IBM Cloud Pak for Business Automation Demos and Labs

IBM Process Mining

Use Process Mining to Unleash Trapped Value in Procure-to-Pay Process

IBM Process Mining v1.14.0
Lab Version 1.2

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1 Introduction

1.1 About 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.

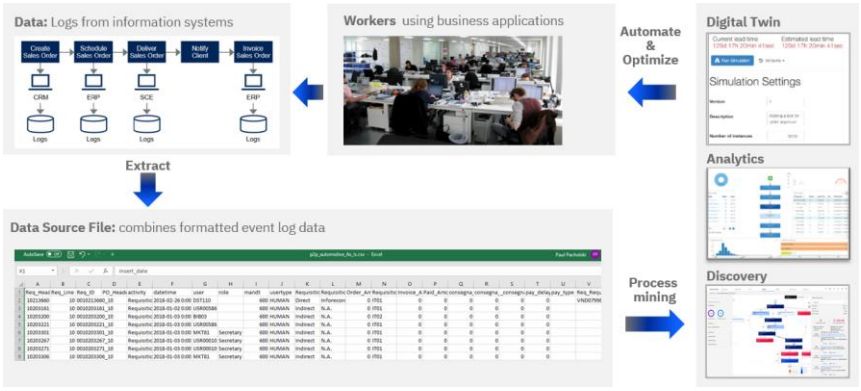


Figure 1. Process Mining

1.2 Lab Introduction

1.2.1 Procure to Pay (P2P) Process

In many private and public organizations, procurement processes have become recognized as "the most complex business function," a fundamental enabler for operational excellence, and the favorite target for achieving cost reduction (Ernst & Young, 2020).

1.2.2 Using IBM Process Mining to Improve P2P Process

This lab will show you how to use IBM Process Mining to tackle the five most critical procurement challenges: maverick buying, deviations, reworks, automation enablement, and cash discount losses (see the figure below).

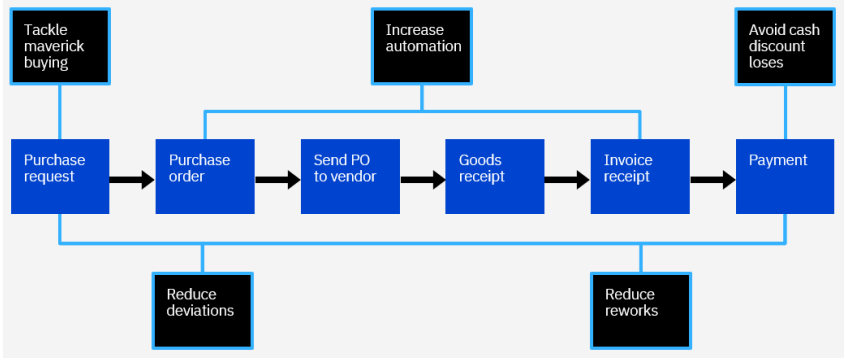


Figure 2. P2P Process Improvement and Automation Opportunities

For more information about the business background of the Procure to Pay use case used in the lab, see:

Procure to pay—overcome the 5 most critical challenges with IBM Process Mining and

AI-powered process discovery helps drive procure-to-pay optimization

1.2.3 Miti-level Process Mining

The P2P Process shown in the figure above is an excellent example of a complex process involving several sub-processes, like purchase requisition, purchase order, goods receipt, and invoice. With each sub-process having a different set of logs, getting a comprehensive view of the entire process is challenging.

Fortunately, IBM Process Mining provides multi-level process capability to analyze complex processes in a single comprehensive analysis.

With multi-level process mining, we don't need to split the process into different analyses because each entity's process parts are streamlined in a single view.

See **Appendix A. Process – Multi-level Process Mining** for more details.

2 Lab Setup

2.1 Provision Process Mining Environment

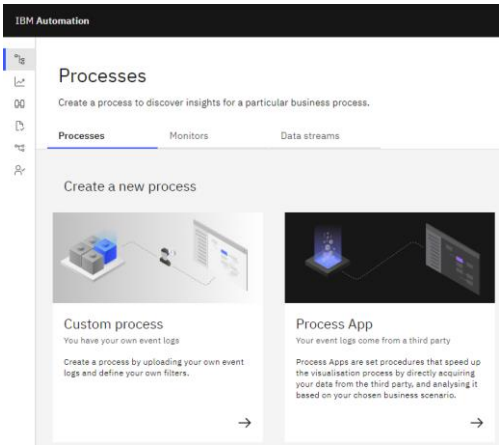
_1. Download this document and follow the instruction for reserving Tech Zone Environment.

_2. Follow the instructions in "**3 Start IBM Process Mining Web Application"** to start the Process Mining Web application.

2.2 Open IBM Process Mining Application

_3. Start your browser using one of the access methods described in this document: Tech Zone Console; Web Browser URL, **Remote Desktop (recommended).**

You should now see the IBM Process Mining web UI.

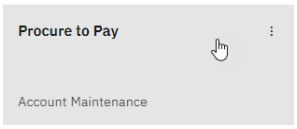


3 Lab Instructions

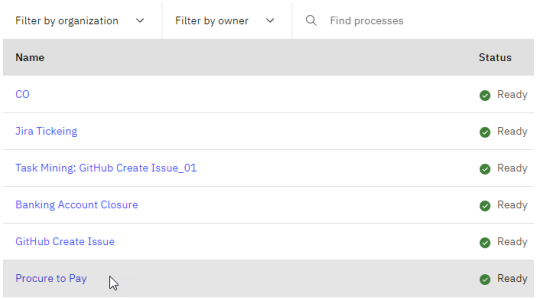
3.1 Open Procure to Pay Process (P2P)

The P2P (Procure to Pay) Process has been imported (from a CSV file) for you.

_1. Click in **Procure to Pay** tile.



Note: if you do not see the **Procure to Pay** tile, use the All processes list to locate the **Procure to Pay** processes



This action will open a mined P2P process.

Note that the event log file has already been loaded, and all the process mining settings and configurations were already done for you. We are ready to explore the P2P Process to gain valuable business insights!

3.2 Gain General Process Improvement Insights from the Model View

This lab part will focus on gaining general process insights such as performance or execution paths. Later on in this lab, we will concentrate on business-specific insights.

3.2.1 The Model View

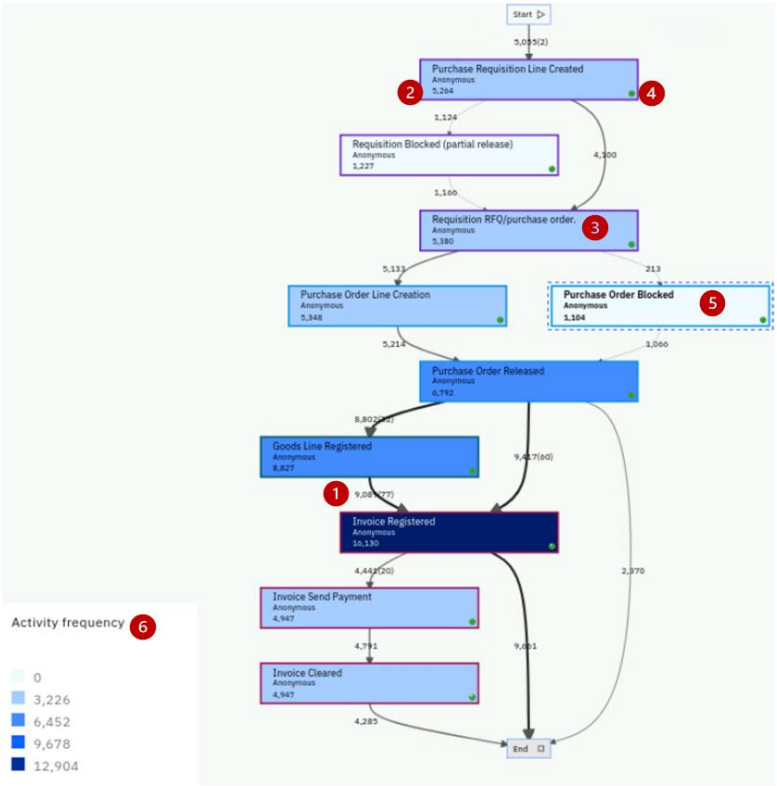
The model view depicts your Process, highlighting the most frequent activities, paths taken, and the "real" Process versus the expected Process. A picture is worth 100 words!

3.2.1.1 Frequency View

You should now see in the default Model View - the Frequency view.

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

In the Frequency View, the dark blue highlights the most frequent activities, while the bold arrows highlight the most frequent transitions. In this way, we can identify the most frequent paths between activities of the Process.



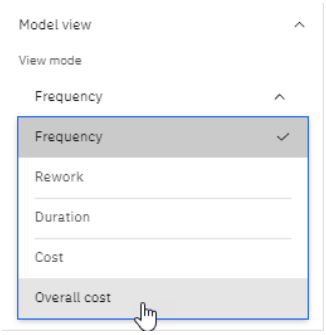
1. The numbers next to the lines show how often followed that specific process flow. The "()" on the transition links (marked by red squares) indicates parallelism. A number in parenthesis represents the number of events of the same Case which was executed in parallel on multiple activities.

   To learn about Process Parallelism in IBM Process Mining, read this article by Patrick Megard.

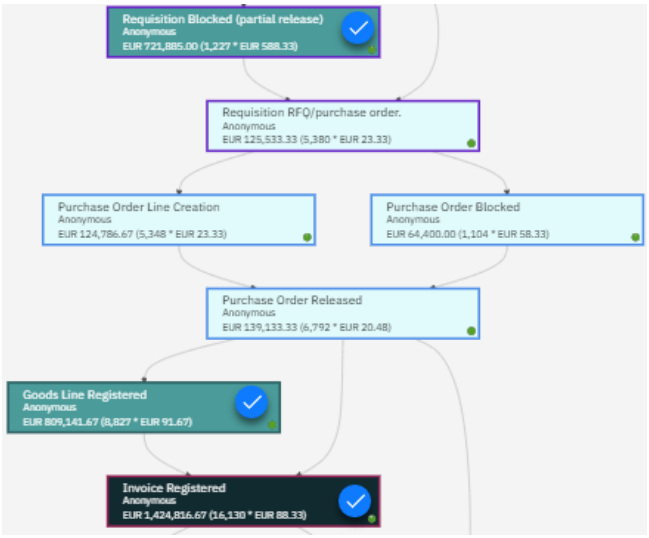
2. The numbers within the rectangles show the number of times that the Activity is performed
3. The description includes the name of the Activity and the roles by which the Activity is carried out. They could be more than one role (multiple roles followed by dots are displayed).
4. A full green circle at the bottom right corner of the activity rectangle indicates the Model coverage is 100%, meaning all the possible connections you are currently visualizing. The level of relations is adjustable.
5. The color saturation of Activity reflects how often an activity was invoked (the frequency).
6. The legend explains the frequency coloring.

3.2.1.2 Overall Cost View

_1. For the *View mode* dropdown, select **Overall cost.**



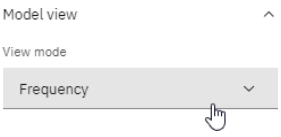
_2. Let's focus on the Activities with the highest overall cost!



- As indicated in the Legend in the bot lefty corner, the darker the color, the highest the overall activity cost has the darkest shade.
- The overall activity cost is calculated by multiplying the activity cost by the frequency.

Later in this lab, we will learn how to reduce the cost or frequency of the above high overall cost activities!

_3. For the *View mode* dropdown, select **Frequency.**

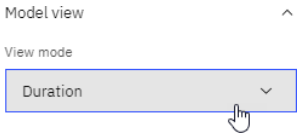


3.2.1.3 Process Performance Bottlenecks

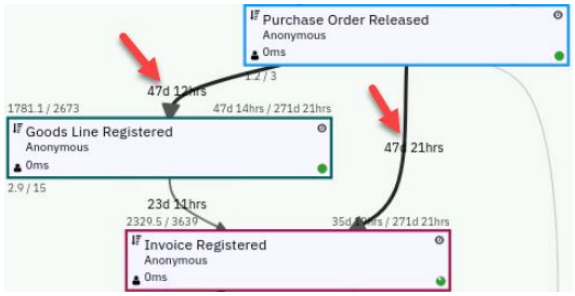
You can use the Duration View to determine which activities and tasks create critical bottlenecks (i.e., take a long time to complete) and whose automation can lead to the most significant overall process time improvements.

