Aspects of Digitization in Agricultural Logistics in Germany

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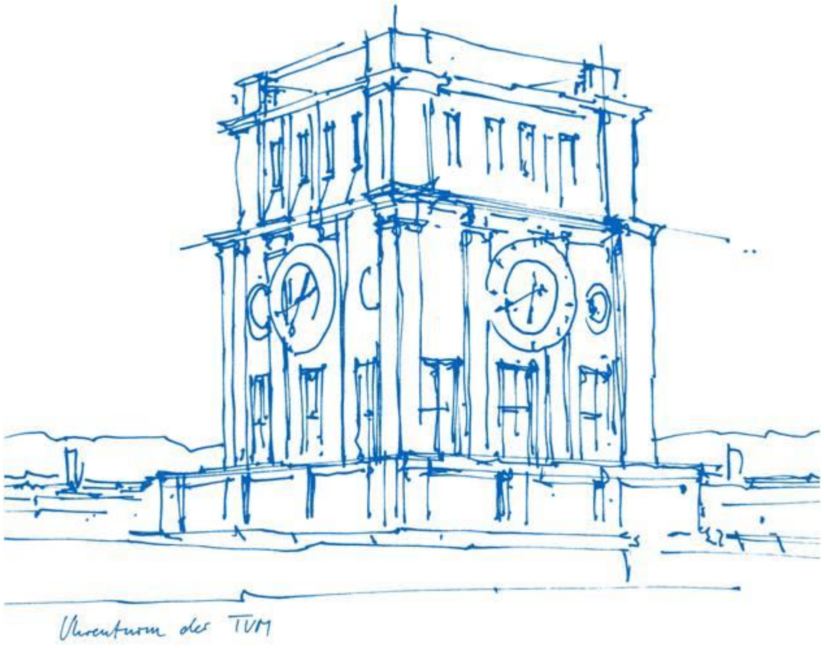
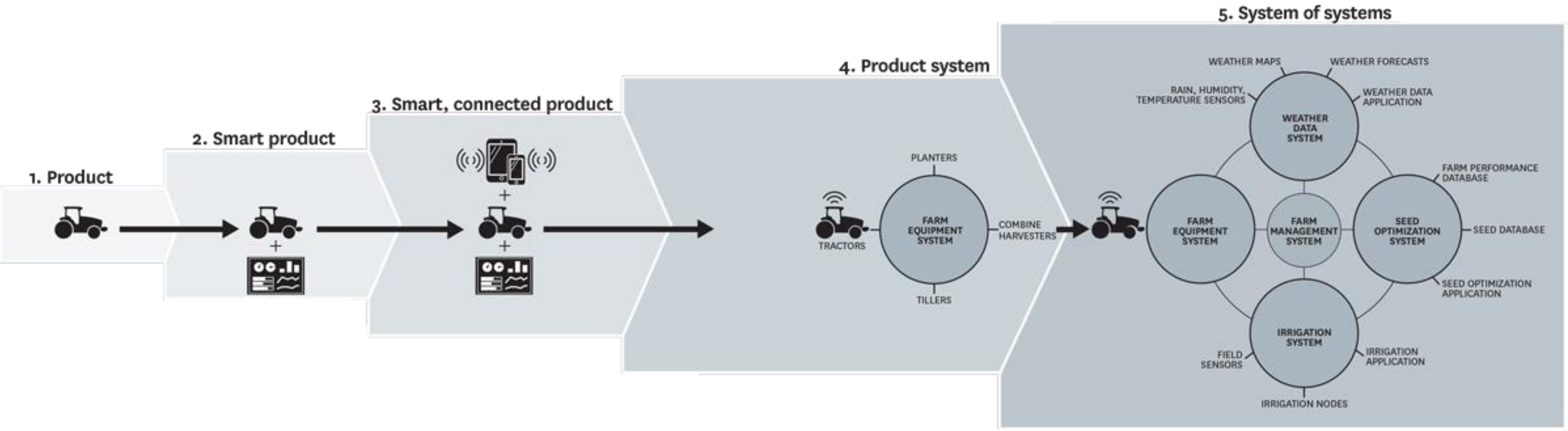


Development of Data Management in agriculture

- Germany: „Industry 4.0“ is en vogue (digtial networking of all production processes)
- In agriculture: „Digitization“ more common



