Intelligent Process Management & Process Visualization

TAProViz 2014 workshop

Presenter: Dafna Levy
The Topics

- Process Visualization in *Priority ERP*
  - Planning
  - Execution
  - BI analysis (Built-in)
- Discovering implementation & operational issues (with Disco)
- Click, View & Do! - Process Intelligence (PI) in action
- Disco on the production floor - a hot opportunity
- Q & A
Possible Answers

- A Hedgehog in his mating Season*
- A Process Model
- Encrypted mission of a Mosad agent
- None of the above
The right Answer: A Process Model (in Priority ERP)
The BPM Flowchart in *Priority ERP*

- Built-in mechanism to define and control process steps
- The model includes statuses and paths between them - the desired workflow
Business Rules in *Priority ERP*

- A tool to define business goals for a business process
- Enables to define time-based rules & alerts
- Analysis of all deviations from rules is not enabled in the ERP system
Handling a Sales Order

- Display of the sales orders screen in **Priority ERP**
- When updating a status or an employee in a sales order, an event record is created in a sub-level form.
- The history of statuses data (i.e., event log), together with business data can be easily retrieved and exported from **Priority** for process analysis.
The Sales Manager Dashboard in *Priority ERP*

- The dashboard displays information about open sales orders
- Currently, there is no way to discover inefficiency, bottlenecks with reports generated by the ERP system
Improving the Implementations of *Priority ERP*

with Process Mining Technology
Some Questions that can be Answered

- Can we visualize how our BPM flow chart is actually executed?
- Are there any bottlenecks in the process?
- Are there problematic paths taken between statuses?
- What about fulfilling SLA conditions?
- Which and how many employees deviate from rules?
- Why are there performance differences among branches?
Process Mining Started in Eindhoven
Fluxicon: The Parents of Disco

At your service.
Our experienced team is passionate about finding the right solution for you. Who are we, and why is it good for you that we are so small?

We know our stuff.
We have researched process mining and BPM for more than four years. This has resulted in quite some publications, and we have written Ph.D. theses on the topic. Also, we have been software engineers for ten years now. So we know a thing or two about how to build stuff that works.

We love this.
Vision, research and development could never be a nine-to-five chore for us. We are passionate about what we do, and it shows. When we're onto something, we'll stop only when it's done — or when there's no more coffee left.

Small is beautiful.
Yes we're tiny, but that's a good thing — we move fast and adapt quickly. Most important, it's also great for you: For support, you have direct access to developers. And your suggestions can really make a difference, because we're eager to listen.

Dr. Anne Rozinat
Market, customers, and everything else
anne@fluxicon.com
Anne knows how to mine a process like no other. She has conducted a large number of

Blog.
On our blog, we write about anything that scratches our itch. The latest posts are:
Fluxicon’s Academic Initiative

- Academic institutes in Israel are surrounded with rectangles
The Project: Analyzing Purchasing Process in Priority ERP
The Purchasing Process

- Three separate sub-processes
- Three different documents in Priority ERP (i.e., three different log files)
The Project Goals

- Discovering how the Purchasing process is implemented & executed in Priority ERP
  - End-to-End (a must!)
  - Sub Processes
- Identifying implementation & operational issues
- Present results to top management
- Define process targets and metrics
Some of the Analysis Requirements

- Various visual maps of the common process
- Similarities and differences from the ideal process
- Durations of cases & statuses
- Bottlenecks & Delays
- Work loads on the various process participants (buyers)
- Rework
- Undesired paths
The Process Model in *Priority ERP*
The Planned Workflow

- Bizqagi process modeler was used to design the process flow according to the data & information received from the customer.
Three event logs were joined with QlikView

The process model was discovered with Disco
A Live Demo of Process Discovery

With Disco

Handling of the Vendor Quotes in Priority ERP*

*Anonymized data is used the demo
The Vendor Quotes Event Log in Excel

- The mandatory data labels are marked in red
- The extended data labels are marked in green