Let's find bottlenecks in our P2P Process!

_1. Change the View from Frequency to **Duration**



Note the three **bold transition connections.**



Since we are looking for process bottlenecks, we should consider the activities with the "thickest" transition arrows, which indicate the most extended wait times.

The arrows connecting the activities include Wait Time values. Note that the longer the waiting time, the thicker the line. For example, the longest wait time is associated with completing the *Purchase Order Release* activity: 47d 12hrs to start the *Invoice Registered* Activity and 47d 21hrs Activity.

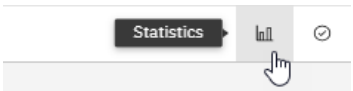
The wait times between the activities shown above are significant and can be considered process bottlenecks worthy of further investigation. One possible cause of the excessive wait time could be the lack of sufficient human resources to start working on the *Purch Order Released* Activity.

_2. Change the View back to **Frequency.**

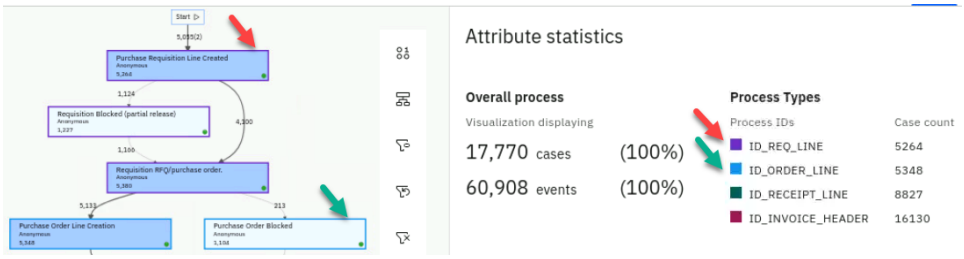
3.2.2 Statistics View

Traditional process mining techniques analyze multi-level processes separately. Unique to IBM Process Mining, multi-level process mining provides a holistic view of the entire P2P Process, allowing one to discover and correlate all process types and their dependencies in a single tool. Often the bottleneck is between systems and process types.

_1. Select **Statistics** view (from the top right corner).



_2. Examine the *Process Types* legend.



3.2.3 The colors of the Activity borders reflect the multi-level nature of the Process. For example, the first Activity belongs to the Goods Receipt process, and the second one to the Invoice Process. Each Activity represents potentially several SAP transactions!Process Paths (Case Variants)

Often, business processes have multiple paths (e.g., happy path, exception cases, etc.) IBM Process Mining can visualize them individually or together.

_1. Click the **Variants icon** in the top right corner.

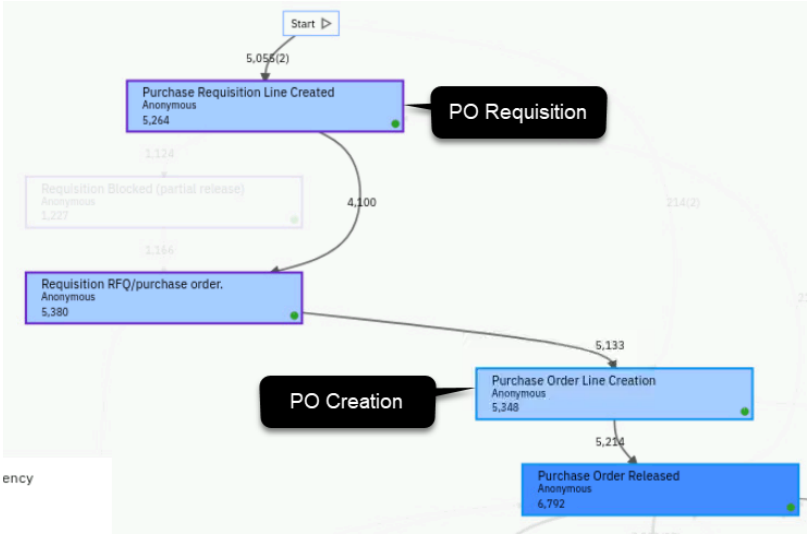
_2. Scroll down to locate the *1.24% (220)* variant**,** and click the **checkbox**.

_3. Note that the Model now shows only the selected process variant (process path).

In this Variant, we see that purchase order requisition (*Purchase Requisition Line Created*) is followed by purchase order creation (*Purchase Order Line Creation*)!

Commented [MS1]: This seems incorrect, the case was picked wrong - the situation where POLC is after PRLC seems correct and not Maverick Buying.

It should be the other way round, POLC before PRLC is Maverick Buying, as per screenshot on page 14.



This is one of the unacceptable business practices (Requisition without Purchase order) and is referred to, among other violations, as Maverick Buying. We will investigate this further later in this lab.

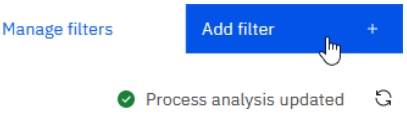
_4. Use the **check box** to **un-select** the Variant.

_5. Click the **Variants icon** to close the Variants View.

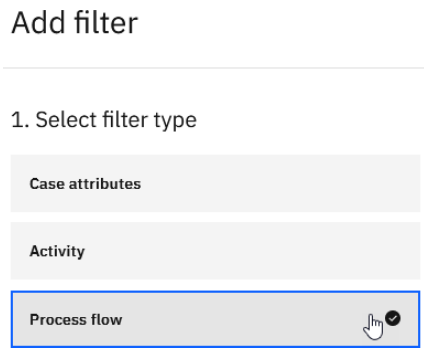
3.2.4 Filters

Let's create a filter to identify cases that include the "Requisition without Purchase Order" type of "Maverick Buying."

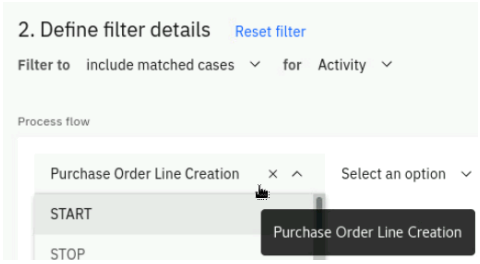
_1. Click the **Add filter** button.



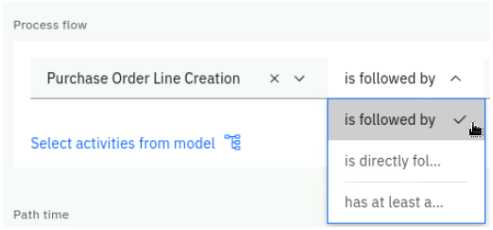
_2. Select **Process flow**.



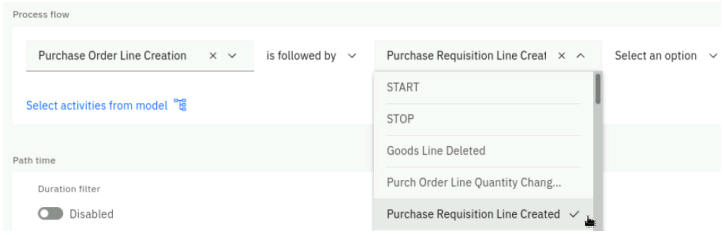
_3. From the *Select activity* dropdown, select **Purchase Order Line Creation.**



_4. From the *Select an option*, select **is followed by**

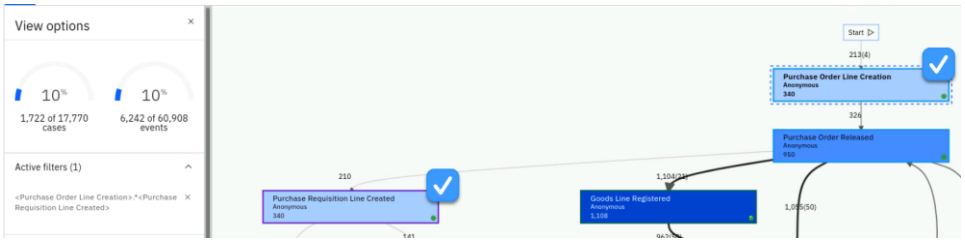


_5. From the *Select activity* dropdown, select **Purchase RequisitionLine Created.**



_6. Click **Add filter**

_7. Note that 10% of the cases involve this type of "Maverick Buying"!



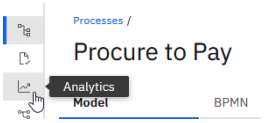
_8. From the *Active filters (1)* dropdown, click **X** to remove the filter.

3.3 Process Performance Analysis

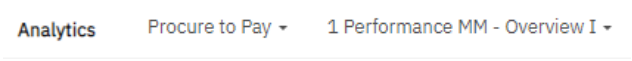
We will use IBM Process Mining Analytics capabilities in this part of the lab. Specifically, we will use a custom-built Dashbaord to understand performance bottlenecks in two key P2P process phases; **Purchase Requisition to PO Creation** and **PO Creation to PO Released.**

What are Analytics Dashboards? For each IBM Process Mining process, one or more Analytics dashboards can be created. Dashboards are composed of individual charts used to explore, represent, and filter process data.

_1. Click the **Analytics** icon located in the top left corner.



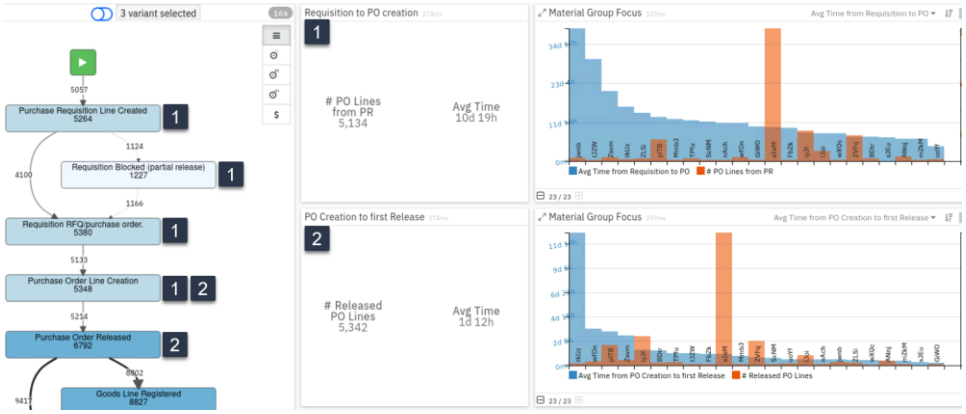
_2. Note the 1 Performance MM – Overview opens automatically.



_3. Let's examine this Dashboard.

