IBM Cloud Pak for Business Automation Demos and Labs

IBM Process Mining

Lab Guide - Use Process Mining to Get Insights into Client Onboarding Workflow

IBM Porcess Mining v1.13
Lab Version 1.2

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1 Introduction

1.1 Process Mining

Process mining is a family of techniques in process management that support the analysis of actual business processes based on event logs. During process mining, specialized data mining algorithms are applied to identify trends, patterns, and details in event logs recorded by an information system. Process mining aims to improve process efficiency and understanding of processes.

More technical information about IBM Process Mining: https://ibm.box.com/v/IBMProcessMiningTechIntro
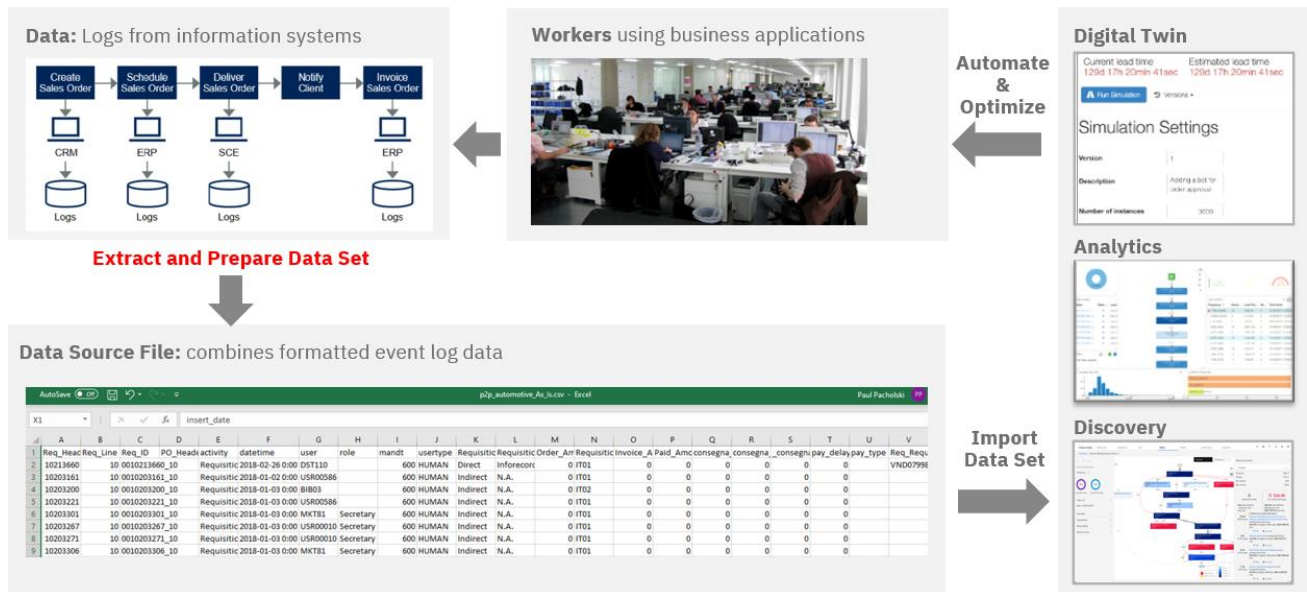
Figure 1. Process Mining

There are two key impediments to a successful process mining initiative - see the **Extract and Prepare Data Set** Step in the Figure above, marked in red.

1. Generating and extracting audit log data from applications intended for process mining.
2. Converting the raw audit log data to the format acceptable by IBM Process Mining.

The good news is that if we use IBM Business Automation Workflow with IBM Business Automation Insights, IBM Process Mining can automatically perform data set extraction and data preparation and create a Process Mining Project for you!

1.2 Using IBM Business Automation Insights for Data Extraction

IBM Business Automation Insights enables the capture of events generated by the operational systems implemented with the IBM Business Automation products. Captured events are aggregated into business-relevant KPIs and presented in dashboards for lines of business to have a real-time view of their operations.

More technical information about IBM Business Automation Insights: https://ibm.box.com/v/IBM-BAI-Tech-Intro
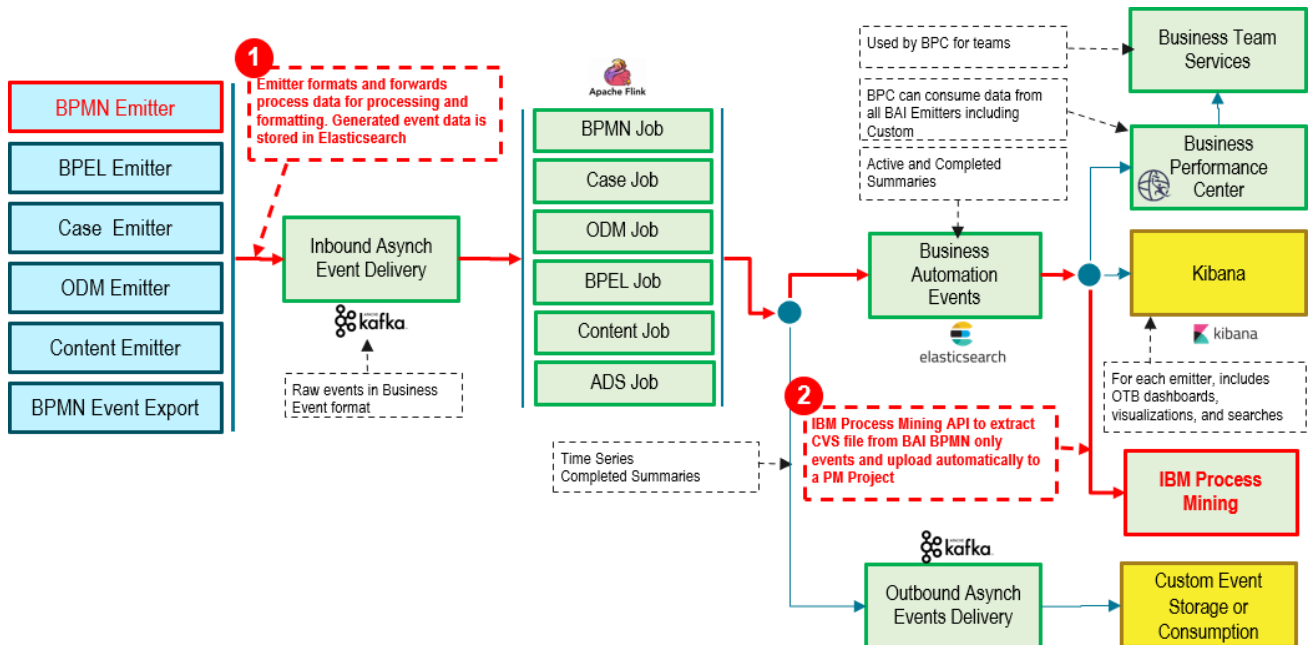
Figure 2. IBM Business Automation Architecture. Path 1: Data Generation. Path 2: Process Mining Project Creation

IBM Business Automation Insights emitters send business and process lifecycle data to the Elasticsearch datastore. The only programming effort required when designing a Workflow is to define what and when to emit the data from Cases and Processes - see **Path 1** in figure 2 above, marked in red.

1.3 Using IBM Process Mining API for Data Preparation

IBM Process Mining provides several APIs to transfer IBM Business Automation Workflow process data from BAI Elasticsearch directly to an IBM Process Mining project. This capability helps avoid costly manual data preparation and automates process data importing directly into the IBM Process Mining project- see **Path 2** in figure 2 above, marked in red.

The two key IBM Process Mining APIs are (see figure 3 below):

1. API to retrieve all Process Apps that have events in Elasticsearch, and
2. API to convert events from all Processes in a selected Process App to CSV files and send them to the IBM Process Mining server.
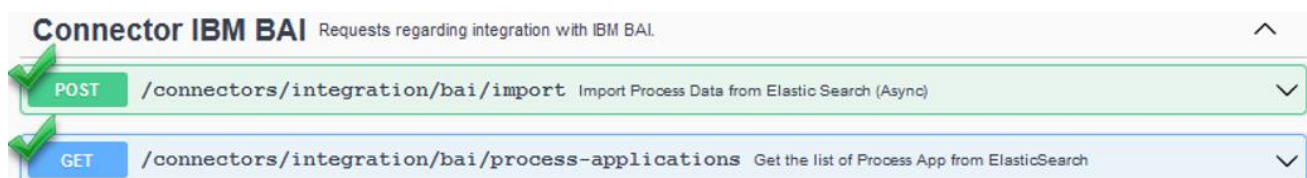
Figure 3. IBM Process Mining API for IBM Business Automation Insights

For more details, see a recorded demo: https://ibm.box.com/v/BAI-2-PROCESS-MINING-EXPORT and lab instructions: https://ibm.box.com/v/BAI-2-PM-EXPORT-LAB

1.4 Client Onboarding Solution

1.4.1 Client Onboarding Use Case

Focus Corp is a business services provider that offers various services for different industries. Focus Corp uses a fully automated solution called Client Onboarding to onboard clients to the services it provides.

Watch this video to see how client onboarding requests are completed: https://ibm.box.com/v/CLIENT-ONBORDING-USE-CASE

1.4.2 Client Onboarding Workflow Implementation Details

We implemented the Client Onboarding use case using most of the capabilities of IBM Cloud Pak for Business Automation. For orchestration, we selected the Case Solution capability of IBM Business Automation Workflow. There are several reasons for this choice. The use case is ad-hoc event-driven (new situations may arise unexpectedly, e.g., backing documents expire or new regulations require additional documents). A knowledge worker often decides the next steps in the Process. Finally, the use case is document-intensive and requires data persistence beyond the end of a process (we want to go back and reopen a case).

Figure 4 below shows the implementation details. Each Case Activity is implemented using a BPMN Process. Each step in a BPMN Process includes a series of Process steps. Each Process step emits BAI events which are stored in Elasticsearch.
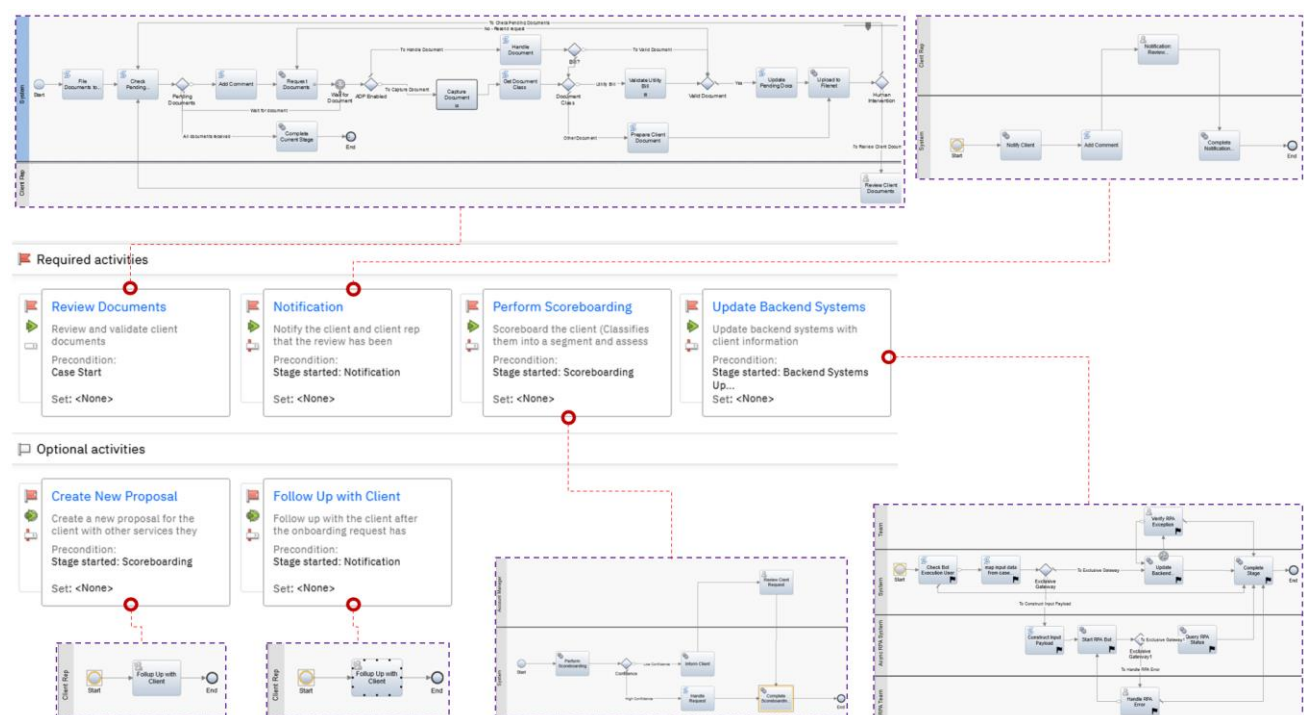
Figure 4 Client Onboarding Solution - Implementation Details

1.5 Lab Objectives

This lab demonstrates how IBM Process Mining leverages the Client Onboarding event data captured in BAI to identify automation and business improvement opportunities.

The primary objective is to introduce you to the rich feature and functions of IBM Process Mining through the experiential learning of identifying process improvement opportunities.

If you feel you need to dive deeper into any particular topic while working through the instruction or after completing the lab, please take a look at the documentation: https://www.ibm.com/docs/en/process-mining/1.13.0.x

Let's get started!

2 Lab Setup

2.1 Import Lab Files

_1. Download the following files. You will use them in this lab:

File	Link
Client Onboarding.zip	https://ibm.box.com/v/CO-LAB-DATASET
Client Onboarding.idp	https://ibm.box.com/v/CO-LAB-IDPFILE

2.2 Open IBM Process Mining Application

If you are performing this lab as a part of an IBM event, access the document that lists the available systems and URLs along with login instructions. For this lab, you will need to access **IBM Process Mining**.

_1. Start your browser and use the **IBM Process Mining** link

_2. Click **Enterprise LDAP**

Log in to IBM **Cloud Pak | Administration Hub**

Select your authentication type:

Enterprise LDAP

OpenShift authentication

IBM provided credentials (admin only)
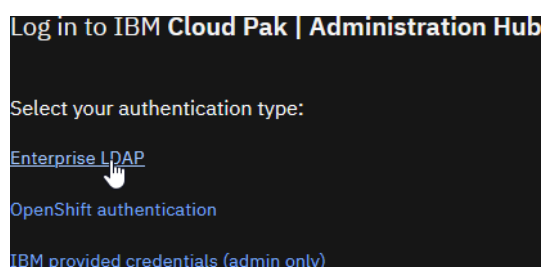
_3. Enter your username and password, and then click **Log in**

Log in to IBM **Cloud Pak | Administration Hub**

Enter your enterprise LDAP username and password

Username

user

Password

••••••••

Log in

Change your authentication method
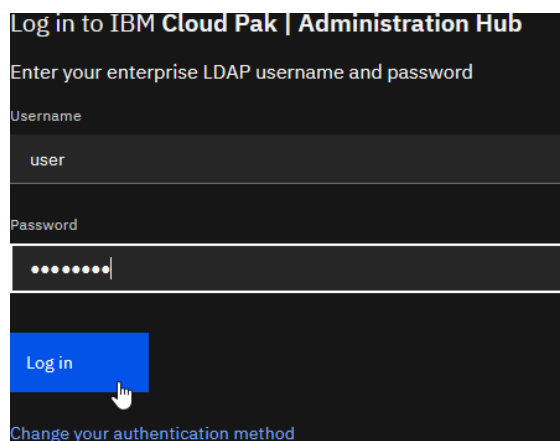
_4. If you see the Welcome window, check **Don't show this message again;** check the box and click **Let's go!**

Welcome to Process mining

Start by looking at our fully functional tutorial process, or create a new process!
You will need a comma separated value (CSV) file inclusive of:
• Process Id
• Activity type
• Activity Start time

The following fields are not necessary but will give you much better insight:
• Activity End time - to see activities\' duration in your process
• Resource - will show relationship between activities and resources
• Role - will group resource in relation to activities.
• Any other field you may require can be tagged as custom field.

☑ Don't show this message again!

Let's go!

You should now see the IBM Process Mining web UI.
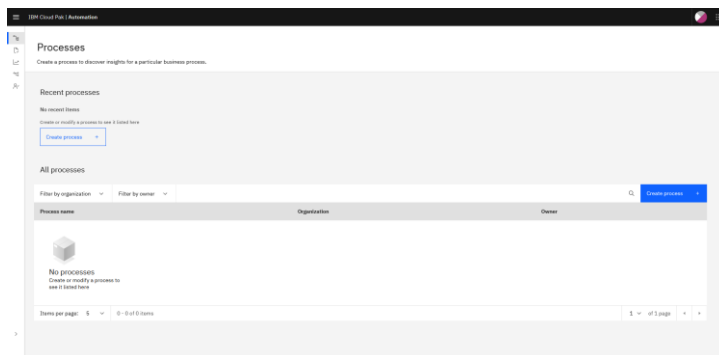
3 Exercise: Use Process Mining to Get Insights into Client Onboarding Workflow

3.1 Create and Configure the Client Onboarding Process

Typically, the Process Mining API that extracts process data from Elasticsearch would create a Process for you, populate it with the process data, and even map the mandatory data columns (process id, time-stamp, and activity name). In this lab, you will not be using the API directly. However, the data set you will be using in this lab to create your Process Mining Project was extracted from the Elasticsearch data store using the IBM Process Mining API.
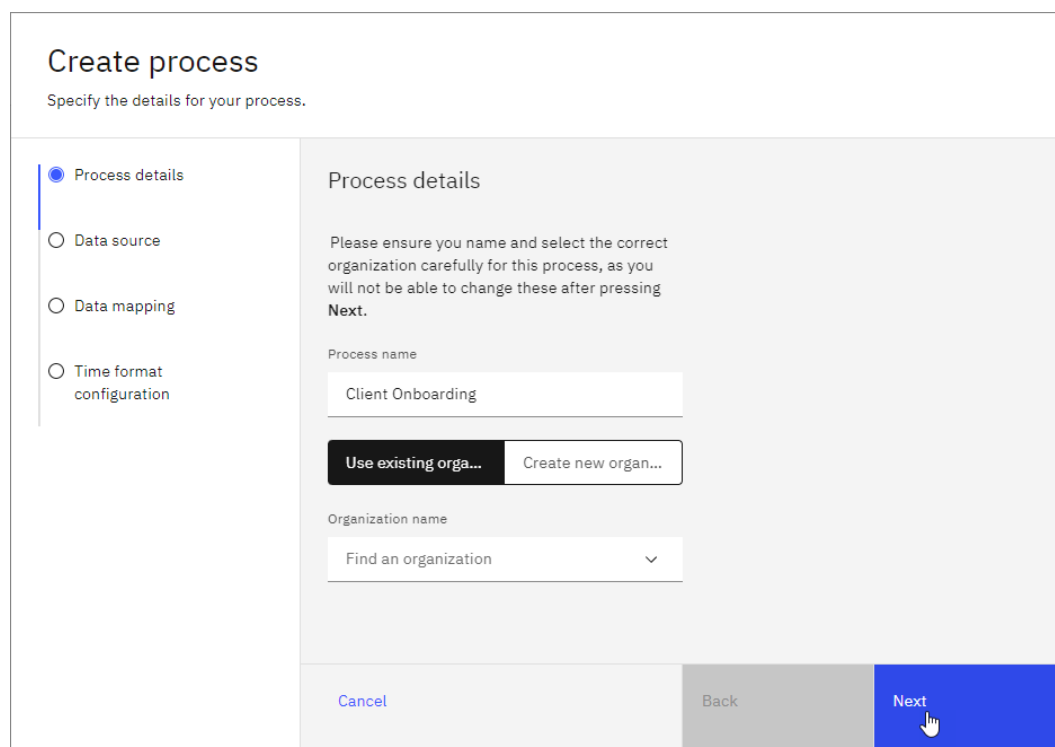
3.1.1 Create Client Onboarding Process

> Note: IBM Process Mining tools use the term Process for a **Process Mining Project**. From now on, we will refer to Project Mining Project as a **Process**.

_1. Click on **Create Process +**
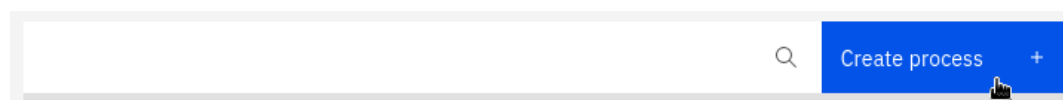
For *Process Title,* enter **Client Onboarding** and click **Next**

3.1.2 Upload Process Data and Configuration Settings

In addition to the CSV file generated by extracting process data from IBM Business Automation Insights (BAI), we will also upload a process configuration. The process configuration file includes predefined process filters, Client Onboarding dashboards (which we will use to analyze Client Onboarding processes), and the process reference model.

> The reference model of a process describes its expected standard behavior in terms of activities and Workflow. A process owner usually designs the reference model in the BPMN or XPDL language and then imports it to a Process Mining project. A reference model is optional; it is not required to visualize a process.

_1. **Drag and drop** (or click to upload) the **Client Onboarding.zip** file you downloaded earlier.

The supported Data Sources file format is a zipped CSV file.

Data source

Upload data source
Only raw or compressed (.zip, .gz) CSV, XES, up to 200MB. A preview of the uploaded data will be displayed below.

Drag and drop file here or click to upload

You should now see your file uploaded

	Name	Uploaded date	Events	Included	
☐	Client Onboarding.zip	09/09/2022	1,043	🟢	🗑

_2. Select **Yes** for *Use a process configuration backup*

Use a process configuration backup? ⓘ

🟢 Yes

Upload process configuration backup
Only process backups (.idp) files, up to 200MB

_3. Click **Add file**

🟢 Yes

Upload process configuration backup
Only process backups (.idp) files, up to 200MB

Add file

_4. Select the **Client Onboarding.idp** file you downloaded earlier.

_5. Click **Next**

13.0Backup	×	Uploaded: 4:17 PM, 09/09/2022

Close	Back	Next

3.1.3 Perform Additional Data Mapping

The Process Mining API automatically extracted the data from BAI, created a Project for us, and even performed the compulsory data mapping. It mapped the essential fields required to generate Process visualization. The required fields are:

- **Process ID.** Can be multiple columns; in our dataset, we only have one – the Case Reference ID: CO.ReferenceID)

- **Activity.** In Our dataset, it is the name of an Activity in a Process - activityName

- **Time Stamp.** Only one is required (start or stop of an activity). Because BPMN processes emit this lifecycle data to BAI, our dataset has both start and stop time stamps (startTime and endTime). This is important because having both time stamps allows us to compute Activity durations!

Note that some additional fields are already mapped (**green tick**), such as Resource, Role, and a few other business data fields. We mapped these fields for you. The **red x** shows examples of the fields that were not mapped.

performerName	potentialPerformerName	type	CO.ApprovalStatus	CO.NumberOfEmployees
Resource ✓ ×	Role ✓ ×	Text ✓ ×	Select mapping ✗	Select mapping ✗
Automation Script	autoTask	autoTask	Under Review	75
Automation Script	autoTask	autoTask	Under Review	75
Automation Service	autoTask	autoTask	Under Review	75
Automation Service	autoTask	autoTask	Under Review	75
Automation Service	autoTask	autoTask	Under Review	75
usr140	userTask	userTask	Approved	75

> An Event represents the execution of an Activity in a process. Events are rows in the data source CSV file.

_1. In the **CO.NumberOfEmployees** from the dropdown, select **Integer**

_2. Map the **Co.ApprovalStatus** to **Text**

Under Review

The following are high-level optional steps that are not required to complete the lab.

You can map other columns that have Select mapping selected.

Be sure to match the column with an appropriate data type. For example, CO.RiskConfidence is Numeric.

Note: Because the Co.ServicesRequest variable in BPMN Process is a List of Business Objects, and the IBM BAI BPMN Emitter does not serialize complex types, it is marked as [object Object], and the data is not accessible in Process Mining.

_3. After you have mapped all the columns, click **Next**

_4. On the "Time format configuration" page, click **Next**

_5. On the "Custom configuration" page, click **Create Process**

The Client Onboarding process should now open in Model View...

3.2 Gain Business and Technical Insights into Client Onboarding

3.2.1 Explore Model View

The Model View depicts the Client Onboarding Process highlighting the most frequent activities, paths taken, and the "real" Process versus the expected Process. A picture is worth 100 words!

> Our data set only has one Process ID field (Reference ID). IBM PM supports the visualization of multiple processes, each having a different Reference ID.

When initially opened, the Model opens in the Frequency View showing all the **Cases** discovered in the imported data.

> A case is an instance of a process. In flat processes, a different Process ID defines a new case. In our data set, a Case represents all activities executed to onboard a customer.
>
> In multi-level processes, the combination of process ids defines a new case. Each process-id represents a different sub-process that contributes to executing a single Case. See this link for more details about multi-level process mining.

