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# SALCA
# Swiss Agricultural Life Cycle Assessment

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# SALCA: An integrated concept for agricultural environmental assessment

**SALCA** = **S**wiss **A**gricultural **L**ife **C**ycle **A**ssessment

SALCA consists of the following elements:

- **Database for life cycle inventories** for agriculture (in collaboration with ecoinvent)
- Models for the calculation of **direct emissions from field and farm**
- A selection of **impact assessment methods (midpoints)**
- Methods for the assessment of impacts on **biodiversity** and **soil quality**
- **Calculation tools** for agricultural systems (farm, crop)
- **Interpretation scheme** for agricultural LCA
- **Communication concept** for the environmental management of farms

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# Principles of SALCA tools: Organisational structure

- **Generic LCA systems** to cover all types of farms (SALCAfarm) or crops (SALCAcrop) within the validity range
  - → wide range of applications
  - → applicable for multiple purposes
- **Standardised LCA calculation**
  - → ensures consistency
  - → avoids redundancy
- **Parameterisation**
  - → inputs and processes defined by variables
  - → non-existing inputs and processes set to 0
  - → hundreds to thousands of parameters
- **Modular structure**
  - → each module has clearly defined interfaces
  - → modules can also be used/tested independently
  - → complexity can be managed
- Illustrated by the example of **SALCAcrop**

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# Levels of analysis of SALCA tools

- **Crop** (arable crops, permanent crops, grassland): one crop one cropping season
- **Cropping system** (crop rotation): several crops, several years
- **Farm** (includes also animals and feedstuffs, can have many fields and many crops): one calendar year (crop cycle for arable crops)

**SALCAcrop**



**SALCAfarm**

# SALCAcrop

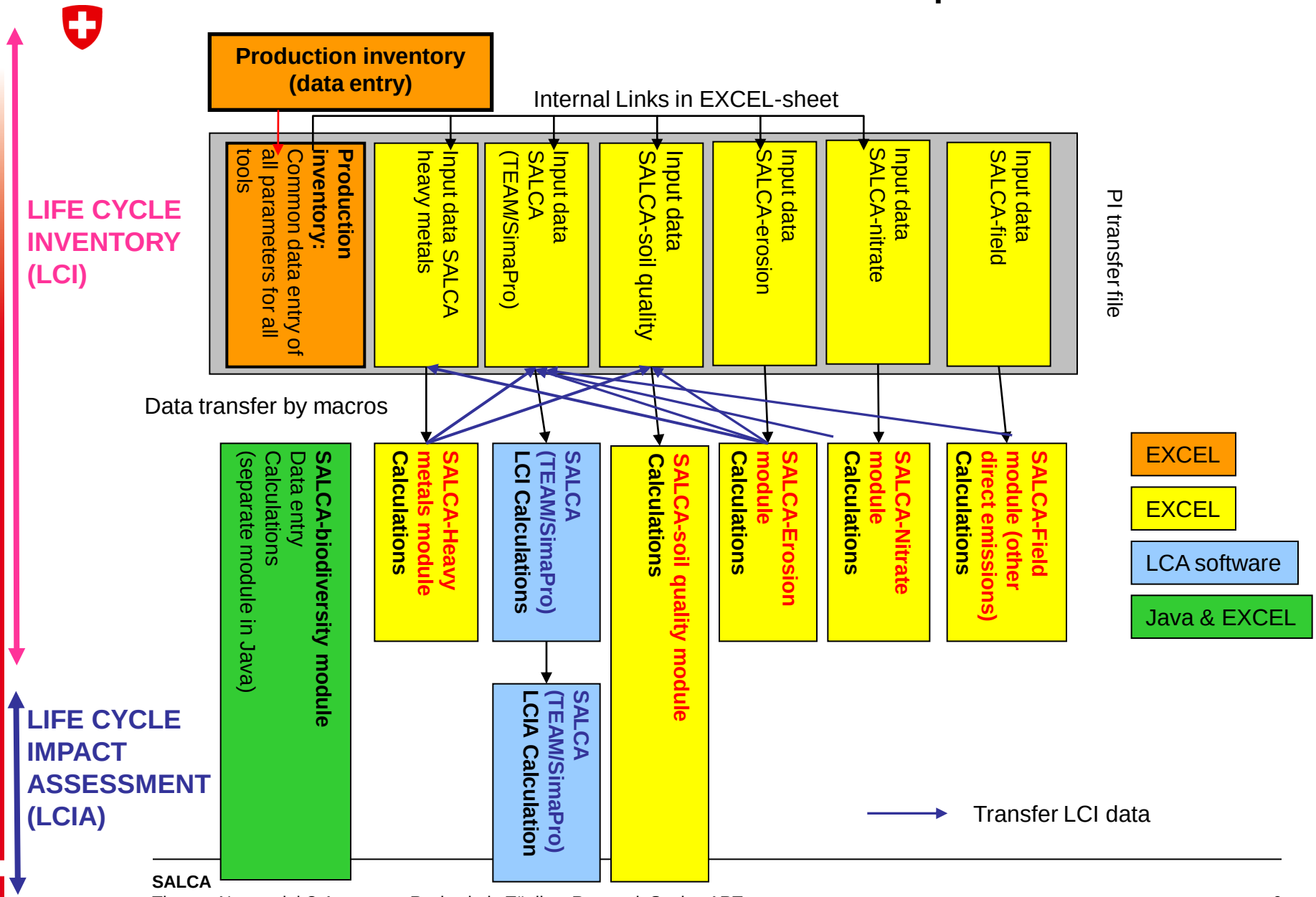
- System boundary: 1 crop per growing season
  - By multiple calculations it can represent also crop rotations and permanent crops
- 140 arable/permanent crops and vegetables covered
- Valid for Central Europe