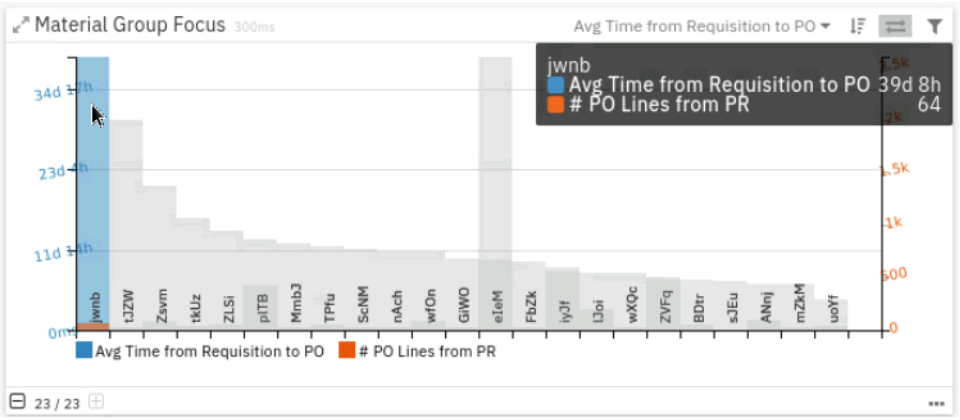
The Dashboard analyses the average time of two critical process paths focused on Material Groups, Purchasing Groups, and Vendors:

1. **Purchase Requisition to PO Creation** path (Purchase Requisition Line Created Activity to *Purchase Order Line Creation* Activity
2. **PO Creation to PO Released** path (*Purchase order Line Creation* Activity to *Purchase Order Release* Activity)



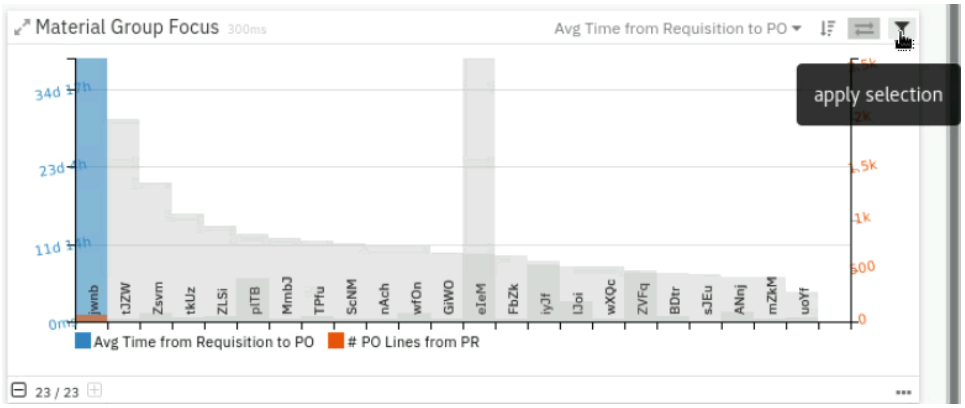
Note that, on average, the "Requisition to PO Creation" path takes 10d 19h. Let's analyze this path since it has the highest average time!

_4. Click on the **first column** in the *Material Group Focus* (for Requisition to PO Creation – the first chart

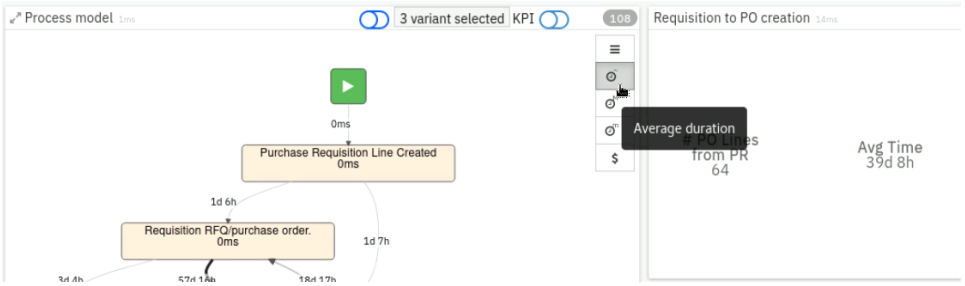


Each column in this chart represents a Material Group. Note that Material Group **jwnb** has the lowest performance (longest lead time from Requisition to PO Creation).

_**5.** Click the **Filter icon** to apply this *Dashboard Filter* to all charts in the Dashboard.



_**6.** In the *Process model* view, click **Average duration.**



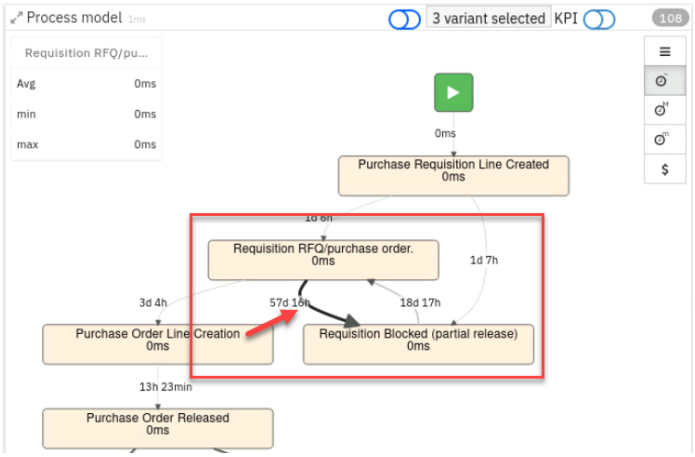
_7. Let's now see the actionable insight we can glean from the Performance MM dashboard!

1. The average time for this Material Group is higher: 39d 8h

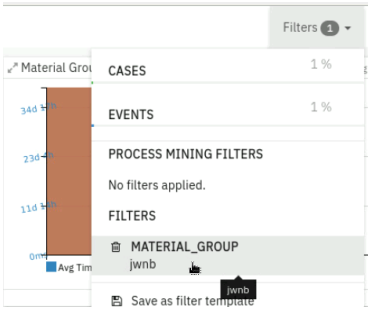
2. Only the entries for Material Group "jwnb" are in the table.

You can then identify inefficient vendors, plants, companies, or purchasing groups and talk with the related stakeholders to understand how to improve the performance.

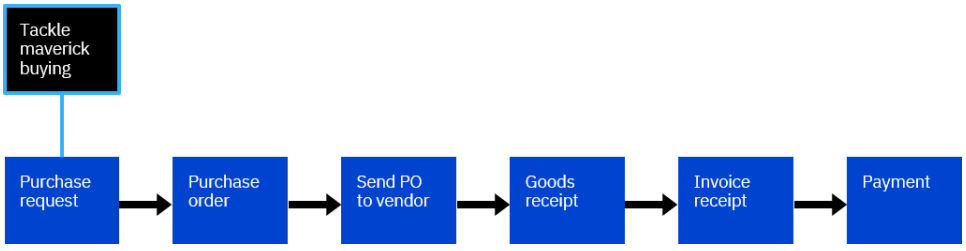
3. In some cases, the key contributor to poor process performance is a rework loop with a high average Activity transition - for example 57d 16h!



_8. Remove the MATERIAL_GROUP jwnb filter



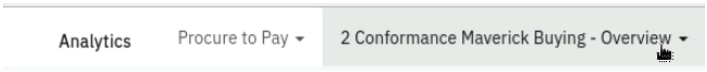
3.4 Tackle Maverick Buying



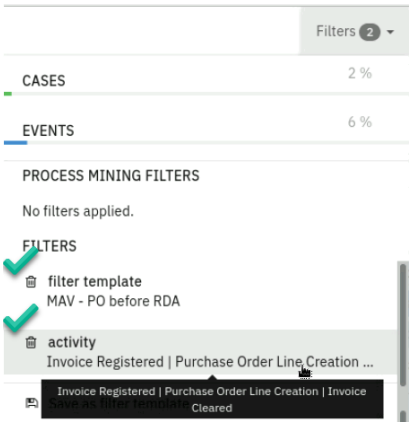
Maverick buying is defined as buying from suppliers without following the company's pre-established procurement policy. Purchasing goods or services out of contract or from non-preferred suppliers means that your company doesn't benefit from the preferred supplier discounts that you worked hard to negotiate.

Let's examine prebuilt dashboards designed to tackle the Maverick Buying problem.

_1. Select **2 Conformance Maverick Buying - Overview** dashboard.



_2. Click **Filters 2**



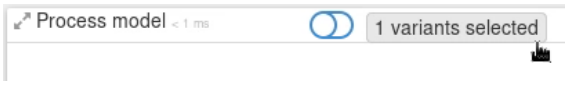
Note that this Dashboard includes two filers:

1. *MAV – PO before RDA* filter - Recall that this is the filter you created in **Filters section in this lab**. This filter identifies cases that include the "Requisition without Purchase Order" type of "Maverick Buying."
2. *Invoice Registered | Purchase Order Line Creation ...* - This is an *activity* filer. We use it to ensure we only see cases with the three critical activities involved in Maverick Buying (Invoice Registred, Purchase Order Line Creation, and Invoice Cleared).

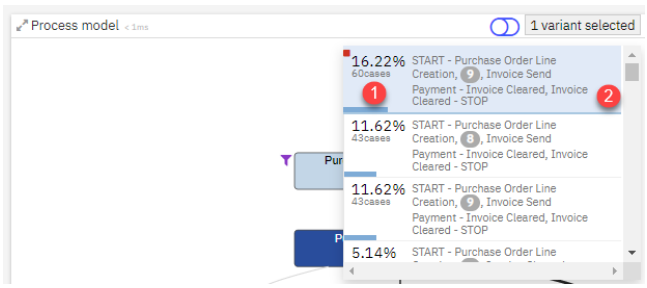
3.4.1 Maverick Buying Variants

This chart shows all the variants of the cases with the Maverick Buying problem.

_1. Click **1 variants selected**.

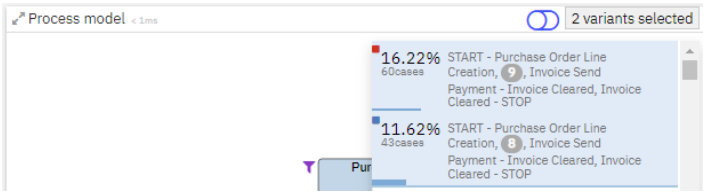


You should now see other variants and see (1) the frequency and (2) the path for each Variant.

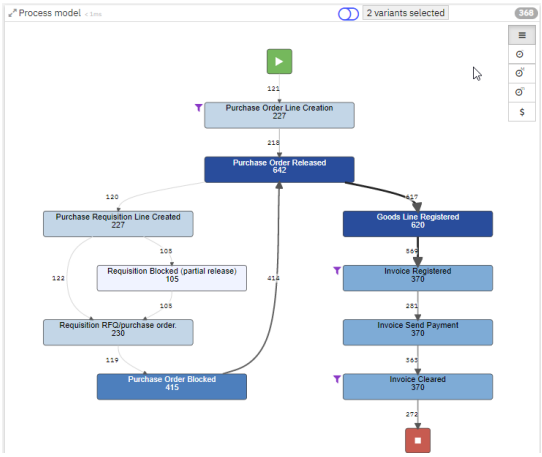


_2. Use the **Ctrl** key to multiply select the first 2 variants

If you are using Mac, use the **Cmd** key instead



You should now see a more complex Process model view. The "expand icon" (top left corner) can maximize the Process model view.



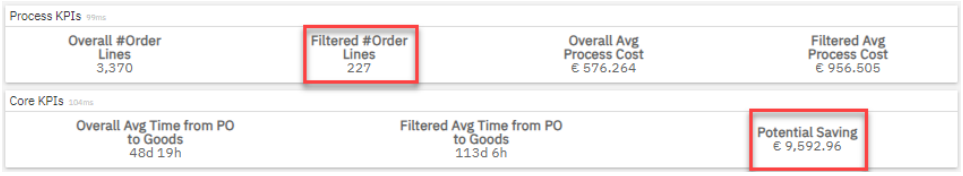
3.4.2 Impact of Maverick Buying on the Process KPIs

As mentioned before, not following the recommended Process (i.e., Maverick Buying) results in a loss of the vendor discount.

_1. Examine the *Process KPIs* and *Core KPIs* widgets.

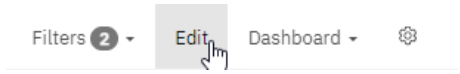
The organization could have saved EUR 9,592.96 across 277 orders in this example.

Commented [MS2]: For me this shows a completely different number. That's because Potential Saving (see next page) is calculated as sum(order_line_amount)*0.4*0.05 - only after removing the x0.05 I get this number shown here.

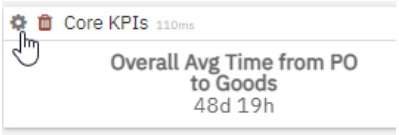


Let's examine how the costs savings were calculated

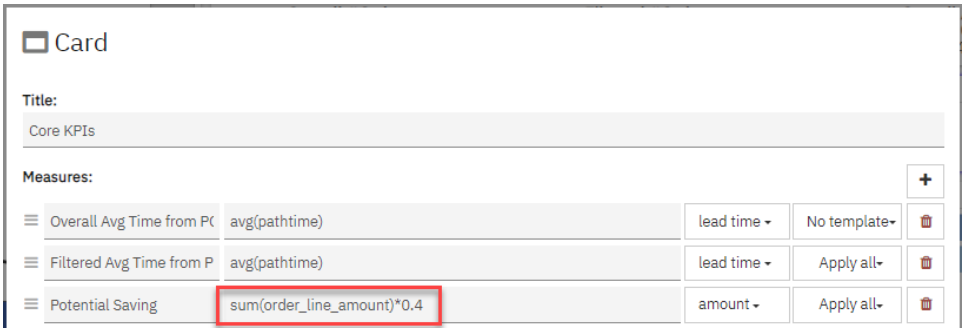
_2. Click **Edit**



_3. Click the **gear icon** to edit the Chart and use your discount amounts.