The dark blue color highlights the most frequent activities, while the bold arrows highlight the most frequent transitions. In this way, the most frequent paths between activities of the Process can be identified.
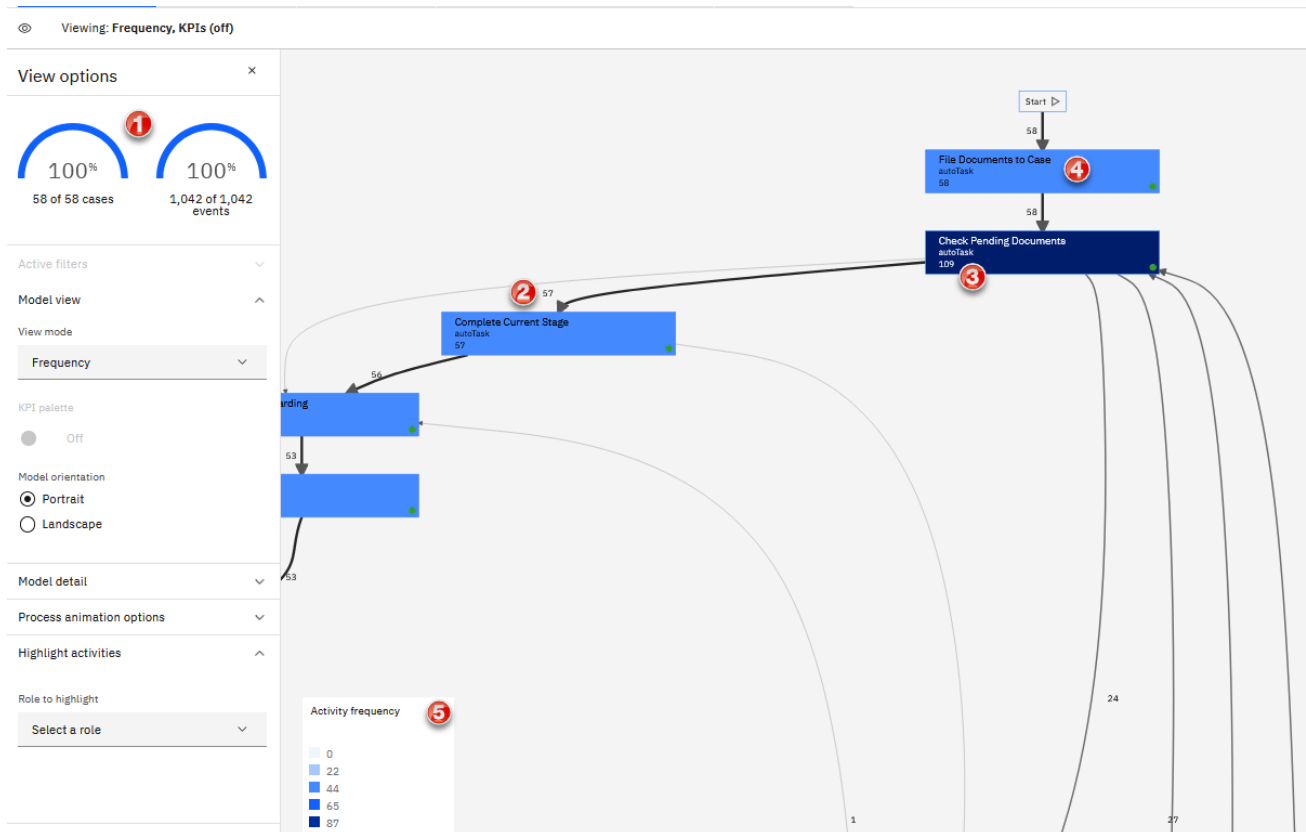
Hint: Use the mouse wheel to zoom and the mouse right button to move the Process diagram.

Let's examine the default Frequency View:

1. The top left view shows the number of Cases and all the associated events (rows in the CSV file). 100% indicates that we have no filters and are seeing all the data. The number of events represents the number of rows in the data set, Each row representing an invocation of an Activity.

2. The numbers next to the lines show how often a particular path to a given activity has been followed.
3. The numbers within the rectangles show the number of times the Activity is performed. The Activity count is typically a sum of the numbers on the inflowing paths.
4. The description in the rectangles includes the name of the Activity and the roles that performed the Activity.
5. The color saturation of Activity reflects how often an activity was invoked (the frequency). See the Activity frequency legend.

3.2.2 Investigate Parallelism in Client Onboarding

Case users can easily create multiple Optional Activities, resulting in parallel process paths. Parallel paths may lead to longer Case lead times if not completed in a timely manner. Let's see how we can identify when this occurs and what users are involved.

_1. Click the **path** from **Inform Client** to **Create New Proposal** Activity
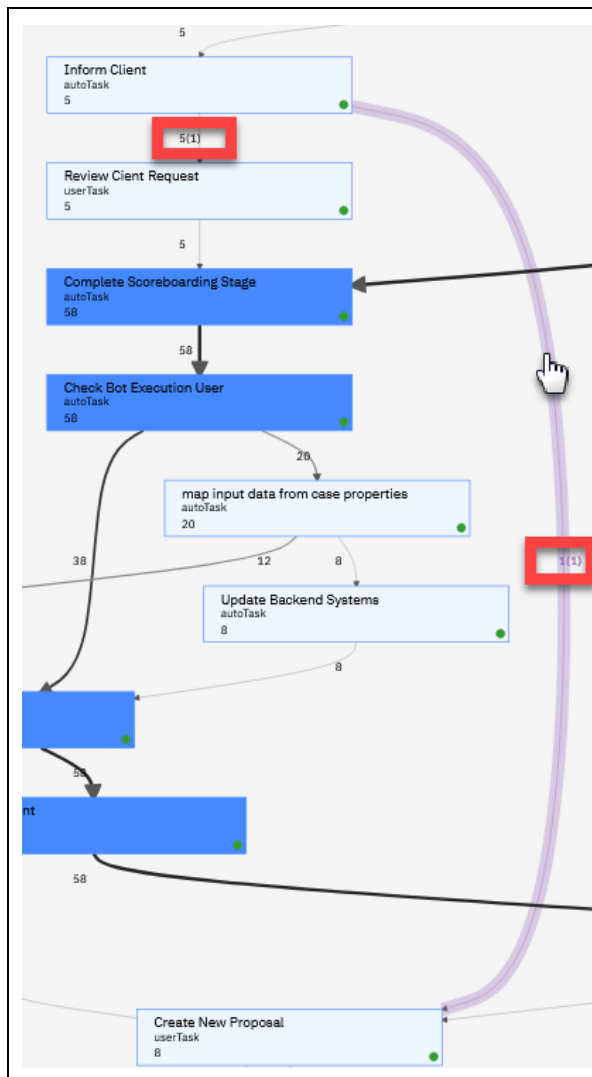
The "()" on the transition links (marked by **red squares**) indicates parallelism.

5(1) leading to Review Client Request – there were 5 transitions, and one of them occurred in parallel with another transition

1(1) leading to Create new Proposal – there was 1 transition, and one of them occurred in parallel with another transition

Looking back at the Case Solution, we can see that Client Rep., while working on the Review Client Request human task, also started the Create New Proposal optional activity from the Case UI.
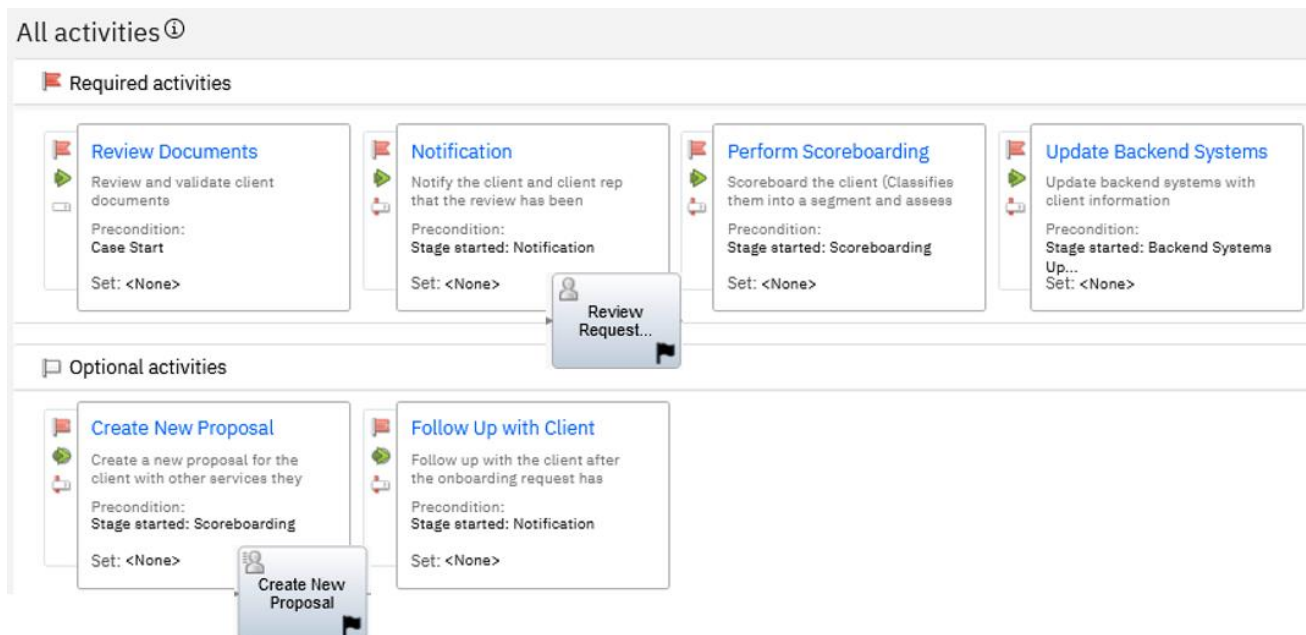
> **Note:** If you want to learn about Process Parallelism in IBM Process Mining, read [this article](#) by Patrick Megard.

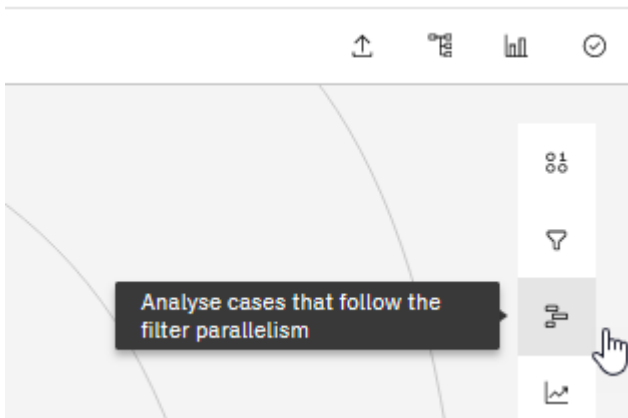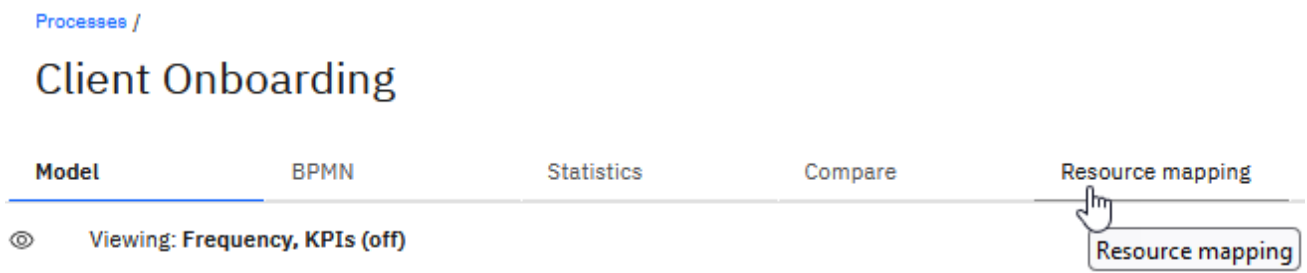_2. Click **Analyze cases that follow the filter parallelism**

You should now see that only 1 Case included this parallelism, and you can examine in detail all the steps involved.

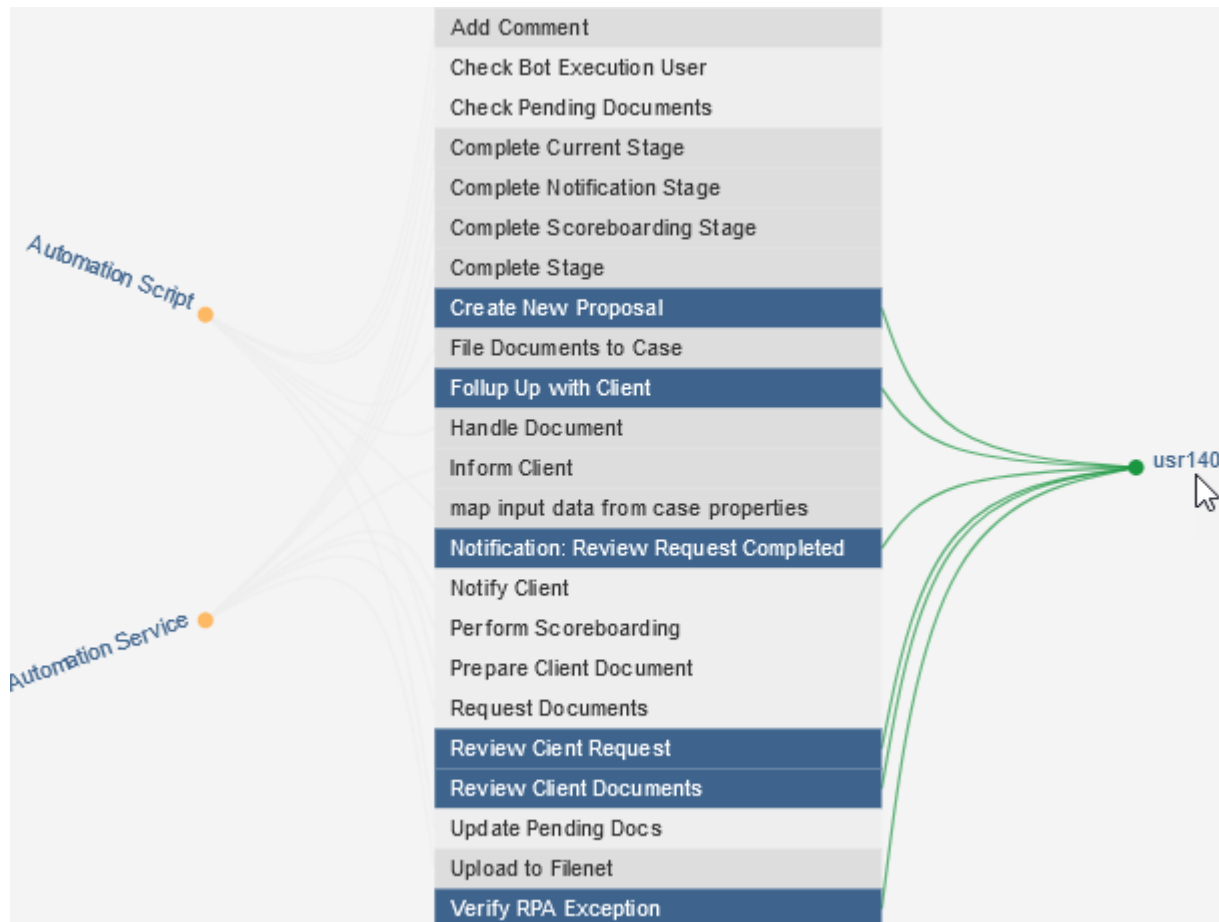Let's Find out whom the user was working on this particular Case.

_3. Click **Resource mapping**

_4. Click the **green dot** close to **usr140**

You can see now that all the manual activities, in this Case, were completed by usr140, including the parallel activities (Review Client Request and Create New Proposal).

The Resource Mapping capabilities include Activity Map View to discover how resources and roles are involved in each Activity and Social Net View to discover and analyze the relationships that are formed within a process. Use this documentation link to learn more.

_5. Click **Model** tab

Client Onboarding

Model   BPMN

_6. Click the **Active filters (1)** dropdown on the left

Active filters (1)

Include parallelism between <Inform Client> ×
<Create New Proposal>
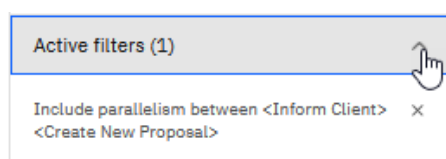
_7. Click **X** to delete "parallelism" filter

Include parallelism between <Inform Client> ×
<Create New Proposal>
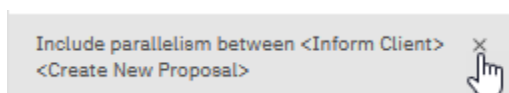
> **Business Insight:** We identified where the parallel paths occur, their impact on the Process, and what users are involved.

3.2.3 Identify the Most Costly Activities

The following formula governs activity cost:

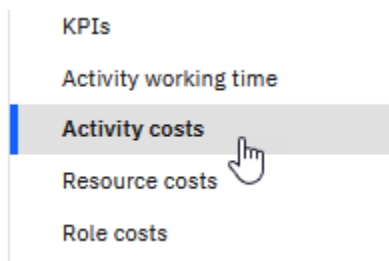**Activity Cost = Activity Standard Cost + (A.V.G. Working Time * Avg Resource or Role Cost)**

The variables in the formula are hardcoded in the Manage settings section

_1. Click **Manage** tab

_2. Click **Activity costs**

_3. Note the Activity costs. The Manual activities have their costs set individually. Specifically, note EUR 110 for the Notification: Review Request Completed.

4. Click **Activity working time** and note 45 minutes for the Notification: Review Request Completed.

5. Click **Resource costs** and note EUR 150 for all manual (human) tasks.

Note: automated tasks have a higher rate than human tasks because the automated task duration is sub seconds, so the overall costs (duration * cost) are significantly smaller for automated tasks.
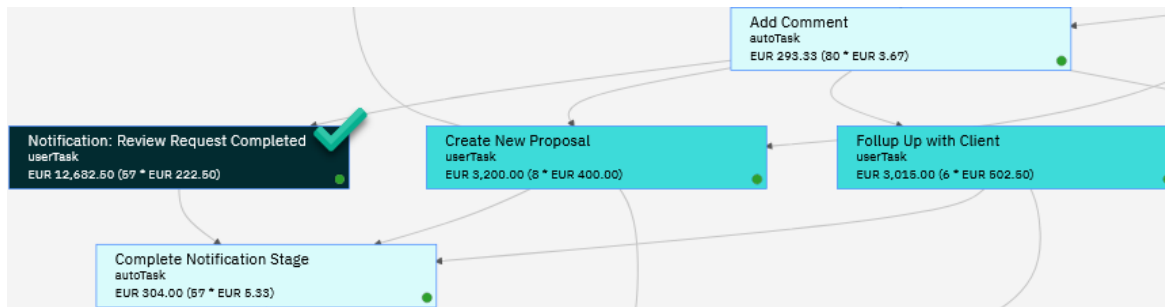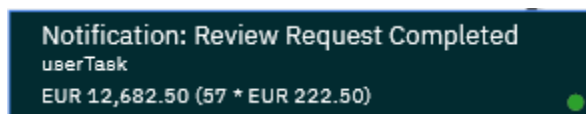
6. Click **Model** tab

7. For View mode, select **Overall cost**

_8. Note that the Overall Cost (the sum of all 57 cases) is the highest for the darkest Activity: **Notification: Review Request Completed**

_9. Let's examine how IBM Process Mining calculated this Activity's overall cost.

Activity Cost = Activity Standard Cost + (A.V.G. Working Time * Avg Resource or Role Cost)

57 - is the number of Cases in our dataset. This Activity was executed once in each of the 57 cases.

EUR 222.50 = **EUR 110** (Activity Cost) + **0.75** hour (Activity Working Time) * **EUR 150** (Resource cost)

Business Insight: We identified the most costly Activity in the Client Onboarding Process.

3.2.4 Identify Rework

Activities that are repeated more than once in the same process instance are defined as Rework. Activities with Rework typically reveal process inefficiencies that can be targeted for process re-engineering.

IBM Process Mining automatically discovers two kinds of Rework:

1. If you can see an arrow that goes out and falls into the same Activity, it is called a **self-loop**.
2. When the Activity is repeated several times in the same process instance, it is called **instance-looping**.

3.2.4.1 Instance Looping Rework

_1. Under *Model view, open View mode, and* select **Rework** to change from Frequency to Rework view
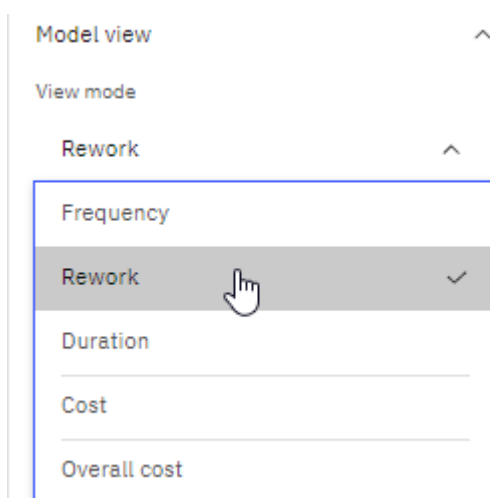
_2. Note that Activities with Rework are marked according to the legend. The darker the activity color, the more times a rework occurred in the same process instance.

Activity rework

■ 0
■ 5
■ 10
■ 14
■ 19
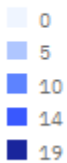
_3. Click **Check Pending Documents** activity – an example of *instance-looping*
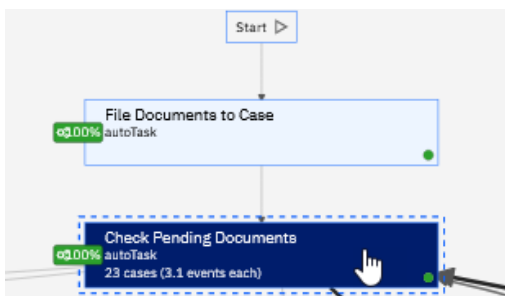
- This Activity is repeated (rework) in 23 out of 57 cases
- On average, the Activity repeats 3.1 times during the 23 Cases where it occurs.
- This Activity has a 100% automation ratio (meaning it is automated)

_4. Click **Show activity statistics**

_5. For *View details for cases by* select **CO.ProcessName**
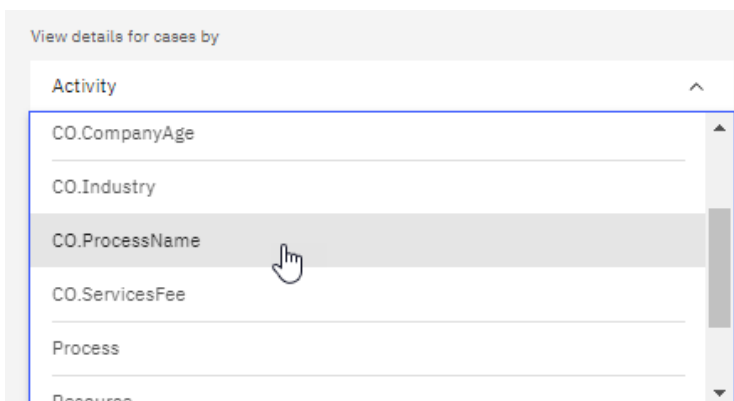
_6. Note that the BPMN Process name is *Review Documents*

CO.ProcessName

Review Documents

_7. Let's examine the *Review Document* process to understand what causes the Rework we identified in the ou Process Mining Project.

The Rework occurs when the documents uploaded are incorrect or rejected when inspected by a human.

_8. Click **X** to close the Activity statistics window

> **Business Insight:** We know the impact of Rework on the process metrics, such as lead time and costs. Business action is to ensure the customer provides all documents and that the documents are correct when requesting a new service for the first time.

3.2.4.2 Self Looping Rework

_1. Click the **self-link** on the **Verify RPA Exception** activity.

_2. Click **Filter to include cases that follow this sequence**

_3. Let's examine how the Process Mining diagram correlates with the BPMN process...

Let's examine the Update Backend system process in the Figure below.
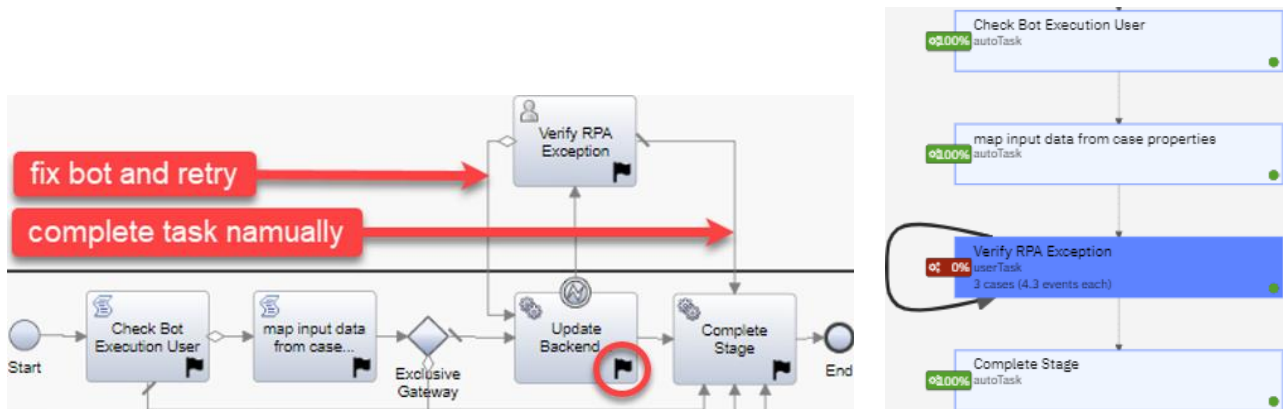
When RPA Bot fails, the Event Emitter (black flag in the **red circle**) on the Update Backend System activity does not fire because the Activity never completes. The Event Emitter fires upon the completion of the Activity (it appears on the right-hand side of the Activity; hence it is a post-event). Therefore we see Verify **RPA Exception Activity** immediately after **map input data from case** Activity.

