An Internship Report

on

Process Mining virtual internship

Submitted in partial fulfilment of the requirements

for the award of the degree of

BACHELOR OF TECHNOLOGY

in

Computer Science and Engineering (Data Science)

by

K RANGA SWAMY **(214G1A3285)**

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

(DATA SCIENCE)

SRINIVASA RAMANUJAN INSTITUTE OF TECHNOLOGY
(AUTONOMOUS)

(Affiliated to JNTUA, accredited by NAAC with 'A' Grade, Approved by AICTE, New Delhi & Accredited by NBA (EEE, ECE & CSE))
Rotarypuram village, B K Samudram Mandal, Ananthapuramu-515701.

2023 – 2024

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Certificate

This is to certify that the internship report entitled "Process Mining virtual internship" is the bonafide work carried out by **K RANGA SWAMY** bearing Roll Number 214G1A3285 in partial fulfilment of the requirements for the award of the degree of **Bachelor of Technology** in **Computer Science and Engineering (Data Science)**from May 2023 to July 2023.

Internship Coordinator

Mr. P. Veera Prakash, M. Tech., (Ph.D.),
Assistant Professor & HOD of CSE

Head of the Department

Dr. P. Chitralingappa, M. Tech., Ph.D.,
Associate Professor

Date:

Place: Ananthapuramu

EXTERNAL EXAMINER

PREFACE

Brief overview of the company's history:

Celonis is a technology company known for its process mining software. Process mining involves analyzing and visualizing business processes based on data logs from various IT systems. Celonis's software allows organizations to gain insights into their operational processes, identify inefficiencies, and make data-driven decisions for process optimization and improvement.

- Who founded it

  Celonis was founded in 2011 by three students from the Technical University of Munich: Bastian Nominacher, Alexander Rinke, and Martin Klenk. They aimed to develop software that could analyze and improve business processes using real-world data.

- What purpose and when

  The purpose of Celonis is to provide organizations with a powerful tool to analyze and optimize their business processes through process mining. Process mining involves extracting and analyzing data from various IT systems to gain insights into how processes are actually being executed within an organization

Company's Mission Statement:

Celonis' mission statement was to empower businesses with data-driven insights to optimize their processes and drive transformational growth

Business Activities:

"Empowering organizations with cutting-edge process mining technology to drive operational excellence, enhance customer experiences, and enable data-driven decision-making."

ACKNOWLEDGEMENT

The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of people who made it possible, whose constant guidance and encouragement crowned our efforts with success. It is a pleasant aspect that I have now the opportunity to express my gratitude for all of them.

It is with immense pleasure that I would like to express my indebted gratitude to my internship coordinator **Mr. P. Veera Prakash, Assistant Professor & HOD, Department of Computer Science and Engineering**, who has supported me a lot and encouraged me in every step of the internship work. I thank him for the stimulating support, constant encouragement and constructive criticism which have made possible to bring out this internship work.

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I wish to convey my special thanks to **Dr. G. Balakrishna, Principal** of **Srinivasa Ramanujan Institute of Technology** for giving the required information in doing my internship. Not to forget, I thank all other faculty and non-teaching staff, and my friends who had directly or indirectly helped and supported me in completing my internship in time.

I also express our sincere thanks to the Management for providing excellent facilities and support**.**

Finally, I wish to convey my gratitude to my family who fostered all the requirements and facilities that I need.

K RANGA SWAMY

(214G1A3285)

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LIST OF ABBREVIATIONS

PM	Process Mining
RPA	Robotic process automation
CSV	comma-separated values
XML	Extensible Markup Language.
ERP	Enterprise Resource Planning
SRM	Supplier Relationship Management
MRI	Magnetic Resonance Imaging

CHAPTER - 1

INTRODUCTION TO PROCESS MINING

what is Process ?

A process is a series of actions or steps repeated in a progression from a defined or recognized 'start' to a defined or recognized 'finish'. The purpose of a process is to establish and maintain a commonly understood flow that allows a task to be completed as efficiently and consistently as possible.

What is Process Mining?

Process Mining is the combination of two disciplines: Data Science and Business Process Management. Process Mining essentially uses Data Science techniques, such as Big Data and AI, to address Process Science problems such as process improvement and automation (cf. van der Aalst 2016).