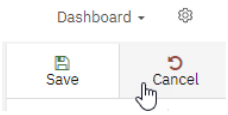


_4. Note that the missed discount calculation is in the Expected Savings measure. The "Expect Saving" is calculated as the missed discounts.



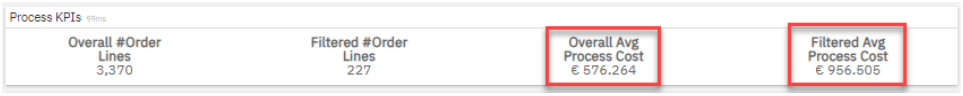
_5. On the *Card* widget, click **Cancel.**

_6. Click **Cancel** to stop editing the Dashboard.



_7. Examine the *Process KPI*s widgets.

The *Filtered Average Process Cost* represents the Case cost of Cases subject to Maverick Buying is significantly higher than the overall average case cost (no Maverick Buying filter applied).



Now that we understand the impact of Maverick buying, we will next identify the responsible parties.

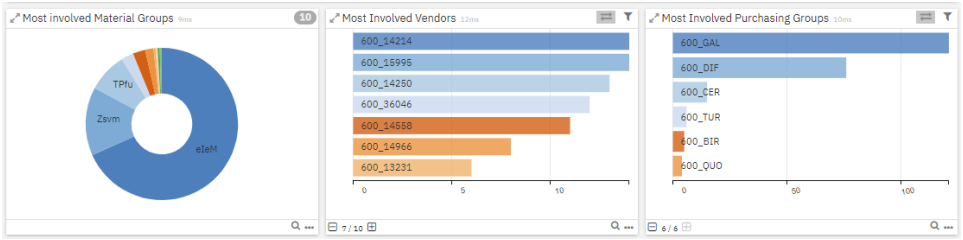
3.4.3 Identify the Maverick Buying Actors

We can then identify the most involved dimensions (materials, vendors, groups, etc.)

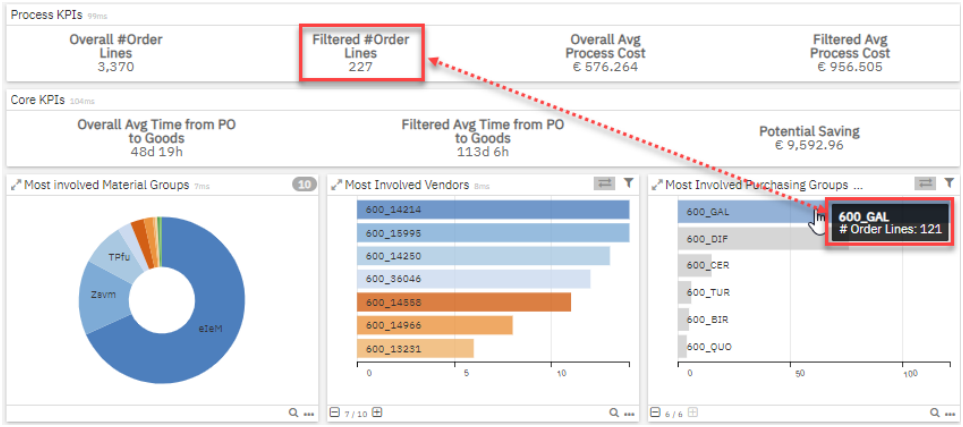
Once we know he actores responsible for Maverick Buying, we can introduce process improvement actions to avoid the Maverick behaviors from happening. For example, we can:

- Put in place policies to avoid maverick behaviors, focusing on the most involved companies and plants.
- Implement automation, controls, and blocks to avoid maverick behaviors.

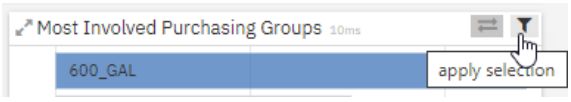
_1. Note the three dashboards showing the actors involved in Maverick buying: Material Groups ordered, Vendndors from which the materials were ordered, and the Purchasing Groups involved



_2. In the *Most Involved Purchasing Groups* widget, Click **600_GAL**. This is the most involved Purchasing Group. It participated in 121 of 227 Maverick orders!



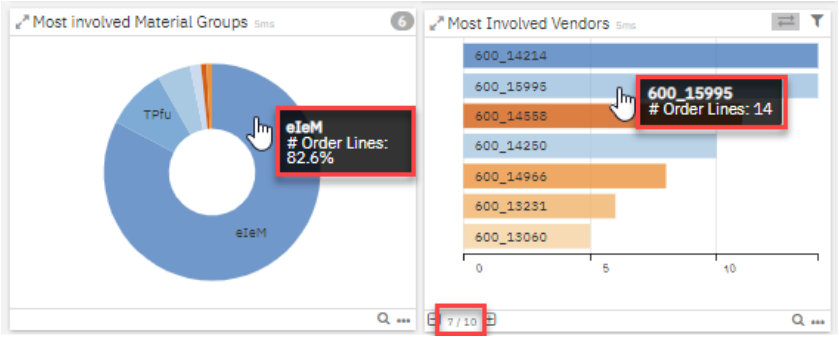
_3. Click the **apply selection** icon



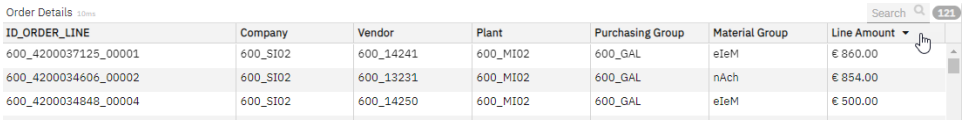
_4. Note that we now see that the most involved in Maverick buying done by the **600_GAP** Purchasing group.

The material involved in Maverick buying most often is "eIeM".

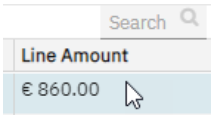
Out of the 10 vendors involved, the top two are 600_14214 and 600_15995.



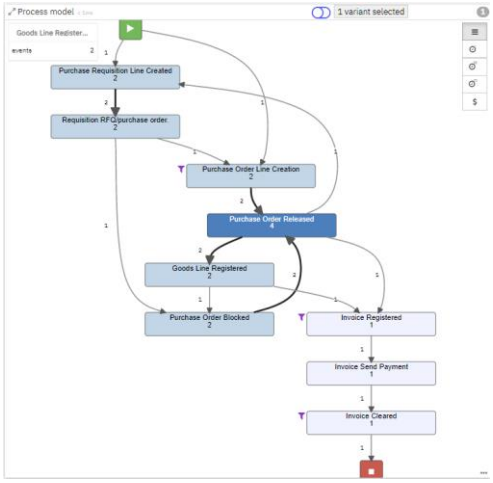
_5. In the *Order Details* widget (where you see all the 121 cases) click the **Line Amount** column title twice to sort it in descending order.



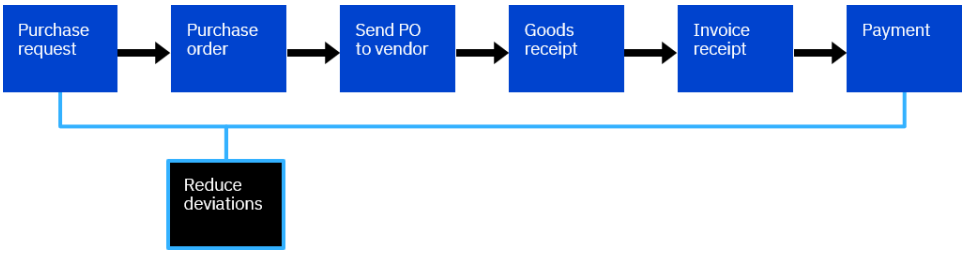
_6. Click the order with the amount of EUR **860.00**



_7. You can now examine the order details provided by other charts, including the process steps.



3.5 Reduce Deviations



Now let's examine our Process for deviations where our preferred path isn't being followed.

IBM Process Mining can locate and analyze deviations and provide insights into the root causes of deviations, such as the cost of extra resources and process delays.

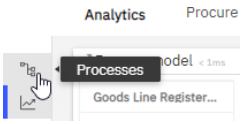
Process deviations are discovered by comparing the Model discovered from process mining data with a reference model from Blueworks live or other BPM modeling tools.

A frequently recurring deviation could be the result of the department preferring the services of one particular specialized vendor, but it could also indicate a lack of governance. A thorough deviation analysis will clarify the behaviors of the department or entity involved and identify any reworks that may occur during the purchasing process.

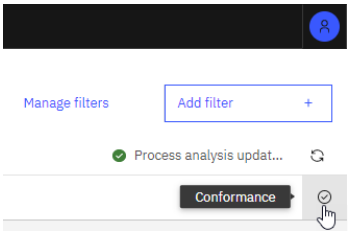
3.5.1 General Insights

First, let's examine the cost of non-conformance and how pervasive the non-conformance is in the P2P Process.

_1. Click the **Processes** icon located in the top left corner.

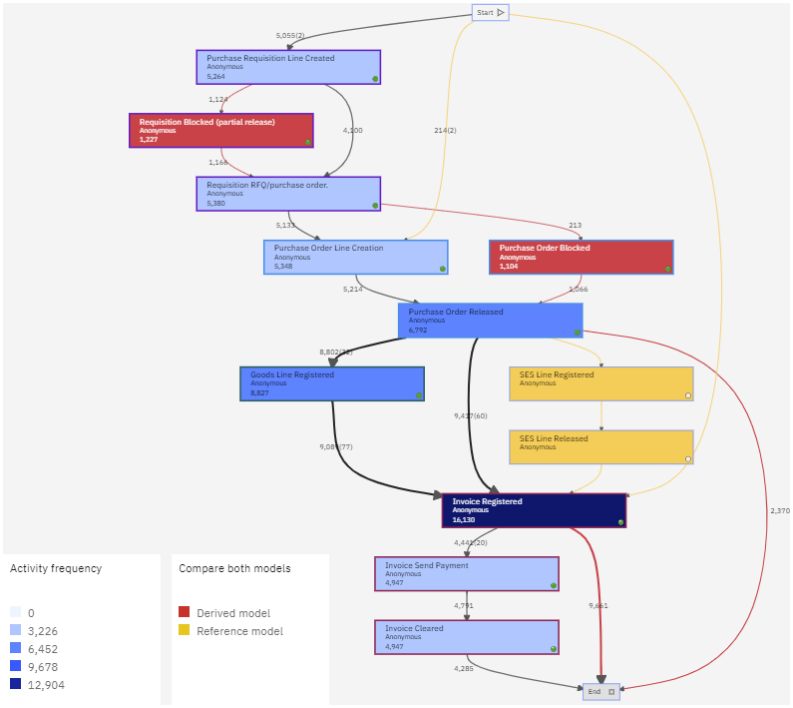


_2. Click the **Conformance**

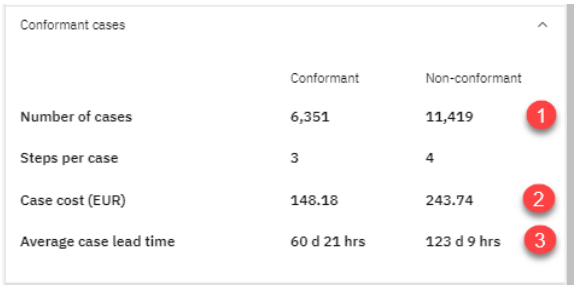


_3. It is easy to identify how pervasive the non-conformance in the P2P Process is:

- **RED** box or arrow in the process model indicates that the Activity or transition is present **only for the data-derived model**.
- **YELLOW** box or arrow in the process model indicates that the Activity or transition is present **only in the reference model**.