The user that completes the Verify RPA Execution activity is responsible for either fixing the bot execution (restart the Bot in Bot Control Center) or performing the task that the Bot does manually.

_4. Click the **self-loop** path
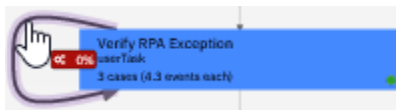
_5. Click **Show path statistics**
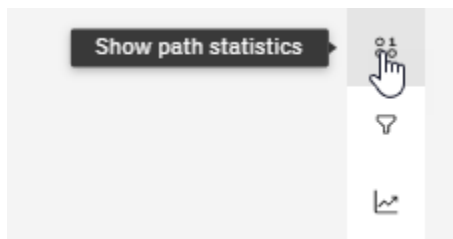
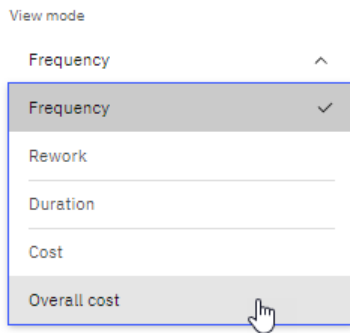_6. Note the Case IDs and the number of retries between 1 and 6

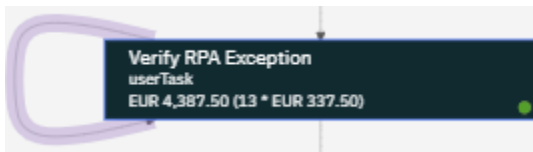### Verify RPA Exception - Verify RPA Exception

CO.ReferenceID	Count
8NTSYXBT	3
L593QKNV	1
9N5XVWH8	6

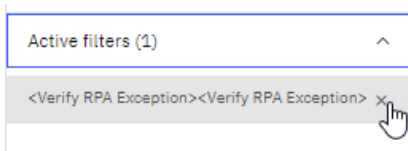_7. Click **X** to close the *Path statistics* window

_8. Change *View mode* to **Overall cost**

_9. Note the high overall Cost of having 3 cases, including the Verify RPA Exception activity. EUR 4,387.50! This Cost is avoidable,

_10. Click **X** to remove the Active filter

> **Business Insight:** We discovered self-loop style Rework pattern is associated with failing RPA bots and quantified its impact on the Cost and Lead Time of cases. To address this issue, the IT organization could consider replacing RPA Bots with an API-based Integration.

3.2.5 KPI Analysis

3.2.5.1 KPI Compliance

With IBM Process Mining, we can define KPIs (related to case cost/duration or activity duration) and monitor KPI compliance.

Let's view the current KPI settings for this porject.

_1. Click the **Manage** tab

_2. Select **KPIs** view

You should now see the Process and Activity threshold settings for this project.

KPIs

Overall process KPIs	Edit process KPIs ✎
Case duration thresholds	
Between 45 minutes and 3 hours	
Case cost thresholds	
Between 300 EUR and 810 EUR	

Default activity KPIs	Edit activity KPIs ✎
Activity throughput thresholds	
Between 1 second and 30 seconds	
Activity wait queue thresholds	
Between 1 second and 30 seconds	
Activity duration thresholds	
Between 1 second and 30 seconds	
Resource allocation thresholds	
Between 33 % and 66 %	

Specific activity KPIs	Edit activity KPIs ✎
Create New Proposal	⌄
Review Client Request	⌄
Notification: Review Request Completed	⌄
Verify RPA Exception	⌄
Review Client Documents	⌄
Follup Up with Client	⌄

_3. Click the **Mode**l tab to get back.
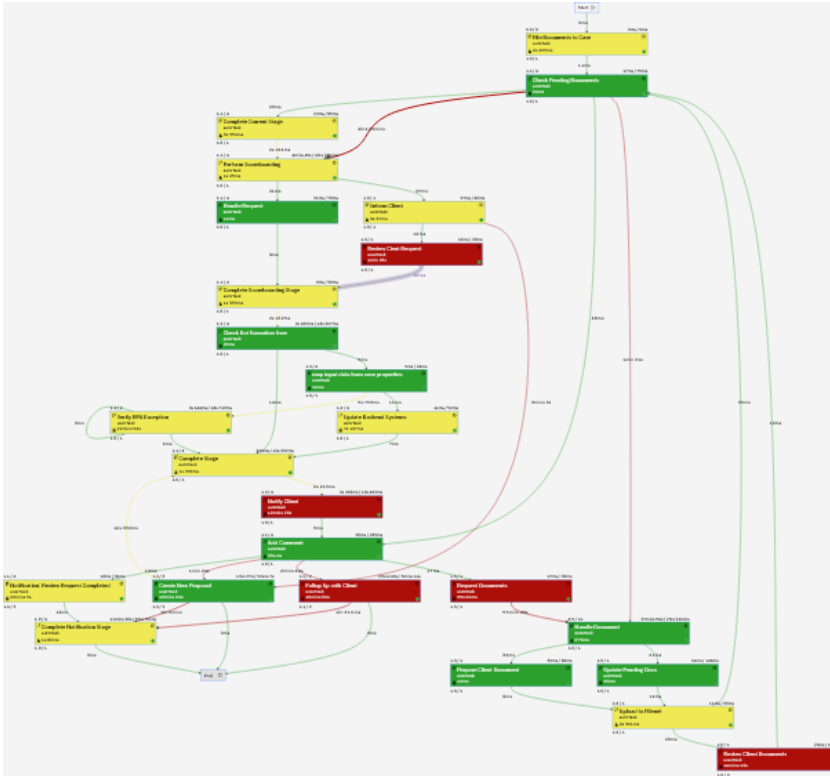
_4. In the section *Model view*, for *View mode,* select **Duration**

_5. Toggle the *KPI palette to* **On**

You should now see the Model with Activities and Transitions. You can use this view to identify what Activities and Transitions deviate from the KPI.


The Activities and Transitions color reflects the KPI settings. See the note below about the KPI Settings.

ACTIVITY	Activity with service time in line with the defined KPIs
CONNECTION	Transition with waiting time in line with the defined KPIs
ACTIVITY	Activity with risky service time
CONNECTION	Transition with risky waiting time
ACTIVITY	Activity with critical service time
CONNECTION	Transition with critical waiting time

3.2.5.2 Root Cause Analysis of KPI Violations

Let's focus on identifying Automated Activities that exceed their Duration KPI.

_1. In *View options*, under *Highlight activities*, for *Role to highlight,* select **autoTask**
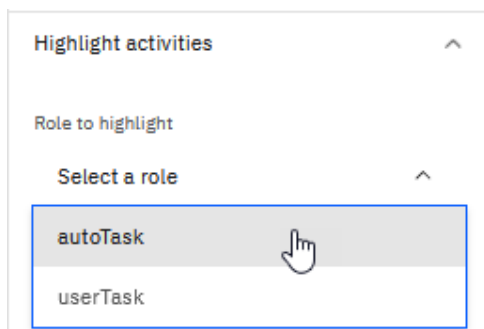
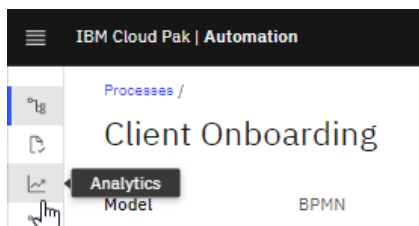_1. Notice that **Notify Client** Activity is marked in red

_2. Let's focus on the *Notify Client* Activity! It has an average service time of 12min 29s, way above the 30 seconds in the KPI Settings (Manage Tab > KPIs)
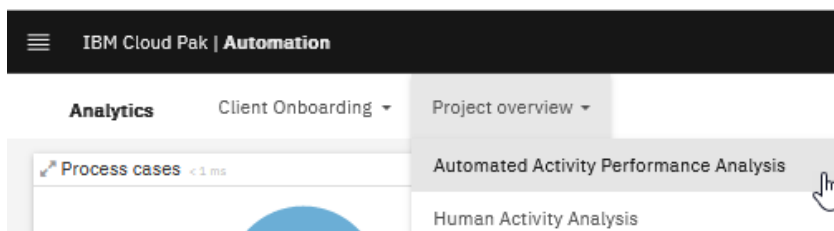

Let's drill down into details to include enough information to create a Ticket for the IT organization to investigate this issue!

_3. Click **Analytics** on the left

_4. Under **Project overview,** click **Automated Activity Performance Analysis**

_5. Note that there are two Cases with Notify Activity exceeding 10 seconds of service time.
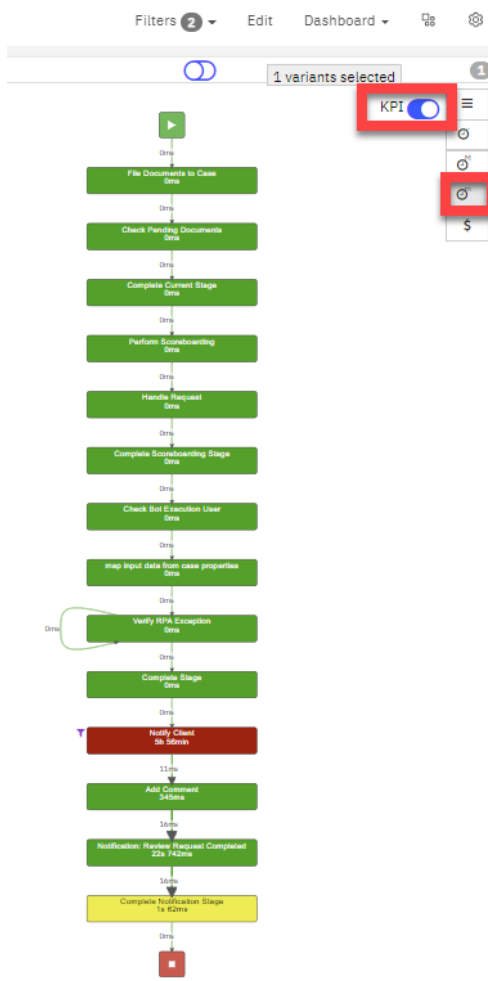


_6. Click the **first row** in the table

This action adds a filter to restrict the process Model to show the flow only for Case with the Case ID 9N5XVWH8

_7. Select **Maximum duration** first and then select the **KPI** switch

Notice that only the *Notify Customer* Activity took a long time to execute. This indicates the problem lies with the Notify Customer service call, and we can exclude general system outages affecting all automated activities.

_8. Click the **red garbage cans** to remove **both** Dashboard filters.
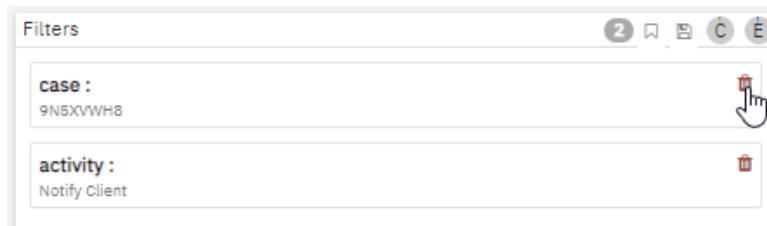
_9. Select **Process mining** to return to the Model View.
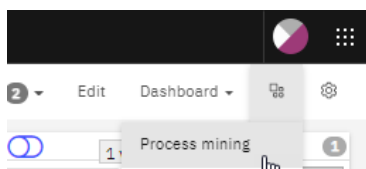
> **Process Improvement Insight:** We found that several API calls (Automated Activities) contributed to excessive Case lead times and were generally way above their KPI settings. We singled out the Notify Client activity and used the Analytics Dashboards to drill down to get more information. We provided the IT organization with the Case IDs and determined that there were no general system outages during the case execution.
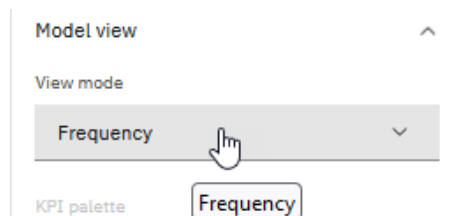
3.2.6 Process Variant Analysis

Client Onboarding Workflow has multiple paths (e.g., happy path, exception cases, etc.). IBM Process Mining can visualize them individually or together.
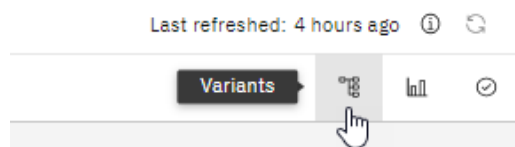
> Process Variant represents a unique path that cases take to execute the Process from the start to the end.
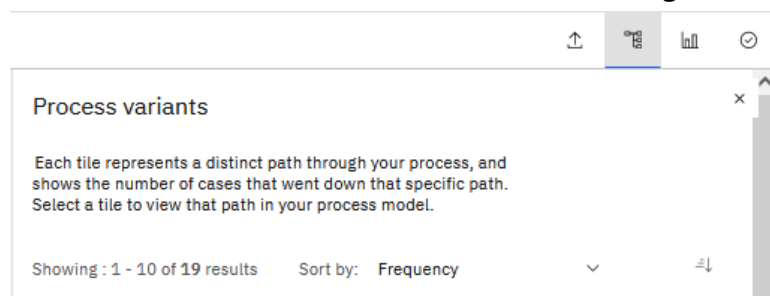
_1. Select **Frequency** view

_2. Click **Variants**

You should now see the Process variants view on the right-hand side.

> The process Variant view enables us to find the most frequent Variant and compare it with other variants in terms of performance (average lead time) and the number of events (flat processes) or relations (multi-level processes).

3.2.6.1 Filter the top N variants

When analyzing process data, excluding outliers and focusing on the most frequently executed process paths is often essential. Focusing on the top process variants simplifies the analysis and allows us to focus on the most impactful process paths.

_1. Select the **check boxes of the first 5 Cases**.

19.3% (11 cases)	Number of steps 12 steps	Average duration 1 hour 23 minutes	☑

15.79% (9 cases)	Number of steps 14 steps	Average duration 3 hours 38 minutes	☑

14.04% (8 cases)	Number of steps 14 steps	Average duration 3 minutes 10 seconds	☑

12.28% (7 cases)	Number of steps 23 steps	Average duration 4 hours 18 minutes	☑

8.77% (5 cases)	Number of steps 18 steps	Average duration 1 hour 34 minutes	☑

_2. Click **Create filter**

5 items visualized	Create filter ▽	Cancel

_3. For *Filter name* enter **Top 5 Variants** and click **Create filer**

Create filter ×

Filter name

Top 5 Variants|

Exclude matched cases

◯ Off

Cancel	Create filter

Note that if we selected **Exclude matched cases** in the *Create filter* window above, the resulting Filter would include all the outliers, namely, the cases that belong to the least frequent Variants. If needed, we could use this to Filter to understand these outliers.

_4. The Model is now updated and shows fewer steps and connections, yet it covers 70% of all process paths.
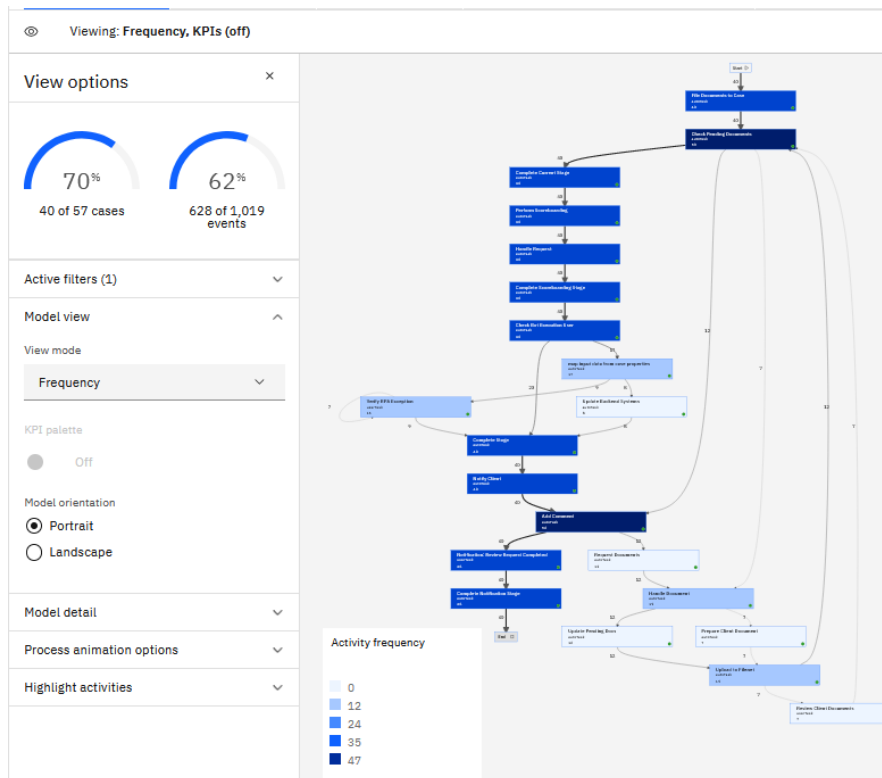
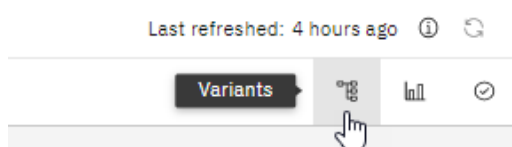🟥 Note that it is possible to permanently save this Filter and use it later in all process analysis tasks!

_5. Under *Active filters* click **X** to remove the *"Include:Top 5 Variants"* filter
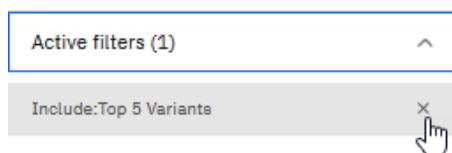
3.2.6.2 Use Filter to Discover Happy Path

Let's find the fastest Variant with fewer steps! The Happy Path.

_1. Click **Variants**

_2. Click the **checkbox** to filter out all other cases

Note that it just happened that the most frequent Variant also is the one with the fewest steps (12)!
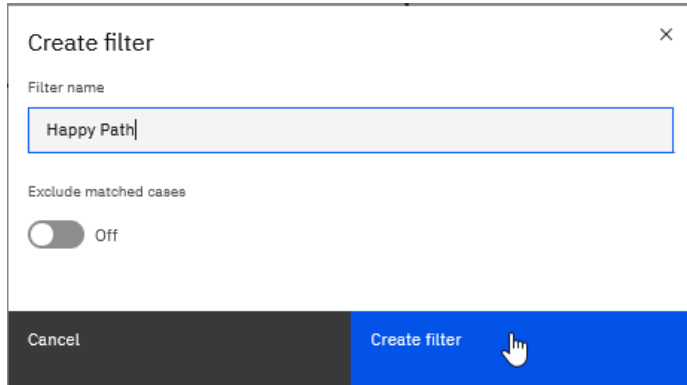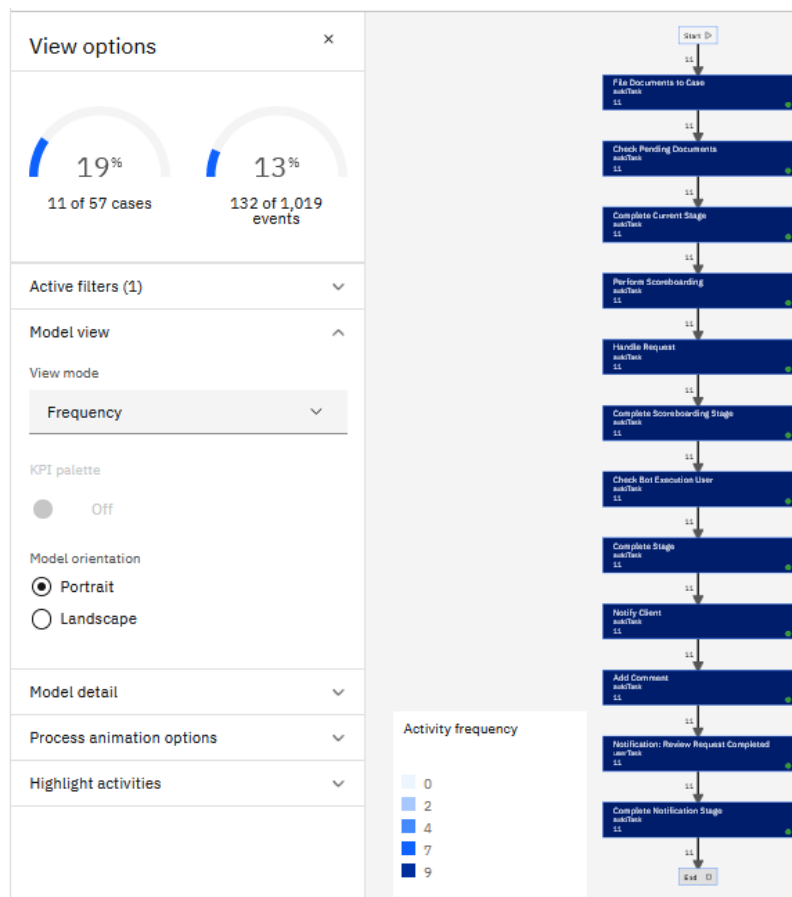
Did we find the Happy Path?

_3. Click **Create filter**

_4. For the *Filter name* enter **Happy Path** and click **Create filer**


_5. Note that we now see the Happy Path in the Model view. 19% of the cases include 11 steps, no loops, or conditional activities. Happy Path, indeed!

> Note that to keep this Filter for future use, you need to save it as a Template Filter (we have already done this for you because we will use it later in this lab). However, you will learn how to create a Template Filter later in this lab.
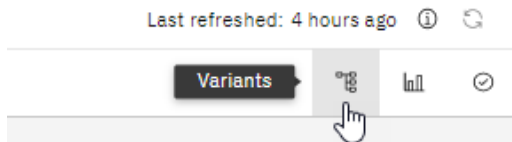
_6. Click **X** to remove the Happy Path filter
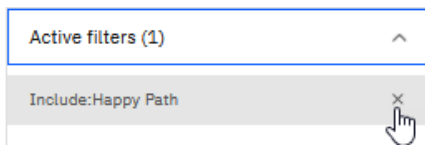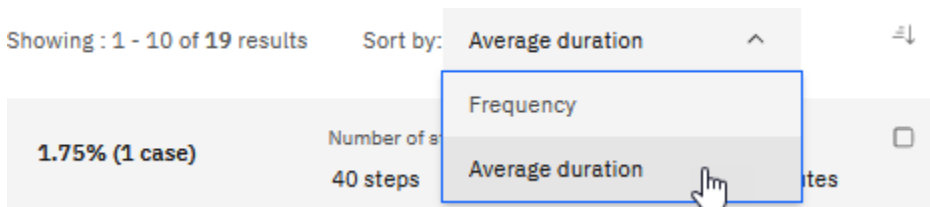

3.2.6.3 Use Filter to Discover Unhappy Path

Let's find the slowest Variant and discover what the root causes are.
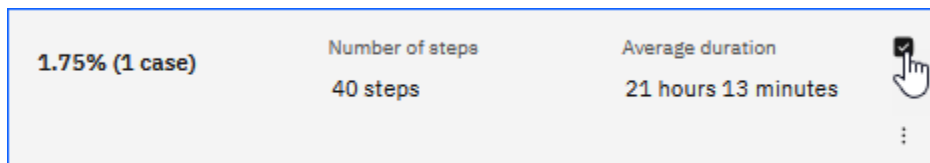
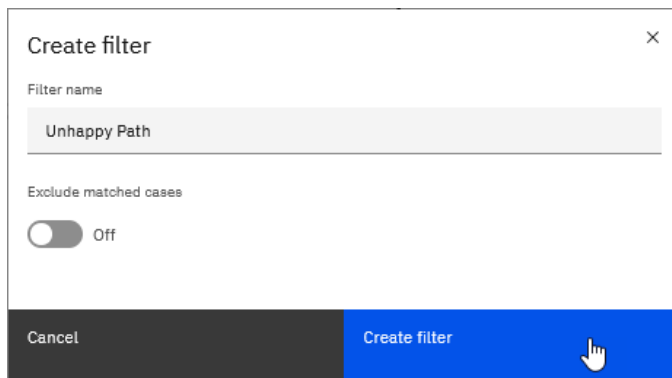_1. Click **Variants**

_2. Select **Average duration**

_3. On the Variant that has *40 steps*, click the **checkbox** to filter out all other cases

Note that we found the Variant with the highest duration (21 h 13 m).
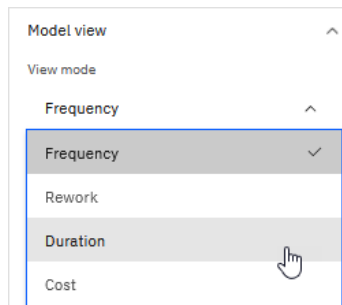

_4. Click **Create filter**

_5. For *Filter name* enter **Unhappy Path** and click **Create filer**

3.2.6.3.1 Investigate Long Case Duration

_1. For *View mode,* select **Duration**

_2. Note the two areas of concern that contribute to the case duration of 21 h 13 m:

- There is a considerable delay between the two automated tasks. We will investigate this later when examining Model Conformance. We will discover that this transition is not conformant with the reference model
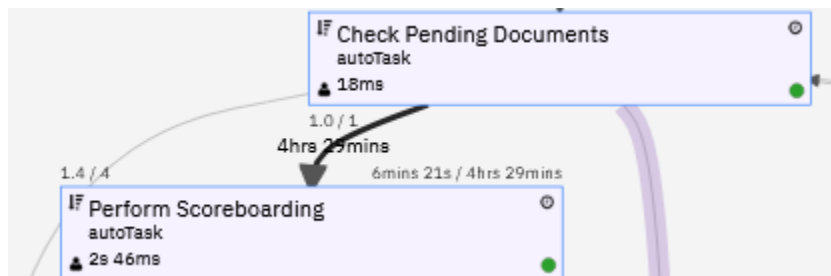
- Note that the *Review Client Documents* task takes 1hr 51 minutes to complete. We will now further focus on this automated task.
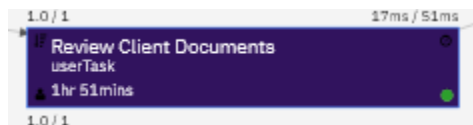
3.2.6.3.2 Investigate a Large Number of Steps

Rework (repeating the steps in the same Case) is a key contributor to an excessive number of steps in Cases.