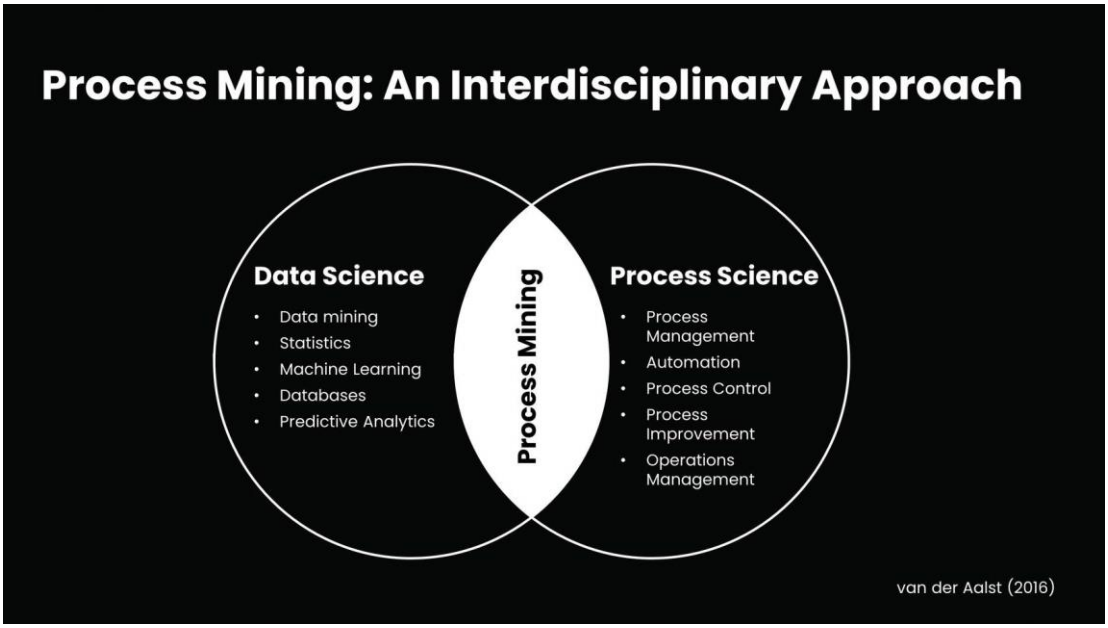

Fig. No. 1.1: process mining

1.1 Types of Process Mining:

Process mining encompasses several different types or perspectives, each focusing on a specific aspect of the analysis of process data. The three main types of process mining are:

- **Discovery (Process Discovery):** This type involves constructing process models from event logs without prior knowledge of the actual processes. It aims to uncover the underlying process flow based solely on the sequence of events recorded in the logs. The most common form of discovery is the creation of a process model known as a "process map" or a "workflow model." There are various algorithms and techniques that help in automatically generating these process models, such as Alpha algorithm, Heuristic Miner, Inductive Miner, and more.
- **Conformance (Process Conformance or Alignment):** Conformance analysis compares the actual process execution, as recorded in event logs, with a pre-defined reference process model (often assumed to be the norm or best practice). The goal is to identify deviations, non-compliance instances, and variations between the expected process flow and the real execution. This type of process mining helps organizations understand where and why deviations occur, supporting compliance efforts and process improvement initiatives.
- **Enhancement (Process Enhancement or Extension):** Enhancement analysis seeks to extend existing process models with additional information or insights extracted from event logs. This includes information such as performance data (e.g., execution times, waiting times), resource assignments, and more. By adding this data to the process model, organizations can gain a more detailed view of how the process operates in reality, helping them optimize and fine-tune processes.

