Using TOSMANA for fsQCA
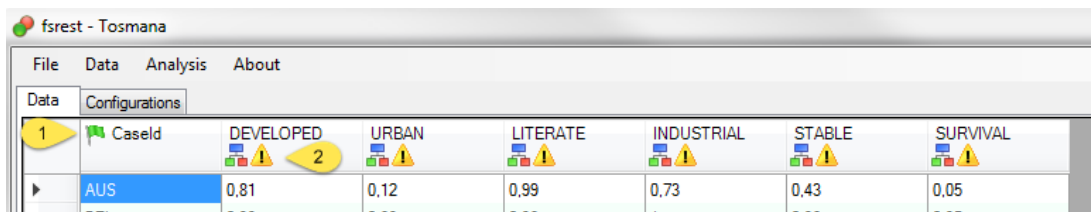
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This document illustrates a first simple use of *TOSMANA* for fsQCA. It aims to clarify the import of data as well as all steps necessary for a complete fsQCA analysis. Please refer to the manual or the *Getting Started with TOSMANA Guide* both found on the *TOSMANA* website for further information.

The following steps do illustrate the import of data to *TOSMANA* as well as the procedure for a simple fsQCA analysis with the software:

1. The simple way to include data with *TOSMANA* is to copy data directly from a spreadsheet program. To do so, open the data set in a spreadsheet program. *Select* all cells with data in the data set and *copy*. Please remember to include variable names in the first row.

2. In *TOSMANA*, select *File>Create new from Clipboard* in the menu. The data will be loaded to the software and will replace existing data. After the successful import, you should save your file in the format used within *TOSMANA* (*File > Save As)*. The software saves the data as a XML-File, so you can edit the data outside of *TOSMANA* with a XML-Editor as well.

3. *TOSMANA* tries to identify the type of data imported. A variable containing characters will be marked as a possible case identifier with a green flag (1, this is the case for *CaseId* in this example). In addition, TOSMANA identifies metric data and marks the respective column with a subdivision symbol (2, here e.g. *DEVELOPED*). The yellow warning sign indicates that the condition has no thresholds attached to it (this can be <u>ignored</u> if the data is only subject to a fsQCA analysis and no cs- or mvQCA calculations are made).

4. Data can be calibrated with the use of steps or anchor points.

   a. To assign cases to specific steps, do enter the thresholds and the fuzzy-set values using the following syntax: (threshold value 1, fuzzy-set value 1)(threshold value 2, fuzzy-set value 2)… E.g. if you want to use four steps as a calibration for the DEVELOPED condition in the example data set, using the values 400, 600 and 800 to separate the steps, enter the thresholds as follows: (400; 0.33)(600;0.66)(800;1). All cases with a value below 250 will be assigned the fuzzy-set value 0, cases with a value between 400 and 600 the value 0.33, cases showing a value between 600 and 800 will be assigned the value 0.66 and finally cases with a raw value above 800 will show a fuzzy-set value of 1.

   b. To realize a calibration with the use of a formula, anchor points can be used.

   $$FS_{DEV} = \begin{cases} 0 & , & if \ DEV < 400 \\ \frac{DEV-400}{150} * 0,5 & , & if \ 400 < DEV \le 550 \\ \frac{DEV-550}{250} * 0,5 + 0,5 & , & if \ 550 < DEV \le 800 \\ 1 & , & if \ DEV > 800 \end{cases}$$

   If you want to set the thresholds as found in the formula above, enter the thresholds as follows: (400;0)(550;0.5)(800;1).

5. After loading the data set, the fsQCA calculations can be started by calling *fsQCA > Start fsQCA* from the menu bar or by pressing the *F10* key. In the fsQCA-window, first select the conditions, the outcome and the case descriptor (Area marked 1). Then, select the outcome value to be minimized (2). In a first step, you can check for necessary conditions (*check necessary conditions,* 3). In addition, you can calculate the consistency of the configurations in the truth table (*calculate consistency,* 4).

   In *TOSMANA*, the outcome values of the truth table are automatically determined by the consistency threshold entered (6). The software assigns the outcome value 1 to configurations with a consistency value above the threshold; the outcome value 0 is assigned to cases below this threshold. Only configurations representing at least the number of cases set as frequency threshold (5) will be included. Select if logical remainders should be included in the minimization or not (7) and press the *full analysis* (9) button to create and minimize the truth table. In addition, a number of options regarding the output of the calculations can be defined (Area marked 8).
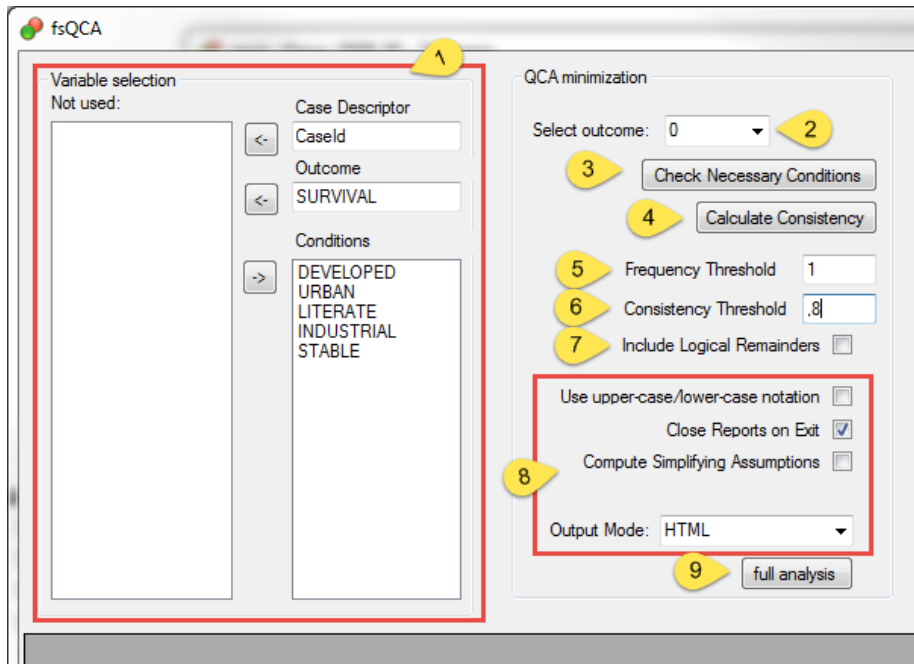
Further fsQCA features in TOSMANA

In addition to the analysis of consistency addressed above, TOSMANA also allows to study fuzzy set relations. To do so, please open the XY Plot from the main window (*Analysis – XY Plot*, or *F8*). One or multiple variables can be included on each axis (1) – select multiple variable by keeping *ctrl* pressed while selecting. Press the *create plot* button (2) to draw the XY Plot. In addition, the software calculates the consistency and the coverage values for the fuzzy set relation (X ≤ Y).

Single points in the plot show the individual cases. Cases sharing the same values are combined to a single, larger point. Hover the mouse over a point to see the case ID and the values of the case(s). To show all data, deselect the checkbox *hide labels* (3). Save the shown plot as an image by pressing *save plot as image* (4).