_1. Change *View mode* to **Rework**

_2. Note the thick rework arrows (Activity transitions)

See the Figure below to understand the Process logic where missing or inaccurate documents cause the Process to request a document – document upload request loop.
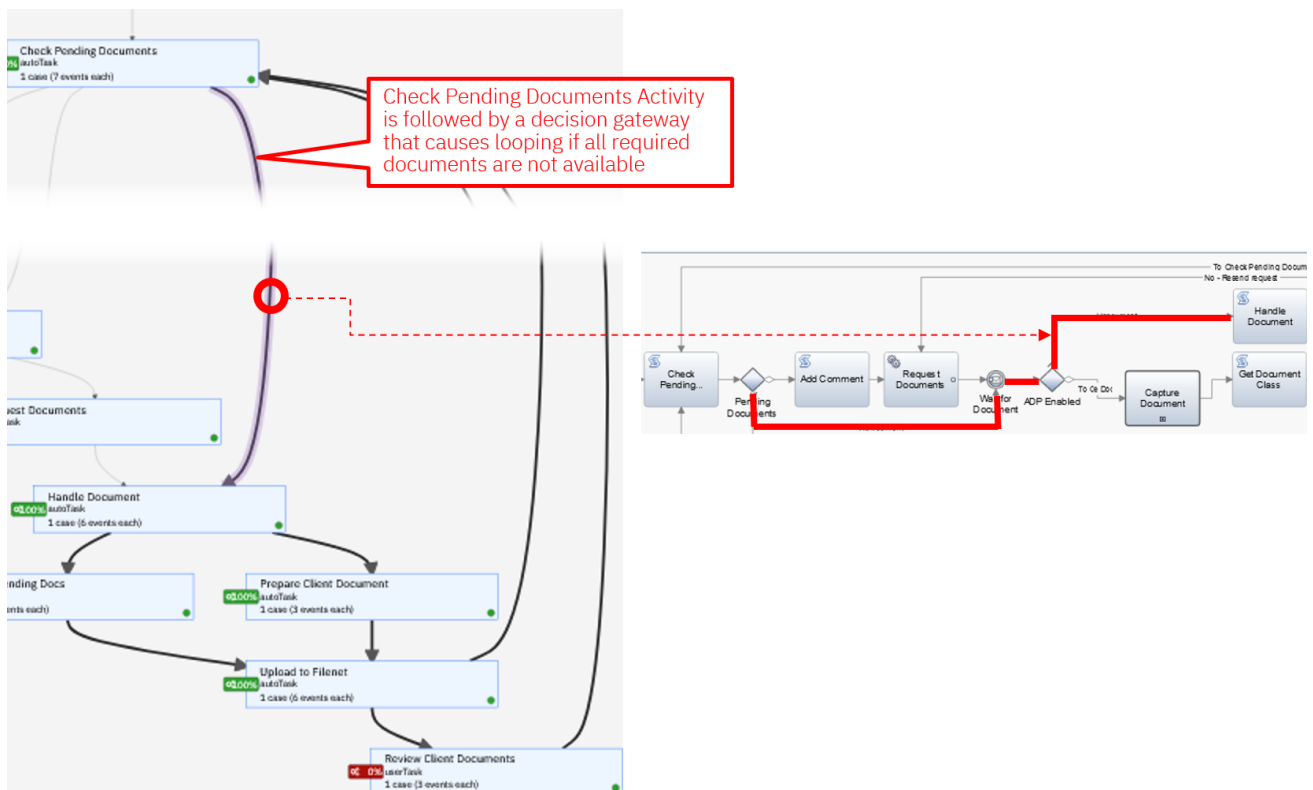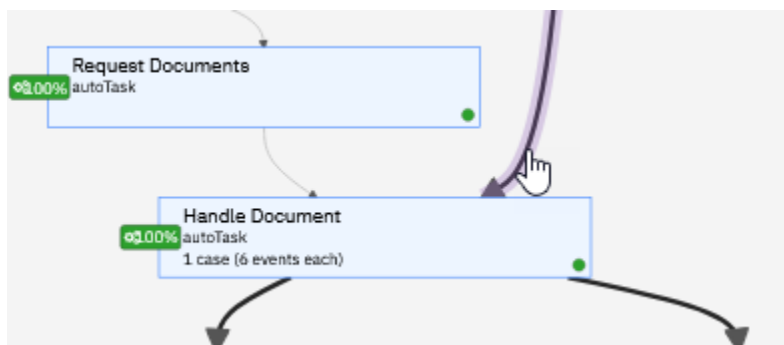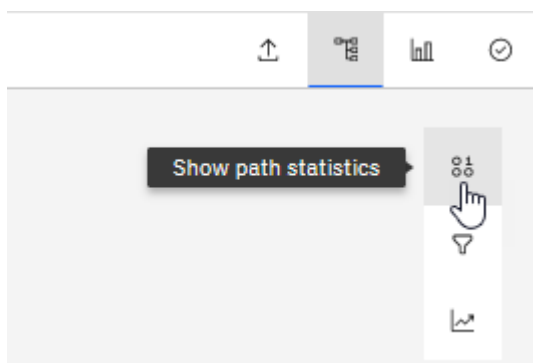

Figure 5. Document Request Upload Loop

_3. Click the thick transition arrow leading to Handle Document Activity



_4. Click **Show path statistics**

_5. Note that the loop occurred 5 times!

Check Pending Documents - Handle Document

CO.ReferenceID	Count	Wait time
TNHWLHQJ	5	3 minutes 2 seconds

Items per page: 10 ∨   1 - 1 of 1 item

If you count the number of activities repeated, we can now see that this loop is responsible for 5 * 5 = 25 of the 40 Activities executed in this Unhappy Path Process Variant.

_6. Click **X** to close the *Path statistics* window

_7. Remove **Unhappy Path** filer

Active filters (1)   ∧

Include:Unhappy Path   ×
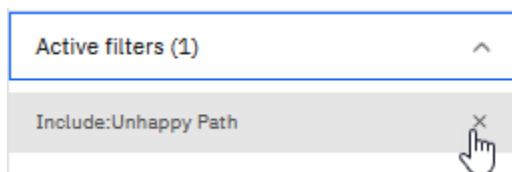
> **Process Improvement Insight:** We identified a Variant with the least number of steps, lowest Cost lowest lead time. We also discovered a variant with the longest lead time. We determined the root causes: (i) a long delay between two automated activities (to be probed further) and (ii) a large number of executed Activities (25) caused by missing or incorrect documents. The former is an IT insight, while the latter is a business decision to ensure a complete set of correct documents is supplied first.

3.2.7 Analyze Model Conformance

The Model Conformance view provides a visual conformance check between the data-derived and reference models.

Let's address why, with fully orchestrated processes, there could be non-conformance. After all, BPMN processes are predictable by definition! There are two reasons. The Client Onboarding was implemented as a Case that, by definition, is unstructured, allowing for unexpected process variability. The second reason is that even the structured BPMN processes (Activities in the Case) can have unexpected paths: **business fault** handling (throwing exceptions to deal with process faults) and **technical faults** that the admin resolves in the Process Admin Console. The above can cause deviations from the ideal process path defined by our Reference Model!
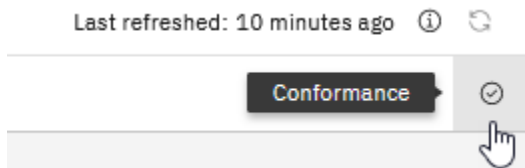
> Note: The reference model is supplied with the BPMN diagram and can be uploaded when the new Process Mining project is created. The reference model can also be added or changed after the project is created.
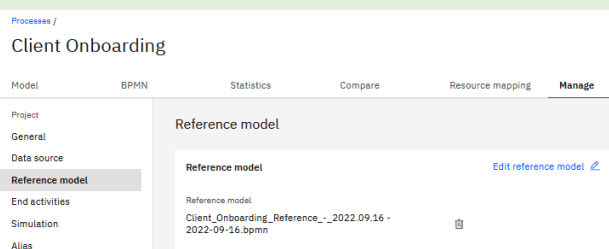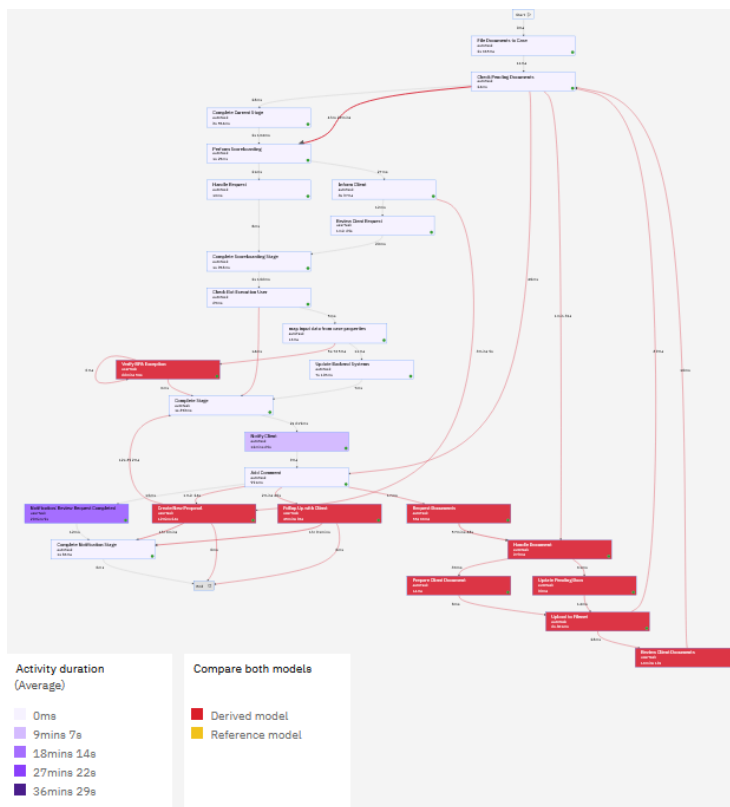
_1. Set *View mode* to **Duration**
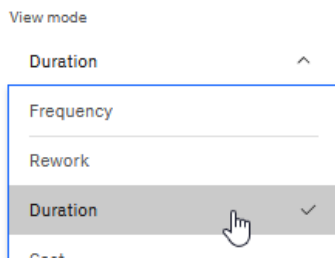
_2. Click **Conformance** (top right)

_3. Note summary of the impact of non-conformance on critical process statistics. It includes three critical Case statistics, as shown below.
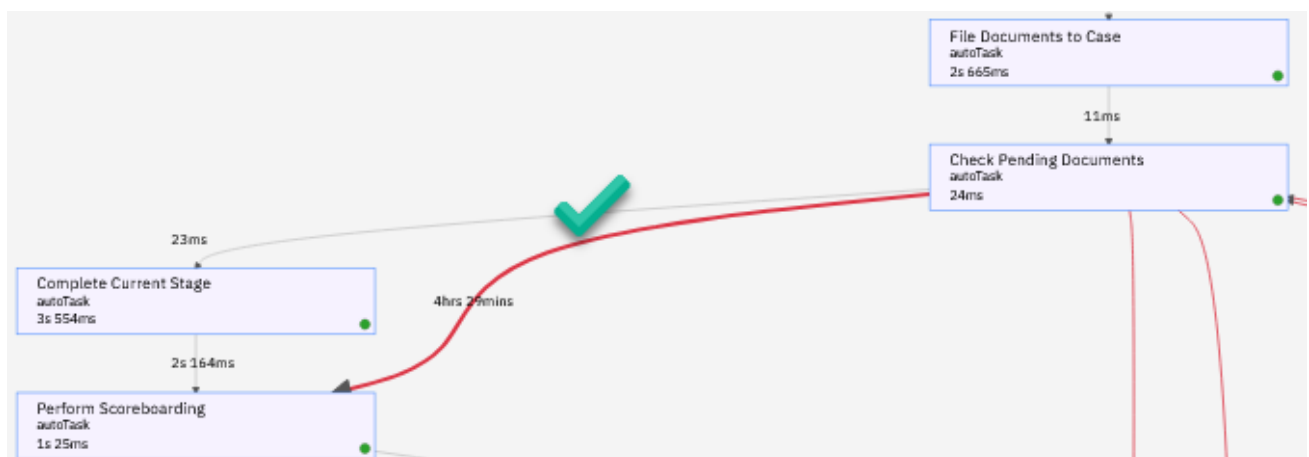
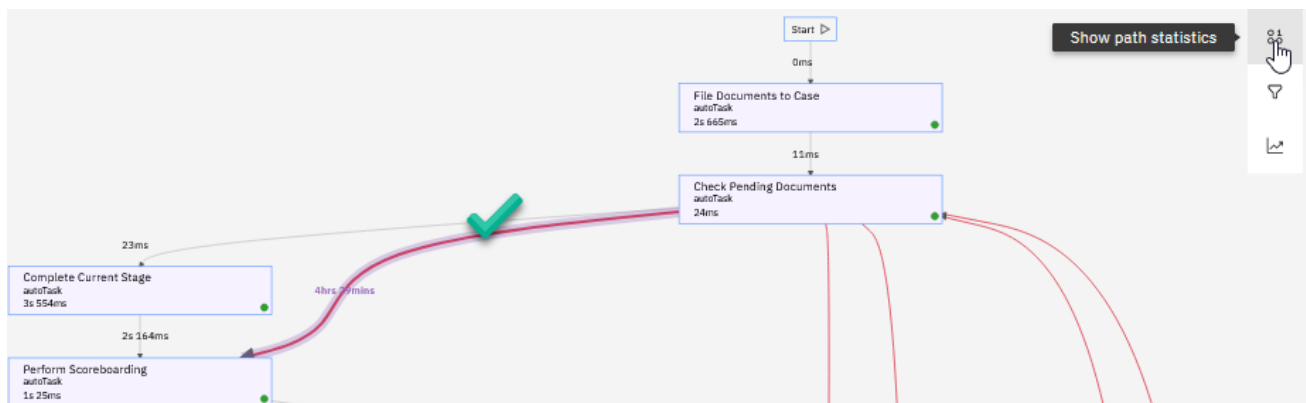4. Note that non-conformant Activities and Transitions are marked **red**

3.2.7.1 Analyze an Unexpected Process Flow

1. Notice the non-conformant transition that is taking **4hrs 29min**

2. Select the transition and then select **Show path statistics**

3. Note that we now see the reference ID.

To understand and prevent such significant delays in the future, we could provide the instance Reference ID to the IT organization for further investigation.
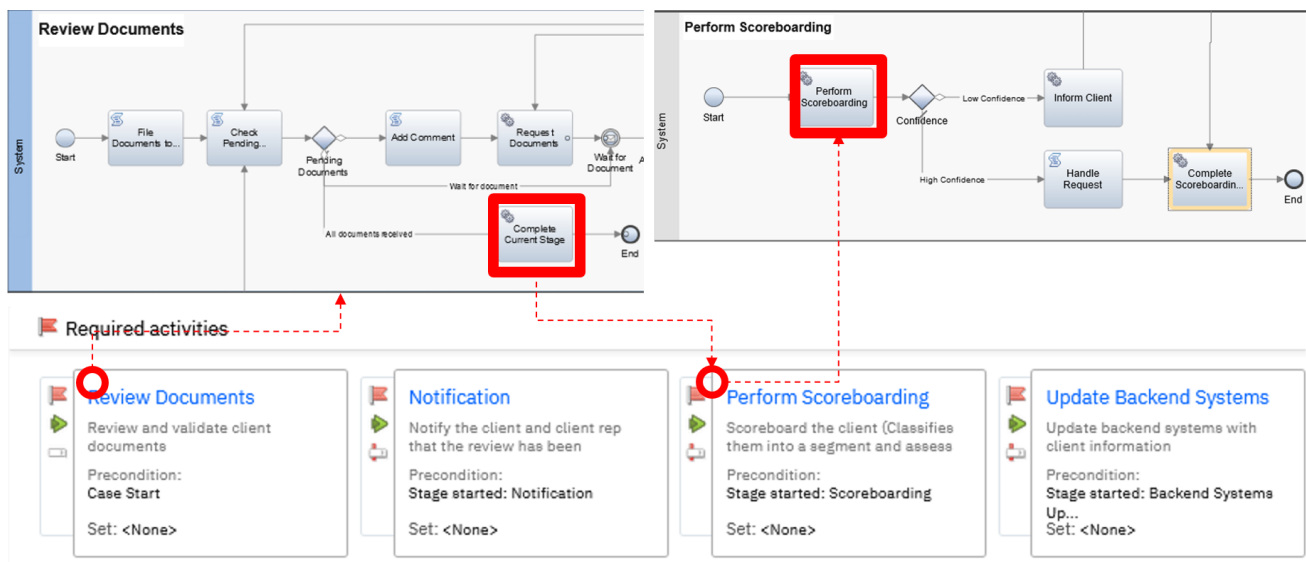
4. Click **X** to close the *Path statistics* window.

Figure 6. The Explanation of Invalid Transition Causing 4h 29 min Wait

After consulting the IT organization, the incident was explained as follows (See the Figure above):

- The process instance with the reference id **TNHWLHQJ** failed when executing the **Complete Document Stage** Activity.
- This process failure caused it to get stuck at the **Review Documents** Case Stage
- The IT organization manually advanced the Workflow to the **Perform Scoreboarding** Stage using ACCE Admin Console

- After this happened, the Workflow advanced to the next stage (**Perform Scoreboarding**) and started **executing the Perform Scorebarding Activity**.
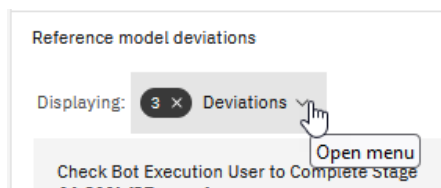
This IT intervention took almost 5 hours!

3.2.7.2 Identify the Most Costly Deviant Transition
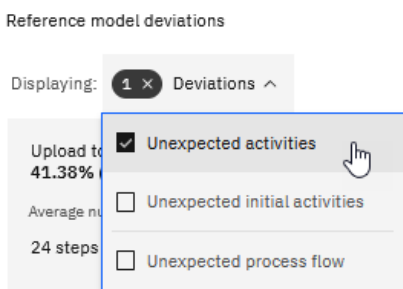
_1. For *View mode,* select **Frequency** view
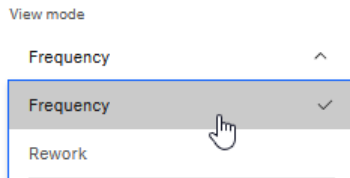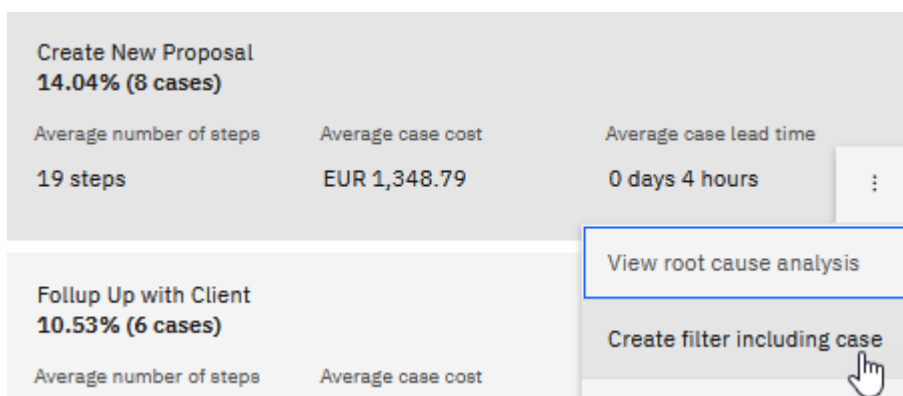

_2. Click **Deviations** dropdown

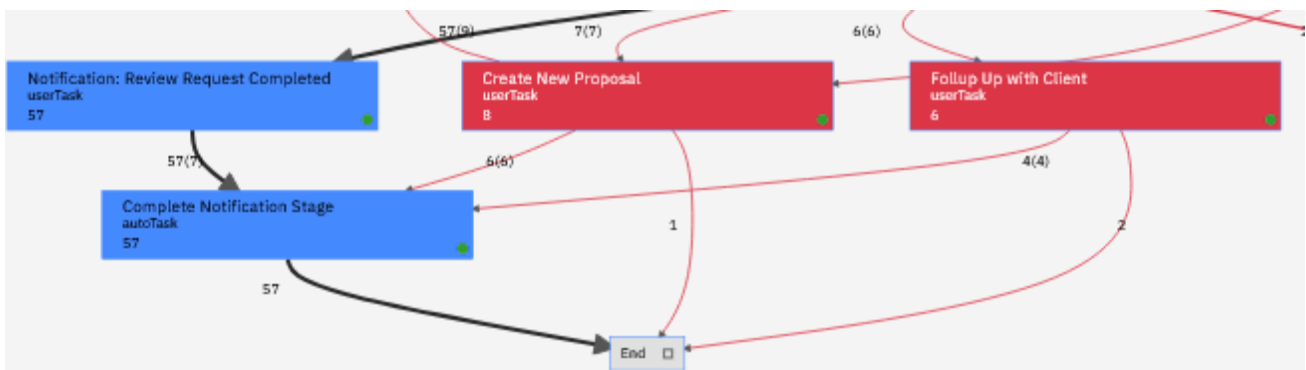_3. Make sure only **Unexpected activities** is checked

_4. Scroll down to **Create New Proposal,** unexpected Activity

_5. Click **vertical ellipses** and then select **Create filter including case**

6. Focus on the part of the Model **close to the End Activity**.

As shown in the Figure below, both **Follow Up with Client** and **Create New Proposal** are optional Activities. Note the preconditions; both are available to start when the Notification Stage is reached.
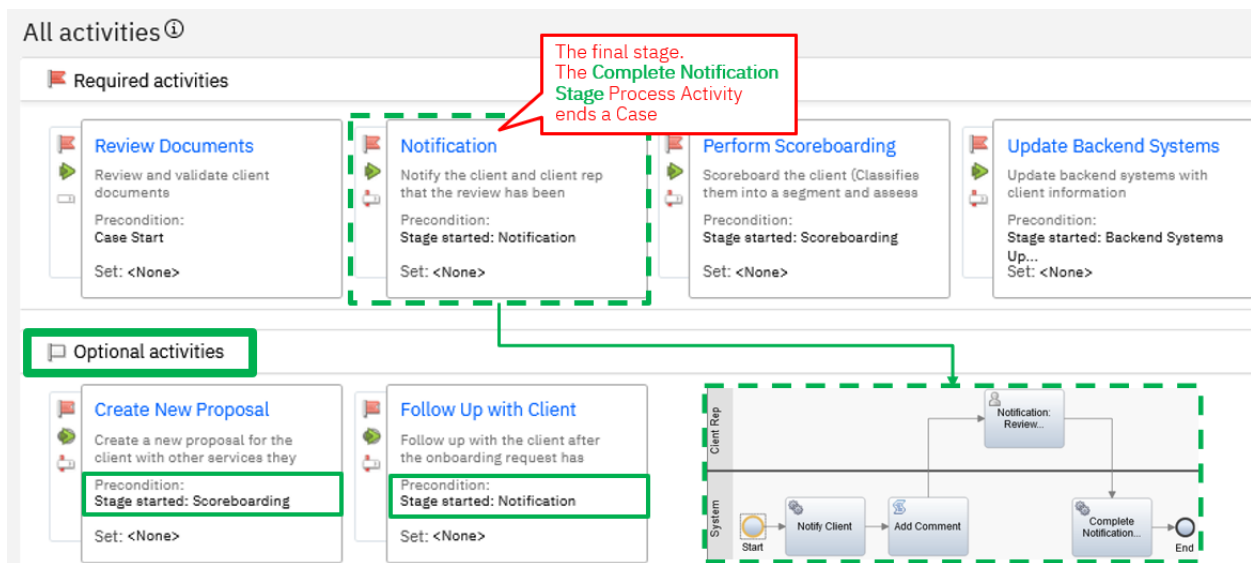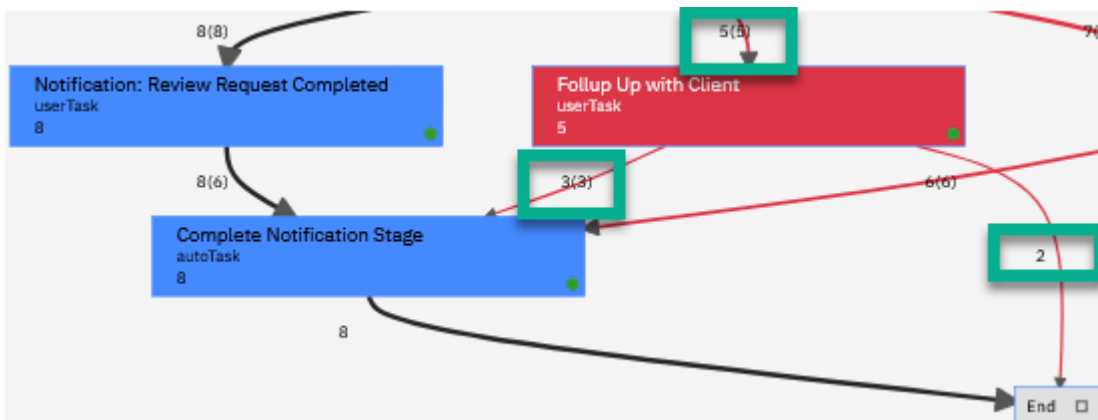

Figure 7. "Follow up with Client" - an Optional Activity Enabled in the Scoreboarding Stage

Here are key insights you can draw from the Frequency view regarding the **Follow up with Client** Activity:

- The **Follow up with Client** Activity was started before the **Notification: Review Request** Completed (a human Activity).
- 2 times the **Follow up with Client** Activity was completed after Case was completed (Complete Notification Stage activity completed)
- 6 times the **Follow up with Client** Activity was completed **before** Case was completed (Complete Notification Stage activity completed). This implies that the Client Rep. delayed the Case completion until the Create New Proposal Activity was completed.