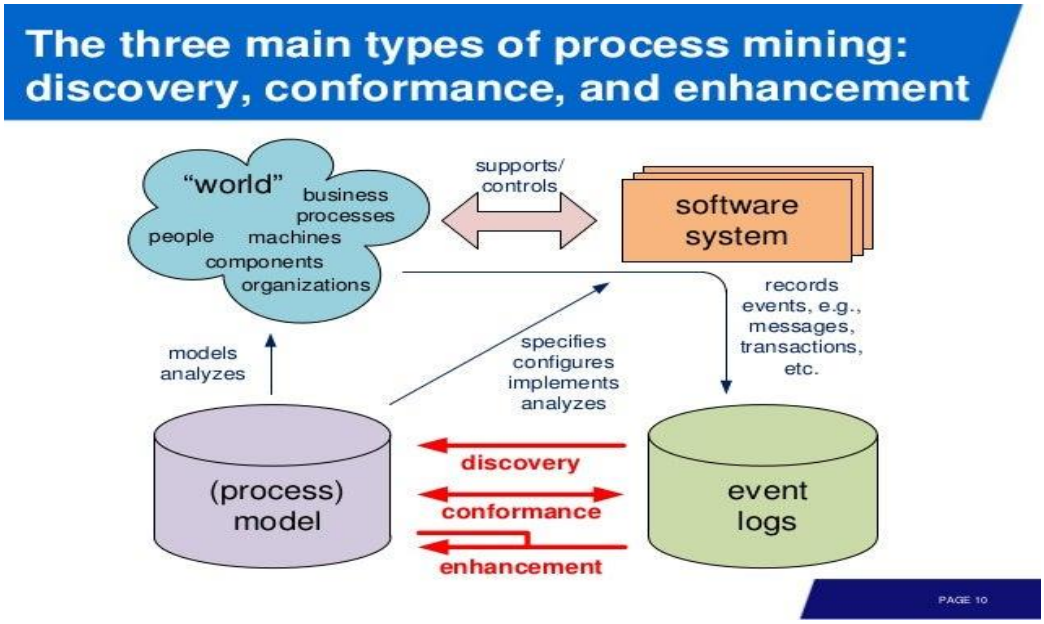

Fig. No. 1.2: Types of Process Mining

1.2 Why is process mining important?

Process mining holds many benefits that can serve several industries—from its roots in the halls of academia to the vast depths of the business world. In the past decade alone, process mining has become one of the most valuable and important new technologies that businesses are using to not only improve their business processes but also to thrive in the next decade.

This is because process mining is so much more than improving your sales—it also helps businesses reduce operational costs that affect their overall return-on-investment (ROI) by quantifying the inefficiencies in their operational models, allowing managers to make objective, data-based decisions on the right resource allocations for better workflows.

CHAPTER – 2

IMPLEMENTATION OF PROCESS MINING

2.1 Implementation :

Implementing process mining involves several steps to effectively analyze and improve business processes using event data. Here's a step-by-step guide on how to implement process mining:

- **Correct data:**

As the famous saying goes "garbage in – garbage out". Process mining, as any data analysis technique, stands or falls on the quality of the underlying data. A process mining analysis that is based on low-quality unrepresentative data has little or no value for the organization and more often than not leads to false conclusions.

- **Training:**

Since process mining is still a rather innovative topic for most companies, take time to educate your stakeholders and subject matter experts on process mining techniques, what it can do and –even more importantly— what it cannot do. Demonstrate the possibilities of dedicated process mining tools and explain the benefits.

- **Top-down management:**

I have written on the importance of top management support and endorsement in my previous **article**. This research confirms that top management support is critical, as often general staff does not have the resources or the authority to make impactful decisions.

- **Focus:**

Process mining analysis can result in a long list of insights and, consequently, many potential improvements. Restrain yourself from working on an unmanageable amount of improvements at any given time. Rather, focus on a small selection of the most promising areas, then iterate.

❖ **Dedication:**

Dedication is understood as the willingness of senior management to allocate resources, both human resources as financial resources, to realize process improvements.

❖ **Context:**

When it comes to understanding process behavior, context is key. If you leave the context out while interpreting the data, findings can be misleading. Data typically does not take into account local legislation or customer-specific requirements. That is why it is crucial to have a process expert be part of the core team in order to interpret data in the context of business process.

❖ **Approach:**

The purpose of process mining is **not** to reveal negative performance and find someone to blame. According to the research, a frequent mindset in companies that work with process mining is that disappointing performance indicators are a bad thing. This results in managers who do not want to show their process mining results, because they fear being reprimanded.

Fig. No. 2.1: Factors for implementing Process Mining

2.2 How exactly does process mining work?

Process mining can be viewed as a four step method from data extraction to data analysis.

- **Extract data** - A process mining tool is used to extract process data from IT systems.
- **Reconstruct data** - process data is collected and harmonized in preparation for analysis.
- **Visualize data** - process mining algorimths are used to display as-is state of processes.
- **Analyze data** - process data is analyzed to identify process improvement opportunities.

