



# **Business Analytics and Data Warehouse Management**

## **Case Study: Process Mining**

*Alexander Prosser, 2019*

*Institute of Production Management, WU Vienna*

## 1. Background

This case study deals with conformance-oriented process mining in a sales process. Our manufacturing company produces umbrellas and sun shades.

The process – in its ideal variation has the following steps (see details below):

- Write quote (and send it, automatically included in the SAP functionality via customized channels);
- Change quote (if necessary);
- Convert quote into order and write order;
- Change order (should be the absolute exception);
- Outbound delivery;

Each process step is considered on a line item level, as a quote or order may have several line items.

For an introduction to process mining, see Aalst, W. vd, Process Mining - Discovery, Conformance and Enhancement of Business Processes, Springer, 2011.

## 2. The Process

In the following, the process to be analysed is depicted in SAP ECC.

For more details see Prosser, A., Bagnato, D., Müller-Török, R., Integration Management with SAP ECC. 3<sup>rd</sup> Ed., Facultas, 2017.

As a first step, we are going to create a quote (sales information is disregarded). This is done via the following menu path.

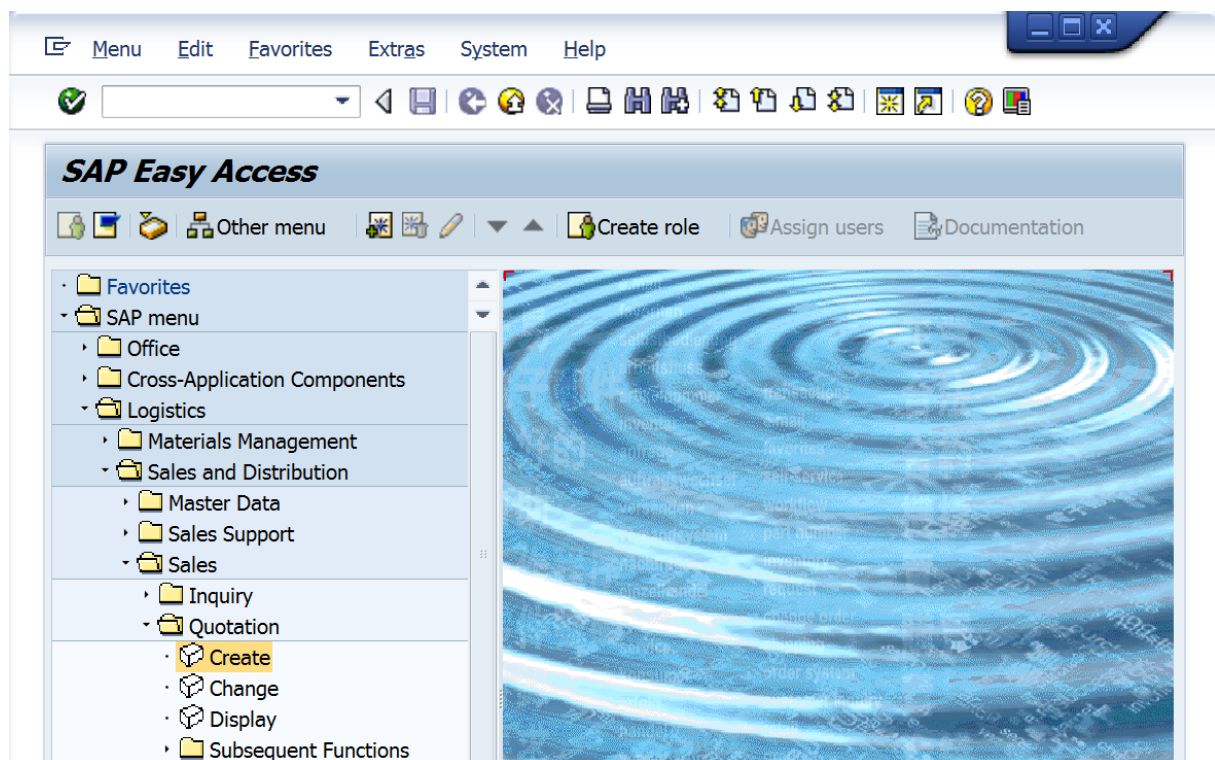


Figure 1: Menu path create quote (© SAP AG)

In the initial screen, select Quotation type “QT”, Sales organisation 0001, Channel 01 and Division 01 and confirm with <Enter>. In the following quotation document, select a customer (as sold-to and ship-to party) and the following line items (three sunshades available in the system). Also select a valid-to date for the quote.