_4. Let's look at the Model conformance summary view to see the negative impact of the P2P process non-conformance on business.

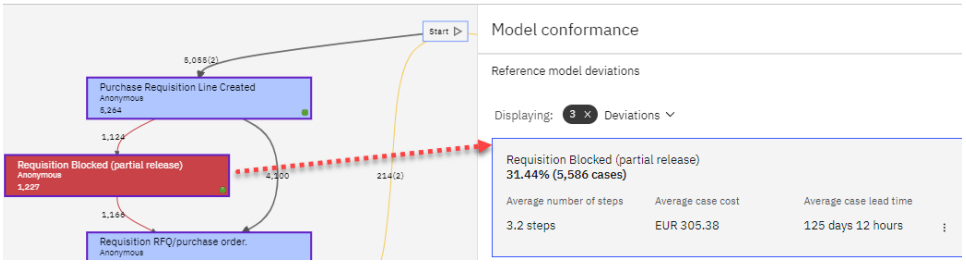


1. 11,419 Cases of 17,770 cases did not conform to the reference model
2. The average cost of a non-conformant Process is about EUR 95 (243-148) per Case.
3. Non-conformant processes' average lead time (Lead Time is the time between process initiation and completion) is about 60 days longer.

3.5.2 Root Cause Analysis

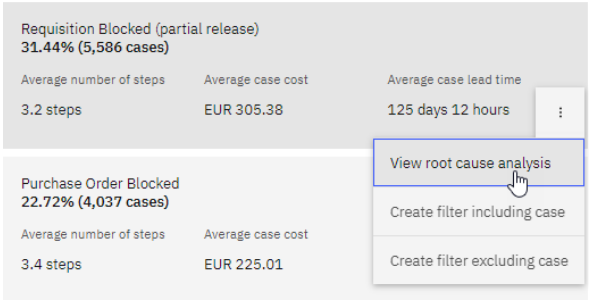
Once we identify non-conformant activities or transitions, we can use the Root Cause Analysis feature to obtain information derived from the custom fields in the dataset. For example, we can determine if a non-conformance involves a particular resource, role, supplier, product, company, etc.

_1_. Note that the non-conformant *Requisition Blocked (partial release)* Activity is invoked in 5,586 cases (31.44%).



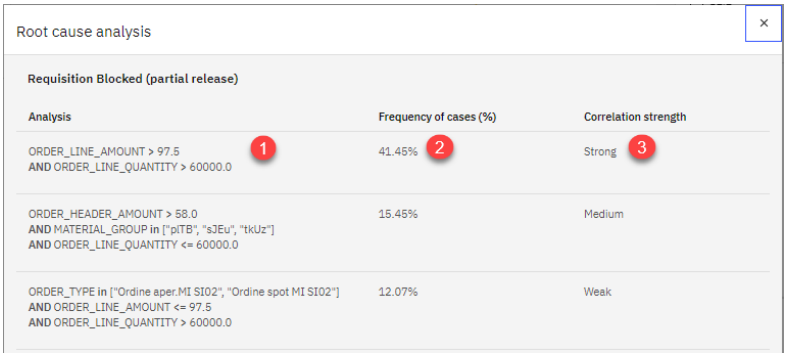
Let's examine the root causes of this non-conformant Activity!

_2. In the *Requisition Blocked (partial release)* click **vertical ellipses** and then select **View root cause analysis**



_3. Let's examine *Root-cause analysis* window

The root-cause analysis uses ML techniques to determine what custom data fields included in P2P Process dataset can explain a deviation.



It seems like this deviation depends mostly (41.45%) on the order amount and quantity, not on any particular vendor or purchasing group!

Let's examine the three columns of the strongest correlation.

1. **Analysis.** The Activity is involved when the order amount exceeds EUR 97.5, and the quantity exceeds 60000.
2. **Frequency of cases (%).** The Activity is involved in 41.45% of Cases**.**
3. **Correlation strength.** The above analysis is strongly correlated

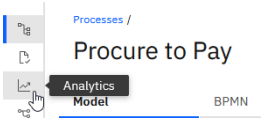
Note that the strength of the correlation is reduced for the following cases: (i) Lack of precision: Instances where the root-cause condition matches and the deviation does not occur; (ii) Lack of coverage: Instances where the root-cause condition does not match and the deviation occurs.

_4. Click **X** to close the *Root cause analysis* window.

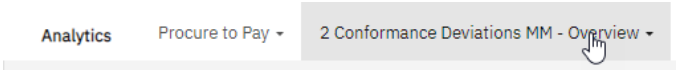
3.5.3 Cost of Deviations

We will examine a prebuilt dashboard designed to tackle the Cost of Deviations.

_1. Click the **Analytics** icon located in the top left corner.



_2. Select **2 Conformance Deviations MM - Overview** dashboard.

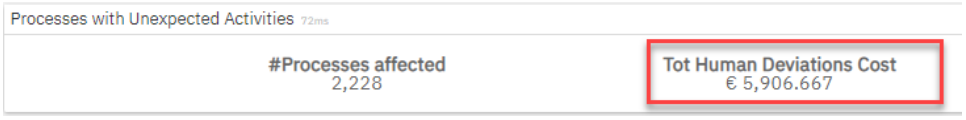


Let's examine the charts in the Deviation Cost Monitoring dashboard

3.5.3.1 Expected Savings

The *Processes with Unexpected Activities* chart shows the expected savings that can be achieved if the deviations were to be eliminated. Specifically, it is the cost of performing all the unexpected activities (not found in the reference model). You saw these activities in the Conformace view marked in red.

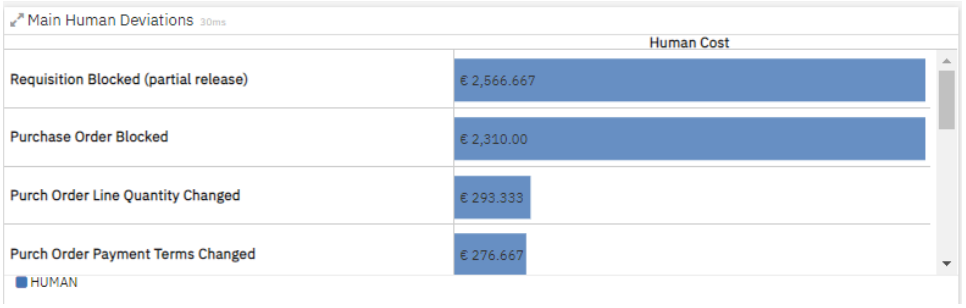
The total cost (hence savings) of execi=tuing non-conformant Activities is EUR 5,906.667



3.5.3.2 Deviations

The *Main Human Deviation* chart shows the activities identified as deviations from the reference model, including frequency and incurred costs.

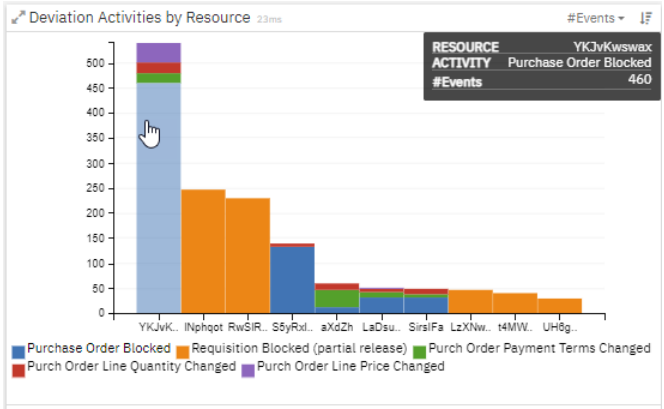
The *Requisition Blocked (partial release)* and *Purchase Order Blocked* activities are the most frequent and costly.



3.5.3.3 Identifying Sources of Deviations

The first step to eliminate the deviations would be to investigate why the users felt it necessary not to follow the process paths defined by the reference model. This Dashboard allows you to identify what resources were involved in the deviations.

_1. Hover over the **first blue column** on the *Deviations Activity by Resource* chart.

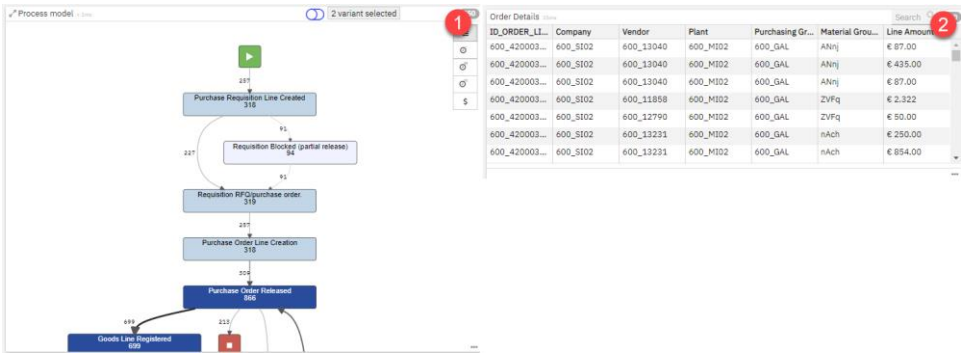


_2. Note that Resouce the pop-up, you can identify the RESOURCE responsible for invoking Purchase Order Blocked ACTIVITY in 460 Cases (#Events).

RESOURCE	YKJvKwswax
ACTIVITY	Purchase Order Blocked
#Events	460

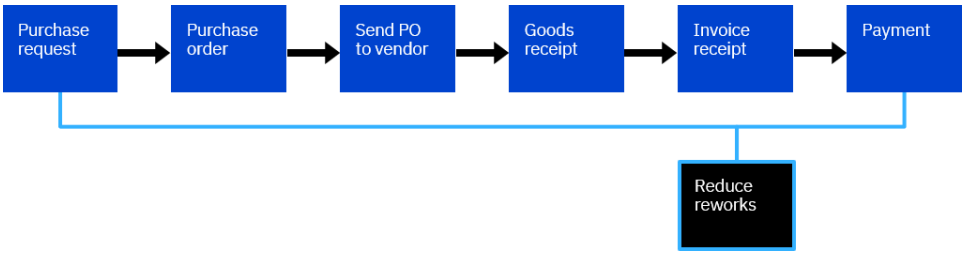
_3. Click the **first Blue column** to apply a Filter that includes only the Cases for the above RESOURCE and ACTIVITY.

_4. Note that we now use the Process model charts (showing variants) and the Order Details charts (showing order data for each Case) to investigate the use of Purchase Order Blocked Activity.



1. The Process mode chart shows the Variants that involved the RESOURCE involving the Purchase Order Blocked ACTIVITY.
2. The order Details chart shows the order details for each Case involved in Purchase Order Blocked Activity. We can use it to see if there are any patterns, such as the same Vendor, Plan, or Purchasing Group.

3.6 Reduce Reworks



Activities repeated more than once in the same process instance are defined as Rework.

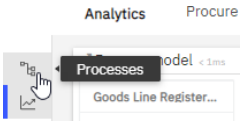
Reworks are often present when not enough of the P2P process is automated and manual activities are either not carried out correctly the first time or information necessary to complete a case is missing. Activities with Rework typically reveal errors when filling-out forms and can become candidates for automation such as RPA.

IBM Process Mining automatically discovers two kinds of Rework:

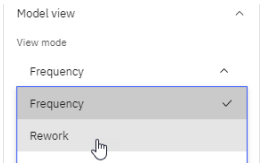
1. **Activity repeated in the same Case**.
2. **Self-loop**. The Activity is immediately repeated without other Activities in between. Self-loops are indicated in the Model by an arrow that goes out and falls into the same Activity.

3.6.1 Activity Repeated in the Same Case

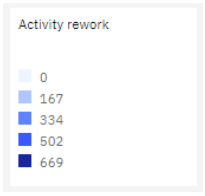
_1. Click the **Processes** icon located in the top left corner.