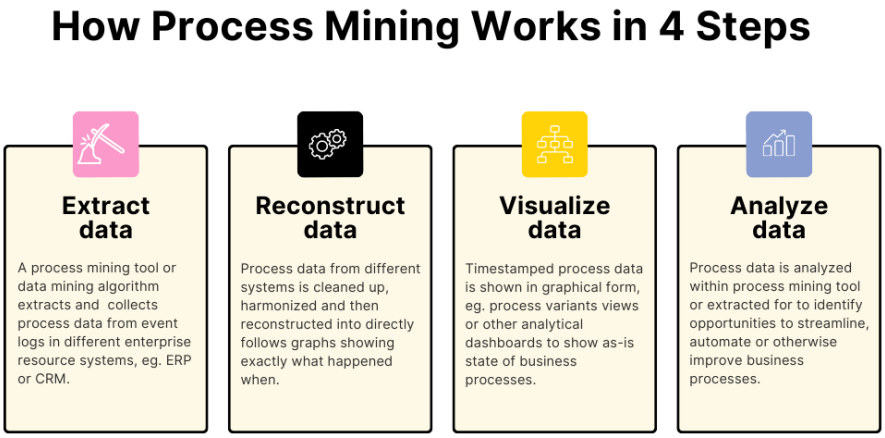

Fig. No. 2.2:Steps of Process of Mining

CHAPTER – 3

APPLICATIONS

Process mining has a wide range of applications across various industries and sectors. It provides valuable insights into how processes are executed, identifies inefficiencies, and helps organizations make data-driven improvements. Here are some key applications of process mining:

Process mining and RPA:

Robotic process automation or RPA is focused on automating repetitive business processes to increase efficiency. QPR, one of the largest providers of process mining software, claims that process mining can reduce RPA implementation time by 50 percent and RPA project risk by 60 percent. And according to UiPath, one of the leading RPA companies, "78 percent of people who automate say process mining is key to enabling their RPA efforts." Here's why.

- Process mining discovers areas that need improvement and can benefit from automation.
- Processes can be optimized to ensure that you're not automating a mess.
- Process maps can be used as a guide or template to train bots, outlining the sequence of necessary steps.

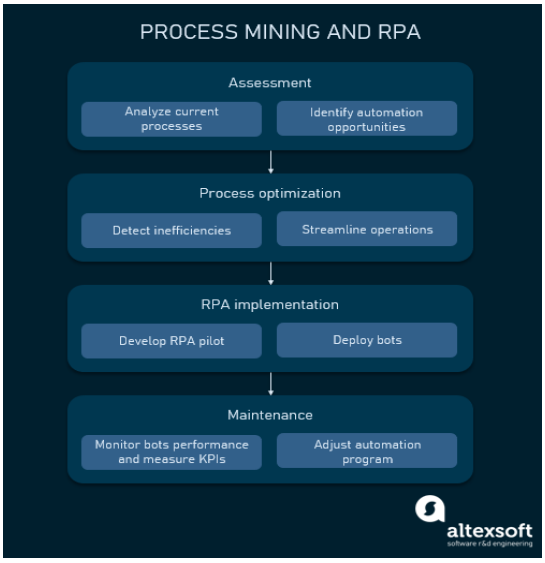

Fig. No. 3.1: Process mining and RPA

Vodafone, a multinational telecom giant, partnered with Celonis, the world leader in process mining, for an RPA project. One of the aspects that required automation was purchase order (PO) processing as Vodafone wanted to improve its rate of 73 percent correctly completed POs. Before actually launching RPA, process mining was implemented to understand process variations and noncompliance and prepare for automation.

Alexander Rinke, co-founder and co-CEO of Celonis, emphasizes the importance of process analysis and optimization BEFORE starting an RPA project: "If a process is already flawed, RPA will only make a bad process faster. It's essential that businesses take a transparent approach to RPA, ensuring that automated processes are first optimized to be the most efficient."

As a result of process mining and RPA implementation, in the first six months Vodafone achieved a PO rate of 85 percent followed by a reduction in operational purchasing costs by 11 percent and a reduced time to market by 20 percent. Eventually, Vodafone managed to further increase its PO rate up to 92 percent.

Process mining and supply chain:

Process mining offers a lot of optimization opportunities to the complex, multifaceted supply chain industry, including such aspects as manufacturing, warehousing, transportation, inventory management, retail management, etc. Some of the typical processes that are often performed inefficiently and require improvement include

- procure to pay,
- order to cash,
- production process,
- warehouse operations, and
- accounts payable/accounts receivable management.