_7. Click **X** to remove the *Activity is "Create New Proposal"* filter
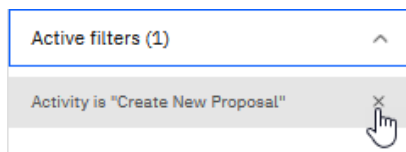
> **Process Improvement Insight:**
> **(1) Non-conformant Path Analysis.** We found an exception path not covered in the reference model. We discovered that when a process instance fails, it takes too long (the IT intervention took almost 5 hours!) for the process admin to repair a failed instance. This has a significantly negative impact on the Case leas Time KPI. Business action is to improve monitoring of failed process instances or change the Process to handle technical faults more gracefully.
> **(2) Non-Conformant Activity Analysis.** We discovered a negative impact on Case Lead Time by an Activity not covered by the reference model. Client Reps sometimes delay the Case completion until they complete the Follow Up with Client Activity, negatively impacting the Case Lead Time KPI. Business actions are to instruct Client Reps always to complete the Case first, and a long-term solution is to change the Client Onboarding Workflow to prevent this from happening.
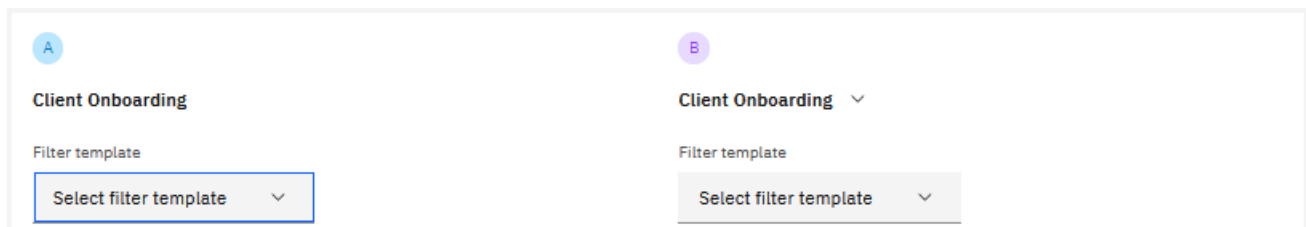
3.2.8 Compare Case Variants

The Compare feature helps you to compare two Case Variants concerning key Process metrics and KPI.

_1. Click **Compare** tab
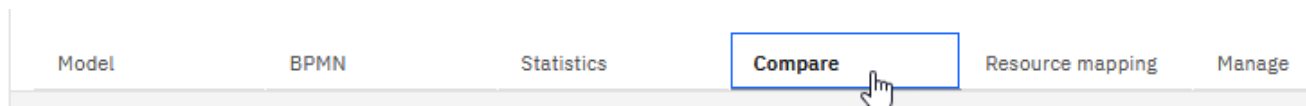
_2. Examine the *Compare View*

Note that it is organized into two columns:

A – (As-is), where you can specify a Filter Template that filters the data in your current project.

B – (To-be), where you can specify a Filter Template that filters either the data in your current project or a different project. Note that you can also use simulation data here (we will do this later in this lab).

3.2.8.1 Compare Clients

Let's compare Client Onboarding Workflow metrics between two different clients. We have already created Filter Templates that filter out cases that represent two different clients: Automation Elite Inc. and Legacy Consulting.

_1. For *As-is*, select **Automation Elite** template filter (you will learn how to create template filers later in this lab)
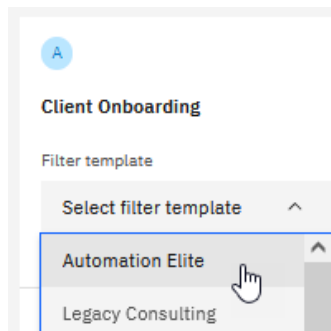
_2. For *To-be*, select **Legacy Consulting template filter**

_3. Click **Compare processes**

_4. The **Process details** view shows each customer's key statistics.

Process details		
	A	B
Measure: Average ∨	As-is	To-be
Case count	35	22
Average case lead time	3hrs 24mins	1hr 35mins
Average case cost	EUR 619.64	EUR 644.55
Total case cost	EUR 21,687.50	EUR 14,180.17

We can use the information here to launch a deeper root-cause analysis. Either in this view or using other features of IBM Process Mining, such as the Dashboards or the Model view.

_5. The **Case duration and count** view shows the Average remaining duration of active cases (line) and the number of active cases (block).
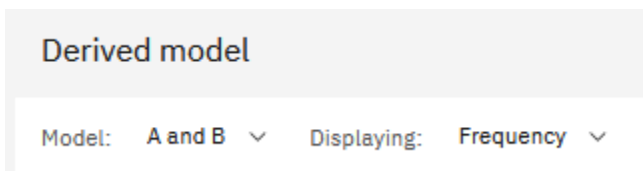
_6. Let's examine the **Activity Duration** view, explicitly focusing on the **Review Client Document** (Human Activity)
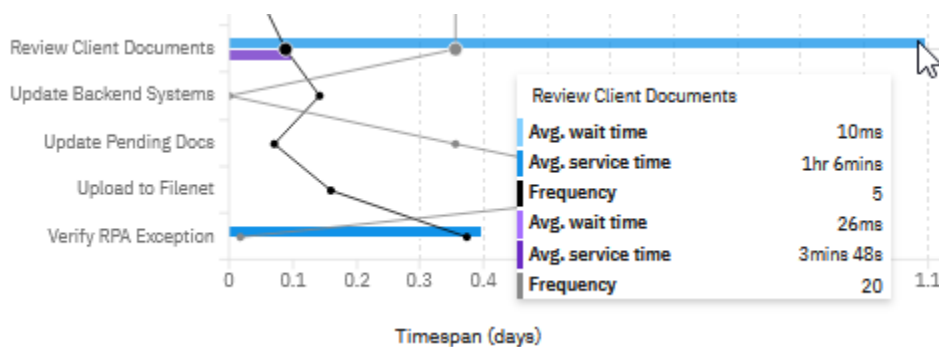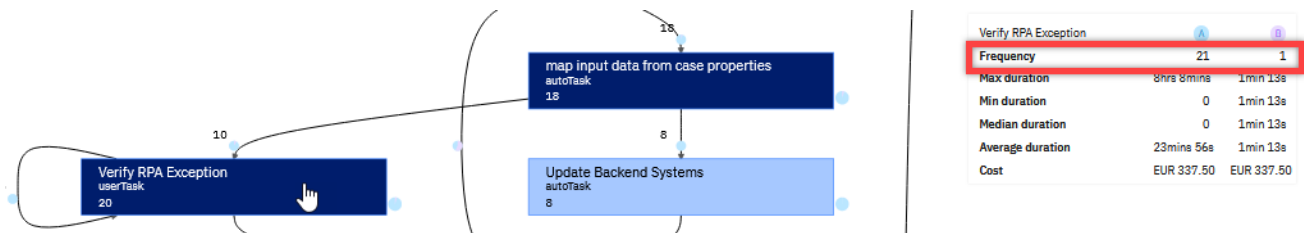

On average, we can see that it takes significantly longer to review documents when onboarding the Automation Elite Inc. client!

_7. In the **Derived model** view, ensure Model **A and B** are selected.

_8. Find and click **Verify RPA Exception** Activity

Notice that Legacy Consulting onboarding shows only one Case where Verify RPA Exception was raised, and manual intervention was required to recover a failed bot.

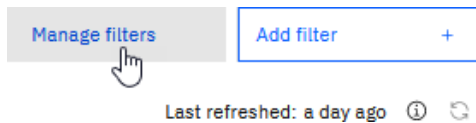_9. Click the **self-loop** on the **Verify RPA Exception** Activity

Notice that Automation Elite Inc. shows 10 reworks, where the same Bot had to be fixed/retried multiple times!

3.2.8.2 Compare the Performance of Focus Corp Employees

Let's compare how different Focus Corp employees complete Client Onboarding requests!
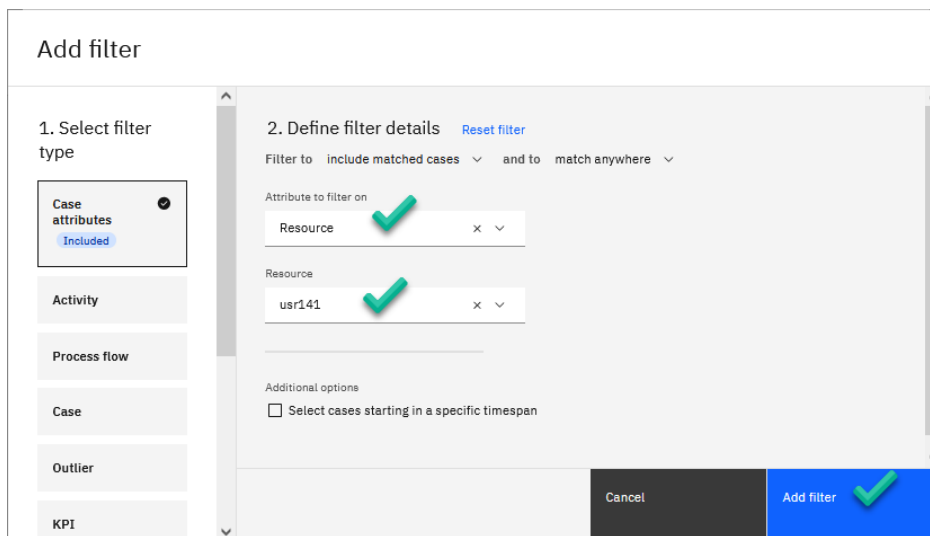
3.2.8.2.1 Create Filter Templates
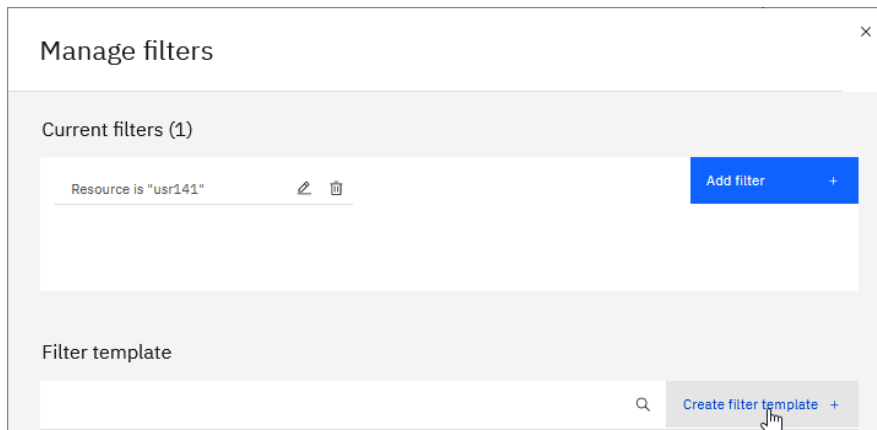
_1. Click **Manage filters**

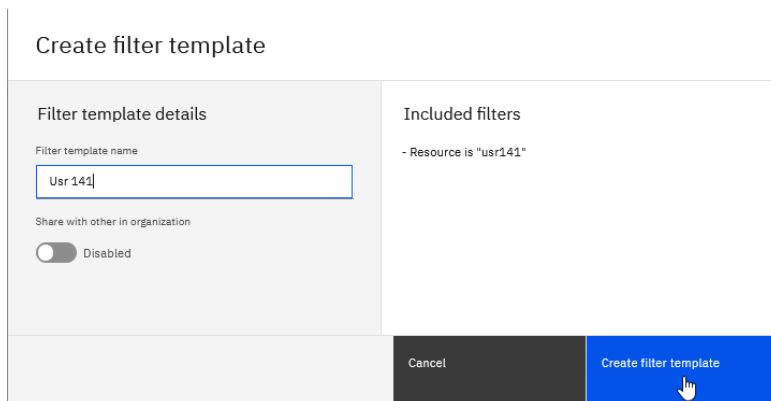_2. On the *Manage filters* window, click **Add filter +**

_3. For *Attribute to filter on,* select **Resource**; for *Resource,* select **usr141,** and then click **Add filter**
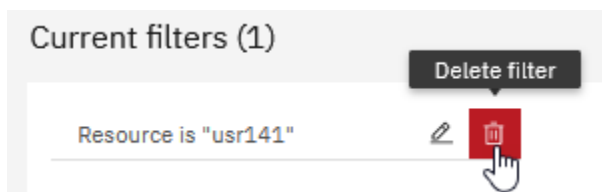

_4. Click **Create filter template +**

_5. For the *Filter template name,* enter **Usr 141** and then click **Create filter template**

_6. Click **Delete filter** (We do not want this Filter to be our current Filter!)

_7. Click **X** to close the *Manage filters* window

_8. Follow the above steps to create **Usr 143** Template Filter.

You should now see 2 new Template Filters.

3.2.8.2.2 Create Filter to Exclude KPI Outliers

Since the only fair comparison of employee performance is to consider consistent adherence to the KPI, let's exclude the cases considered to be outliers for the KPI.

> So far, you have used filters created from the UI. You can also create filters explicitly.
>
> Filters allow you to analyze the Process considering a limited subset of cases that answer specific user requests. For example, to exclude simulated cases or to exclude all cases which are non-conformant to the reference mode

_1. Click **Add filter+**

_2. Select the following and then click **Add filter**

Select filter type – **Outlier**

Filter to – **exclude matched cases**

Case lead time, Activity wait time, Activity service time – **check**

Outlier filtering level (%) - **100**

_3. Click **X** to close the *Manage filters* window

3.2.8.2.3 Use Template Filter to Compare Employee Performance

Let's find out which employee turns out to be more productive! As you will find out, the answer is not simple.

_1. For As-is, select **Usr 141** for To-be, select **Usr 143,** and then click **Update comparison**

2. Let's examine the **Process details** view.

Measure: Average ∨	As-is	To-be
Case count	8	5
Average case lead time	1hr 11mins	1hr 32mins
Average case cost	EUR 423.94	EUR 393.20
Total case cost	EUR 3,391.50	EUR 1,966.00

The results look confusing. **Usr 141** completes cases faster than **Usr 143**, but **Usr 143** case cost is lower than **Usr 141**.

3.2.8.2.4 Average Lead Time Comparison and Explanation

Let's examine the Activity Duration view to see why **Usr 141** completes cases faster than **Usr 143**

1. Hover the mouse over **Handle Document** Activity
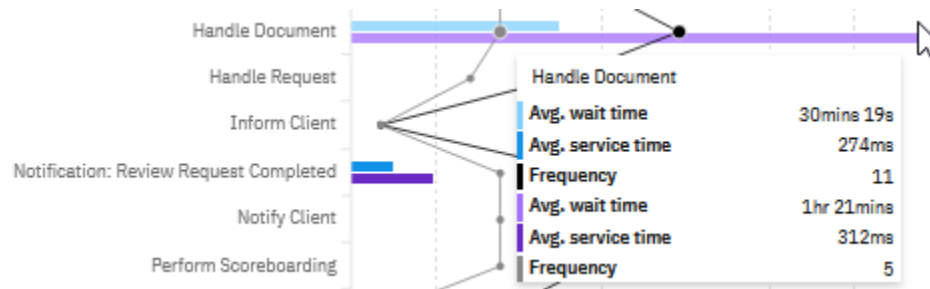
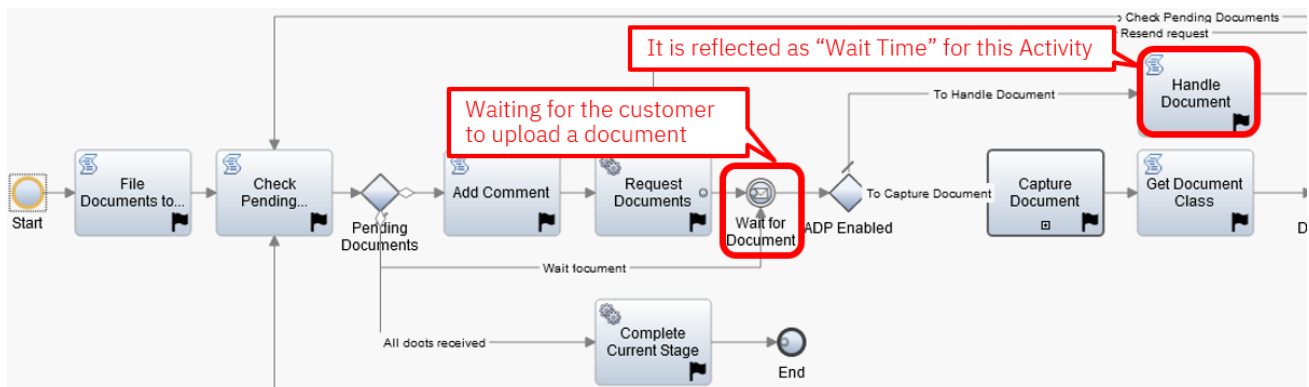Let's examine the Review Document process to see how Handle Document Activity is orchestrated.

Figure 8. Impact on Waiting for Documents to be Submitted on Lead Time

The Figure above shows that the **Wait for Document** message-receive Activity (not recorded in the Process Mining Model) must be complete before the **Handle Document** Activity can start! The **Wait for Document** message-receive Activity blocks the **Handle Document** Activity

We discovered that waiting for customers to supply documents is the root cause of the employee's **Usr 143** poor Case Lead KPI score, but at the same time, we concluded that although it is impacting Case Lead time, we cannot blame **Usr 143**.

3.2.8.2.5 Case Cost Comparison and Explanation

Let's examine the Derived model view to see why **Usr 141** cost is higher than **Usr 143**

_1. In the *Derived model* view, **find Review Client Documents** Activity
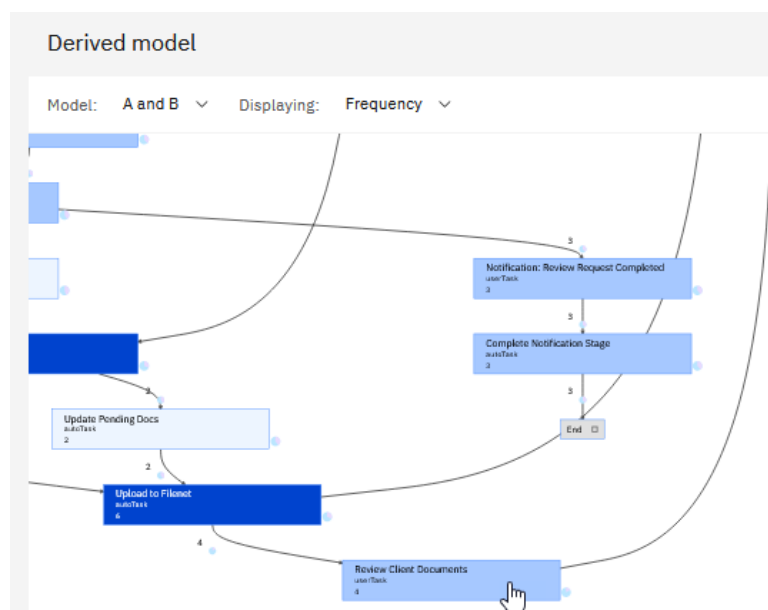
_2. Click **Review Client Documents Activity** and examine the legend in the top right corner of the view

| Review Client Documents	A	B
Frequency	5	1
Max duration	16mins 45s	1min 8s
Min duration	0	1min 8s
Median duration	49s 396ms	1min 8s
Average duration	3mins 53s	1min 8s
Cost	EUR 125.00	EUR 125.00

Let's use this formula to calculate the Average Cost of the Average Review Client Documents Activity:

**Average Activity Cost = (Activity Frequency / Number of Cases Completed) * Activity Cost**

The results are summarized in the table below:

| Employee	Average Activity Cost	Conclusion
Usr 141	(5 / 8) * EUR 125.0 = EUR 780.0	The employee **Usr 141,** had to review documents more often. Since this is a costly activity, it had a more significant impact on the average case cost than for the employee **Usr 143**
Usr 143	(1 / 8) * EUR 125.0 = EUR 150.0	

_3. Click **Manage filters (1)**
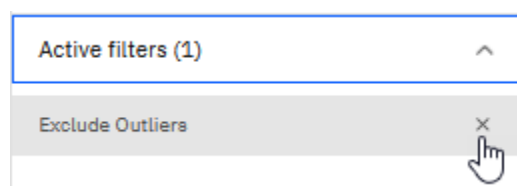
4. In the *Manage filers* window, click **Delete filer**
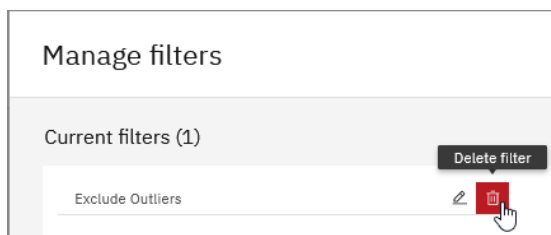
5. Click **X** to close the *Manage filers* window

> **Process Improvement Insight:**
> **(1) Comparing two clients**. Two factors affected Automation Elite Inc.'s longer case lead time. Due to inaccurate or missing documents, it took significantly longer to review documents. Time-consuming manual intervention was required to recover a failed RPA bot that updated client information.
> **(2) Comparing the performance of two employees**. Waiting for customers to supply documents is the root cause of the employee's Usr 143 poor Case Lead KPI score. The employee Usr 141 reviews documents more often. Since this is a costly activity, it had a more significant impact on the average case cost than for the employee Usr 143

3.2.9 Happy Path Analysis for New Straight Though Workflow Candidate

In Use Filter to Discover Happy Path, we discovered the "Happy Path" in the Client Onboarding Workflow. We will now evaluate it against instances that did not follow the "Happy Path." If the evaluation goes well, we will export the BPMN diagram and hand it to the IT Organization to consider using the Happy Path Process Variant as a fully automated Straight-Through-Process implementation!

3.2.9.1 Happy Path Comparison

We have already created two filter templates for you to save some lab steps: Happy Path and Exclude Happy Path. We will use them to compare the Happy Path case variant with one that does not include the Happy Path cases.