Challenges for Agricultural Logistics in Germany

- Structural changes:
  - farm size ↑
  - nr. of trading sites ↓
  - quantities of transported goods ↑
  - distances ↑

- Consumer demands traceability and more diverse qualities

- Farmers, Traders, Processors & Wholesale strive to optimize their processes
  - Cost ↓
  - Efficiency ↑

Particularities of Agricultural logistics

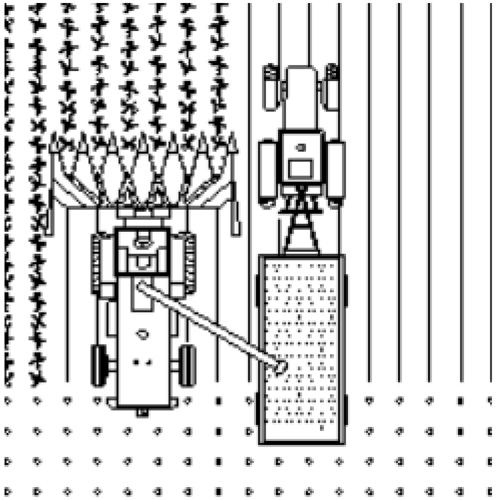
General logistics	Agricultural logistics
Machines optimized for road use	Machines used for infield & road transport (mainly tractors due to historic circumstances)
Start point and target specified	Sources & sinks of goods move during logistics process
Fixed locations for overloading	Precise location forecast of machines is difficult. Influencing factors on time, place and amount of goods for overload: - Yield - Driving patterns on field - Soil properties - Driver‘s operation - Vehicle movement during overloading etc.
Long term planning	Dynamic real-time planning processes

➢ **Agricultural Logistics need smart algorithms, powerful Information Systems, smart Software & Hardware solutions and reliable information sharing throughout the value chain**

Hardware

Hardware in agricultural logistics

- Navigation Systems (dirt-roads, bridge loads, one-way rules) – dynamic influencing factors
- Yield recording (inside harvester too late, preferably by satellite imagery or drones)
- Automated steering systems for overloading
- Vehicle identification in Telemetry Systems: Bluetooth & RFID Chips



Data Transfer Models for tracking commodities during agricultural logistics:

1. Data is uploaded to a central cloud service and updated during the process steps
2. Data stays with the commodity and undergoes several transmission processes during overload between machines/facilities

Software

Farm Management Information Systems

Farm Management Information Systems are the basis for planning and decision making.