Twenty-two percent of respondents to a PwC study believe that procurement is the area that would benefit most from process mining. For example, an ideal procure to pay process is supposed to involve a short sequence of specific steps.

1. Purchase request or requisition is created.
2. Request is approved.
3. Purchase order (PO) is created and sent to the supplier.
4. Goods are delivered and approved.
5. The vendor's invoice is received.
6. Payment is processed.

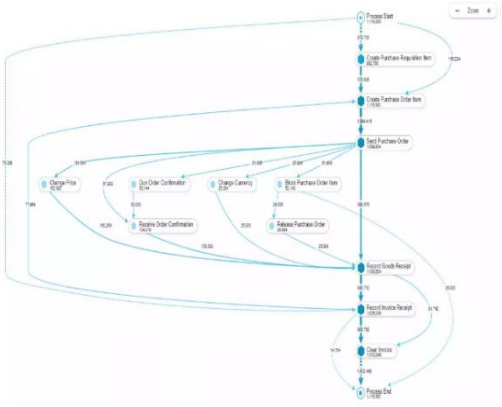

Fig. No. 3.2: Process mining and supply chain

Process mining can help uncover those bottlenecks by offering full transparency into how the processes are performed in your organization.

In 2016, Veco Precision, the world-leading manufacturer of precision parts, won the Process Miner of the Year award after successfully applying process mining techniques to their manufacturing workflow.

Veco partnered with Fluxicon, another major process mining vendor, to reduce their manufacturing lead times. Fluxicon combined process mining analytical capabilities with the traditional process management approaches. As a result, they managed to identify process variations and missing links, reduce factory lead times, and increase efficiency as the same amount of work could be performed with fewer workers.

That was the first stage of their process mining journey. Inspired by the results, Veco kept applying process mining tools to analyze its performance. They also hired a data scientist to further discover opportunities for process improvement and trained more people in big data.

In 2017, Veco reported on another success. As part of their development strategy, they wanted to produce new samples and deliver them to customers within 15 days — a process that then took 52 days. So, after analyzing data from their internal systems, they found the reasons for delays and had to define a new process "Engineer to Order" that required a completely different management approach.

As Mick Langeberg, the supply chain manager in Veco, announced, "The pilot results were jaw-dropping and gave us the green light to implement the new design. After we mined the customer journey, Veco has been consistently growing new business at an accelerated speed."

Process mining and finance:

For financial institutions, such as banks, insurance companies, or loan associations, the biggest operational priorities are security, accuracy, and speed of transactions. However, just like in any other industry, a lot of organizations suffer from inefficiencies, bottlenecks, and poor process management.

In 2018, Piraeus Bank, a Greek multinational financial services company, encountered problems after adopting RPA to automate the consumer loan process. Since traditional analytical methods proved to be of little value, they implemented QPR Process Analyzer to gain a deeper understanding of their process problems and identify bottlenecks.

The process analysis quickly revealed that "the main pain point was a lack of standardization of the consumer loan process and multiple inefficient variants of the process". After uncovering the problem sources, an optimization plan was developed and implemented, resulting in cutting the loan application process from 35 minutes to 5 minutes and cutting lead time of the entire loan process by 86 percent.

Fig. No. 3.3: Process mining and finance

Healthcare Process Analysis:

Analyze patient pathways and medical workflows to identify opportunities for reducing waiting times and improving patient care.

Enhance healthcare processes through data-driven insights.

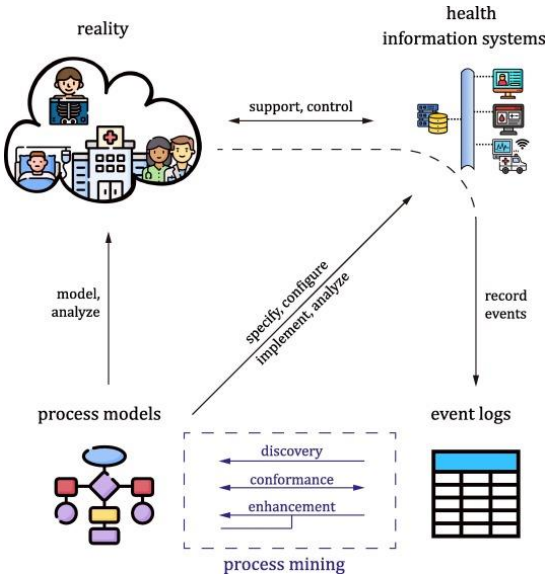

Fig. No. 3.3: Healthcare

CHAPTER – 4

PROCESS MINING TOOLS & SOFTWARES

What is Process Mining Tools?