1. For As-is, select **Exclude Happy Path** for To-be, select **Happy Path,** and then click **Update comparison**
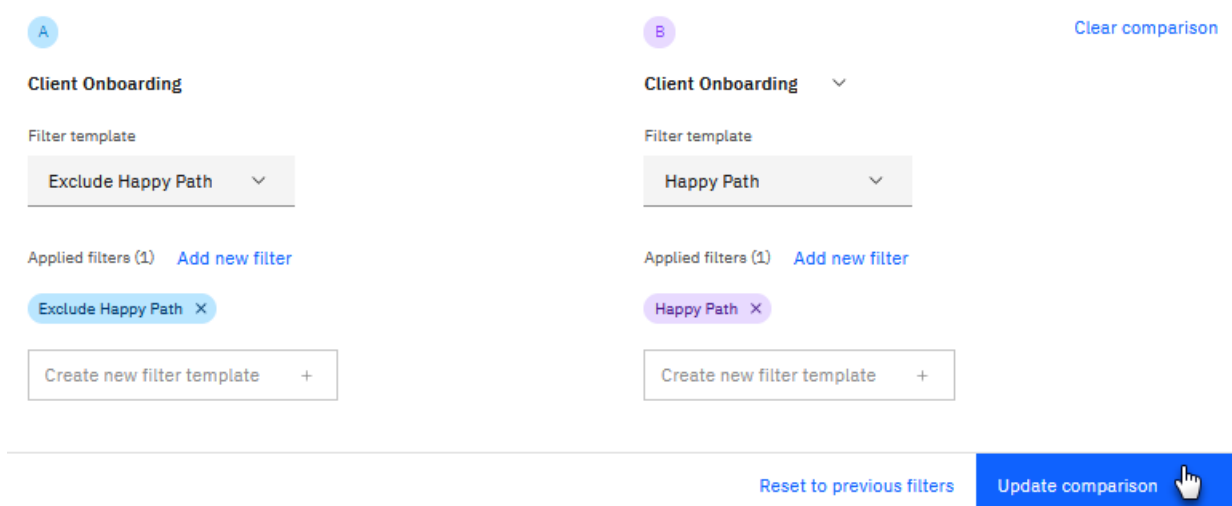
_2. Let's examine the **Process details** view.

| Measure: Average ⌄	A	B
	As-is	**To-be**
Case count	46	11
Average case lead time	3hrs 1min	1hr 23mins
Average case cost	EUR 714.49	EUR 272.83
Total case cost	EUR 32,866.50	EUR 3,001.17

The "Happy Path" process variant is the winner! It has almost 3 times lower lead time and almost 3 times the cost. It looks promising!

3.2.9.2 Generate Happy Path BPMN Process

We will create a BPMN Process diagram, export it to a file, and hand it over to the IT Organization.

3.2.9.2.1 Create BPMN Diagram

_1. Click **Manage filters**
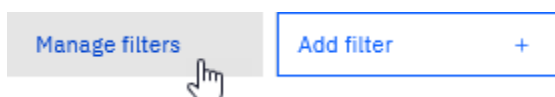
_2. Select **Happy Path** filter, click **vertical ellipses** and then select **Replace current Filter with template**

Template name	Created by	Shared with organization	
⌄ Automation Elite	cp4badmin (you)	No	
⌄ Exclude Happy Path	cp4badmin (you)	No	
⌄ Happy Path	cp4badmin (you)	No	

Filter template

Replace current filters with template
Add filter to template
Enable sharing
Delete template

_3. Click **X** to close the *Manage filers* window

_4. Click **BPMN** tab

Client Onboarding

Model | BPMN | Statistics | Compare

You should now see the BPMN diagram of the Happy Path process
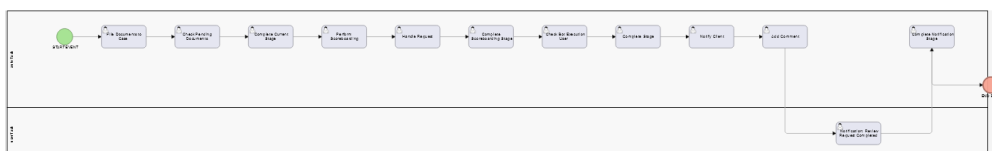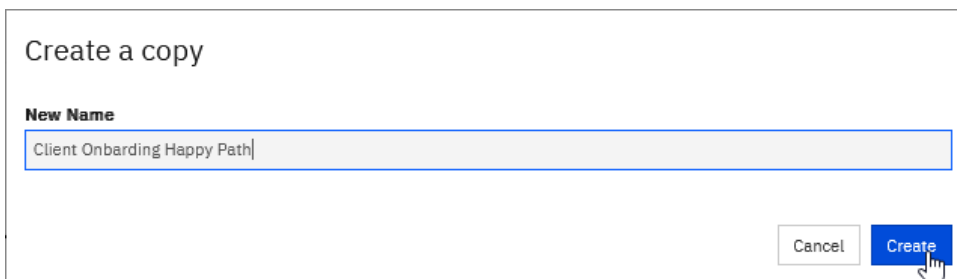
3.2.9.2.2 Export BPMN Diagram

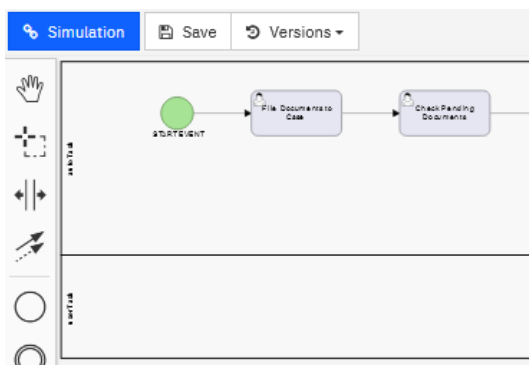_1. Click the **dropdown** next to *Create simulation +* and then click **Publish to BPA**
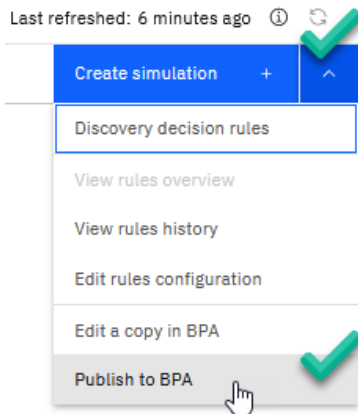
_2. Click the **Model dropdown**, and then click **Create a copy**
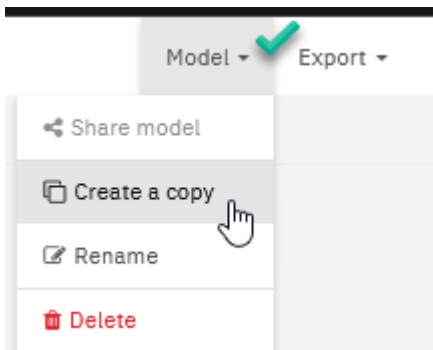
_3. For *New Name* enter **Client Onboarding Happy Path** and then click **Create**

You should now see the BPMN diagram in edit mode, with the palette appearing on the left.

**The following are optional high-level steps that are not required to complete the lab.**

The next step would be to export the BPMN Process. Before exporting the BPMN Process Model, we could now make some changes in the BPMN Editor. Or you could export the Process as is and make the changes in IBM Process Designer in Business Automation Studio.

If you prefer to make the changes in the BPMN Editor, follow these steps.

Change activity types from User Task to a Manual Task

Remove Activities associated with Complete Case Stages (there are no stages in a Straight-Through-Process)
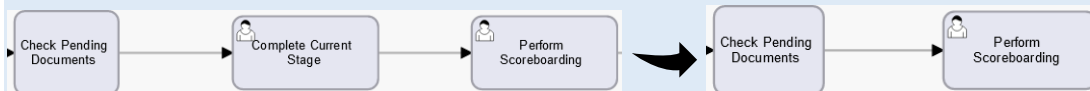
Making these model changes is not required to complete the exercise. But if you like to attempt it, here is how.

To change activity type   To delete an activity
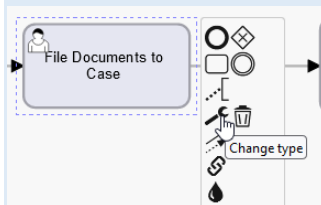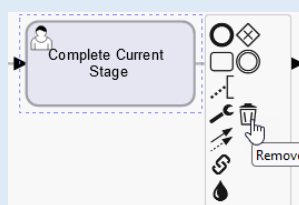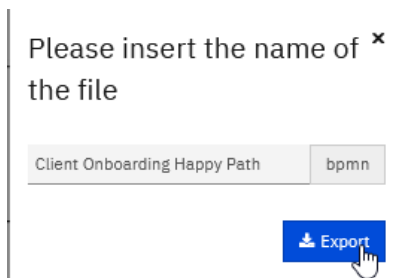

The edited flow should then look similar to this
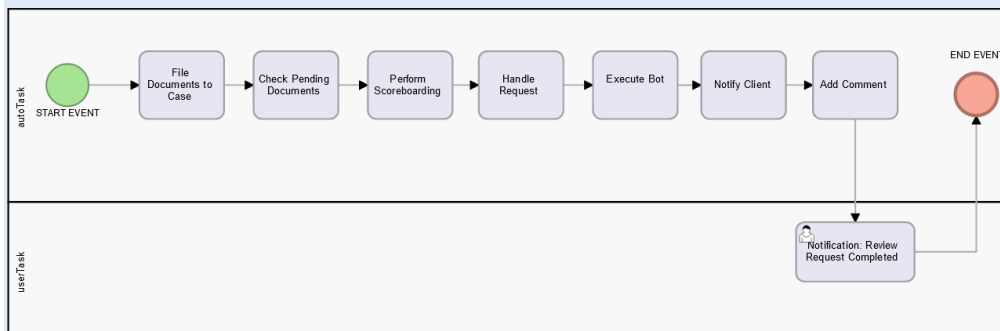
When you are done, click Save

4. Click the **Export dropdown** and then select **BPMN**
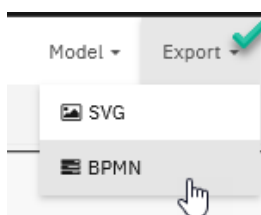
_5. Click **Export**

_6. If you plan to use the exported BPMN file later, select the folder and click **Save**

The exported BPMN model could be imported to any BPMN-compliant editor, including IBM Blueworks Live.

IBM Bluewoks Live processes can also be imported to IBM Process Mining to perform simulations based on the automatically generated event data. The BPMN import transformation maps the Work Time to Working time but does not use Wait time.

The following are high-level optional steps that are not required to complete the lab.

To import the BPMN file to Web Process Designer, switch to Business Automation Studio and follow these steps:
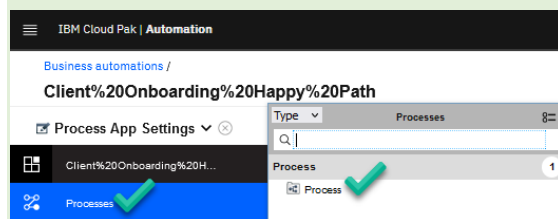
- Create a zip from the "Client Onboarding Happy Path.bpmn" file
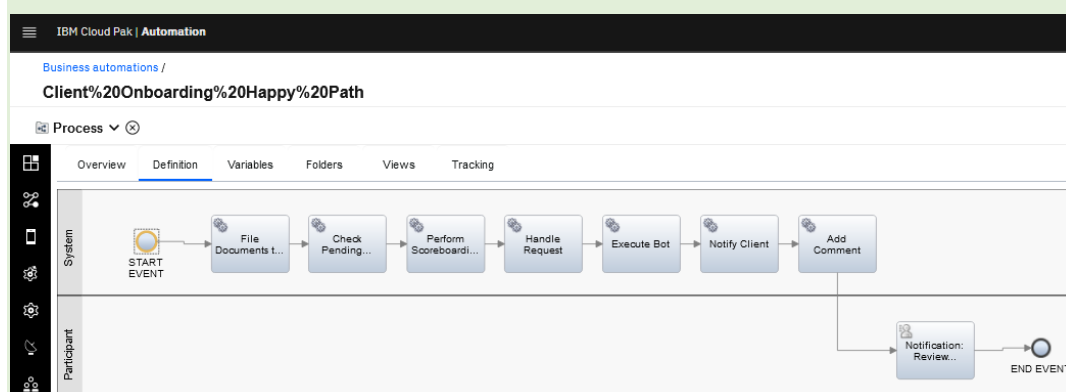- In Business Automations, select Workflow and then Import
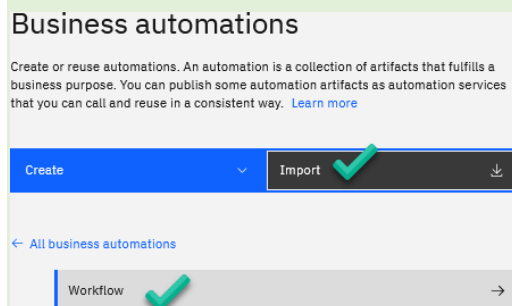
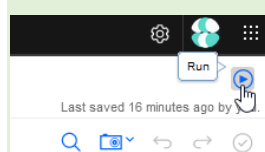- Drag and drop "Client Onboarding Happy Path.zip" file and click OK
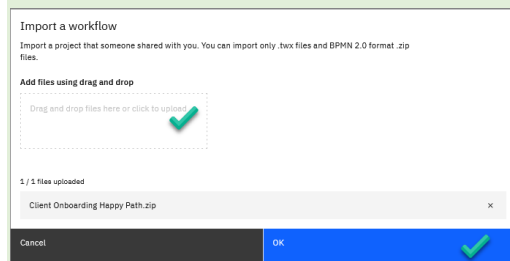
- When Process Designer opens, select Process and then click Process
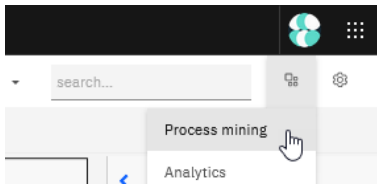

- The imported Process is executable!
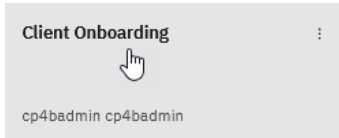

- Try executing it if you like.

Of course, the Process does not do anything because none of the activities are implemented. This would be the next step to create a BPMN Straight Through Process.
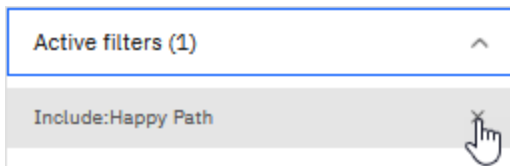
_7. Click **Process mining** to switch back to the Process Mining component

_8. Reopen the **Client Onboarding** Process

_9. Click **X** to remove the Active filter "Include: Happy Path" filter

> **Process Improvement Insight:**
> The Compare feature provided the evidence (significantly lower Case Cost and Lead Time for 20% of all cases) to justify investment in creating a Straight Through Process (STP) version of the Client Onboarding Workflow.
> When implementing the STP process, the IT organization could also consider automating the only remaining human task in the Process:
>
>
>
> Removing this async Activity would make the Client Onboarding Happy Path Process a true STP process,.

3.2.10 Using Dashboards to Optimize Client Onboarding Workflow

Dashboards are a vital feature of the Analytics component of IBM Process Mining. They are authored to provide critical business insights and enable the business user to monitor near real-time critical business metrics and, if needed, dive into a problem-solving mode immediately.

Below are handy definitions of some terms that we will be using in this part of the lab.

> **Throughput Time = Service time + Waiting Time**
>
> **Service Time = End Time – Start Time**
>
> **Waiting Time = Previous Activity Stop time – Next Activity Start Time**
>
> Note that all the above metrics are available because the data is retrieved from IBM Business Automation Insights. Logs from systems that do not provide Activity End Time use different calculations for the above metrics.

_1. Click **Analytics** to switch to the Analytics component
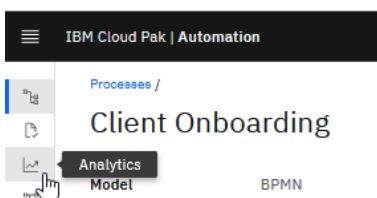
The Analytics view opens, displaying a system-generated Project overview Dashboard available to all projects. The default Dashboard cannot be deleted or changed but it can be duplicated.
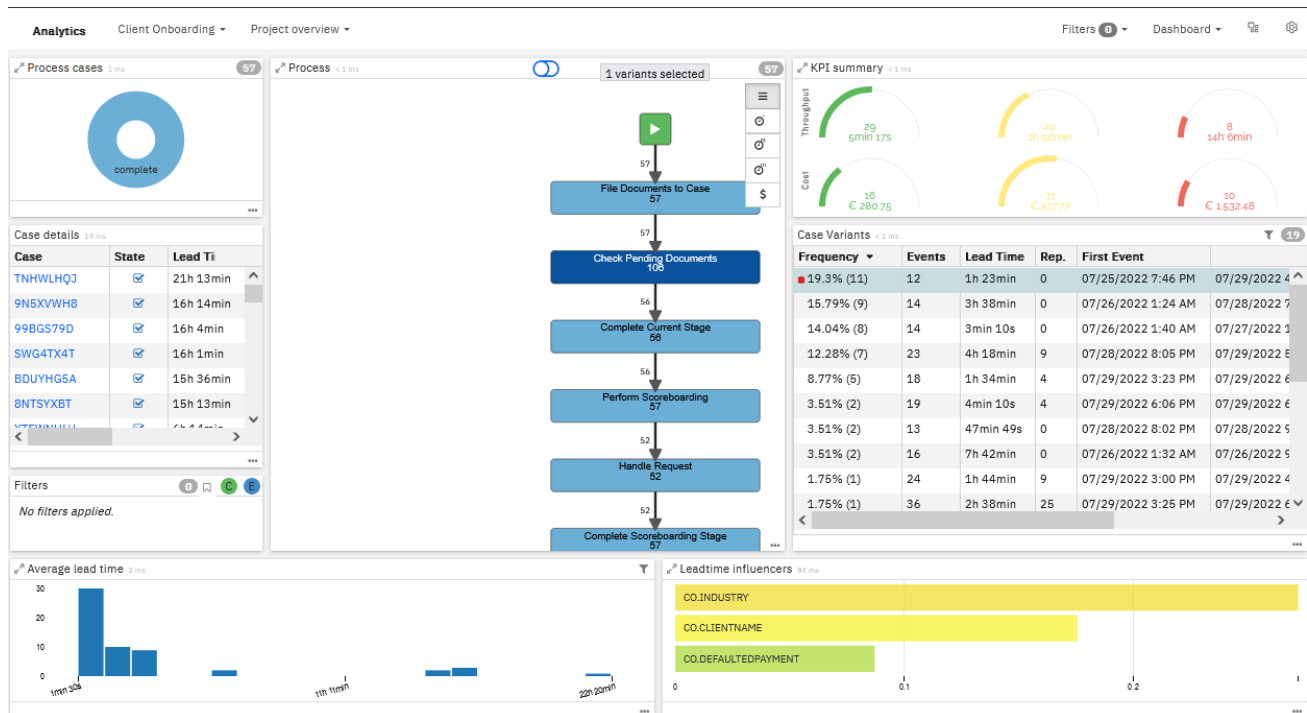
3.2.10.1 Human Activity Analysis Dashboard

This is a custom dashboard we build for you to identify and analyze Human Activities' impact on the Process Lead time and Cost.
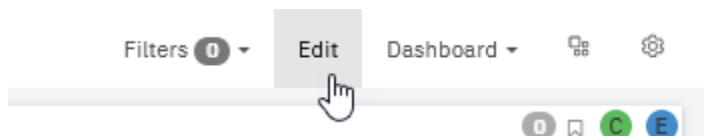
1. Select **Human Activity Analysis**
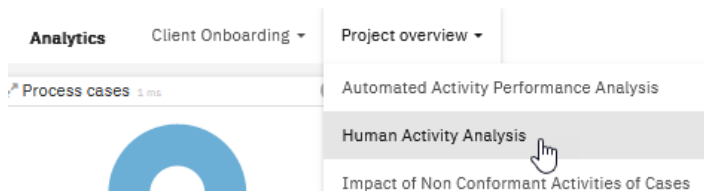
3.2.10.1.1 Build Average Human Activity Service Time Chart

Before we proceed with the analysis, let's gain some practical experience building a chart related to Service Time.
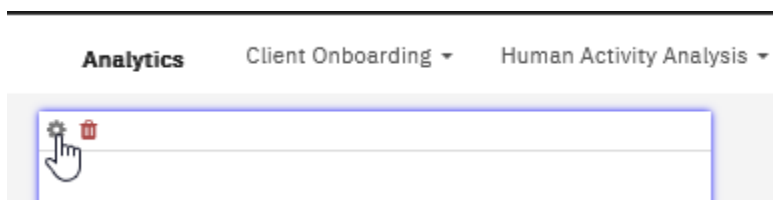
1. Click **Edit**

Custom dashboards are built from configurable pre-built widgets (the first six categories) or form user-defined custom widgets that require IT skills (the last category in the palette 🧩).

_2. From the palette, select **Add histogram widget** and then select **Row chart**
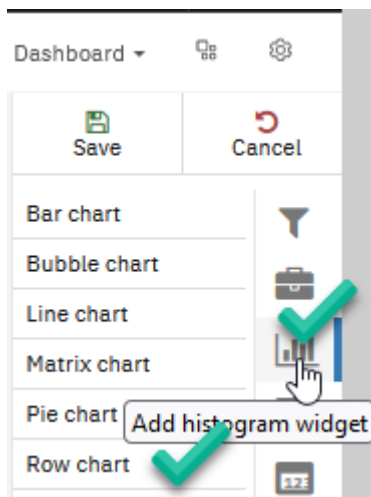
_3. Click the **gear icon** to configure the new widget

_4. For *Title,* enter **Average Human Activity Service Time**
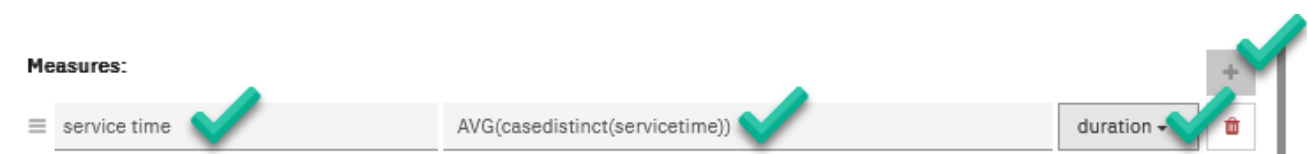
Title:

Average Human Activity Service Time

_5. For *Dimensions*, click **+,** and from the dropdown, select **Activity**

_6. For *Measures*, click **+**, and then enter the following values

Setting	Value
Measure description	**Service time**
Aggregation formulae	**AVG(casedistinct(servicetime))**
Data type dropdown	**duration**

_7. For *Filters*, enter **TYPE = 'userTask'** to ensure we are only looking at the Human Activities

Filters:

TYPE = 'userTask'

_8. The completed Chart should look exactly like this. Click **OK** to create it.

_9. Grab the **bottom right corner** of the Chart to expand it to the right and down,
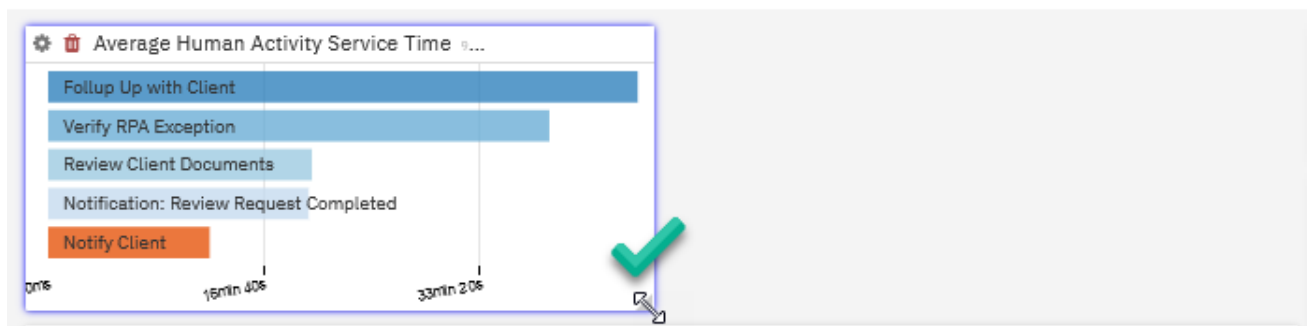
_10. Click **Save**
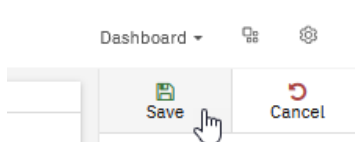
Note, to learn more about creating Dashboard Charts, see https://www.ibm.com/docs/en/process-mining/1.13.0.x?topic=manual-analytics
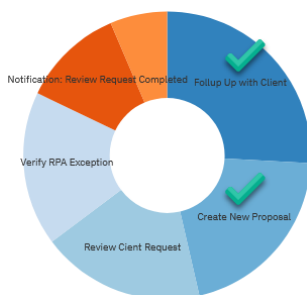
3.2.10.1.2 Human Activity Analysis

Let's focus on two Human Activities that implement the two optional steps in our Case Solution: **Create New Proposal** and **Follow Up with Client**.
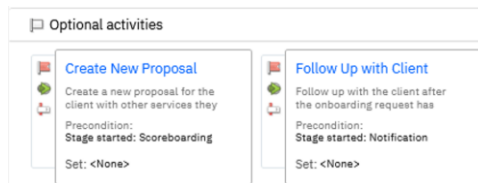
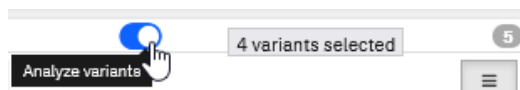_1. Notice that these two activities have high Service Time and high Average Cost
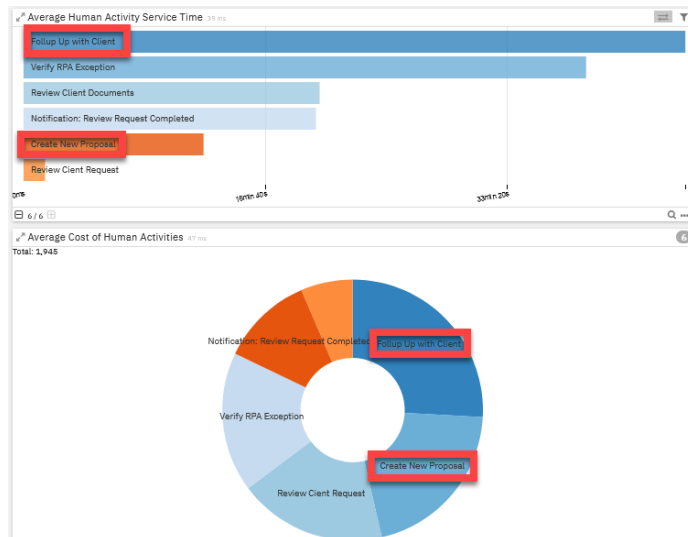
_2. In the pie chart, click **Create New Proposal.** Then **wait a few moments**. Then click **Follow Up with Client**.

