Semi-automatic Tool for Large-scale Production of Environmental Product Declarations

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Introduction

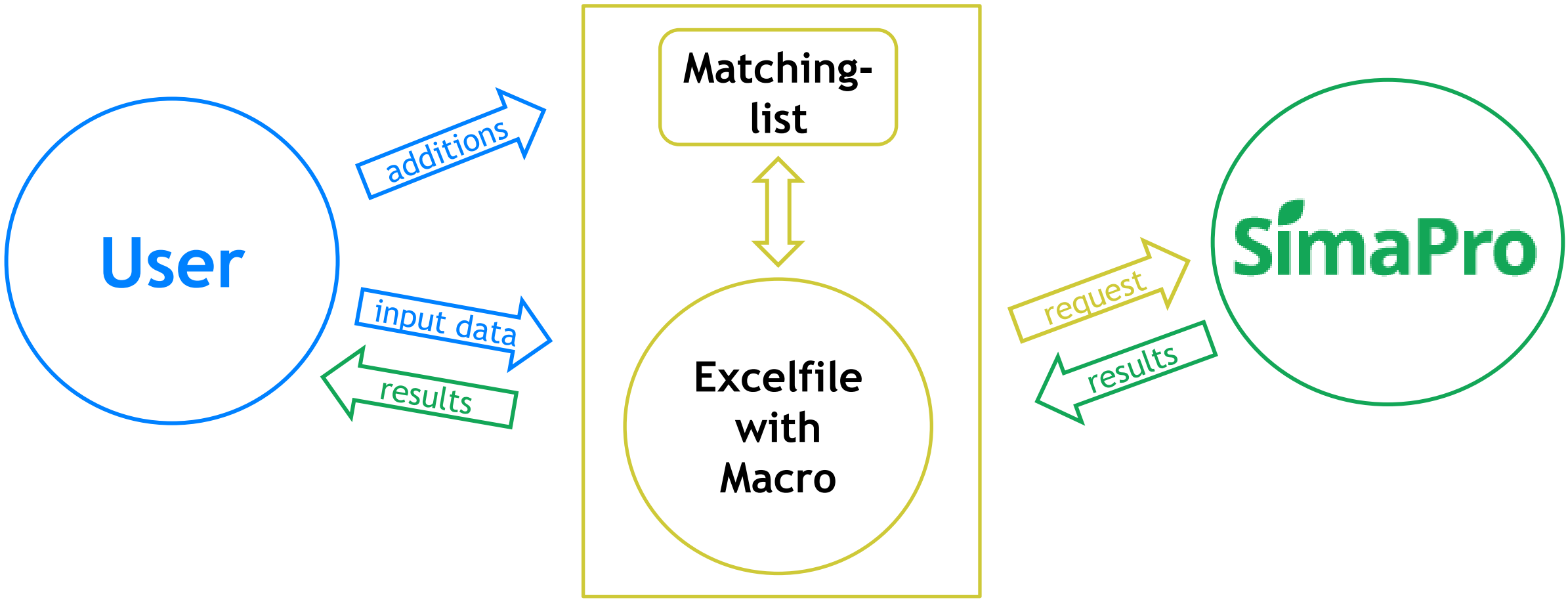
- Rising demand for Environmental Product Declarations (EPD) from customers
- Large parts of the product portfolio in a short period of time
- Bottleneck: manual modelling too time intensive

➢ Need for a faster approach without loss of quality

Objective

- Development of modular tool based on a bill of materials (BOM)
  - easily adaptable to different customer data structures
  - easily adaptable to specifications of different EPD organisations and product category rules
- Results formatted for easy copying into reports and EPD statements