**Create Quotation: Overview**

Quotation  Net value 11.500,00 EUR

Sold-to party  1 Meier Umbrella Store / Wiedner Hauptstraße 123 / 1040 Vienna

Ship-to party  1 Meier Umbrella Store / Wiedner Hauptstraße 123 / 1040 Vienna

PO Number  PO date

Sa... Item overview Item detail Ordering party Procurement Shipping Reason for rejection

Valid from 30.03.2019 Valid to 30.04.2019

Req. deliv.date D 01.04.2019 Expect.ord.val. 8.050,00 EUR

| Item | Material | Order Quantity | SU    | AltItm | Description                |
|------|----------|----------------|-------|--------|----------------------------|
| 101  |          |                | 100ST |        | Sunshade Watson Bay        |
| 203  |          |                | 100ST |        | Sunshade Salamander Shores |
| 302  |          |                | 100ST |        | Sunshade Balmoral Beach    |

Figure 2: Create quote (© SAP AG)

The quote may now be saved, but let us explore the transaction status, which can be done via menu *System* => *Status*. The transaction, cf. circle in Figure 3, is VA21. This will be one of the main characteristics in the process mining cube to be defined.

Close the status window and save the quote by clicking on the floppy disk symbol. The system answers with a message that quotation <Document Number> has been saved. Changing the quotation is done via transaction VA22.

Also the material/s selected, the customer (we will disregard the case that sold-to and ship-to party are different) and the user will be included in our analysis. Regarding the user the assumption will be that the system user is also the person responsible for the transaction.

As usual, the date of the posting will be decomposed into its components and serve as the time dimension.

After saving the document, the systems stays in the function, use the yellow arrow up to return to the menu. In the next step, the order is created from the quote. For the menu path, see Figure 4.



