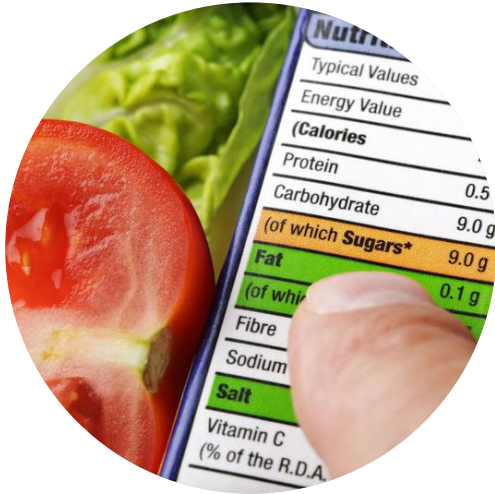


# Digital Innovation for Sustainable Food Systems

**Sjaak Wolfert**, Sr. Scientist @Wageningen Economic Research

Extended presentation for meeting with OECD delegation, 06 Sep. 2019, Wageningen

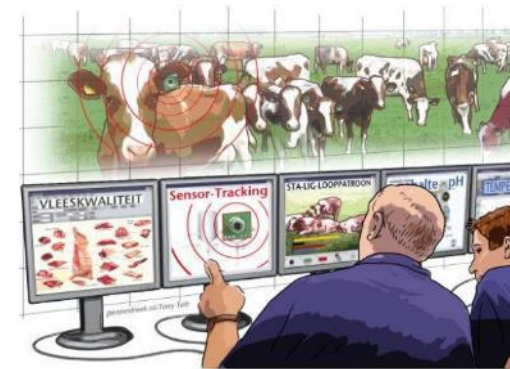
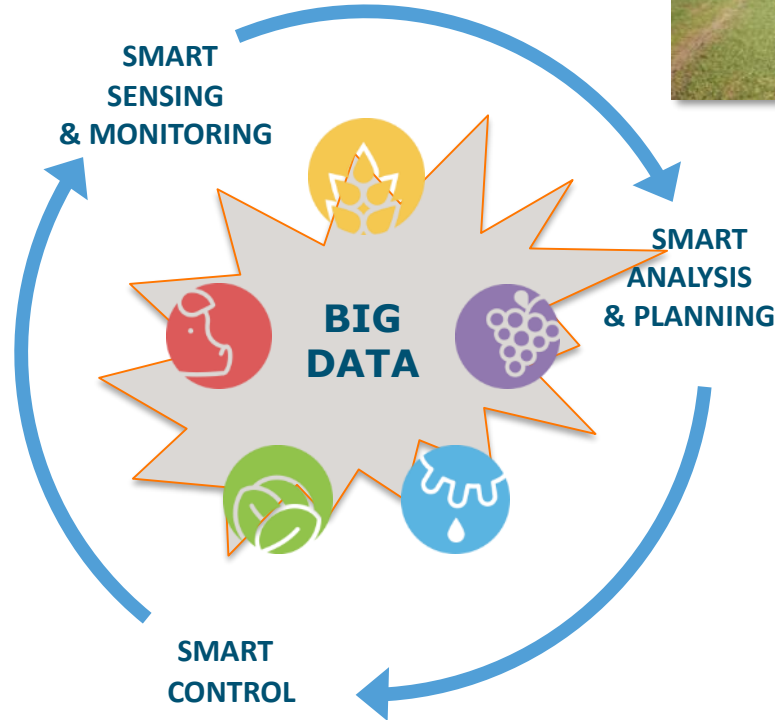
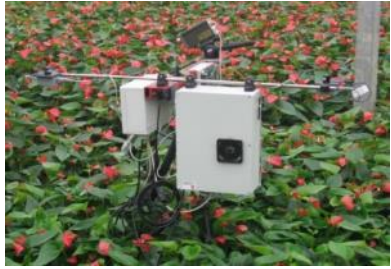


# The grand challenge in food:



The dietary behaviours of 9 billion people in 2050 determine not only their physical health, mental and social well-being, but also the sustainability of the food system that has to **produce these diets within planetary boundaries**.