Structure

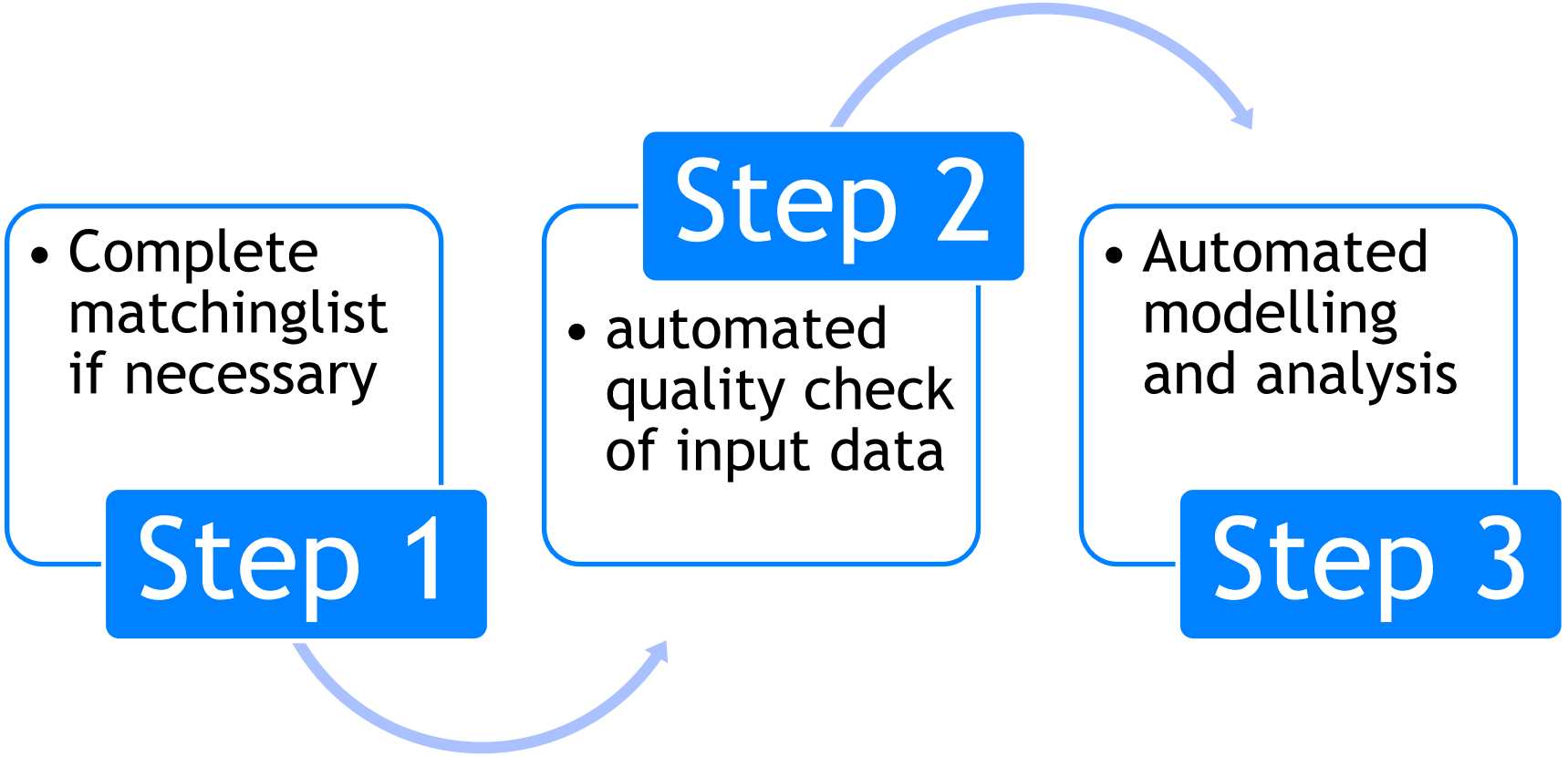

User
additions
input data
results
Matching-list
Excelfile with Macro
request
results
SimaPro

Required input data

- Bill of materials including weights, quantities, material, processing and supplier location
- Additional inputs and emissions in the manufacturing phase
- Parameters for use scenario
- End-of-life scenario if not defined in product category rules

➢ Automated export from Excel to SimaPro of all LCI data

Three steps to full EPD

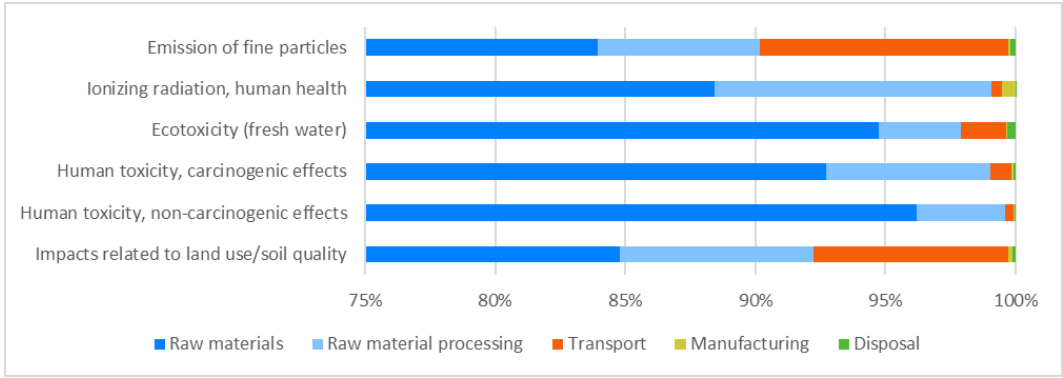


Calculated Output available in Excel

- One Makro provides all required EPD results in < 5 minutes:
  - Mandatory and optional environmental indicators
  - Correction of biogenic global warming potential
  - Inventory indicators including calculation path for verification
  - Hotspot analysis for manufacturing phase
  - Material contribution analysis