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<th>D</th>
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## Importing the Event Log to Disco

A screenshot of a software interface showing a table of data with columns for Doc ID, Status, Start Date, End Date, Assigned To, Approval Type, VQ, Price, Price Range, and Item Number. The Status column contains various statuses such as Draft, Buyer, Authorized, Closed, and Check with Vendor.
The Process Map View

- The Vendor Quote process model which was automatically generated by Disco
The Statistics View

- General & Statistical info about the log is displayed in charts and tables
The Cases View

- Detailed view of the cases and events
- Grouping by variants
Extending the Analysis

- The type of the Vendor Quote approval depends on the purchase quote price
- A more focused analysis was required according to Vendor Quote prices
- The event log was extended with the relevant data in order to focus the analysis by these attributes

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<th>Type of Approval</th>
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<td>&lt;30,000</td>
<td>Automatic Approval</td>
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<td>30,000 – 100,000</td>
<td>One Signature</td>
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<td>&gt;100,000</td>
<td>Purchasing Committee</td>
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The **Attribute** filter in **Disco** was used to analyze the cases according to price ranges.

Here, the highest price range is selected.
Discovering Deviations

- After applying the filter, it was obvious that there are vendor quotes that were not approved as expected (i.e., by the purchasing committee).
- This was also an indication of an issue in the ERP implementation, which was fixed right away.
Details of Relevant Cases & Employees

Resource event classes

- Frequency
- Median duration
- Mean duration
- Duration range
- Aggregate duration

Resources: 8
- Minimal frequency: 9
- Median frequency: 2.6
- Mean frequency: 24.75
- Maximal frequency: 46
- Frequency std. deviation: 12.69

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<th>Resource</th>
<th>Frequency</th>
<th>Relative frequency</th>
<th>Median duration</th>
<th>Mean duration</th>
<th>Duration range</th>
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<td>46</td>
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<td>22 hours, 5 mins</td>
<td>7 days, 18 hours</td>
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<td>Suzys</td>
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<td>17.68 %</td>
<td>1 day, 5 hours</td>
<td>22 days, 24 hours</td>
<td>15 days, 18 hours</td>
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<td>Sara</td>
<td>30</td>
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<td>36 mins, 2,000 s</td>
<td>7 days, 5 hours</td>
<td>5 days, 14 hours</td>
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<tr>
<td>Diana</td>
<td>28</td>
<td>14.14 %</td>
<td>4 hours, 11 mins</td>
<td>7 days, 22 hours</td>
<td>7 days, 2 hours</td>
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<tr>
<td>Mika</td>
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<td>7 days, 2 hours</td>
<td>7 days, 2 hours</td>
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<td>2 days, 22 hours</td>
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<tr>
<td>Iain</td>
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<td>7 days, 22 hours</td>
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<td>4.55 %</td>
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<td>7 days, 22 hours</td>
<td>2 days, 20 hours</td>
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Cases & Variants

Case ID | Events | Started | Finished | Duration
-------|--------|---------|----------|----------
VQ13000044 | 7 | 10.11.2013 11:21:59 | 13.11.2013 09:54:00 | 33 days, 22 hours
VQ13000060 | 7 | 20.10.2013 10:32:00 | 03.11.2013 10:09:59 | 14 days, 37 mins
VQ13000079 | 5 | 31.10.2013 08:35:59 | 08.12.2013 10:54:59 | 38 days, 2 hours
VQ13000097 | 3 | 17.11.2013 11:10:59 | 08.12.2013 12:09:59 | 10 days, 22 hours
VQ13000115 | 9 | 18.11.2013 15:20:00 | 05.12.2013 09:42:00 | 6 days, 18 hours
VQ13000176 | 4 | 18.12.2013 09:00:00 | 19.12.2013 16:21:59 | 8 hours, 19 mins
VQ13000179 | 5 | 01.01.2014 16:30:00 | 02.01.2014 16:50:59 | 14 days, 8 hours
Some of the Project’s Deliverables