# Smart Food production as a cyber-physical system



# ...involves entire supply chain and beyond



Smart Farming

Tracking & Tracing

Smart Logistics



Consumer trends



Domotics



Personalized

Health



Fitness/Well-being





# Societal/Science trends in Food, Nutrition & Health

## Digitalisation: monitor the consumer

- Data platforms, standards
- Apps, sensors, wearables (and test them)

## Personalisation

- Individual feed back structures
- Quantified self

## Citizen science

- Citizens become engaged in research
- GDPR empowers the consumer

## ICT: Artificial intelligence and Big Data

- Move from pre-defined tests to heuristics

## Health: from curative to preventive

- Hospitals recognize role of food in recovery
- Non-communicable diseases are the major health risk and related to food and lifestyle
- Life style medicine / health stress: Role of food

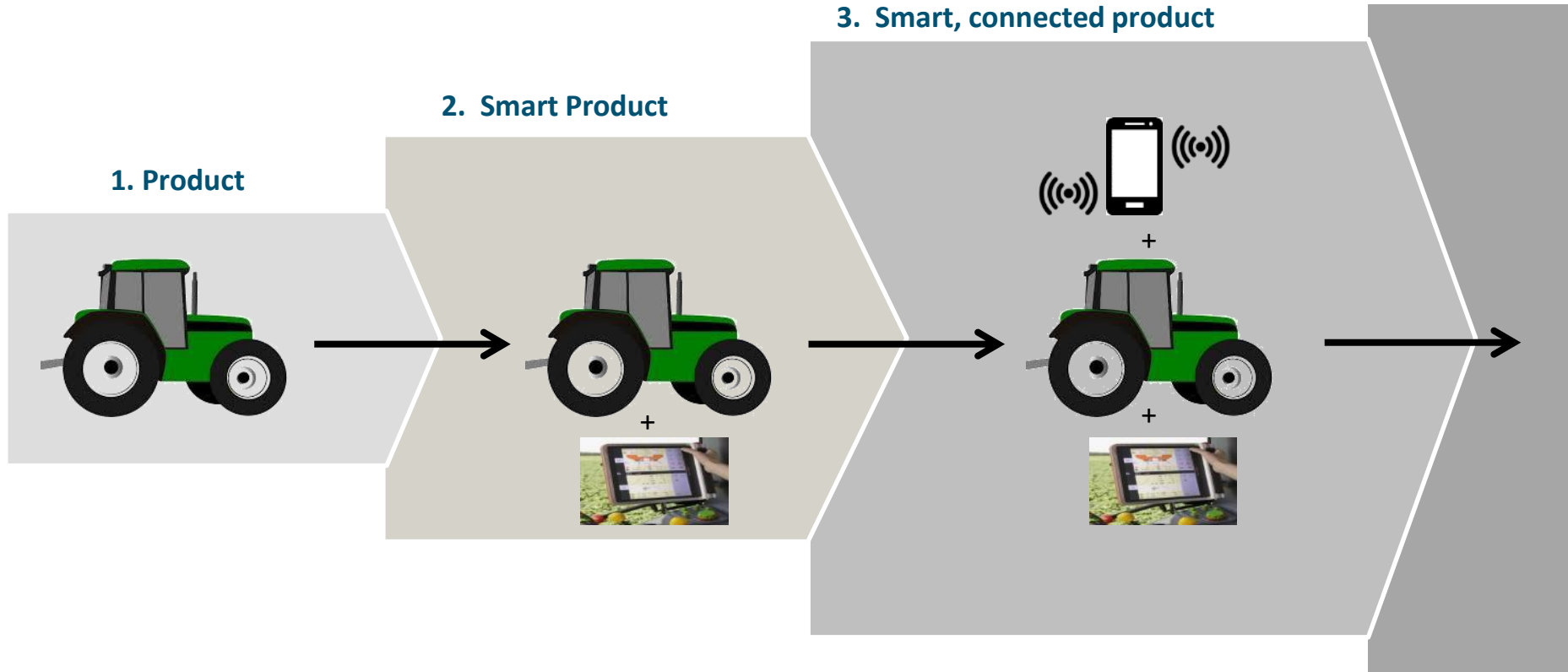
## Science: we learn more on body & brains

- Neuro-science and behavioral economics
- Micro-biome and gut flora

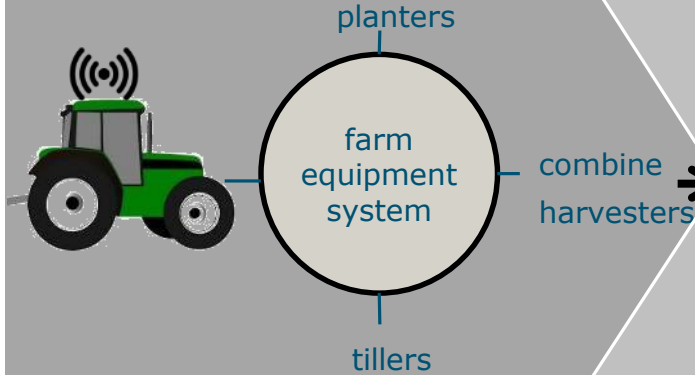
## Policy coherence: integration needed

- Fragmentation in sectoral policies and practices to be overcome
- Food policy is rising on the agenda
- Research policy: open data and access
- Open innovation for SME in food, ict, health