Process mining tools are designed to discover, monitor and improve processes by extracting knowledge from events captured in information systems to continuously deliver visibility and insights. Process mining includes automated process discovery (i.e., extracting process models from an event log), conformance checking (i.e., monitoring deviations by comparing model and log), social network/organizational mining, automated construction of simulation models, model extension, model repair, case prediction, and history-based recommendations.

The Best Process Mining Tools and Software

4.1 Appian:

Description: Appian is a leading low-code platform provider that allows both experienced and citizen developers to build process-centric and case-centric applications with the ability to monitor and improve business processes in response to changing needs. With Appian's process mining capabilities, organizations can integrate data from multiple systems, identify process bottlenecks, develop purpose-built dashboards for specific analysis needs, predict process behaviors, design optimized workflows, maintain compliance with process standards, reduce operational costs, and more.

The features of Appian:

- Appian is Reliable.
- Appian is Secure.
- Appian is Scalable.
- Appian is global.
- RAPID Application Development.
- Appian is 20x faster than any other custom code.

4.2 Celonis:

Description: Celonis is a global provider of execution management solutions that help companies improve how they run their business processes. With Celonis' suite of process and task mining capabilities, companies across industries can improve visibility into their operations, identify bottlenecks, and streamline efficiencies. Those capabilities—powered by machine learning and industry-standard process query language (PQL)—include analytic visualizations, drag-and-drop customization tools, task mining, extensible data models, multi-event logs, best-practice benchmarking, and tools for identifying processes that could benefit from automation.

The features of celonis:

- Wide adoption
- Integrations
- Customization
- Broad user community

4.3 IBM:

Description: The IBM Process Mining product suite uses data-driven process insights to help companies across markets improve processes and make faster, more informed decisions. IBM's process mining tools can be applied in use cases like intelligent automation, customer onboarding, procure-to-pay (P2P), accounts payable, IT incident management, and order-to-cash. Features include automated robotic process automation (RPA) generation,fact-based process models, AI-powered process simulations, conformance checking, task mining, and seamless integrations with leading software SAP, Oracle, and other IBM products.

The features of IBM:

- Easy to use
- Visualizations
- Use of artificial intelligence
- Identify bottlenecks

4.4 SAP Signavio:

Description: Signavio, an SAP company, is a leading provider of BPM solutions, offering an integrated software solution allowing you to model, analyze, optimize, and execute business processes and decisions on one platform. The company's collaborative process mining solution, SAP Signavio Process Intelligence, equips companies with the capabilities needed for achieving improvements across system landscapes, data sources, and departments. Those capabilities include performance monitoring tools, advanced process mining algorithms, process data management, multiple integration options, process modeling, and more.

The features of SAP Signavio:

- ❖ SAP ecosystem
- ❖ Collaboration
- ❖ Process management
- ❖ Process design

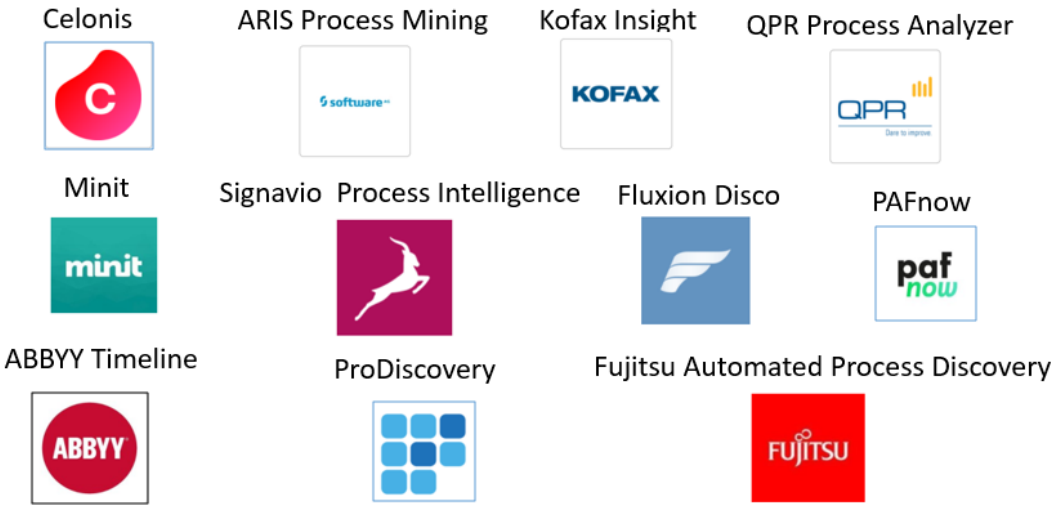

Fig. No. 4.1: process mining tools & software

CHAPTER – 5

REAL TIME EXAMPLES

5.1 Insurance:

Process mining can identify patterns and anomalies in processes that could indicate fraudulent activity. For example, a process mining system could detect when a claim is submitted multiple times, when a payment is made to an unknown party, or when a process takes longer than usual. By detecting these patterns, insurance companies can take proactive steps to prevent fraud and save money.

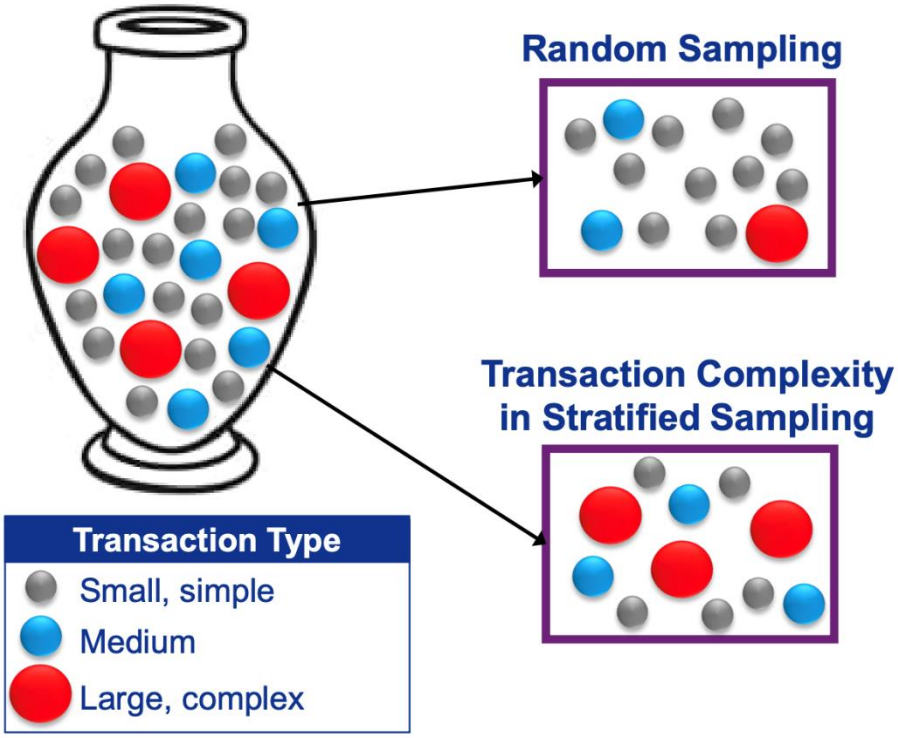

Fig. No. 5.1: Process Mining in Insurance

5.2 Auditing:

While auditors traditionally receive information on processes through extensive interviews and reviewing process documentation, process mining increases the effectiveness of the work of both internal and external auditors by providing them with instant, full insight into the organization's present and past business processes.

This allows auditors to move from an analysis of subjective samples to an analysis of the objective, full, as-is process, bringing along assurance and cutting down on precious time consumed.

Process mining quickly identifies conformance issues, the most common process violations, and the reasons behind them. Whether it is an invoice that was paid before being registered in your ERP system, failing the segregation of duties or any other business rule violation, process mining helps you put all the facts on the table.