- Implementation Discoveries
  - Unnecessary statuses
  - Missing statuses & paths
  - Missing business rules
  - Lack of process control

- Operational Benefits
  - Visual deliverables assist in focused analysis
  - Locating reworks and delays & possible bottlenecks
  - Accurate throughput comparison
Mind Your Processes

Click, View & Do!
The Proposed Solution

- Automatic process discovery (APD): looks at historical event log data and analyzes these data to generate visual models of an organization's business processes.
- Advanced business discovery technology: allows management to analyze & monitor operations and key performance indicators in real-time and alerts management of any anomalies.

Process Mindinig

QlikView Business Discovery

Discover your processes.

Start Your Journey
The Sources of Inspiration
Process Analytics Framework

Business Operations Control

- Historical
  - Analytics
- Real Time
  - Dashboards
  - Alerts & Actions
- Predictive
  - Simulation
  - Data Mining
  - Optimization

Event Detection & Correlation

Event Bus

- EAI
- Legacy
- Custom
- ERP
- BPM
- ECM

Shapiro (2007)
Actions & Alerts

Rules Engine

Process Metrics

KPI Evaluation
- Goals
- Thresholds
- Risk Mitigation

Actions
- Web Service Call
- Execute Script

Action Schedule

Real Time
- Dashboards
- Alerts & Actions

Email and Cellphone notification

Process Event Triggers

Shapiro (2007)
What is Process Intelligence?

To measure their performance, organizations typically use figures such as revenues, profits, cash flow, etc., which are the result of the business processes executed. However, collecting key performance indicators (KPIs) on a data-driven basis without linking them to processes is of little benefit if the figures fail to match the defined objectives. After all, it’s hard to fix things without knowing the cause of the problem.

Process Intelligence delivers an unprecedented combination of corporate and process control at the strategic, tactical, and operational level. If KPIs (such as time, cost, quality, or risk) deviate from anticipated values, the causes can be analyzed within business processes. Corrective action can then be taken in real time before live operations are impacted.

Download PI for Dummies textbook
Mind your Sales
The **Business Discovery** dashboard displays data & metrics based on sales data from the ERP system.

- The sales manager is not satisfied with the financial results in some countries.
- The manager wishes to analyze operational data in order to learn more about the way sales orders are handled.
The Process Model (in Priority ERP)
The **Process Discovery** sheet displays events & business data of closed sales orders from the **ERP**

- Analysis of process performance by various dimensions is enabled
- Gauges display operational info about duration, efficiency, costs and more
- The current sheet is linked to the **Business Discovery** sheet.
Analysis of Slow Orders (> 40 days)

- Upper bar chart displays sales orders durations on the X-axis, and number of orders on the Y-axis
- Left-hand bar chart displays costs and durations per statuses or employees
- Gauges view is updated according to user selections
Business Data of the Slow Orders

- The **Business Discovery** sheet is automatically updated with the previous sheet selections.
- Only the slow orders-related data are displayed.
- Analysis of specific customers, part families or profit centers assists in discovering root causes of issues in the process.
Preparation Data for Automatic Process Discovery

- Further analysis of the slow process can be performed with Disco.
- Data of the slow process can be selected & exported with a click of a button.
### The Data Exported from QlikView

The mandatory data for automatic process discovery

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## Importing the Data to Disco

![Image of Data Import Interface](image_url)

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The Model of the Actual Process

- The actual process flow discovered based on the imported process data

An Indication of inefficiency

Start point

End point
Animation of the Slow Process

- The actual process is replayed based on the imported process data
Analyzing the Fast Orders for Benchmarking

- The chart displays now data of sales orders with a duration of up to 15 days.
- Comparing slow & fast processing of the sales orders can reveal opportunities for improvements (e.g., discover the efficient employees and adapt best practices)
- The data is exported for further analysis with process mining technology.
Process Benchmarking