Note that this action filtered out the cases that do not include the above Human Activities.
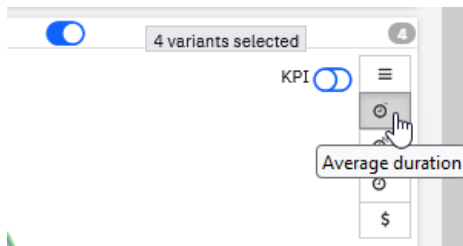
_3. Click **Analyse variants**

Note that we now have four variants. Each variable has a different color and includes only a single case.
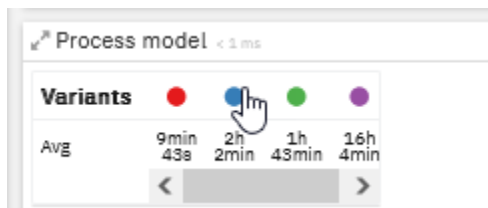
_4. Use the mouse wheel to adjust the *Model view* to fit the viewing area
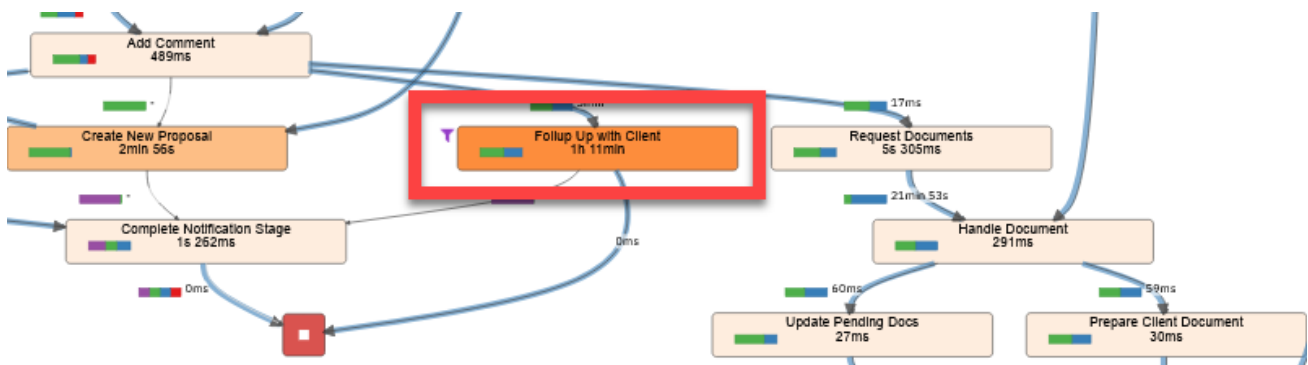
_5. Select **Average Duration** View

_6. Click twice on the **blue Variant**

_7. Notice that following the blue process path, you can see what activities were executed in this Case. Also, notice in this Variant it took 1 hour 11 min to complete Follow Up with Client Activity


> **Process Improvement Insight:**
> We identified human Activities with comparatively large Activity Costs and Service Time. We then linked them to the Variants and Cases where they occurred and assessed their impact. This analysis typically leads to business initiatives such as automation or organizational changes. Later, in this lab, you will learn how any such process improvements we identified in Dashboards can be simulated to understand their impact on process metrics such as Cost and Lead Time.

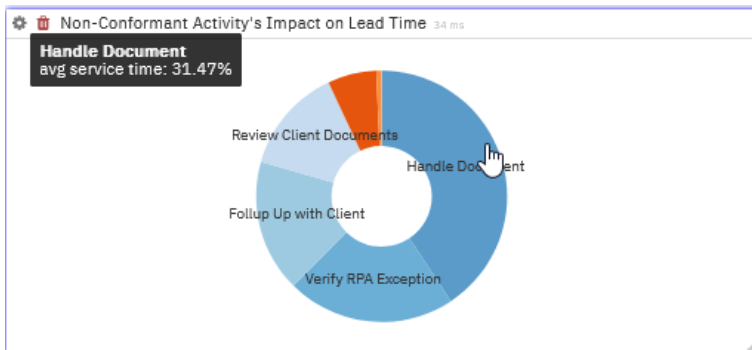### 3.2.10.2 Impact of Non-Conformant Activities on Cases Dashboard

This dashboard helps assess the non-conformant activities' impact on the Case Lead Time and Case Cost.

_1. Select **Impact of Non Conformant Activities on Cases**
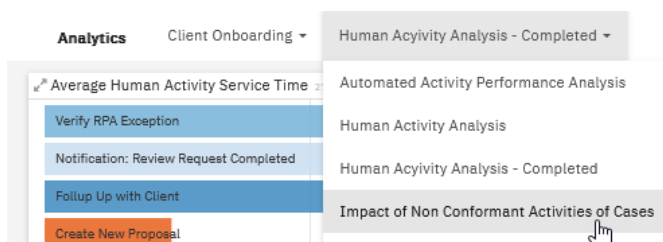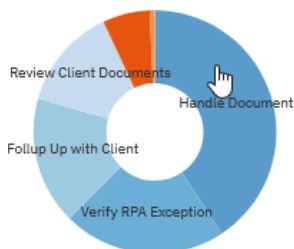
3.2.10.2.1 Case Lead Time

_1. Notice that the **automated** Activity called **Handle Document** contributes to Lead Time with 31.47%.

_2. Typically, automated activities are fast (low Service Time), but as shown in the Chart, they may have a considerable Wait Time.
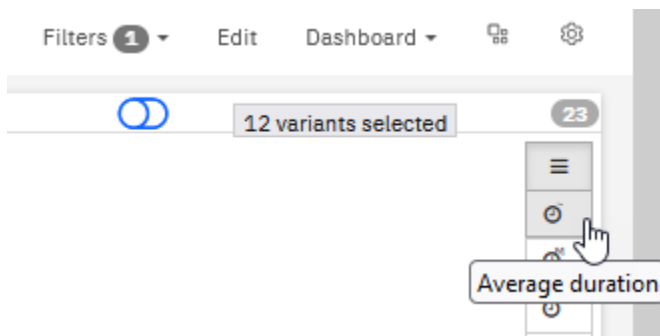

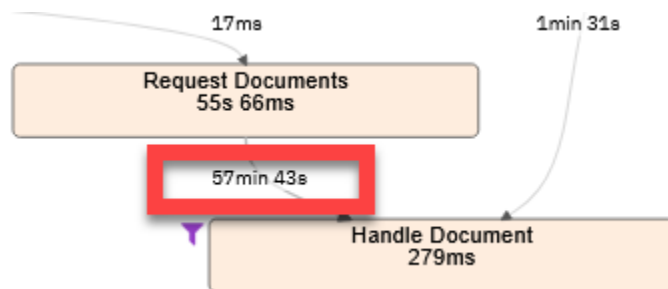_3. Click the **Handle Document** wedge in the pie Chart

_4. Notice we only have 23 instances, but Handle Document is invoked 49 times. This means rework which adds to a Case lead time!
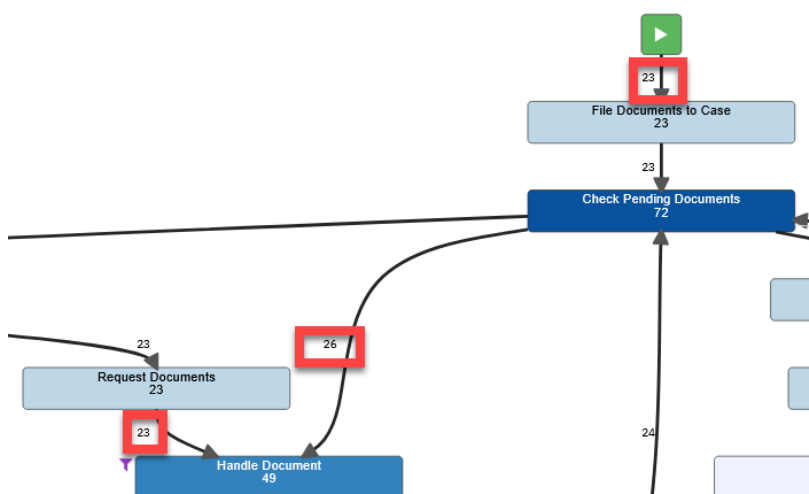
5. On the *Process model*, select the **Average duration**

6. Notice the long wait time!

Recall from the previous analysis that the **Wait for Document** message-receive Activity blocks the **Handle Document** Activity:
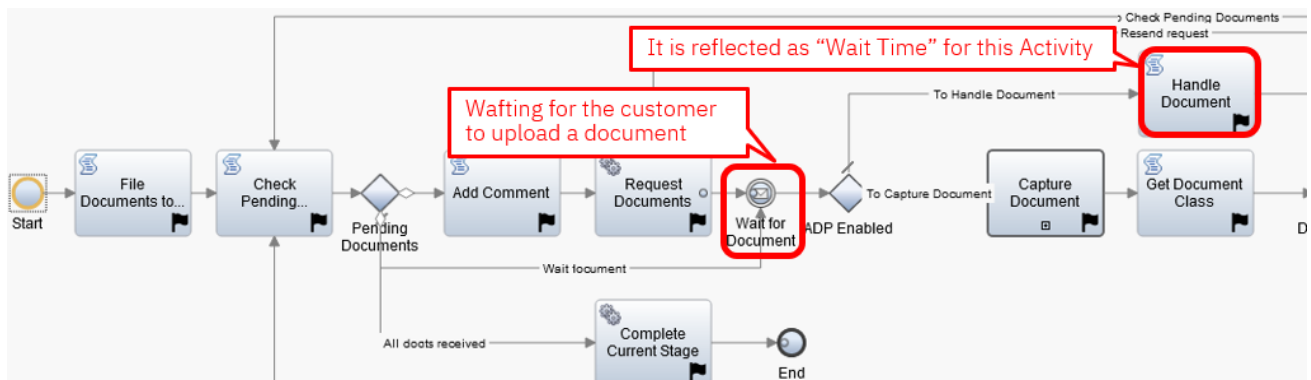
7. Click on the **red garbage can icon** to remove the filter
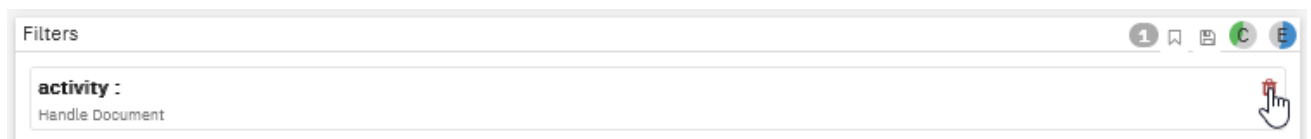
3.2.10.2.2 Case Cost

We have already investigated **Create New Proposal** and **Follow up with Client** (optional Activities). Let's focus now on another non-conformant activity that is not optional**: Review Client Documents** Activity – it has a 3rd high Cost of Deviation!

_1. Click the **Review Client Documents** wedge in the pie Chart
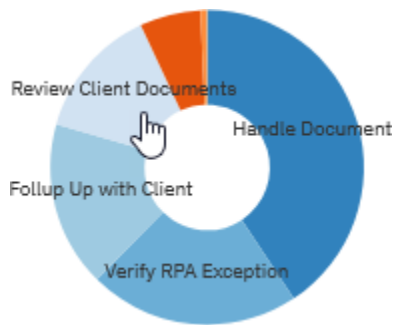
_2. In the *Process model* view, select **Frequency**
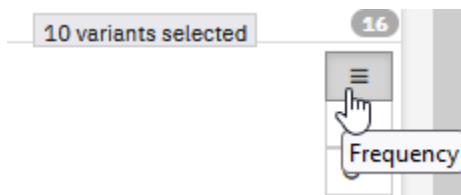
_3. Notice we only have 16 instances, but the Review Client Documents Activity is invoked 25 times. This means rework which adds to a Case Cost.

_4. Click red on the **red garbage can** icon to remove the filter

> **Process Improvement Insight:**
> **(1) Case Lead Time.** We discovered that the Average Wait time of an automated non-conformant Handle Document Activity was a key contributor to Case Lead Time in one of the Variants and, with the help of the IT organization, identified that waiting for clients to upload documents was the root cause.
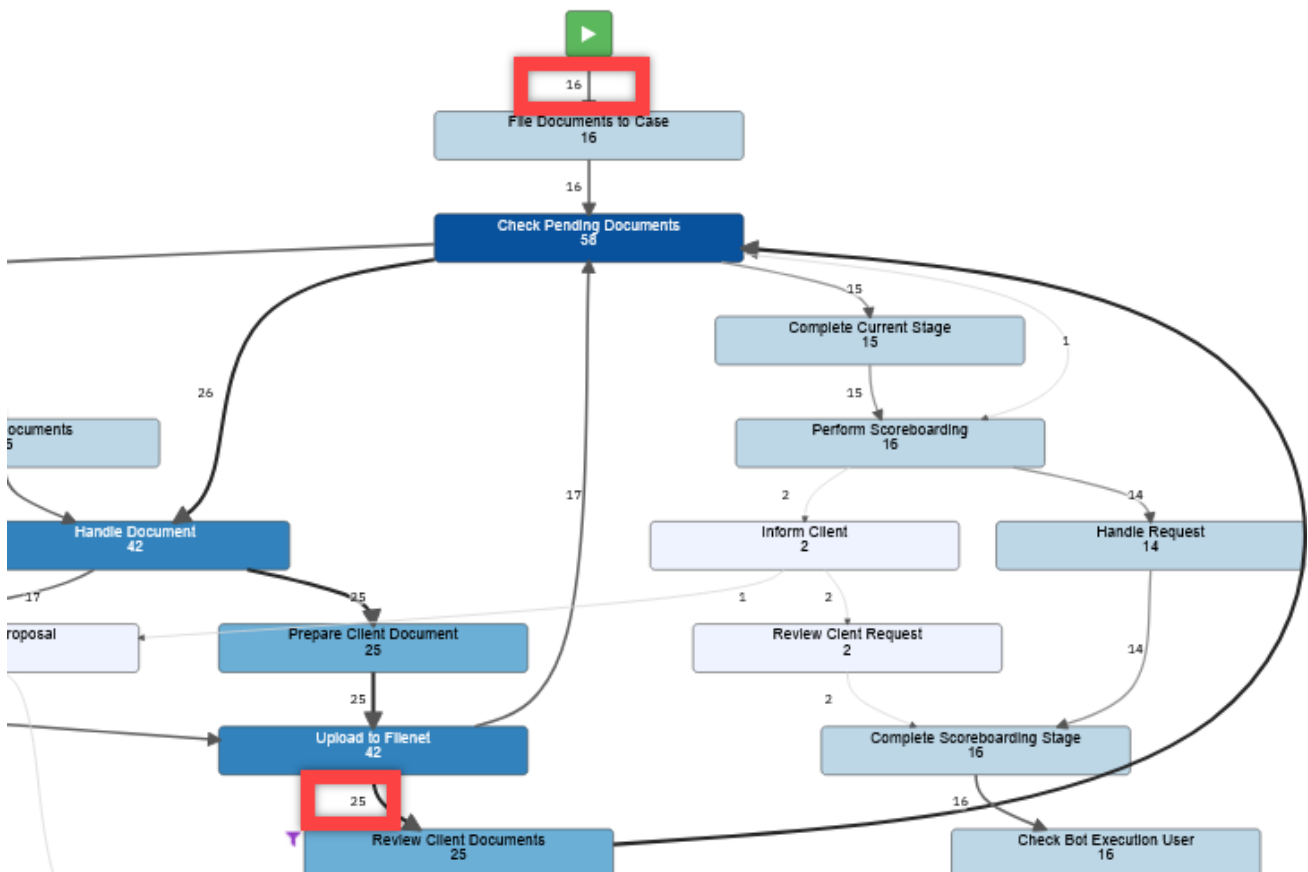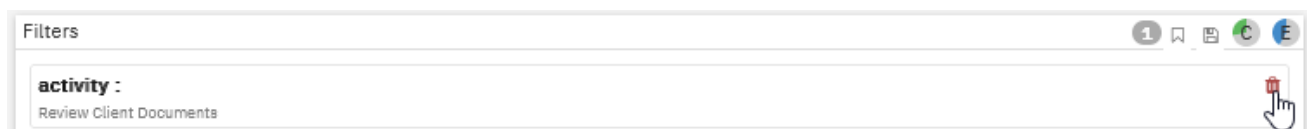> **(2) Case Cost.** We discovered that the Cost of an automated non-conformant Review Client Documents Activity was a key contributor to Case Cost. Additionally, this Activity was involved in rework loops and contributed to high Case Costs.
> Business action is to ensure the customer provides all documents and that the documents are correct when requesting a new service for the first time.

3.2.10.3 Process Time and Cost Analysis Dashboard

This dashboard focuses on individual case performance concerning Cost and Throughput KPI. It identifies KPI violators at the case level and enables drilling down to gain more insights into the root causes.

_1. Select **Process Time and Cost Analysis**
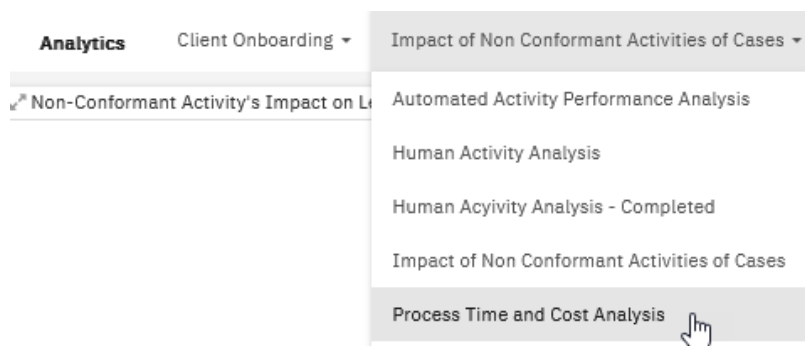
2. Let's examine the widgets.

KPI Summary shows Case Duration and Case Cost according to the KPI Settings. See the Figure below to see how these dashboards are related to the KPI Settings.

The KPI details widget shows the non-conformant activities' impact on the Case Lead Time and Case cost. Some of the less apparent columns are: Status (running or complete), Rep. (number of repetitions/rework loops), KPI (number of KPI violations)
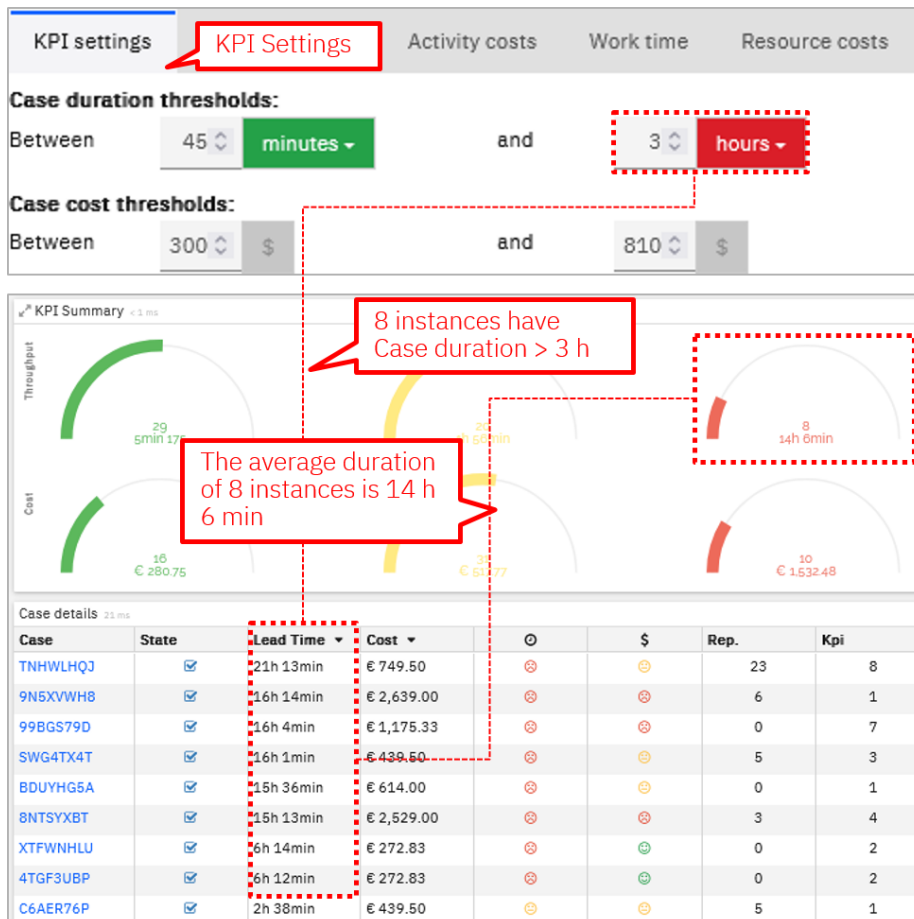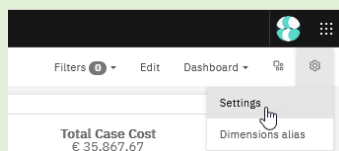

Figure 9. KPI Settings relation to the Built-in Dashboards: KPI Summary and Case Details.

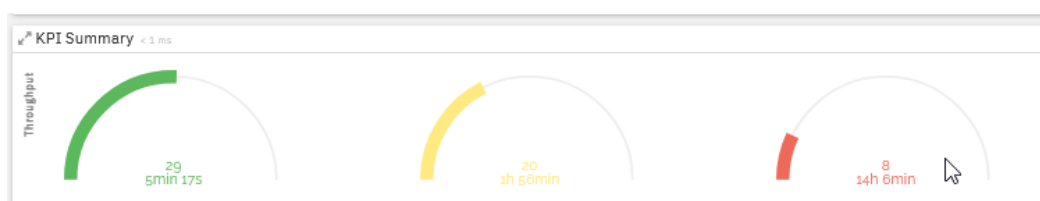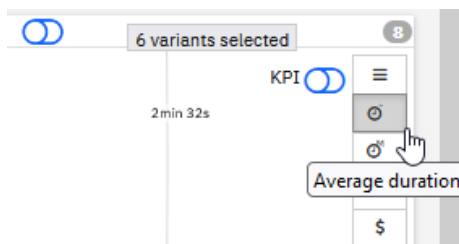> Note that you can display the KPI Settings from the Analytics component.
>
>

3.2.10.3.1 Drill Down into Throughput KPI Violators

Let's examine the cases that contributed to Throughput KPI violations.