_2. From the *View mode*, select **Rework** to change from Frequency to Rework view



_3. Note, Activities with Rework are marked according to the legend. The darker the activity color, the more time a rework occurred in the same process instance.

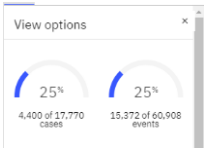


_4. Let's examine the Activity with the highest rework ratio in **Purchase Order Released** Activity.

- 836 Cases included Rework
- On average, the Activity is repeated during each Case 2.7 times.
- This Activity has 21% automation. If we discover that the Rework is due to human errors, it may be a good candidate for 100% automation!

_5. Select the **Purchase Order Released** Activity and then click **Include cases with reworks on this Activity.**

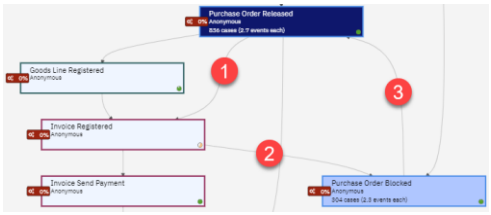
_6. Note that we see only 4.400 cases (25%). These Cases include the Rework of Purchase Order Release Activity.



_7. Note that there are two insights we can gain from this view:

1. Transitions from the Purchase Order Blocked Activity cause the rework loop

2. We can see and investigate a possible sequence of activities causing this rework loop.

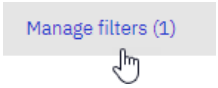


3.6.2 Self-loop

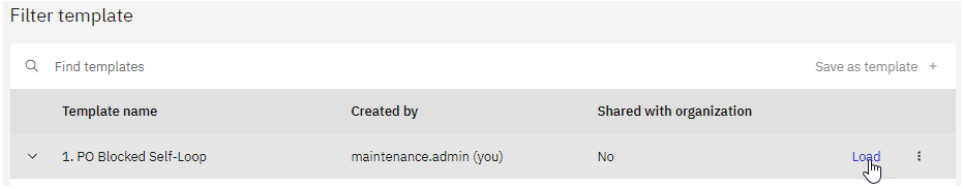
We have created a filter for you to investigate if there are any self-loops on the Purchase Order Release Activity. We will use this filer to analyze self-loop Cases.

_1. Click **Manage filters (1)**

Commented [MS3]: Can't see this filter. I re-created it - Increase model detail to 100%, find the self loop, click it, set filter, and reduce detail. But the pre-made filter the doc claims exists - doesn't.



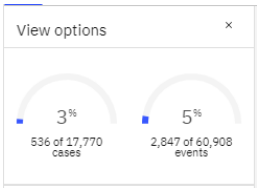
_2. On the *Manage filers* window, click **Load** on the *1. PO Blocked Self-Loop* filter.



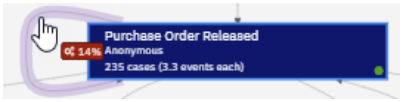
_3. Click **Continue**

_4. Click **Close**

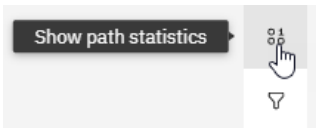
_5. Note that 3% or 536 Cases include this self-loop



_6. Click the **self-loop** on the *Purchase Order Released* Activity.



_7. Click **Show path statistics.**

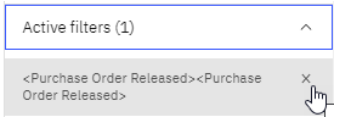


_8. The Path statistics view shows you case details, including the loop count. To see the Case with the highest loop count, click the **Count** column header to sort in descending order.

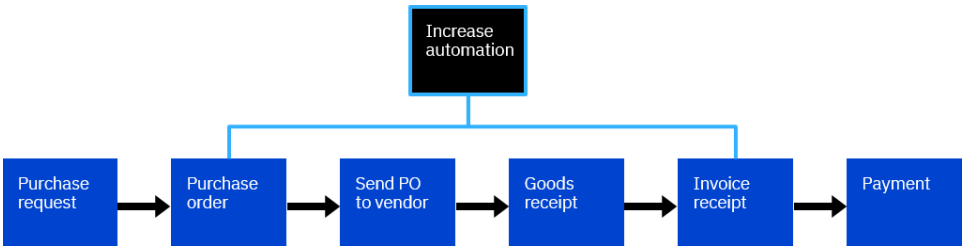
You can now see that one of the Cases had 34 self-loops!

_9. Click **X** to close *Path statistics.*

_10. Click **X** to remove the *<Purchase Order Released><Purchase Order Released>* filter



3.7 Increase Automation



IBM Process Mining helps you quickly identify business process areas that would benefit most from automation.

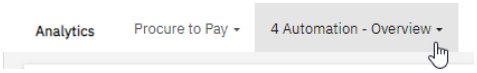
In this part of the lab, you will explore two IBM Process Mining capabilities:

- **Ability to identify automation candidates.** First, we will identify the most impactful automation opportunities for the Process KPI, such as Cost or Lead Time reduction.
- **Simulation**. Once the candidates for automation are identified, we will use **the what-if simulation capabilities** to understand the impact of the automation by comparing the simulation data to the original data captured from the logs. This will enable process owners to determine the ROI before implementing any process improvement initiative, such as Robotic Process Automation.

3.7.1 Identify Automation Candidates

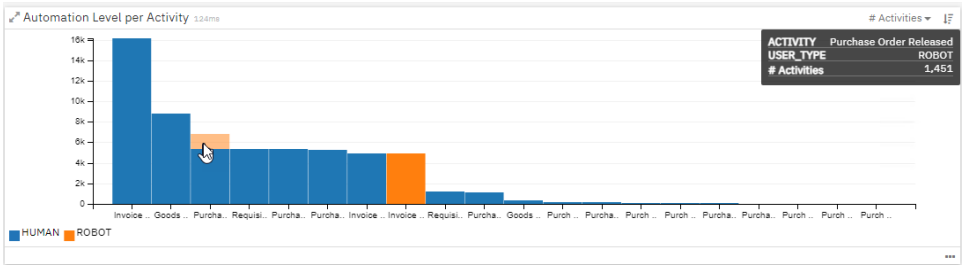
_1. Click the **Analytics** icon located in the top left corner.

_2. Select **4 Automation - Overview** Dashboard.



_3. In the *Automation Level per Activity* chart, position the mouse on the orange part of the **Purchase Order Release** Activity.

Commented [MS4]: Nope, can't do - this chart doesn't exist in the 4 Automation - Overview dashboard

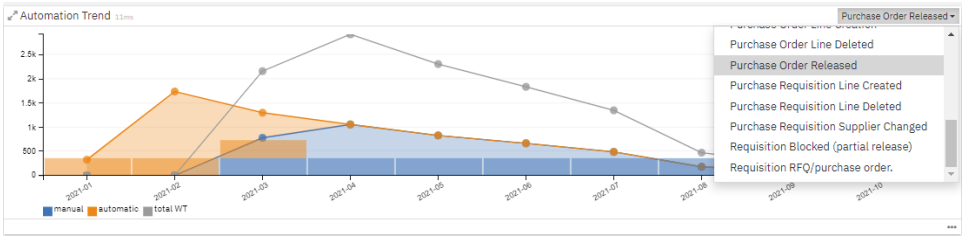


Note that this Activity was partially automated (1141 Cases). Also, note that the completely orange Invoice Send Payment was 100% automated.

Automation means that an RPA bot or some other automation completes an activity. You see partial automation because not all activities may be completed by robots.

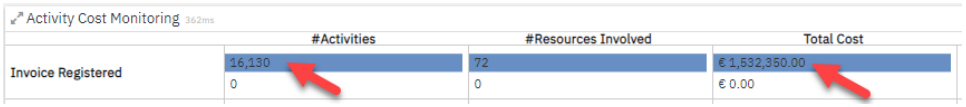
_4. In the *Automation Trend* chart, select **Purchase Order Release** Activity to investigate why this Activity is only partially automated.

Commented [MS5]: This looks correct but the graph is different, while it does maintain the principle that automatic starts high and tapers off.



Initially, the automation was 100% (orange) and started tapering to 0% (orange, 100% blue) by 2021-04.

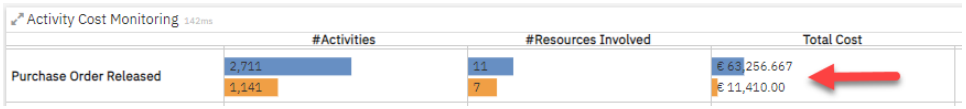
_5. The *Automation Cost Monitoring* chart notes that the *Invoice Registered* activity is the most costly and frequent and is 05 automated (all blue).



This Activity is, therefore, a good candidate for automation!

_6. In the *Automation Trend* chart, scroll down until you see **Purchase Order Release** Activity and notice the lower cost when a robot (orange) executes this Activity.

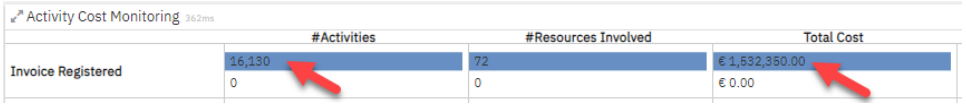
Commented [MS6]: Doesn't look like this - the formulas look correct in the chart design box but there just are no automated activities.



Now that we have identified the *Invoice Registered* Activity as the best automation candidate, we will use the simulation capability of IBM Process Mining to discover the ROI associated with automating *the Invoice Registered* Activity...

3.7.2 Use Simulation to Determine ROI of Automation

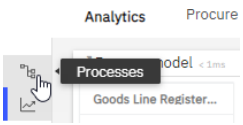
Recall that we concluded that because of its high cost and significant usage frequency, the *Invoice Registered* Activity could potentially provide a great ROI!



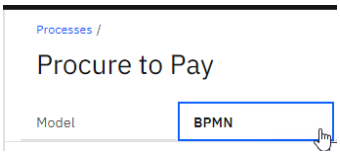
We will now use the Simulation capability of IBM Process Mining to determine the ROI associated with automating *the Invoice Registered* Activity.

3.7.2.1 Create a New Simulation

_1. Click the **Processes** icon located in the top left corner.

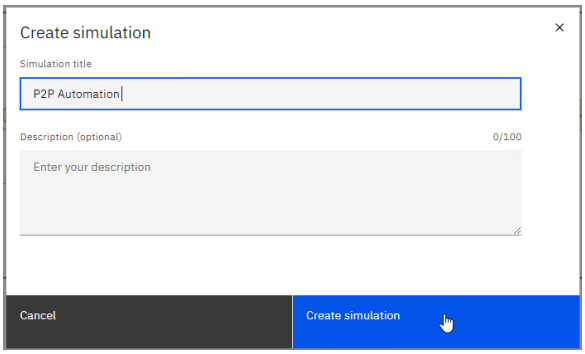


_2. Click the **BPMN** tab.



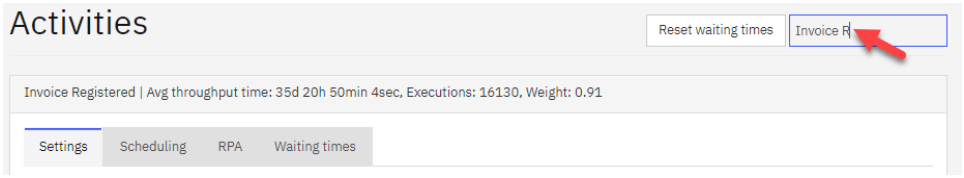
_3. Click **Create Simulation**

_4. For *Simulation Title,* enter **P2P Automation** and click **Create Simulation.**

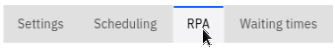


3.7.2.2 Configure Simulation

_1. In the search bar, type **Goods Line R** to locate the Invoice Registered Activity.