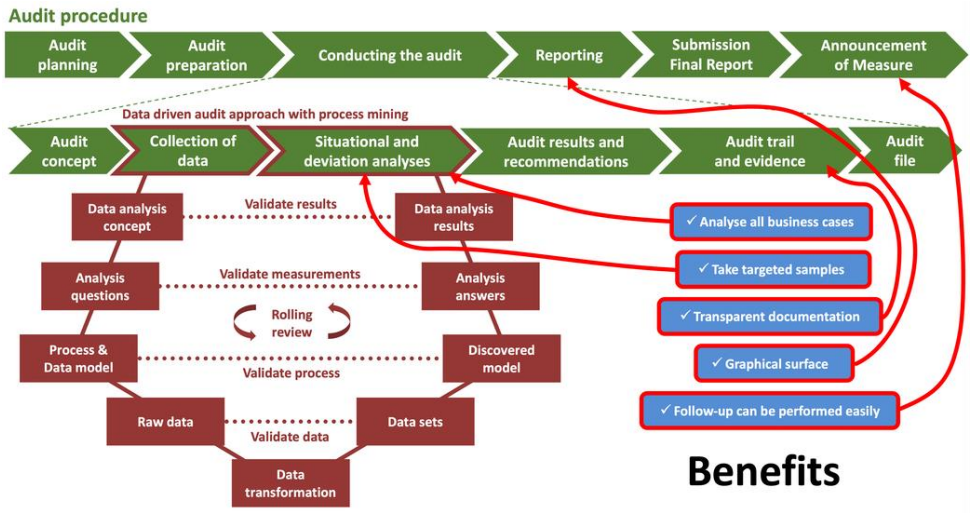

Fig. No. 5.2: Auditing

5.3 Order Management:

The Order-to-Cash (OtC) process covers the whole process cycle of handling customer orders, extending across different units, such as warehousing, delivery, invoicing, and account management. Consequently, this key business process is usually high-volume with lots of variations (for instance, unwanted changes in the process that prolong lead times and affect both internal efficiency and customer satisfaction).

Process mining visualizes the OtC process continuously and automatically. It shows you how to reduce rework, delays, and order changes by showing the root causes for the inefficiencies discovered in your OtC process. Moreover, process mining helps you identify delivery or automation blocks and

compliance issues with ready-made analyses and charts and monitor the performance of the end-to-end process continuously.

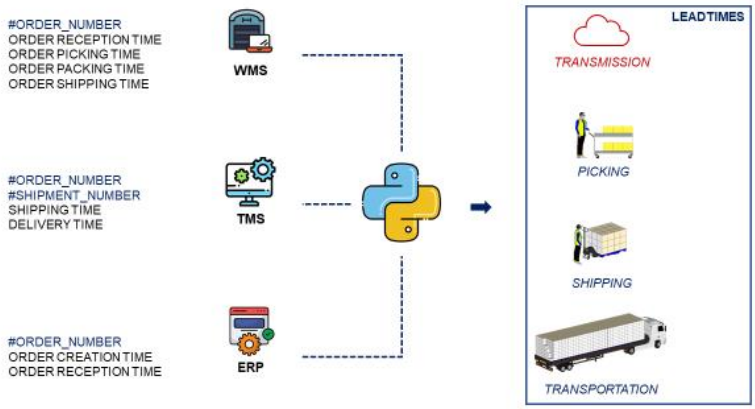

Fig. No. 5.3:Order Management

By applying process mining techniques to order management, organizations can gain a deeper understanding of their processes, identify areas for improvement, and make data-driven decisions to enhance efficiency, accuracy, and customer satisfaction throughout the order fulfillment lifecycle.

CHAPTER – 6

OUTCOMES

After completing this Training Track, you will be able to:

1.understand what Process Mining is and the basics of how it works.

2. summarize what an Event Log is and why we need it for Process Mining.

3.identify business use cases for Process Mining.

4. Interpret process visualizations and leverage analyses to identify process inefficiencies.

5.Conceptualize your process in terms of activities and cases.

6.Save an analysis selection for future reference and share it with your team; export visualizations and process data.

7. Save an analysis selection for future reference and share it with your team; export visualizations and process data.

CONCLUSION

process mining has emerged as a powerful methodology with far-reaching implications across various industries and sectors. It serves as a bridge between data analysis and process optimization, offering organizations the ability to gain a comprehensive and data-driven understanding of their operations. By extracting insights from event logs and process data, process mining uncovers hidden patterns, bottlenecks, inefficiencies, and opportunities for improvement within complex business processes.

From supply chain optimization to healthcare process improvement, process mining adapts to a wide array of applications. It not only streamlines workflows, identifies root causes of issues, and aids in compliance efforts but also serves as a catalyst for continuous improvement. By fostering a culture of process excellence, organizations can adapt to changing market dynamics and remain competitive in an ever-evolving business landscape.

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