| | C | D | F | G | H | I | J | K | L | M | N | O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | Crop rotation without GL | | | | | Crop rotation with GL | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | VARIABLE | INPUT | INPUT | INPUT | INPUT | INPUT | INPUT | INPUT | INPUT | INPUT | INPUT |
| 4 | MODULES | NAME | Saxony_1_OSR | Saxony_2_WW1 | Saxony_3_WW2 | Saxony_4_WW3 | Saxony_5_WB | Saxony_GL_1_OSR | Saxony_GL_2_WW1 | Saxony_GL_3_pea | Saxony_GL_4_WW1 | Saxony_GL_5_WB |
| 557 | N-Dünger Total | N Kalk-Ammoniumnitrat (kg N) | 51.30 | 159.30 | 186.30 | 99.90 | 135.00 | 51.30 | 159.30 | 0.00 | 156.60 | 135.00 |
| 558 | N-Dünger Total | N Ammoniumsulfat (kg N) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 566 | P-Dünger Total | P Triple-Superphos. (kg P2O5) | 53.67 | 53.67 | 53.67 | 46.00 | 46.00 | 46.00 | 46.00 | 53.67 | 53.67 | 53.67 |
| 567 | P-Dünger Total | P Superphosphat (kg P2O5) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 568 | P-Dünger Total | P Monoammoniumphosphat (MAP, kg P2O5) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 569 | P-Dünger Total | P Diammoniumphosphat (DAP, kg P2O5) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 570 | P-Dünger Total | P AN-Phosphat (kg P2O5) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 571 | P-Dünger Total | P Hyperphosphat (Rohphosphat, kg P2O5) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 572 | P-Dünger Total | P Thomasmehl (kg P2O5) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 576 | K-Dünger | K Kalisalz (KCl, kg K2O) | 29.33 | 29.33 | 29.33 | 57.00 | 57.00 | 44.00 | 44.00 | 0.00 | 0.00 | 0.00 |
| 577 | K-Dünger | K Kaliumsulfat (K2SO4, kg K2O) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 578 | K-Dünger | K Patentkali (kg K2O) | 15.77 | 15.77 | 15.77 | 0.00 | 0.00 | 8.25 | 8.25 | 44.00 | 44.00 | 44.00 |
| 584 | Andere Total | Ca Kalk (kg Ca) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 585 | Andere Total | Ca Karbonationskalk (kg Ca) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 586 | Andere Total | Ca Meeresalgenkalk (kg Ca) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 587 | Andere Total | Mg Magnesium (kg Mg) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 588 | Andere Total | Steinmehl (kg) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 589 | | | | | | | | | | | | |
| 590 | Weitere Hilfsstoffe Total | Wasser (Leitung, Alloc) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 591 | Weitere Hilfsstoffe Total | Wasser (Quelle/Bach, Alloc) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

PI | Tabelle2 | Tabelle3

**Production inventory**
Example: 2 crop rotations in Germany

# Modular architecture of the SALCA-crop V3.1



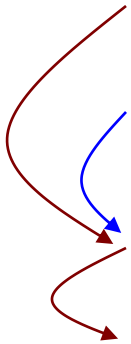
# Principles of SALCA tools: Software implementation

- **Automated workflow**
  → efficient calculation procedure
- **Batch processing**
  → mass calculation
  → many farms or crops can be calculated in one run
- **Core components** (SALCAcrop, SALCAfarm)
  → own programming
- **Peripheral components**
  → IT service provider, parametrisable tools
- Illustrated by the example of **SALCAfarm**