 1. Click the **Red KPI** of the Throughput

_2. Click **Average duration**

_3. There are two activities with excessive Service time:

- **Notify Client** (automated Activity) – 1h 29maverage duration

- **Notification: Review Request Completed** (human Activity) – 1h 23m average duration

Later in this lab, we will use Simulation capability to determine if providing more computing resources to *Notify Client Activity* and automating the *Notification: Review Request Complete*d Activity can help reduce the process cost and increase the throughput.
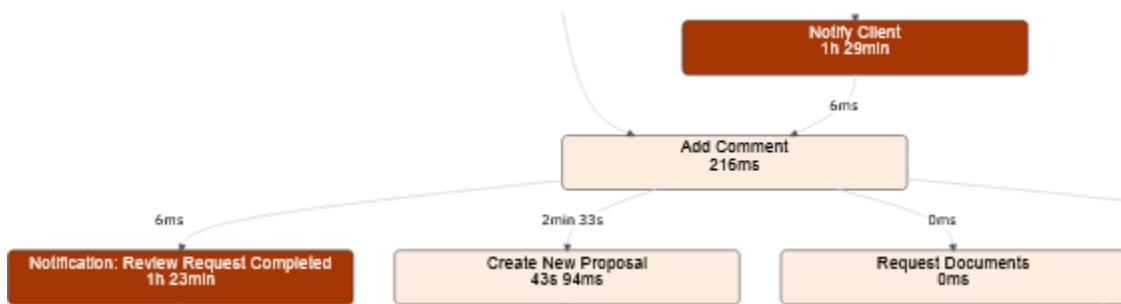
_4. Click **Analyze variants**

Note that all 6 variants and 8 cases contributed to the Case Lead Time KPI violation. You can now analyze them separately by clicking on the colored dots
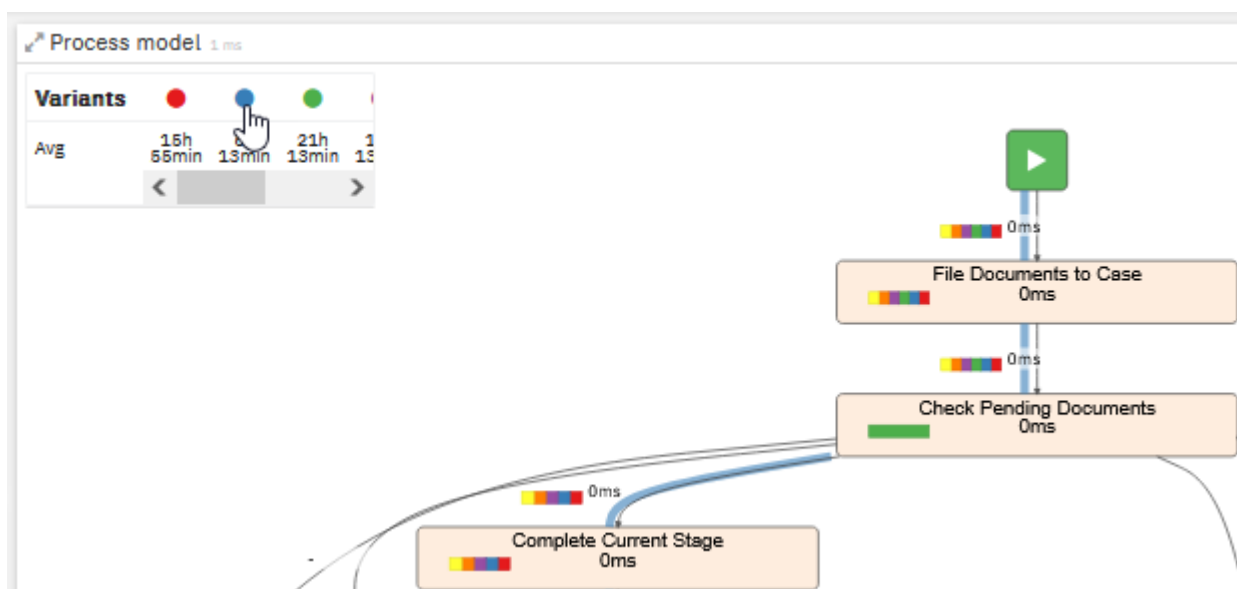
_5. Click the **red garbage can** to remove the dashboard filter

Filters	① 🔖 💾 Ⓒ Ⓔ
lead time : lead time > 3h	🗑️

3.2.10.3.2 Examine a Specific Case with High KPI Violation

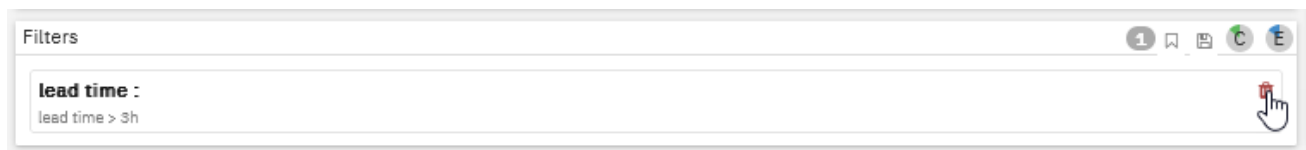Let's pick an individual case of interest and determine the root cause of throughput and cost KPI violations.

_1. In the *Case details* widget, click the row with Case ID **8NTSYXBT**

This Case looks interesting as it has a good combination of undesirable metrics!

Case	State	Lead Time ▼	Cost ▼	⏱	$	Rep.	Kpi
TNHWLHQJ	☑	21h 13min	€ 749.50	⊗	☺	23	8
9N5XVWH8	☑	16h 14min	€ 2,639.00	⊗	⊗	6	1
99BGS79D	☑	16h 4min	€ 1,175.33	⊗	⊗	0	7
SWG4TX4T	☑	16h 1min	€ 439.50	⊗	☺	5	3
BDUYHG5A	☑	15h 36min	€ 614.00	⊗	☺	0	1
8NTSYXBT	☑	15h 13min	€ 2,529.00	⊗	⊗	3	4

_2. A View showing the Model for the selected Case will appear.

> ▌ Hint: Use the mouse wheel to zoom and the mouse right button to move the Process diagram.

💼 Case 8NTSYXBT
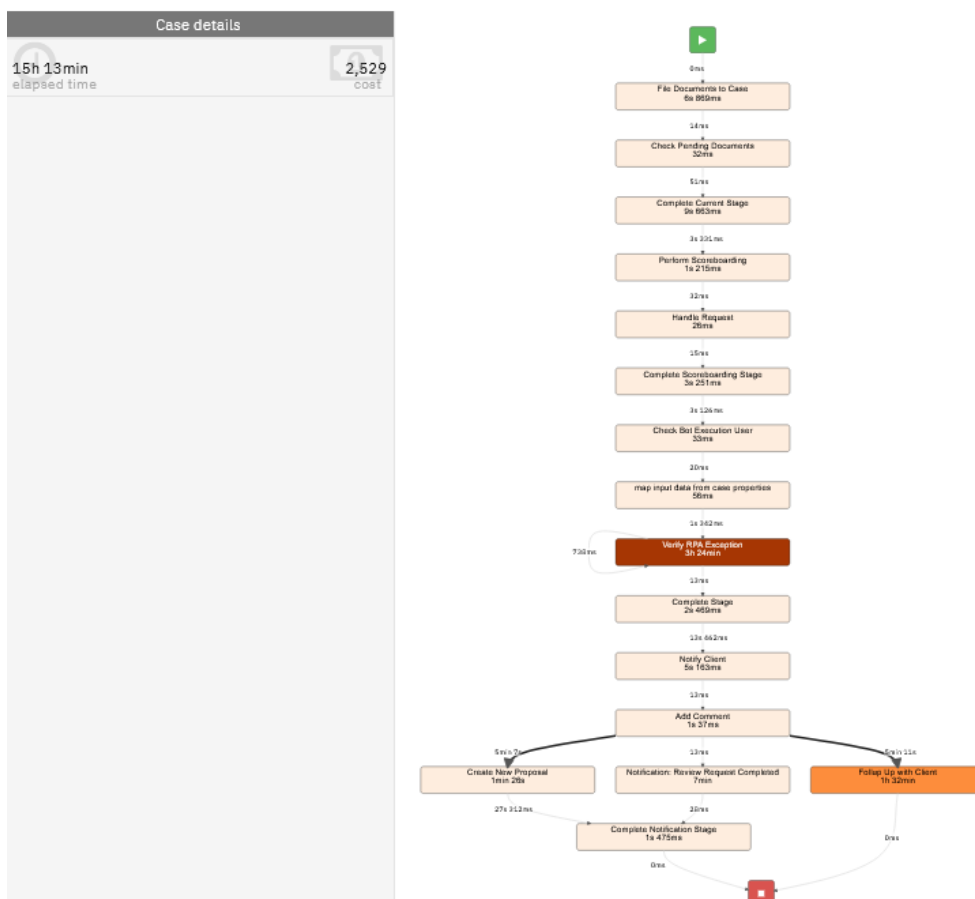
_3. Note that two **brightly colored** Activities contributed to the KPI Cost Violations:

- **Verify RPA Exception** (avg) 3h 24min
- **Follow up with Client** (avg) 1h 32 min
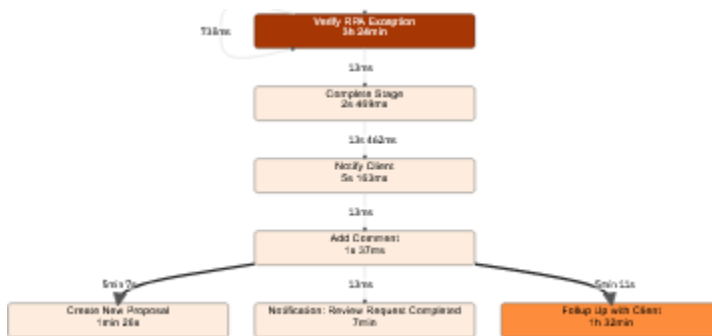
_4. Click the **Frequency View icon**

start: 07/26/2022 1:32 AM
end: 07/26/2022 4:45 PM

_5. Due to rework, Verify RPA Exception was executed 4 times while Follow Up with Client was only once.

6. We can now make our Case throughput calculations and compare them with Case details calculation

Verify RPA Exception Duration * 4 + Follow Up with Client * 1 =

3h 24min * 4 + 1h 32min = 13h 3min + 1h 32min = 15h 8min

We now see that the above two Activities combined with Rework account for 15hr 8min of the combined case duration of 15h 13min.
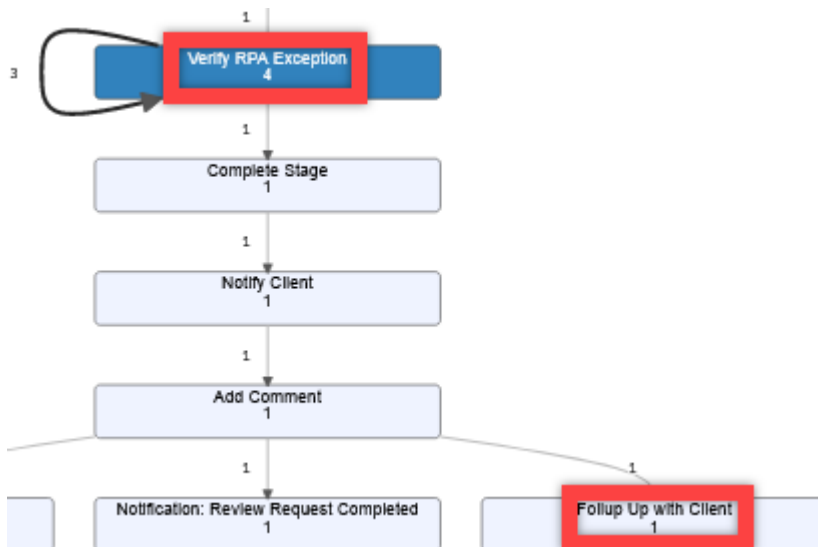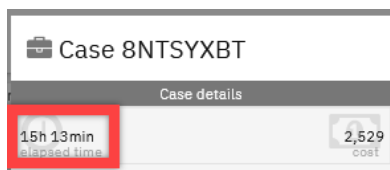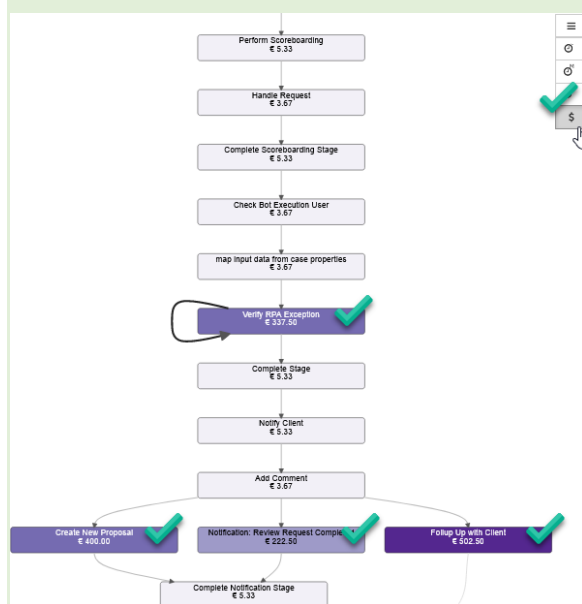
Note: If you like, you can now analyze the Case cost similarly. Hint: use the Cost view to identify the Activities with high Cost.

7. Click **OK** to close the Case View

Process Improvement Insight:
We analyzed the root causes of the Case lead Time KPI violations. We examined Variants (all cases that violated Case Lead Time KPI) and then focused on individual Cases with a high Case lead Time and Case Cost. We discovered, just as before, that the root cause is a combination of Rework and performing high-cost optional non-conformant Activities.

3.2.11 Using Simulation Validate Business Case for Automation Candidate

The Simulation feature can make future predictions by simulating the ROI before implementing any process improvement initiative.

Earlier in this lab, in [Process Time and Cost Analysis Dashboard](#) section, we identified two Activities with an excessive average duration

- **Notify Client** (automated Activity) – 1h 29m average duration
- **Notification: Review Request Completed** (human Activity) – 1h 23m average duration
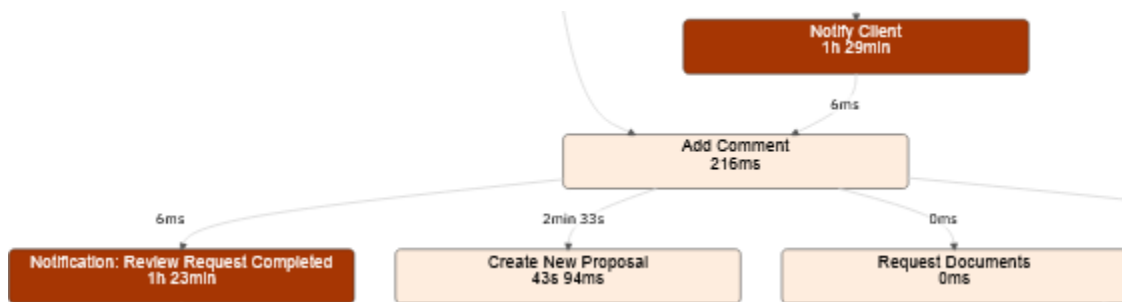

We will now use the Simulation capability to determine if providing more computing resources to the automated *Notify Client Activity* and automating the human-based *Notification: Review Request Complete*d Activity can help reduce the process cost and increase the throughput.

In [Self Looping Rework](#) section, we discovered the impact of self-looping of Verify RPA Exception Activity.
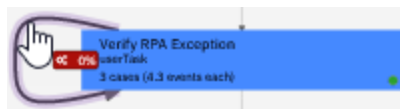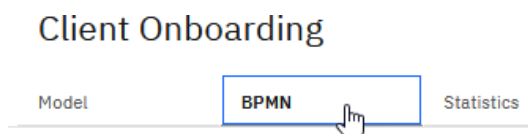

In the long run, we should be fixing the issue at the IT level. Strategically, however, we can immediately improve the performance of this Activity by adding more trained personnel to fix the failing robots.

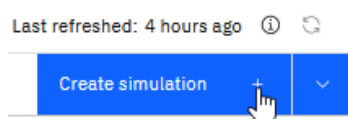### 3.2.11.1 Create New Simulation
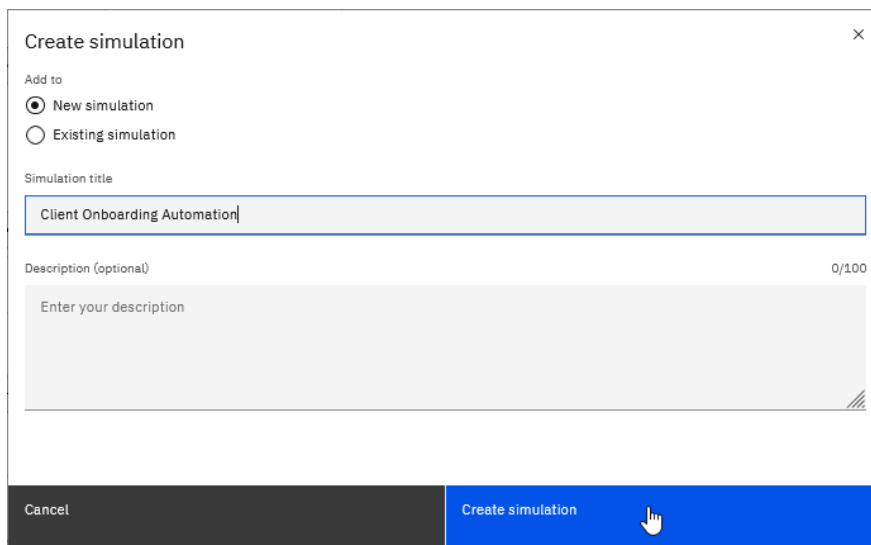
_1. Click **Process mining**
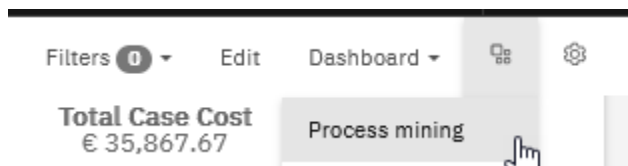
_2. Select **BPMN** tab

_3. Click **Create simulation +**

_4. For the *Simulation title* enter **Client Onboarding Automation** and then click **Create simulation**

3.2.11.2 Configure Simulation

3.2.11.2.1 Initialize Incorrectly Configured Automated Activities

The Service Time on many Automated Activities is less than 1 second (i.e., 340 ms). IBM Process Mining rounds down the Working Time to seconds. As a result, Service Time and Working Time in the activity simulation settings become 0, which is not permitted. We must set the Working Time value to 1 if it is set to 0.
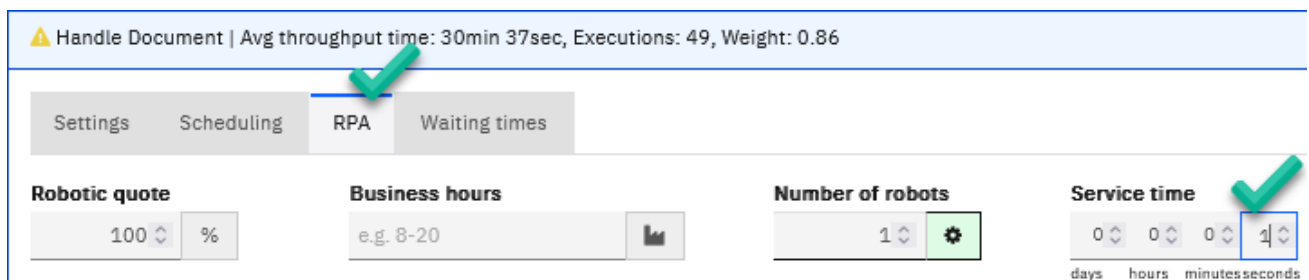
_1. Find **Handle Document** robot Activity

Hint use the search box to locate an Activity.

_2. Click the **RPA** tab and set *Service time* to **1**

_3. Repeat the above steps for the following Automated Activities:

- **Prepare Client Document**
- **Update Pending Docs**
- **Check Pending Documents**
- **Handle Request**
- **Check Bot Execution User**
- **map input data from case properties**

3.2.11.2.2 Add More Computing Resources for Notify Client Activity

Notify Client Activity is already automated but has a service time of 12 min 29 seconds. Because of this, we determined that it has become a bottleneck responsible for significant Case leas times. Let's significantly increase the computing resources available and work with IT to decrease the Activity's Service Time to 1 second.

_1. Locate **Notify Client** Activity

> ⚠ Notify Client | Avg throughput time: 12min 31sec, Executions: 57, Weight: 1

_2. Click the **RPA** tab and set

- *Number of robots* to **100**
- *Service time* to **1 second** (change it from 12 min to 29sec)

3.2.11.2.3 Automate Notification: Review Request Completed Activity

Notify Client Activity is already automated but has a service time of 12 min 29 seconds. Because of this, we determined that it has become a bottleneck responsible for significant Case leas times. Let's significantly increase the computing resources available to it!

_1. Locate **Notification: Review Request Completed** Activity

> ⚠ Notification: Review Request Completed | Avg throughput time: 45min, Executions: 57, Weight: 1

_2. Click the **RPA** tab and set:

- *Robotic quote* to **100** (this means the Activity is fully automated)
- *Number of robots* to **100**
- *Service time* to **1 second** (change it from 1 min to 1 sec)

3.2.11.2.4 Verify RPA Exception Activity

Tactically we create a dedicated team to handle bot exceptions and provide them with better training (this will reduce the Working Time) and increase the number of people in this dedicated team.

_1. Locate **Verify RPA Exception** Activity

_2. Click the **Settings** tab and set:

- *Staff availability* to **5**
- *Working time* to **22 minutes 54 seconds**

Verify RPA Exception | Avg throughput time: 22min 57sec, Executions: 22, Weight: 0.39

| Settings | Scheduling | RPA | Waiting times |

FTE
1.66

Staff availability
5 👤

Service time
0 ⌄ 0 ⌄ 22 ⌄ 54 ⌄
days   hours minutes seconds

Working time
0 ⌄ 0 ⌄ 22 ⌄ 54 ⌄
days   hours minutes seconds

3.2.11.2.5 Run Simulate

_1. Click **Run Simulation**

🅰 Run Simulation   🕤 Versions ▾

_2. Click **Yes** on the *Warning message box*

⚠ (!)

Are you sure?

Working Time not inserted for activities:
Update Backend Systems.

Please, insert the missing working time to evaluate queues
on your process.

No   Yes
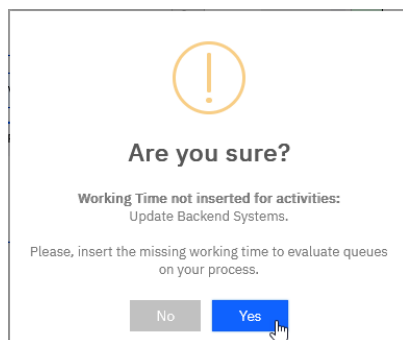
_3. Click **Yes** on the *Warning message box*

You may encounter the following issues

1. **Generic error message.**

Generic error

To fix this, go back to the section [Initialize Increctly Configured Automated Activities](#) and ensure that all robot Activities have a non-0 Service time to 1.

2. **A blank screen or flashing screen**

To fix this, in your web browser go back to the previous page by

and click Run Simulation again.

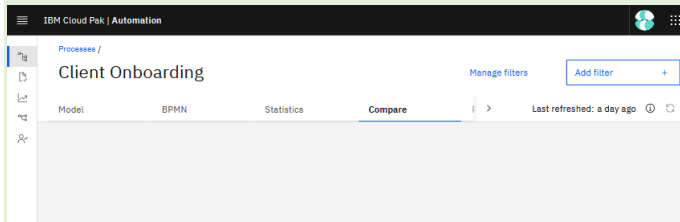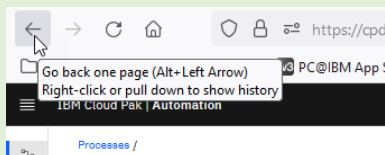### 3.2.11.2.6 Verify Simulation Results

_1. Examine the **Simulation Details** view.

There is a significant Case Cost decrease and an improvement in Case Lead Time. We can use this data to support a business case for process improvement investment.

Note that because of the random nature of simulations, you may see results not exactly as shown in the screenshot below. If you click the **Edit scenario** button, you can rerun the simulation and see slightly different results.
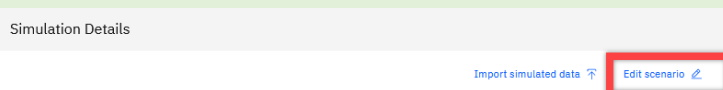
Simulation Details

Import simulated data ⌃   Edit scenario ✎

Simulation Details

	A	B
	As-is	To-be
Measure: Average ⌄		
Case count	57	57
Average case lead time	2hrs 42mins	2hrs 1min
Average case cost	EUR 629.26	EUR 207.74
Total case cost	EUR 35,867.67	EUR 11,841.44

The following are high-level optional steps that are not required to complete the lab.

Optionally, if you want to explore another process improvement change, follow these steps:

Use the **Activity Duration** and **Derived model** views to gain insights into potential process improvement changes. For example, replacing Humans with Automated Activities, decreasing Activity Service Time, or increasing the number of resources (people or robots).

Derived model	Activity Duration
Model: A and B ⌄ Displaying: Frequency ⌄	Displaying: Performance ⌄ By: Average ⌄

Once you have decided what changes you want to make, click **Edit scenario** to get back to the Simulation Setting view

Simulation Details

Import simulated data ⬆   Edit scenario ✎

Process Improvement Insight:
Through this lab, we discovered numerous process automation opportunities both at the IT and business levels. We then used the simulation feature to assess the impact of the proposed process improvements. We can use these results to calculate the ROI before implementing any process improvement initiative.
We discovered that by automating tasks, adding more people to perform tasks, or improving training, we could achieve significant process cost savings and process lead-time improvements.

3.3 Lab Summary

This lab demonstrated how IBM Process Mining leverages the Client Onboarding event data captured in BAI to identify automation and business improvement opportunities.

The primary objective was to introduce you to the rich feature and functions of IBM Process Mining through the experiential learning of identifying process improvement opportunities.

Thank you for completing this lab!