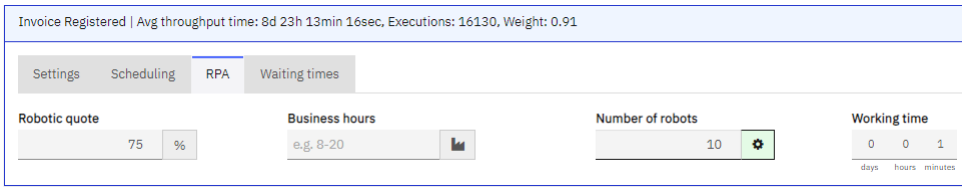


_2. Click the **RPA** tab



_3. Set the following parameters:

- *Robotic quote* to **75** (the percentage of the Activity that robots will manage)
- *Number of robots* to **10** (the number of robots that will work in parallel with the staff to run the Activity**)**
- *Working time* to **1** (the service time of a robot is equal to its working time, as no interruptions must occur in the robotic activities)



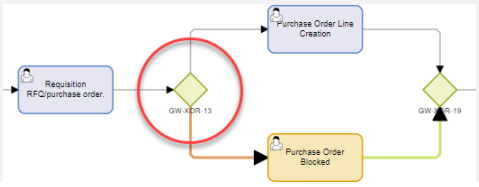
Note: Changing the decision gateway in a simulation is also possible.

The Gateways simulation configuration section in Simulation configuration allows changing the distribution of the Gateway outputs.

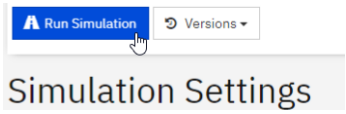
You will find the Gateways section by scrolling to the bottom of the Simulation View.

The simulation gateways appear in the BPMN diagram generated from the Model.

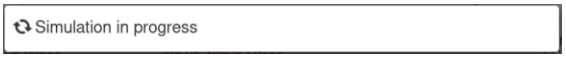
Commented [MS7]: Two gateways have 0% probability on all output paths. Needs fixed before you run sim. And if you do, the sim doesn't complete, at least for me it didn't (tried twice)



_4. Click **Run Simulation**



_5. Wait for the *Simulation in progress* to close.



3.7.2.3 Examine Simulation Results

_1. Let's examine the simulation results.

Note that since this is a simulation, the results in the Simulation Details pane may vary slightly from run to run.

Simulation Details

Measure: Average	A As-is	B To-be
Case count	17,770	17,770
Average case lead time	101d 1hr	54d 19hrs
Average case cost	EUR 209.59	EUR 191.64
Total case cost	EUR 3,724,350.33	EUR 3,405,463.00

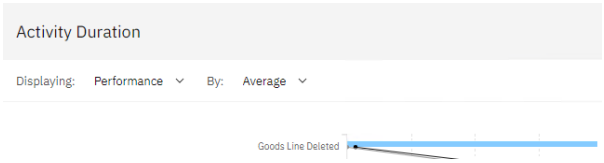
_2. The Process overview table provides a summary of key metrics. **A** represents the as-is Process, and column **B** represents the simulation results. Note the ROI: 3,724,450.33 – 3,405,463.00 = **EUR 318,887.33!**

_3. Notice a decrease in *Average case lead time)*, a reduction in *Average case cost,* and finally, a decrease in *Total case cost*!

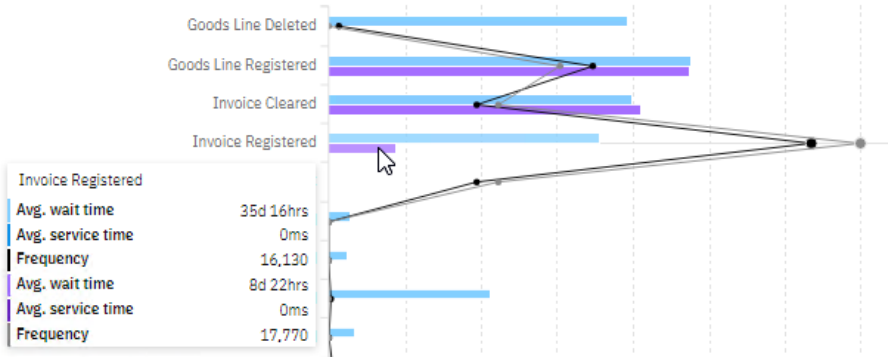
We will now investigate why the *Average Case lead* time decreased by almost 50 days!

Average case lead time	**101d 1hr**	**54d 19hrs**

_4. **Scroll down** to the *Activity Duration* section.



_5. Hover over **Invoice Registered Avg wait time bars.**

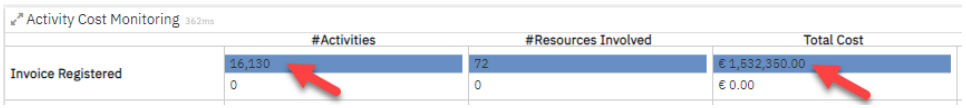


Note the following:

- The *average wait time has decreased because robots do not do 75% of the work* (from 35 d 16hrs to 8d 22hrs).
- The *Frequency* of the Invoice Registered Activity is very high (between 16-17K)

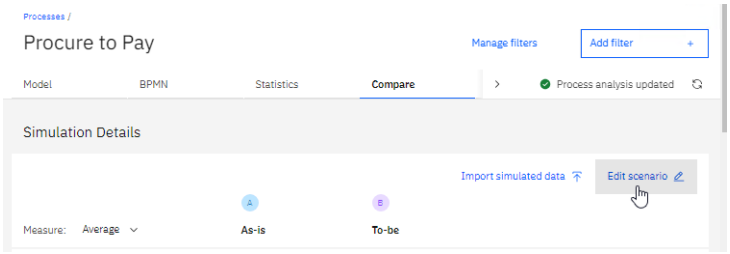
The above findings explain the significant impact on the Average case lead time (combination of high frequency and considerable reduction of wait time of the *Invoice Registered* Activity)

Recall that we selected the *Invoice Registered* Activity as an automation candidate because of its high frequency and high cost.

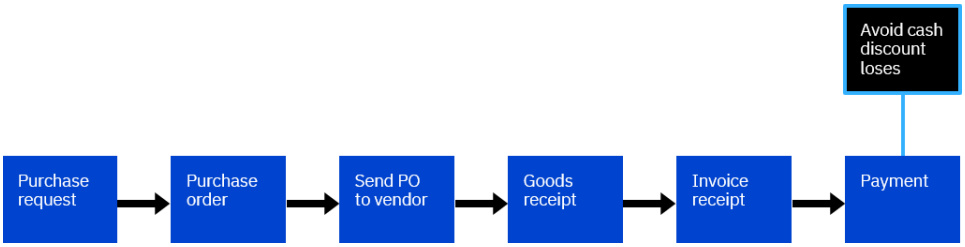


The simulation results confirmed that our automation choice was correct.

Note.: you can change the simulation setting and rerun this simulation by clicking the **Edit scenario** button!



3.8 Avoid Cash Discount Losses

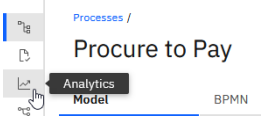


We will now explore using process mining to monitor and better manage supplier payments. Specifically, we will focus on Late Payments. Late Payments are a costly inefficiency with significant business impacts:

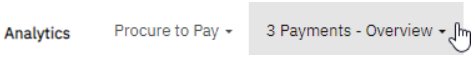
- Detrimental to the organization's valuable supplier relationships.
- Poor relationships and missed opportunities for preferable terms on critical goods and services in the future.
- Additional interest payments and penalties.
- Cash discount losses result when the early payment option is not exercised. Paying early can yield substantial benefits in situations where suppliers offer discounts or rebates for early payment.

3.8.1 Payment Dashboard

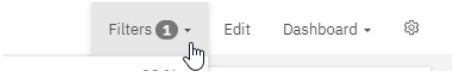
_1. Click the **Analytics** icon located in the top left corner.



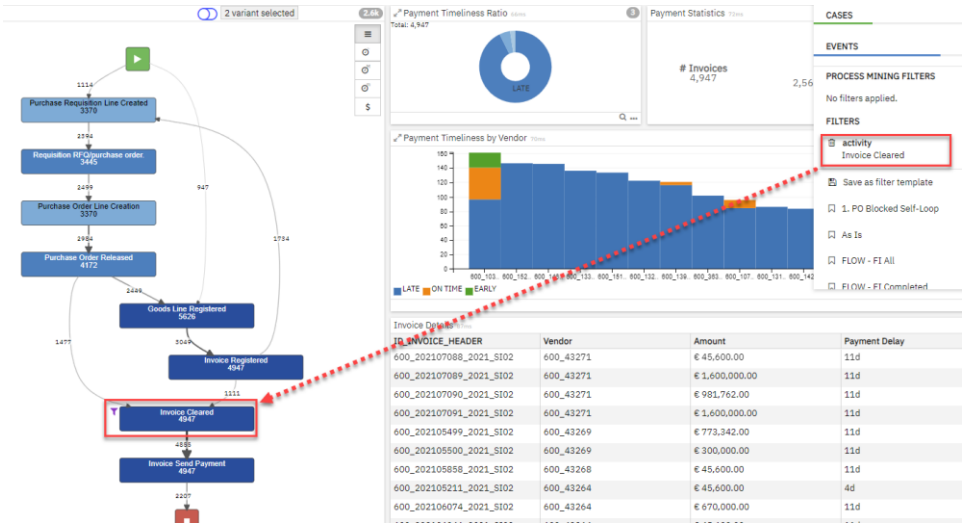
_2. Select **3 Payments - Overview** Dashboard.



_3. Click **Filters 1 dropdown**



_4. Note that this Dashboard uses *activity Invoice Cleard* filter to include only the cases that have already executed *Invoice Cleared* Activity.

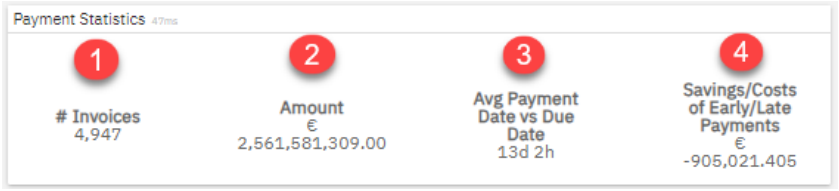


We will use this Dashboard to analyze Payments in the P2P process.

_5. Examine the Payment Statistics chart and note:

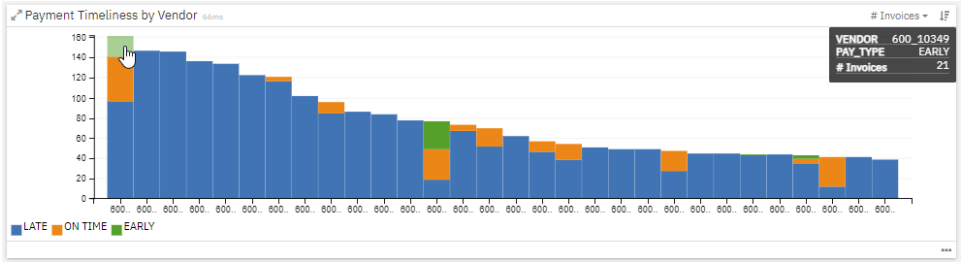
Commented [MS8]: Savings numbers are completely different, much lower

Commented [MS9R8]: This is all over this chart, applies to page 39 also.

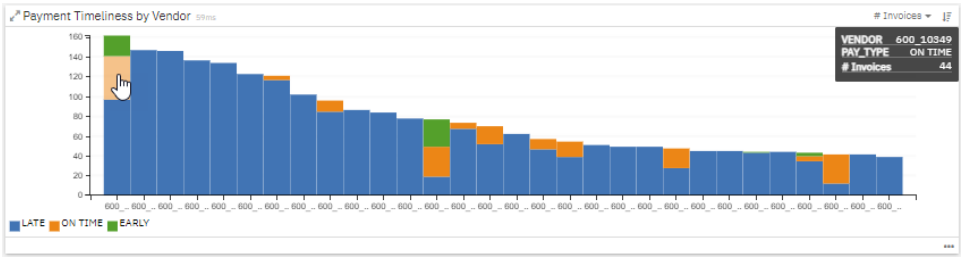


1. 4,947 invoices were paid.
2. The total payment amount was EUR 2.5 billion
3. On average, payments were delayed 13 d 2h
4. The Cost of Late Payments metric is calculated by using a formula that includes the interest charges and discount losses (you can examine the formulae if you Edit and open the Payment Statistics chart).