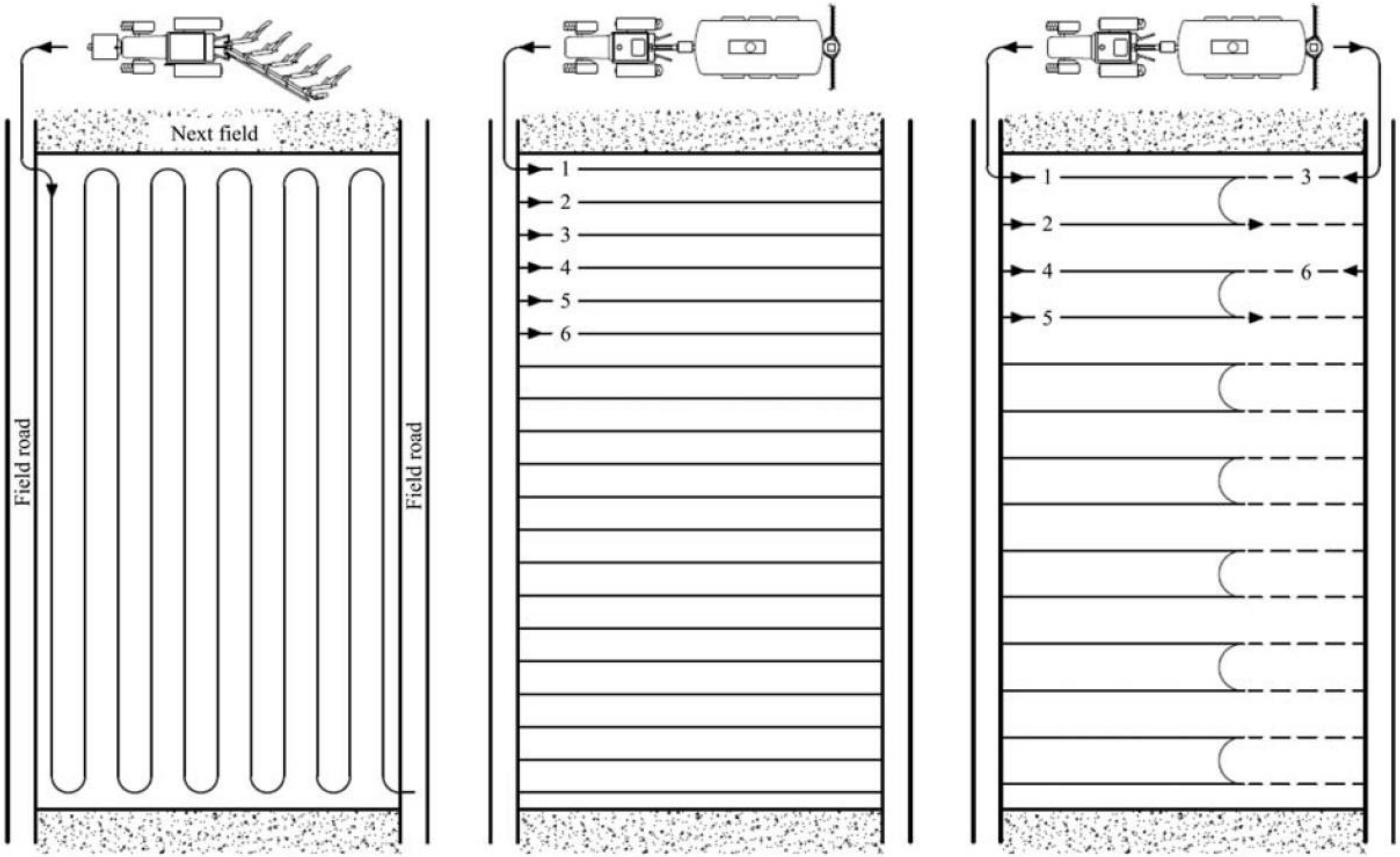
They deliver documentation, processing, analysing of:

- Process flow
- Locations
- Technology
- Employees
- Costs
- Etc.

Problems:

- Conflicting objectives
- Unknown influences of parameters in decision support

Example FMIS Decision Support Systems - Infield Logistics



a. Most efficient way of working for material neutral operations (e.g. tillage)

b. Material input/output operations without pretended tramlines

c. Tramline distances pretend working width

Telemetry Systems

- transfer of a system from demonstration to general use -> Stability
  - Different radio networks
  - Machines of different ages
  - Machines of different manufacturers
  - Different communication and data standards
  - Network coverage (crop harvesting chain does not work if parts of it are temporarily invisible)
  - IsoBus on the limit of its data transfer bandwidth -> Data for FMIS gets lost

  ➢ New standards for data exchange are necessary
  ➢ Data exchange interfaces for older machines should be developed

Value Chain

Value chain

Logistics play a decisive role in trading, data exchange along the stages of the value chain helps improve efficiency and generate benefits.
In Germany chains have developed very differently.

Sugar Beet Logistics:

- Central digital database for planning
- Fields, grower, rowing order, storage location etc. documented
- Harvesting chain optimized through telemetry status updates
- Necessary data of sugar beets transmitted to factory & reported to farmer
- Central database for transport & billing
- all parties involved can querie necessary data
- Only one central processor (9 factories) in southern Germany
- Only one central farming community (economically linked)

