison, trends, and challenges. *International Journal of Data Science and Analytics*, *15*(4), 407–420.
22. Măruşter, L., & Van Beest, N. R. (2009). Redesigning business processes: A methodology based on simulation and process mining techniques. *Knowledge and Information Systems*, *21*, 267–297.
23. McAfee, A., Brynjolfsson, E., Davenport, T. H., Patil, D., & Barton, D. (2012). Big data: The management revolution. *Harvard Business Review*, *90*(10), 60–68.
24. Micus, C., Schramm, S., Boehm, M., & Krcmar, H. (2023). Operations Research Perspectives. *Operations Research*, *10*, 100277.
25. Milani, F., Lashkevich, K., Maggi, F. M., & Di Francescomarino, C. (2022). Process Mining: A Guide for Practitioners. In R. Guizzardi, J. Ralyté, & X. Franch (Eds.), *Research Challenges in Information Science* (Vol. 446, pp. 265–282). Springer International Publishing. https://doi.org/10.1007/978-3-031-05760-1_16
26. Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research*, *42*, 533–544.
27. Stertz, F., Mangler, J., Scheibel, B., & Rinderle-Ma, S. (2021). Expectations vs. Experiences – Process Mining in Small and Medium Sized Manufacturing Companies. In A. Polyvyanyy, M. T. Wynn, A. Van Looy, & M. Reichert (Eds.), *Business Process Management Forum* (Vol. 427, pp. 195–211). Springer International Publishing. https://doi.org/10.1007/978-3-030-85440-9_12
28. Thiede, M., Fuerstenau, D., & Bezerra Barquet, A. P. (2018). How is process mining

technology used by organizations? A systematic literature review of empirical studies. *Business Process Management Journal*, *24*(4), 900–922. https://doi.org/10.1108/BPMJ-06-2017-0148

29. Van Der Aalst, W., Adriansyah, A., De Medeiros, A. K. A., Arcieri, F., Baier, T., Blickle, T., Bose, J. C., Van Den Brand, P., Brandtjen, R., Buijs, J., Burattin, A., Carmona, J., Castellanos, M., Claes, J., Cook, J., Costantini, N., Curbera, F., Damiani, E., De Leoni, M., … Wynn, M. (2012). Process Mining Manifesto. In F. Daniel, K. Barkaoui, & S. Dustdar (Eds.), *Business Process Management Workshops* (Vol. 99, pp. 169–194). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-28108-2_19
30. Van Der Aalst, W. M. P. (2013). Business Process Management: A Comprehensive Survey. *ISRN Software Engineering*, *2013*, 1–37. https://doi.org/10.1155/2013/507984
31. Van Der Aalst, W. M. P., & Carmona, J. (2022). Scaling Process Mining to Turn Insights into Actions. In W. M. P. Van Der Aalst & J. Carmona (Eds.), *Process Mining Handbook* (Vol. 448, pp. 495–502). Springer International Publishing. https://doi.org/10.1007/978-3-031-08848-3_17
32. Van Der Aalst, W. M., Reijers, H. A., Weijters, A. J., van Dongen, B. F., De Medeiros, A. A., Song, M., & Verbeek, H. M. W. (2007). Business process mining: An industrial application. *Information Systems*, *32*(5), 713–732.
33. Vom Brocke, J., Jans, M., Mendling, J., & Reijers, H. A. (2021). A Five-Level Framework for Research on Process Mining. *Business & Information Systems Engineering*, *63*(5), 483–490. https://doi.org/10.1007/s12599-021-00718-8
34. Willaert, P., Van den Bergh, J., Willems, J., & Deschoolmeester, D. (2007). The process-oriented organisation: A holistic view developing a framework for business process orientation maturity. *Business Process Management: 5th International Conference, BPM 2007, Brisbane, Australia, September 24-28, 2007. Proceedings 5*, 1–15.
35. Zerbino, P., Stefanini, A., & Aloini, D. (2021). Process science in action: A literature review on process mining in business management. *Technological Forecasting and Social Change*, *172*, 121021.
36. Zimmermann, L., Zerbato, F., & Weber, B. (2022). Process Mining Challenges Perceived by Analysts: An Interview Study. In A. Augusto, A. Gill, D. Bork, S. Nurcan, I. Reinhartz-Berger, & R. Schmidt (Eds.), *Enterprise, Business-Process and Information Systems Modeling* (Vol. 450, pp. 3–17). Springer International Publishing. https://doi.org/10.1007/978-3-031-07475-2_1
37. Zimmermann, L., Zerbato, F., & Weber, B. (2023). What makes life for process mining analysts difficult? A reflection of challenges. *Software and Systems Modeling*. https://doi.org/10.1007/s10270-023-01134-0

Appendices

Interview Questionnaire

A Introductory Questions

1. Give a brief description of the organisation you work for?
2. What's your organisation's approach to using business process data?
3. What methods are used to store and retrieve business process data?
4. Does your organisation have an established business process model?

B Main Questions

1. What areas of the business process are you looking to get full transparency?
2. What are the limitations/ challenges you encounter?
3. Have you been able to improve the efficiency of how business activities are carried out in your organisation?
4. Please, give an example of what aspects of the business process you have been able to improve its efficiency from the data available?
5. What are the challenges in implementing efficient business processes?
6. Can you tell from the data if the business processes are following the normal procedures?
7. Is it possible to identify reasons for the deviations from the data?
8. Do you collect data on the difference and similarities of variations in your process model?
9. Do you use your business process data for prediction purposes?
10. What challenges do you encounter when working with business process data?
11. Are there any final remarks you would like to make based on this interview session?

N.B: The main questions segment were asked in no particular order, since it's a semi structured interview, questions can be asked based on the responses from the interviewee.

Coding Manual Generated From Interviews

USE CASE	PERCEPTION	CHALLENGES
TRANSPARENCY	• Business needs. • Valuable for consultants	• Insufficient data. • Error in data entry. • Dynamic business environments. • Working with external data.
EFFICIENCY	• Use of historical data • Cost reduction and resource optimisation. •	• Resistance to change. • Interpretation of data. • Lack of adequate resources. • Interpretation of data. • Use of meetings and qualitative means to identify bottlenecks.
COMPLIANCE		• Lack of standardised processes. • Dynamic business environment. •
QUALITY		Interpretation of data.
AGILITY	• Limited application. • Use of AI and machine learning.	• Complexity of business process data. • Lack of adequate knowledge