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Smart Farming – Definitions and Concepts

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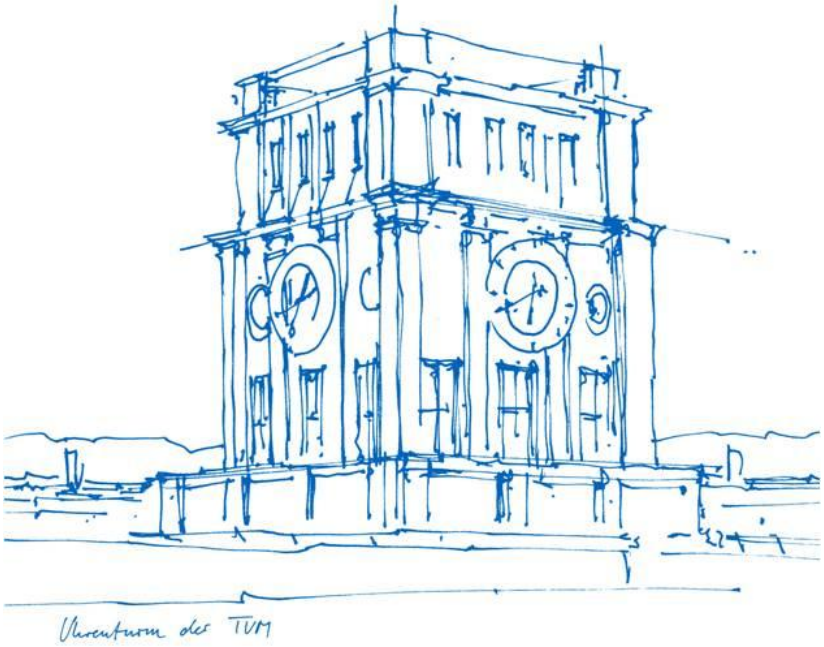

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Digital Transformation Overview

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Who is Major Buzzword and why is he dropped so often?

Digitization
= to convert something into a digital format (e.g. encoding of data and documents)

Digitalization
= to convert business processes over to use digital technologies and digitized data

-> leads to fundamental changes in business processes, results in new business models and social change

Digital Transformation
=business transformation enabled by digitalization (compare german „*Digitalisierung in der Landwirtschaft*“)

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Evolution of Concepts in Farming