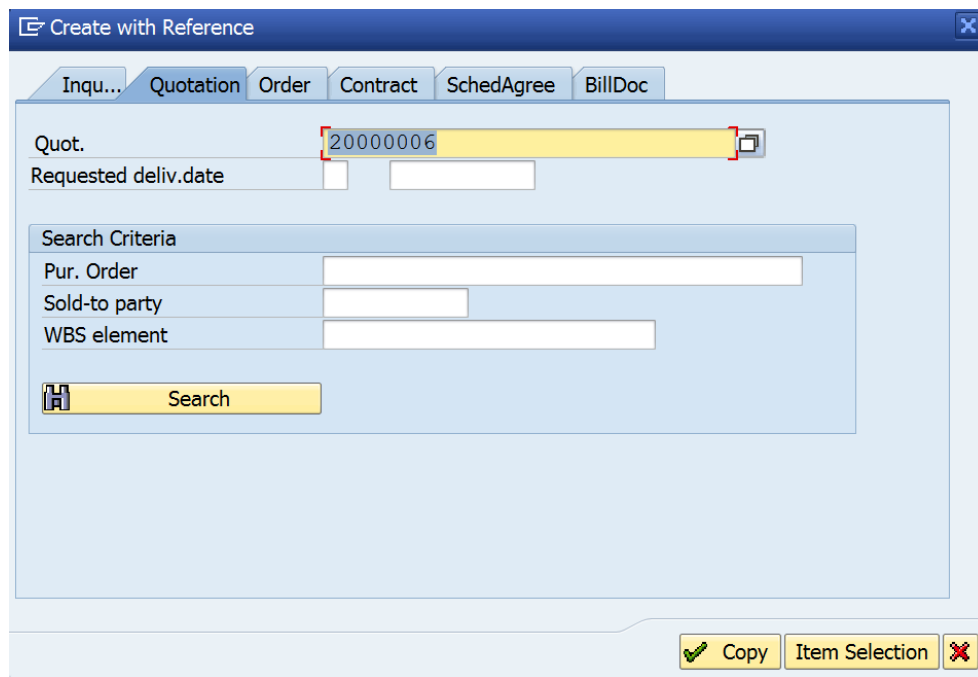


Figure 5: Select quote (© SAP AG)

You will find the quote copied into the order. Let us assume, however, that one line item “Balmoral Beach” was not ordered and is to be cancelled. Select the line header of the line item and the “Delete item” button below (see arrow in Figure 6).

Also enter PO number and date as shown in Figure 6.

Save the document with the floppy disk symbol and you will again receive a confirmation “Standard order <Document Number> has been saved. Selecting *System => Status* again reveals the transaction number shown in Figure 7, VA01.

One may also enter the document in change mode and edit the data. The status information reveals another transaction, VA02 (cf. Figure 8).

The following transactions, such as outbound delivery follow the same pattern, for details cf. Prosser/Bagnato/Müller-Török, 2017. All transactions are recorded with user information and timestamp. This enables us to build a data warehouse cube for process mining.



Sales document   Edit   Goto   Extras   Environment   System   Help

**Create Standard Order: Overview**

Standard Order:  Net value: 11.500,00 EUR

Sold-to party: 1 Meier Umbrella Store / Wiedner Hauptstraße 123 / 1040 Vienna

Ship-to party: 1 Meier Umbrella Store / Wiedner Hauptstraße 123 / 1040 Vienna

PO Number: 12313 PO date: 30.03.2019

Item overview   Item detail   Ordering party   Procurement   Shipping   Reason for rejection

Req. deliv.date: D 01.04.2019 Deliver.Plant:

☐ Complete dlv. Total Weight: 300 KG

Delivery block:  Volume: 0,000

Billing block:  Pricing date: 30.03.2019

Payment card:  Exp.date:

Card Verif.Code:

Payment terms: 0002 14 days 2%, 30 net Incoterms: CFR Cost and freight

Order reason:

All items

| Item | Material | Order Quantity | Un | S                        | Description                |
|------|----------|----------------|----|--------------------------|----------------------------|
| 101  |          | 100            | ST | <input type="checkbox"/> | Sunshade Watson Bay        |
| 203  |          | 100            | ST | <input type="checkbox"/> | Sunshade Salamander Shores |
| 302  |          | 100            | ST | <input type="checkbox"/> | Sunshade Balmoral Beach    |
|      |          |                |    | <input type="checkbox"/> |                            |
|      |          |                |    | <input type="checkbox"/> |                            |

Figure 6 shows the SAP 'Create Standard Order: Overview' screen. The 'PO Number' field is circled in black and contains the value '12313'. The 'PO date' field is also circled in black and contains the value '30.03.2019'. The 'Ship-to party' field is circled in black and contains the value '1'. The 'Item overview' tab is selected. The 'All items' table shows three items: '101' (Sunshade Watson Bay), '203' (Sunshade Salamander Shores), and '302' (Sunshade Balmoral Beach). Item '302' is highlighted in yellow. An arrow points to the 'Delete' icon in the bottom toolbar.