Value chain

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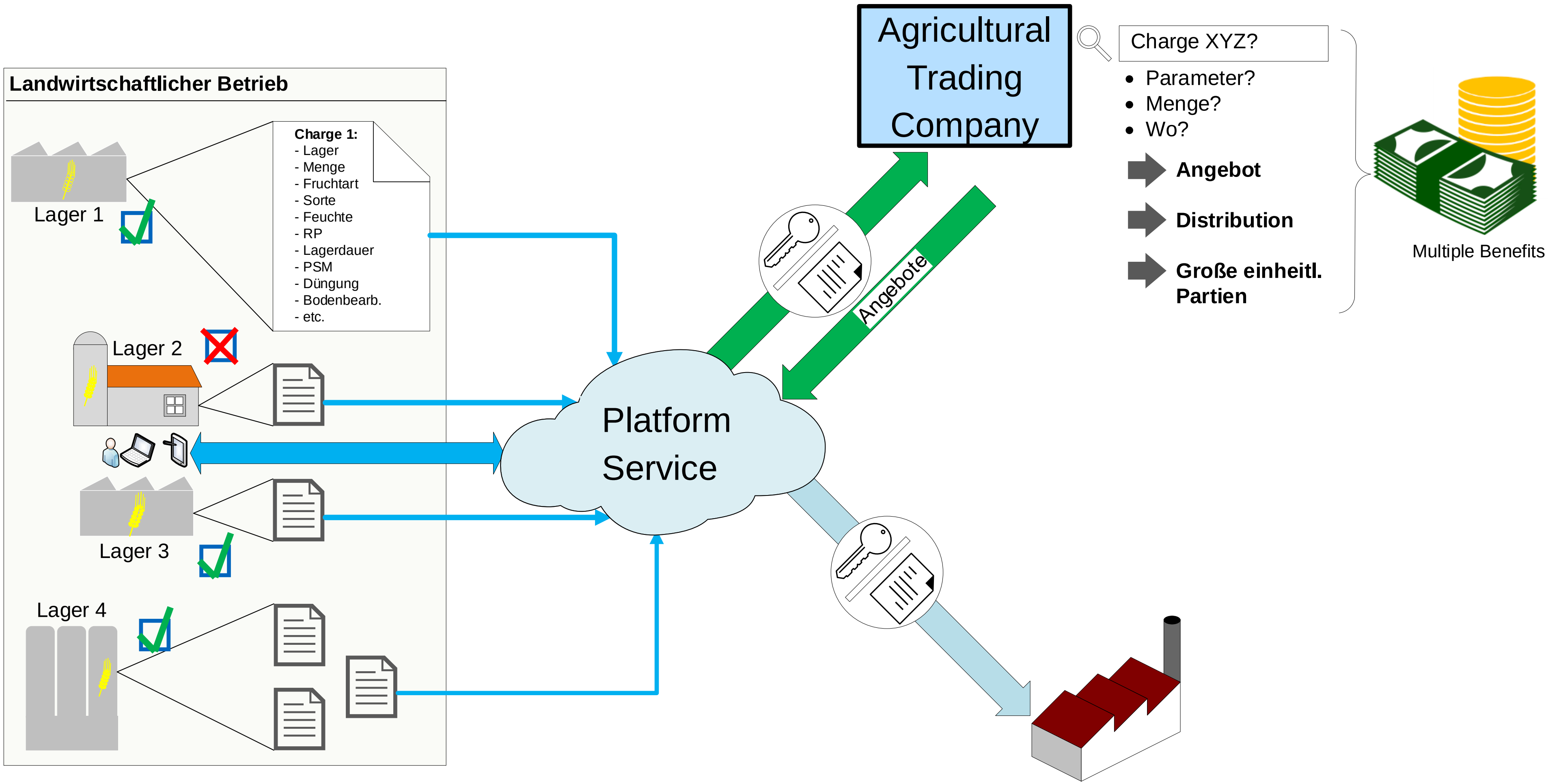
Grain Logistics:

- Neither farmers, nor traders/processors have central organizations
- First approaches for digital data collection and exchange between farmers & traders (mainly supporting exchange of traceability certificates)
- Very inefficient data sharing: Farmers print from FMIS, send paper to trader, trader manually enters data to database
- No organizational structures to be found to share data digitally between farmers and traders as well es further stakeholders in the chain

Information sharing throughout the grain value chain



Outlook

- Digitization of agricultural logistics desired and necessary
- Conditions of growing farms and requirements of agricultural trade promote this change
- First digital solutions are on the market
  - Lack of stability
  - Improvable adaptation to special agricultural requirements
  - Improvement of algorithms & data bases necessary
- Standardization of Hardware, Software, Data-Exchange has to be improved
- Clear regulations about the ownership of data have to be developed
- Knowledge about benefits of improved Data-Exchange has to be generated and distributed to the different stakeholders