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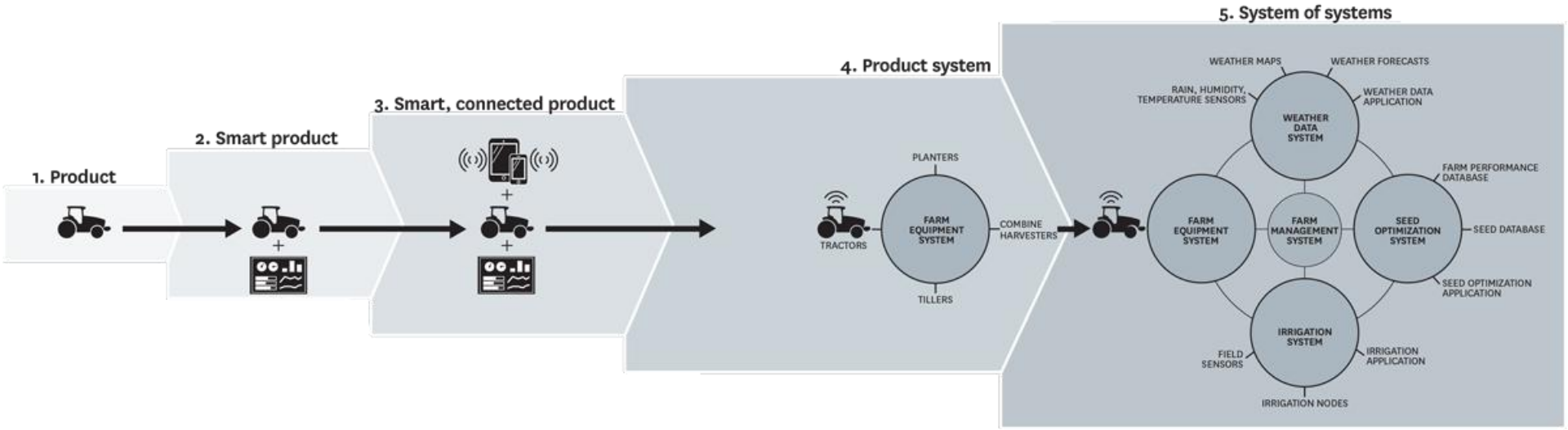
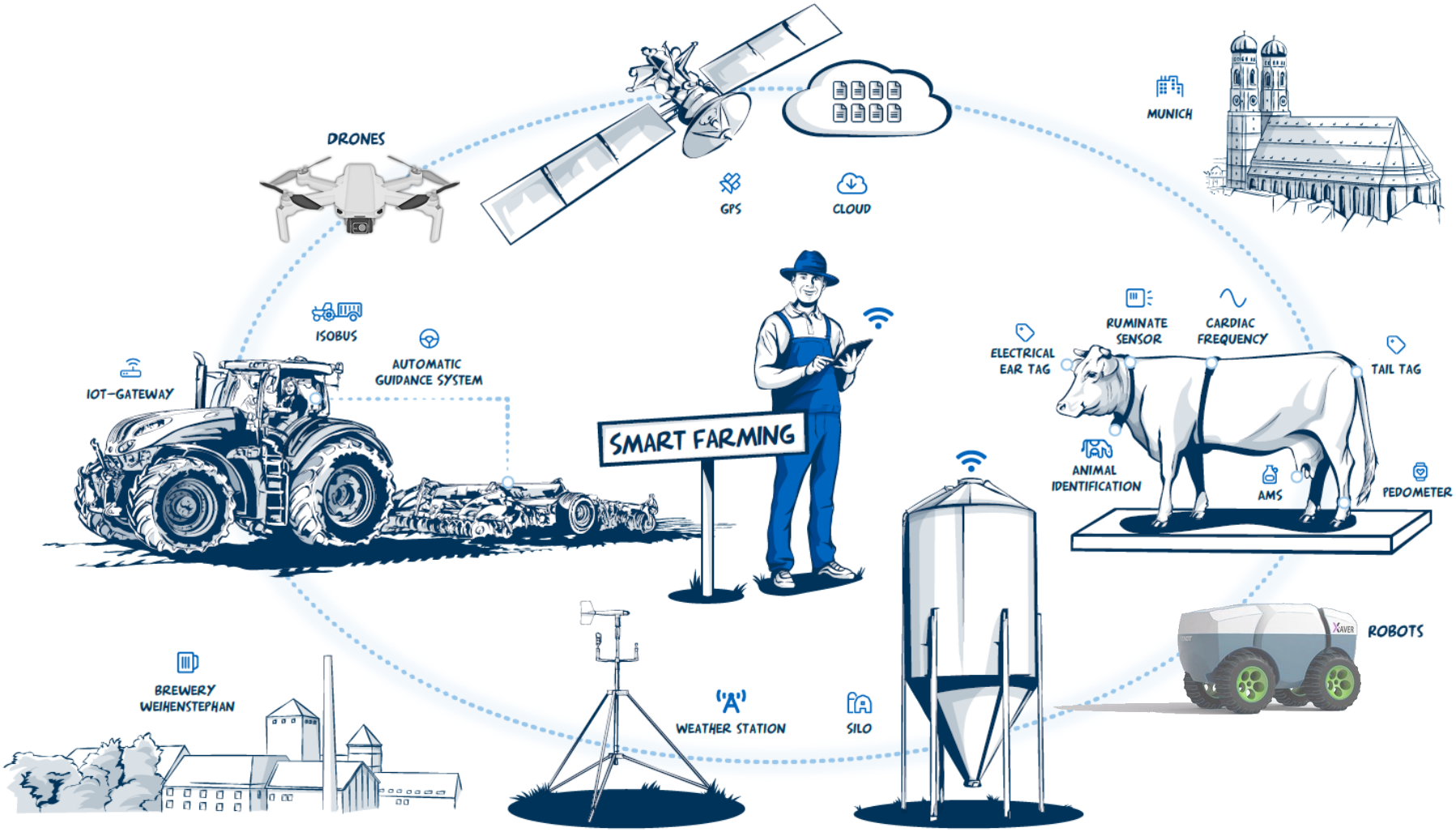
Towards a „System of Systems“-approach



Source: Porter, M.; Heppelman, J. (2014)


DRONES
GPS
CLOUD
MUNICH
ISOBUS
AUTOMATIC
GUIDANCE SYSTEM
IOT–GATEWAY
SMART FARMING
RUMINATE
SENSOR
CARDIAC
FREQUENCY
ELECTRICAL
EAR TAG
TAIL TAG
ANIMAL
IDENTIFICATION
AMS
PEDOMETER
ROBOTS
BREWERY
WEIHENSTEPHAN
WEATHER STATION
SILO