Figure 6: Delete line item (© SAP AG)

SAP data

| Repository data     |             | SAP System data     |             |
|---------------------|-------------|---------------------|-------------|
| Transaction         | <u>VA01</u> | Component version   | SAP ECC 6.0 |
| Program (screen)    | SAPMV45A    | Installation number | 0020186108  |
| Screen number       | 4001        | License expiration  | 31.12.9999  |
| Program (subscreen) | SAPMV45A    | Unicode System      | Yes         |
| Screen number       | 4701        |                     |             |
| Program (GUI)       | SAPMV45B    |                     |             |
| GUI status          | U           |                     |             |

Figure 7 shows the SAP 'Status information for create order transaction' screen. The 'Transaction' field in the 'Repository data' section is circled in black and contains the value 'VA01'. The 'Program (screen)' field contains the value 'SAPMV45A'. The 'Screen number' field contains the value '4001'. The 'Program (subscreen)' field contains the value 'SAPMV45A'. The 'Screen number' field contains the value '4701'. The 'Program (GUI)' field contains the value 'SAPMV45B'. The 'GUI status' field contains the value 'U'. The 'SAP System data' section shows the 'Component version' as 'SAP ECC 6.0', the 'Installation number' as '0020186108', the 'License expiration' as '31.12.9999', and the 'Unicode System' as 'Yes'.

Figure 7: Status information for create order transaction (© SAP AG)

| SAP data            |             |
|---------------------|-------------|
| Repository data     |             |
| Transaction         | VA02        |
| Program (screen)    | SAPMV45A    |
| Screen number       | 4001        |
| Program (subscreen) | SAPMV45A    |
| Screen number       | 4900        |
| Program (GUI)       | SAPMV45B    |
| GUI status          | U           |
| SAP System data     |             |
| Component version   | SAP ECC 6.0 |
| Installation number | 0020186108  |
| License expiration  | 31.12.9999  |
| Unicode System      | Yes         |

Figure 8: Status information for change order transaction (© SAP AG)

### 3. The DFM

This gives the following DFM:

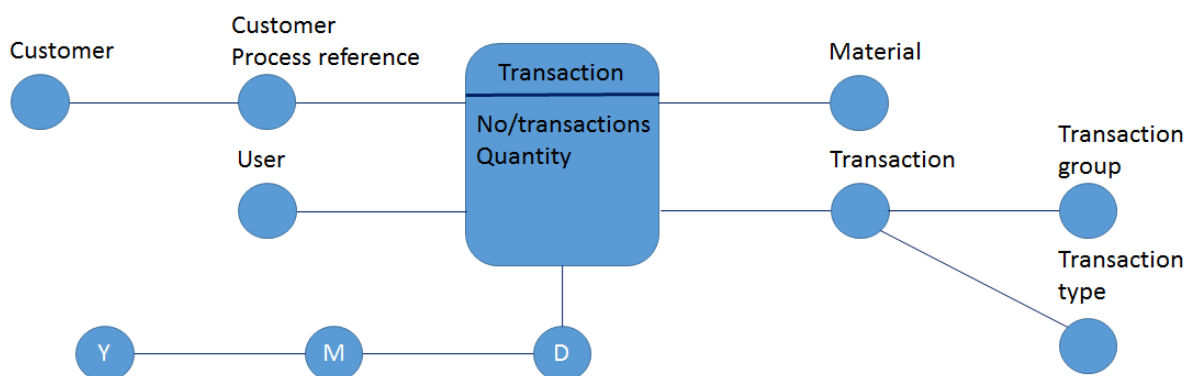


Figure 9: DFM Process Mining

Note that there is a parallel hierarchy: The transactions are grouped by the transaction type (create, change, display) and the transaction group (quotation, order, delivery). Therefore there is a parallel hierarchy. Individual transactions are grouped into a customer process reference, which is in turn grouped into customers.

### 4. Implementation

You find the data for this case study on the same page, where you downloaded this file from (zip archive). Use BEx to answer the following questions:

1. Quotes should not be changed once issued. Did this occur in a relevant number of cases and are there any discernible patterns when this occurs. Provide an analyses in BEx.
2. The same question applies to orders ...
3. ... and to deliveries.
4. Are there significant and regular changes in the quantity offered and the quantity ordered for a process reference? Do you recognise any patterns in the process references, where such a change occurred? Provide the corresponding analyses in BEx.
5. Transaction VL01NO (Delivery w/o order) occurred regularly? By which users? For certain materials? Quantity framework? Provide the corresponding analyses in BEx.