_6. In the *Payment Timeliness by Vendor* chart, hover over the **green EARLY payment bar in the first column** to see the payment details



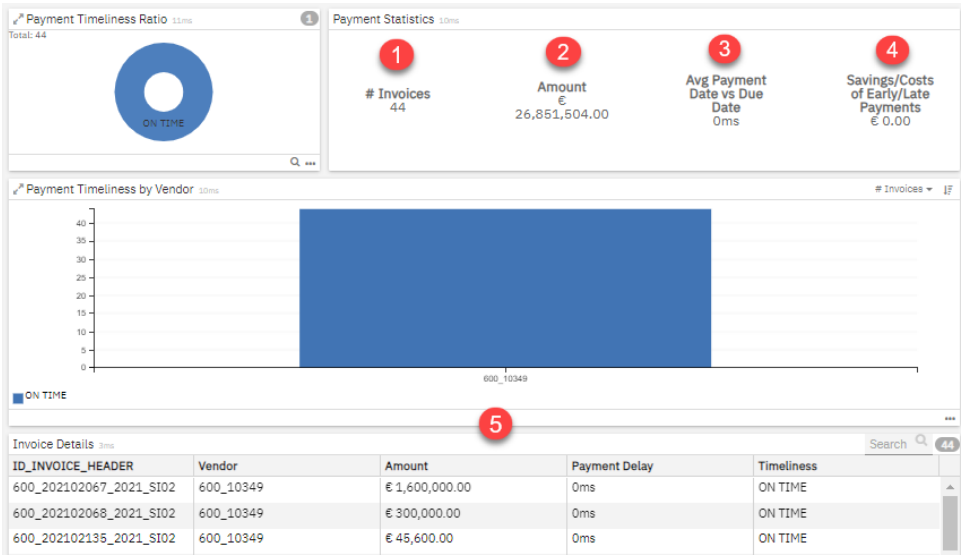
_7. Click the **green ON TIME payment bar in the first column.**



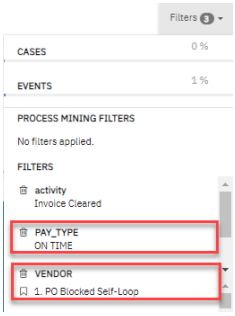
This action applied filters to the entire dashabord.

_8. You can now see all the transaction details for the ON TIME payments paid to Vendow 600_10349:

1. 44 invoices were paid ON TIME
2. The total payment amount was EUR 26.8 million
3. On average, the payments were not delayed
4. There were neither losses nor savings.
5. The Invoice Details chart contains information about the 21 selected Cases



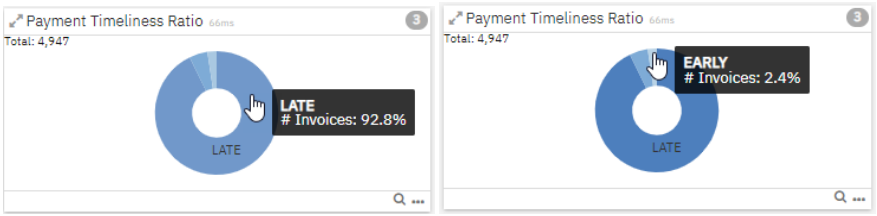
_9. From the *Filters 3* dropdown, click **X** to remove **PAY_TIME** and **VENDOR** filters



3.8.2 Payment Timeliness

By identifying early or late payments, we can discover their root causes and make the necessary changes to business processes to pay on time.

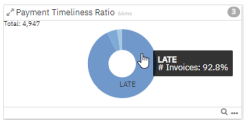
_1. In the Payment Timeliness Ration chart, hover over the **LATE area** of the pie chart and then the **EARLY area**.



Note that the majority of the payments were LATE or EARLY. Only 4.8% were paid on time!

3.8.3 Late Payments

_1. Click on the **LATE** area in the *Payment Timeliness Ratio* chart.



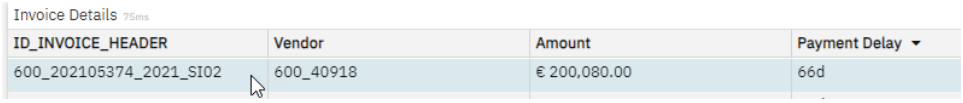
You now see only the Cases with late payments.

_2. Click the **Payment Delay column** in the *Invoice Details* chart to sort it in descending order.

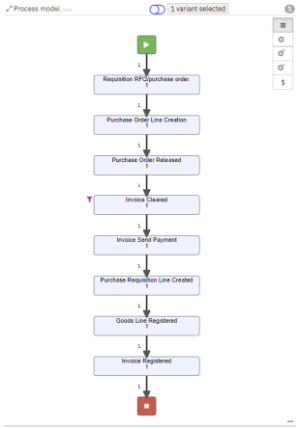
Invoice Details 75ms

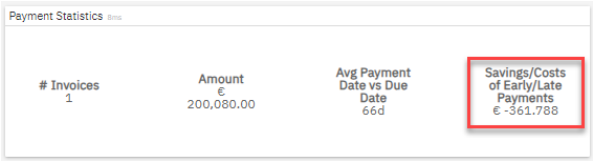
ID_INVOICE_HEADER	Vendor	Amount	Payment Delay
600_202105374_2021_SI02	600_40918	€ 200,080.00	66d
600_70300007_2021_SI02	600_37809	€ 300,000.00	27d
600_202108199_2021_SI02	600_40825	€ 45,600.00	25d

_3. Click the first row in the *Invoice Details* chart to filter out all other Cases but the one with the longest delay of 66d.

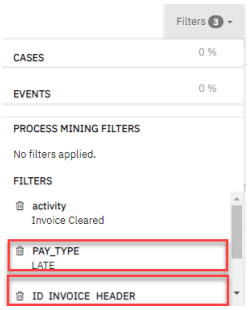


_4. In the *Process model* chart, you can now see how this Case was executed and the actual late payment cost in the *Payment Statistics* chart.



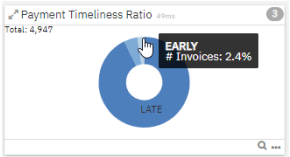


_5. From the *Filters 3* dropdown, click **X** to remove **PAY_TIME** and **ID INVOICE HEDAR** filters.



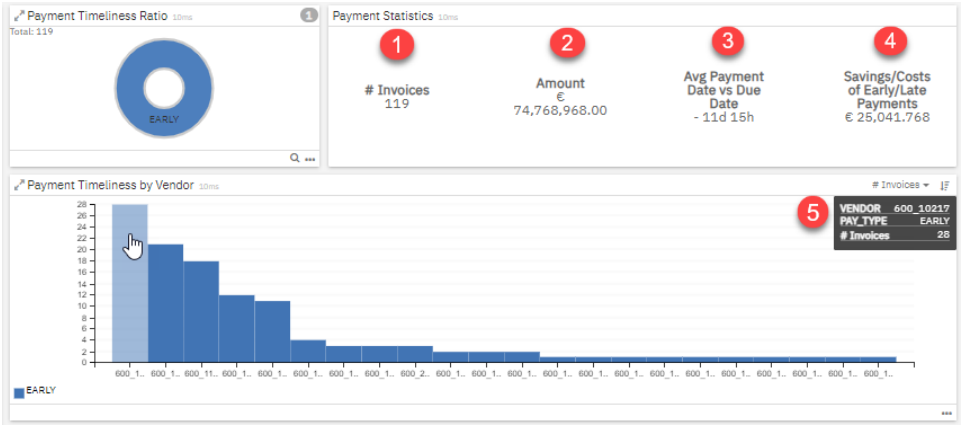
3.8.4 Early Payments

_1. Click on the **EARLY** area in the *Payment Timeliness Ratio* chart.



_2. You can now see the EARY payment statistics:

1. Only 119 of 4947 invoices were paid EARLY
2. The total payment amount was EUR 74.4 million
3. On average, the payments were paid 11 days early.
4. Their entire savings were EUR 25 K.
5. Vendor 600_10217 accepted most EARLY payments



A possible business action is to investigate if early payment discount agreements with vendors are not shown in the Payment Timeliness by Vendoe chart.

3.9 Lab Summary

You have just learned how IBM Process Mining can be applied to improve and gain insights into an SAP-based P2P Process.

Hopefully, this quick tutorial gives you a sense of some of the powerful features of IBM Process Mining. We showed how IBM Process Mining could graphically pull together the end-to-end Process, including BMN. By automating the Activity, we have demonstrated how you can examine which activities take the longest time and which would save the company the most money. We also showed how IBM Process Mining could detect non-conformant process behavior like Maverick Buying, often costing the company lots of money. Finally, we showed some of the built-in simulation capabilities that can help you quantify the benefits of business automation.

What you have experienced with this tutorial is a small subset of IBM Process Mining features. See our other tutorials and training courses to learn even more.

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Appendix A. Appendix A. Multi-level Process Mining

In our scenario, data came from SAP transaction logs and was gathered over 12 months. The four critical P2P processes and a typical set of SAP transactions required to complete them are shown in the figure below.

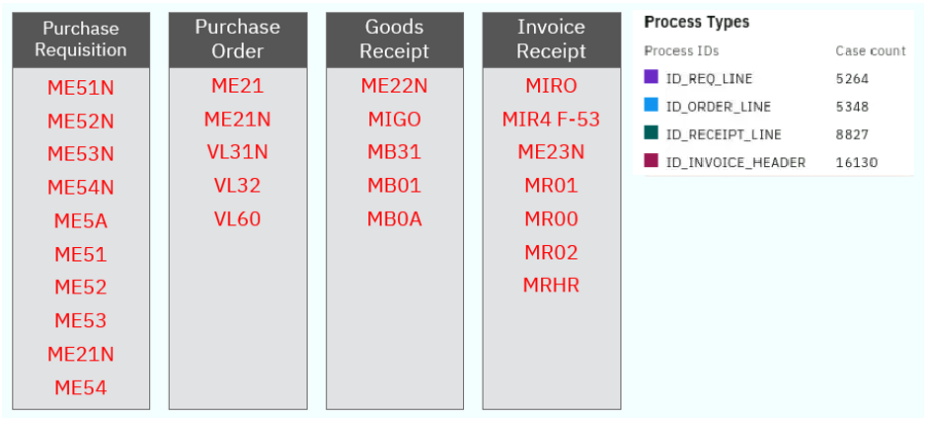
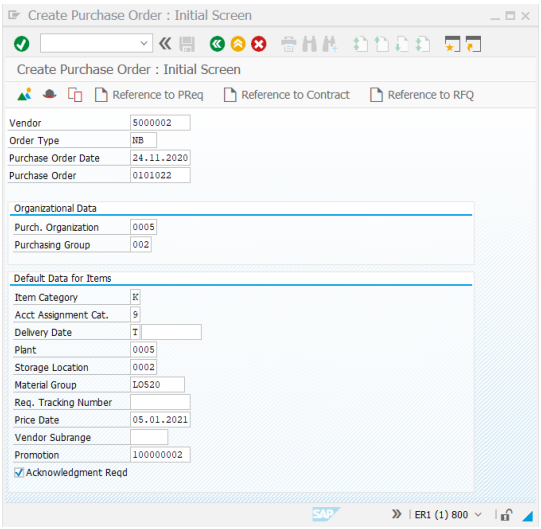


Figure 3. Multi-level P2P Processes Shown as Case Statistic in Process Mining Model View

Typically, each distinct Process is completed by executing a set of related SAP transactions in varying order, including Rework. For example, the Purchase Order process typically involves the execution of ME21, ME21N, VL31N, VL32, and VL60, often by different people over days and months.

Here is an example SAP GUI screen of ME21 (Create Purchase Order) transaction:



Traditional process mining techniques cannot treat these as a single process requiring separate analysis.

With multi-level process mining support in IBM Process Mining, you can map the P2P subprocesses—purchasing, ordering, invoicing, and payment—within a single comprehensive model, solving the

considerable limitation traditional methodologies face. Automatically discovered multi-level processes are a rich source of ideas and insights!