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Evolution of Concepts in Farming

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in detail

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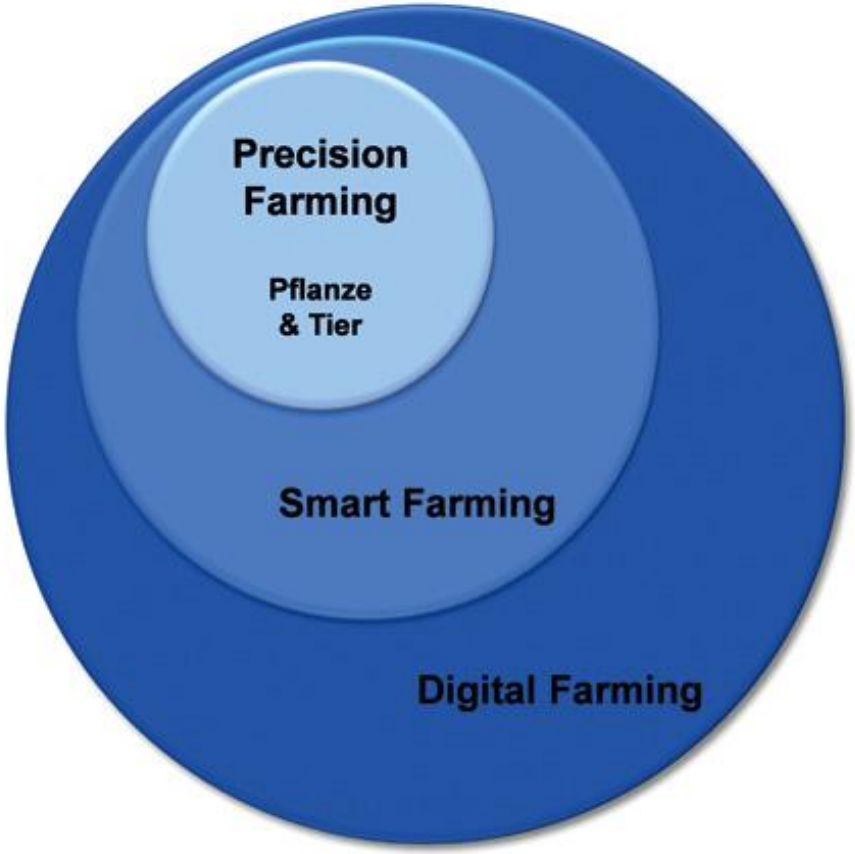
Concepts contain each other



Source: DLG (2019)

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Precision Farming

- Started in the 1990s
- Site-specific farming
- Automatic Guidance Systems (AGS)
- Application maps
- Section Control (SC)
- Variable Rate Application (VRA)
- Self-optimizing grain combines & harvesters
- Optimization of logistic chains

Precision Livestock Farming:

- Use of sensor-actuator combinations in the barn
- E.g. exact dosing of concentrate feeds, automatic milking (not Milking robots!), health monitoring

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Smart Farming

- Since 2000s
- Automation of processes & **decision support**
- Sensor-based real-time systems (e.g. nitrogen sensor controls fertilizer spreader)
- Real-time sensor system replaces the hassle and cost of creating application maps manually (no more manual handling of soil probes, yield maps, biomass imagery etc.)

Smart Livestock Farming:

- Sensor-actuator combinations
- Data logging + decision support + automatic action
- E.g. automated action on executive tasks (e.g. milking) or evaluative tasks (e.g. estrus monitoring)

Digital Farming

- Zeitgeist
- Systemic approaches that add the four major components:
  1. IoT (Internet of Things) & M2M (Machine to Machine Communication)
  2. Cloud Computing
  3. Big-Data-Analyses & Artificial Intelligence (AI)
  4. Robots (mobile & stationary)

Hint: AIoT = IoT Systems that contain AI components (see more during IoT Stack lectures)

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Change in Paradigms

Past:
Humans, nature and landscape subordinate to technology

Future:
Technology adapts to the needs of nature, landscape & humans .
Next to yield, clout and cost, „smarter“ agricultural machines and processes take the needs of ecosystems, cultural landscapes, animal health and operator wellbeing into account (less opposing goals)

Structured observation becomes data	Data + interpretation = information	Combination of information + experience creates knowledge

Source: DLG (2019)