# SALCAfarm

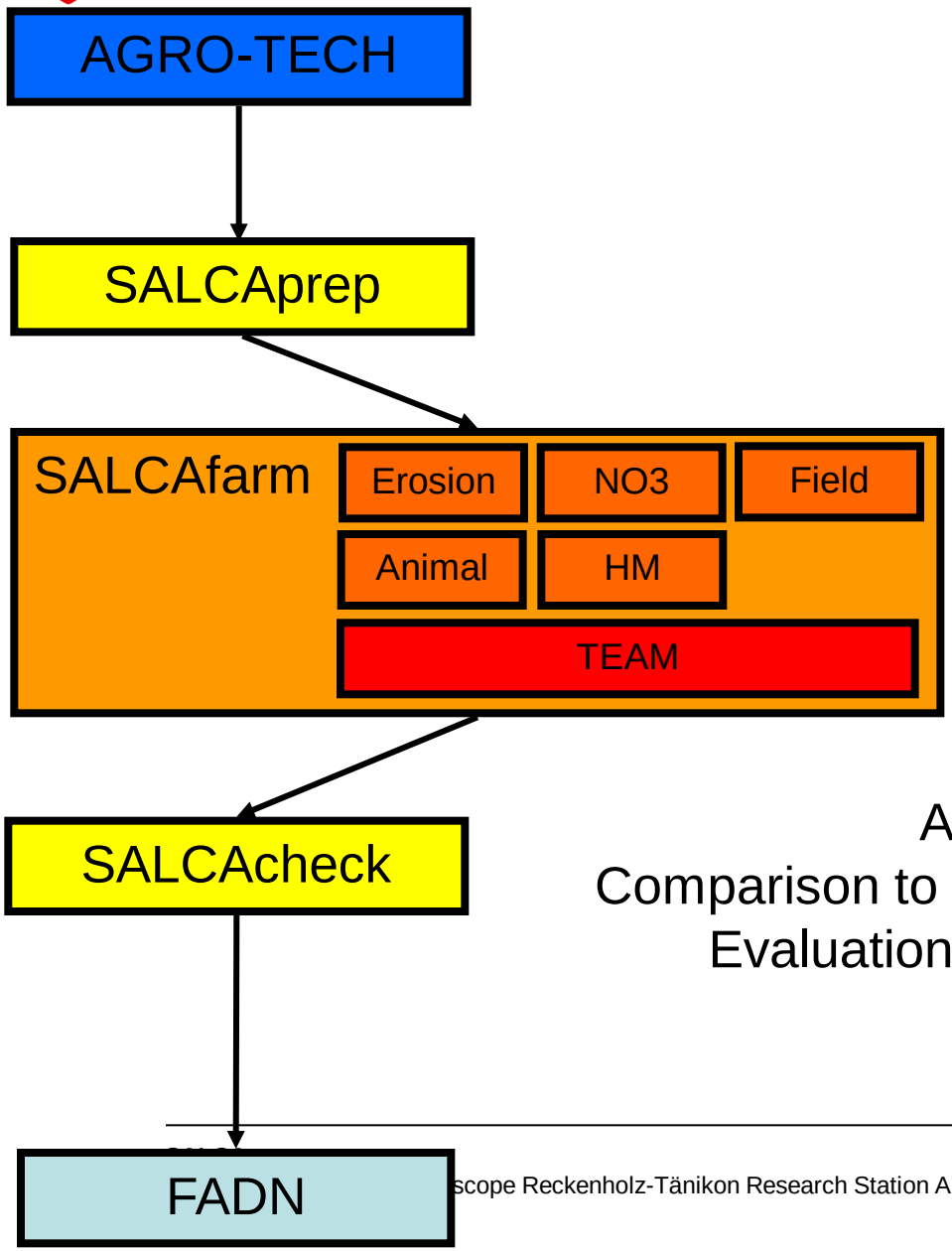
- System boundary: farm / product group
  - Can also be used for animal production systems
- Applicable for Swiss conditions
- Four system levels:
  - **Farm**
  - **Product group** (up to 14 product groups)
  - **Field**
  - **Crop**
- Allocation of inputs and outputs to the product groups by a set of allocation rules (economic, area, arable area, livestock units)

# SALCAfarm:
## Iterative calculation procedure at several levels



| | Calculation level | | |
|---|---|---|---|
| **Module** | **Crop** | **Field** | **Farm / product group** |
| SALCAerosion | ↻ | ↻ | |
| SALCAnitrate | ↻ | ↻ | |
| SALCAfield | ↻ | ↻ | |
| SALCAheavyMetals | | | ↻ |
| SALCAanimal | | | ↻ |

# Automated workflow as used in LCA-FADN




Data collection

Data extraction/export
Data processing

LCA
calculation

SALCA-SQ

SALCA-BD

Absolute values
Comparison to ref. values → relative values
Evaluation, validation, data export