Results Example

Impact category	Unit	Manufacturing	Distribution	Installation	Use phase	End-of-life	Total
Climate change - total	kg CO2 eq	4.11E-01	9.15E-03	2.27E-02	2.98E-02	3.65E-03	4.76E-01
Climate change - fossil fuels	kg CO2 eq	4.21E-01	9.14E-03	5.10E-03	2.97E-02	3.65E-03	4.68E-01
Climate change - biogenics	kg CO2 eq	-1.05E-02	3.50E-06	1.76E-02	7.77E-05	8.01E-07	7.19E-03
Climate change - land use and land use transformation	kg CO2 eq	4.22E-04	4.71E-06	1.30E-06	6.13E-05	5.27E-07	4.90E-04
Ozone depletion	kg CFC11 eq	8.77E-08	1.86E-10	2.77E-11	2.04E-10	1.86E-11	8.81E-08
Acidification	mol H+ eq	6.19E-03	7.57E-05	7.51E-06	1.51E-04	4.79E-06	6.43E-03
Freshwater eutrophication	kg P eq	3.89E-05	6.62E-08	4.48E-08	1.49E-06	9.95E-09	4.06E-05
Marine aquatic eutrophication	kg N eq	5.90E-04	2.28E-05	4.05E-06	2.58E-05	4.88E-06	6.47E-04
Terrestrial eutrophication	mol N eq	6.95E-03	2.49E-04	2.57E-05	2.88E-04	1.89E-05	7.53E-03
Photochemical ozone formation	kg NMVOC eq	2.12E-03	8.03E-05	9.38E-06	8.58E-05	7.25E-06	2.30E-03
Abiotic resource depletion - elements or resource depletion - metals and minerals	kg Sb eq	9.19E-05	2.16E-08	8.37E-09	1.62E-07	1.98E-09	9.21E-05
Abiotic resource depletion - fossil fuels or resource depletion – fossils	MJ	6.54E+00	1.27E-01	2.09E-02	3.76E-01	1.51E-02	7.08E+00
Water depreviation potential	m3 eq depriv.	4.69E-02	5.70E-04	3.89E-04	5.30E-03	4.21E-04	5.36E-02



Indicator	Copper	Copper alloys	Other metals	Cardboard	Paper	Glass-fibre reinforced plastic	Other plastic	Steel
Climate change - total	2.90%	23.34%	4.13%	-3.84%	-0.53%	69.67%	0.76%	3.57%
Climate change - fossil fuels	2.50%	19.92%	3.58%	7.13%	1.83%	61.26%	0.67%	3.11%
Climate change - biogenics	0.29%	3.54%	0.20%	-83.13%	-18.16%	-2.76%	-0.07%	0.09%
Climate change - land use and land use transformation	3.09%	26.29%	3.95%	45.94%	4.90%	13.98%	0.31%	1.54%
Ozone depletion	1.12%	9.77%	2.08%	7.49%	1.80%	33.93%	41.74%	2.07%
Acidification	11.06%	70.46%	2.45%	2.76%	0.68%	11.69%	0.13%	0.77%
Freshwater eutrophication	7.84%	51.80%	9.90%	5.04%	1.68%	22.10%	0.32%	1.34%
Marine aquatic eutrophication	5.62%	39.18%	7.55%	11.25%	1.37%	33.06%	0.27%	1.70%
Terrestrial eutrophication	6.93%	46.99%	8.15%	7.60%	1.27%	27.18%	0.25%	1.63%
Photochemical ozone formation	6.50%	44.42%	6.38%	7.80%	1.37%	30.68%	0.32%	2.54%
Abiotic resource depletion - elements or resource depletion - metals and minerals	9.52%	63.42%	24.16%	0.11%	0.03%	2.69%	0.01%	0.07%
Abiotic resource depletion - fossil fuels or resource depletion – fossils	1.96%	16.05%	2.91%	6.31%	2.27%	67.53%	0.89%	2.07%
Water depreviation potential	15.72%	110.14%	5.51%	20.23%	10.89%	-68.36%	1.81%	4.05%
Material share	1.08%	10.89%	0.03%	37.13%	6.37%	39.20%	0.67%	4.63%

Additional Analysis Options in SimaPro

- Full access to detailed model in SimaPro
- Automated modelling includes pedigree assessment of all inputs and outputs
- In depth hotspot analysis
- Scenario analysis
- Monte-Carlo Simulation

Challenges - Data

- Data Availability at client's site
  - Information scattered across multiple systems
  - Lack of centralized data management
- Inaccurate data
  - Erroneous information
  - Discrepancies in material specifications

Challenges – EPD methodology

- Guidelines
  - Inconsistencies between EPD platforms
  - Updates to specific guidelines/product category rules
- Verification
  - Limited number of qualified verifiers (New bottleneck in EPD process)

Conclusions

- Used for 15+ EPDs in 2023/2024
- Semi-automatic approach balances speed (~ 1 day/EPD) and detail
- Fully automated tool possible with improved data structure
- Common nomenclature and centralized information system
- Need for clear requirements for the verification of tools

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