**Fast Process**

- Draft: 9.6 hrs
- Confirmed: 3.2 d
- Cust Hold: 40.7 hrs
- Cont. rev: 2.1 hrs
- Con. re ready: 4.9 hrs
- Closed: 34.1 mins

**Slow Process**

- Draft: 3.2 hrs
- Confirmed: 8.6 hrs
- Confirmed - Re: 5.4 hrs
- Cont. re ready: 12.9 hrs
- Cont. rev: 22.4 hrs
- Closed: 11.6 hrs

Times: 5.3 mins, 9.2 secs, 107.4 mins, 26.7 mins, 28.5 mins, 36 mins, 111.9 mins, 61.9 secs, 112.9 mins, 101.8 mins.
The **Process Control** dashboard displays both business & operational data of open sales orders.

- A deviation of case durations can trigger an alert (online or Email).
Business Rules Control

- The dashboard enables to track deviations from business rules defined for the process
- Gauges limits can be set dynamically
- Alerts can be defined for deviations
Some of the Benefits

- integrating automatic process discovery (APD) & BI technologies enable:
  - Holistic approach vs. detached (i.e., a stand-alone solution/service)
  - Event data are extracted directly from the BI database
  - Event data are enriched with business data
  - Analysis and benchmarking results enable fine-tuning of KPIs
  - Operational & business managers can share results and insights
  - Continuous process control & improvement
Mind your Production
An Overview of the Solution

- The solution enables the analysis of the performance on a production floor and its production process.
- It is possible to analyze overall production performance and individual machine performance across a number of key dimensions such as Work Center, Part, Time etc.
- Automatic process discovery can be performed on selected data to identify root causes of deviations in costs, scrap, work orders cycle times and more.
- This demonstration is based on sample of production reporting and cost data of work cells, operations, products and machines from a metal processing company.
Manufacturing Analysis

with QlikView*

* Based on the Plant Operations demo app
The Dashboard

- The Dashboard enables analysis of the high level KPIs: Costs, Scrap and Runtime
- Completed and Open work orders KPIs are displayed separately
- The data can be further analyzed by using the list boxes on the left of the sheet and the time dimensions at the top.
The Cost sheet lets you analyze the costs of the plant & its operations. With the charts in the container object, you can analyze Material, Overhead and Labor costs and Actual vs. Standard costs for various dimensions (Work Center, Operation and Part). You can drill-down to focus on work order or operations with costs deviations.
Analysis of Scrap

- In the Scrap sheet scrap is displayed as a percent of production.
- Scrap can be analyzed over time and by key dimensions.
Discovering the Actual Production Process

With

Disco

Example Deliverables
The Planned Production Process

Turning & Milling → Turning & Milling - Q.C → Laser Marking → Lapping → Round Grinding → Final Inspection → Packing
Some Possible Deliverables

- A process map of the executed production processes
- Conformance Checking
  - Deviations from routings
- Performance Analysis
  - Machines
  - Operators
  - Idle times
  - Bottlenecks
- Focused analysis of:
  - Breakdowns
  - Rework
  - Rejected parts
- Comparison of workers performance
Automatic process discovery can be performed on selected data to identify root causes of deviations in costs, scrap, work orders cycle times and more.

The data imported from QlikView with a click of a button.
Revealing Deviations from Routing

- For some work orders, the process starts and ends with different operations than defined in the routing (circled in red)
Locating the Slow Work Orders

- The **Performance** filter is used to retrieve slow work orders by a selected duration.

Use cases running longer than 30 days.
The Slow Process Flow

The mean waiting time between operations

The mean duration of operations
Idle Times in the Process

The numbers represent the maximal waiting time between work cells.
Thank You!

Dafna Levy

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Phone: +972 (0)54-6881739
Intelligent Process Management