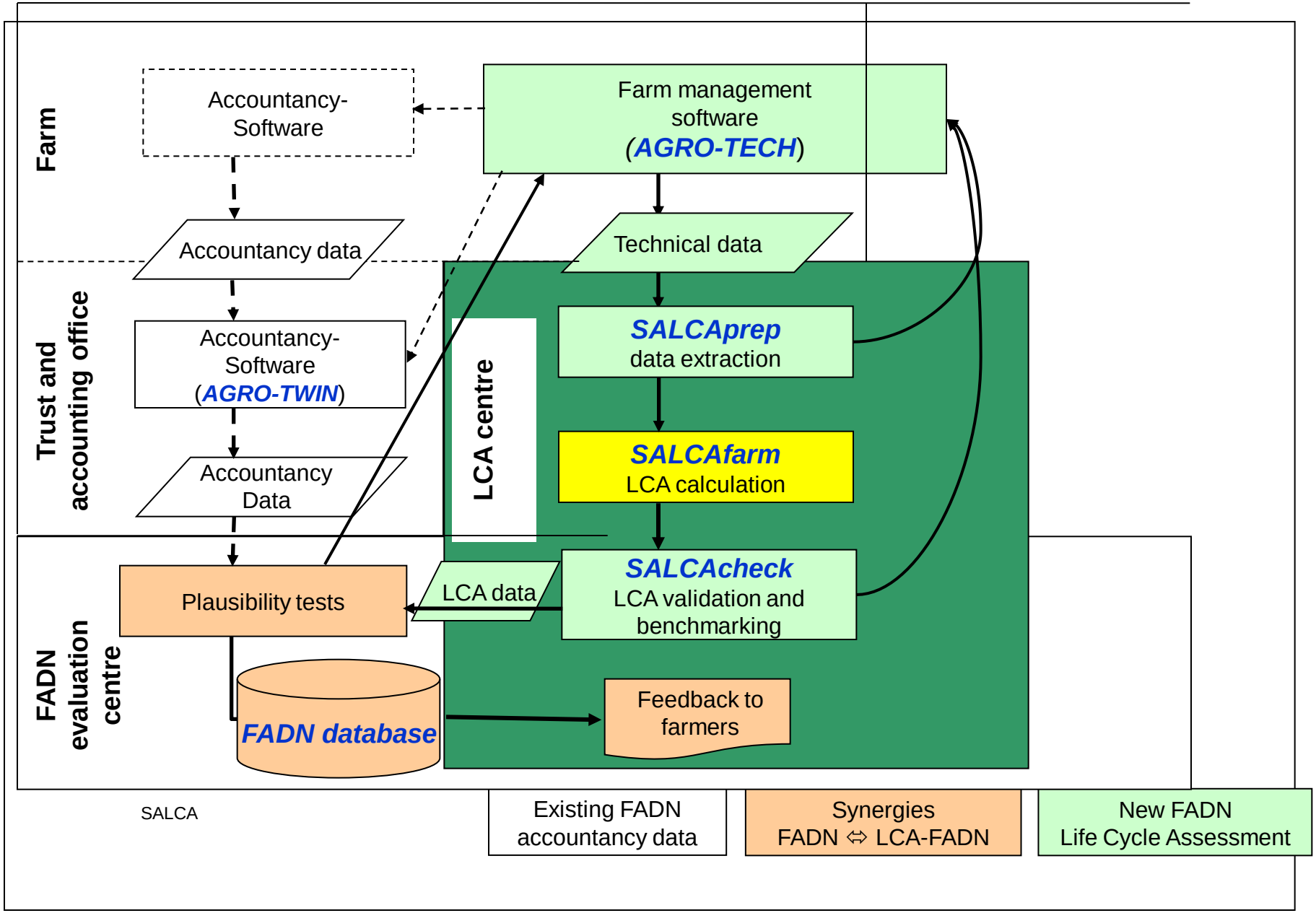
EXCEL

EXCEL

Java

Access

# Embedding into existing IT infrastructure Workflow in the project LCA-FADN



# Conclusions

- Advantages of generic LCA tools
  - Consistent, standardised calculation of a large number of LCAs
  - More efficient calculation → allows to assess variability better
  - Avoids redundancy → changes and improvements made only once
  - Flexibility by parameterisation
- Drawbacks of generic LCA tools
  - Time-consuming development
  - System gets more complex (need to consider all cases) → modular structure required
- Generic LCA tools are required
  - to handle large datasets
  - to assess variability
  - to foster agricultural LCA

# Outlook

- SALCAfuture (IT project)
  - Fundamental revision of the SALCA tools
  - Easier, faster, more user friendly data collection
  - Better analysis tools, scientific support
  - Import options for various data sources
  - Easier maintenance