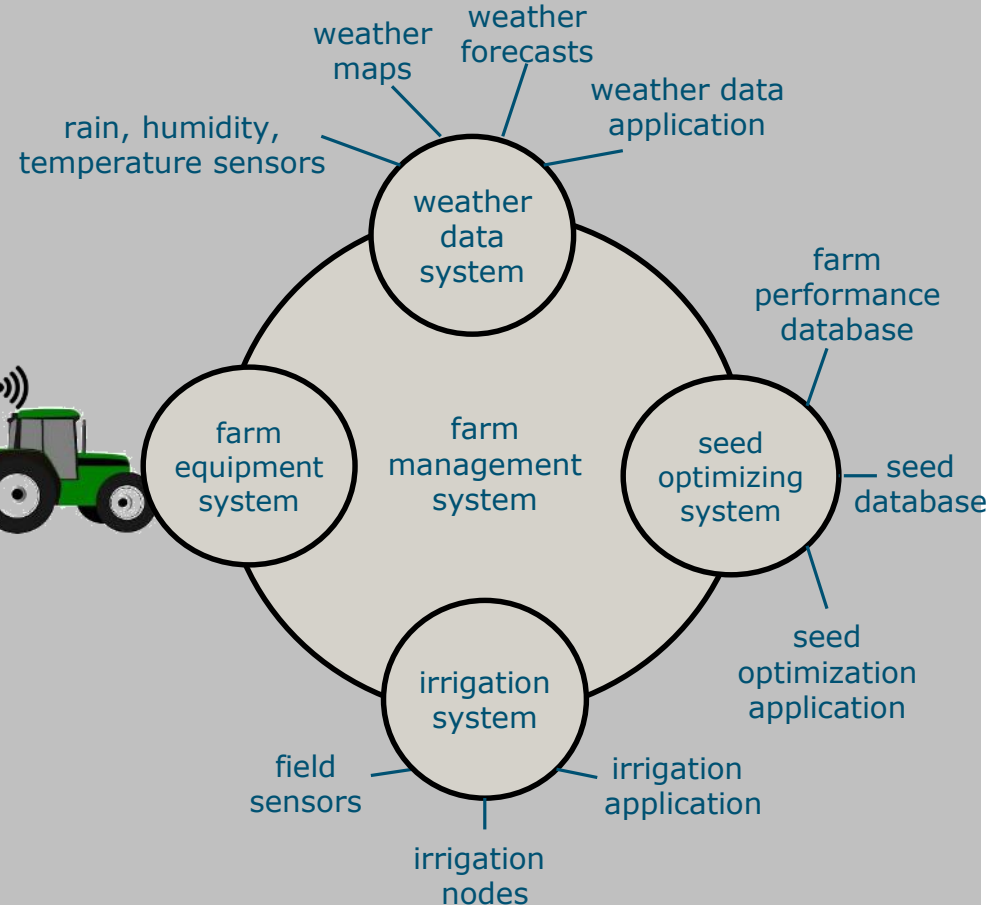
# Redefining Industry Boundaries



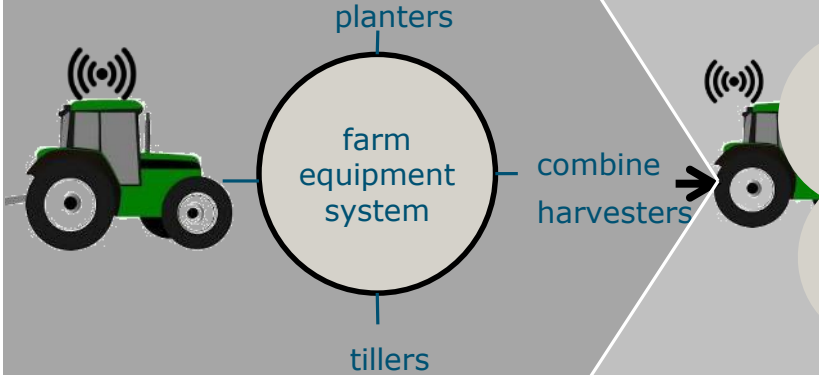
## 4. Product system



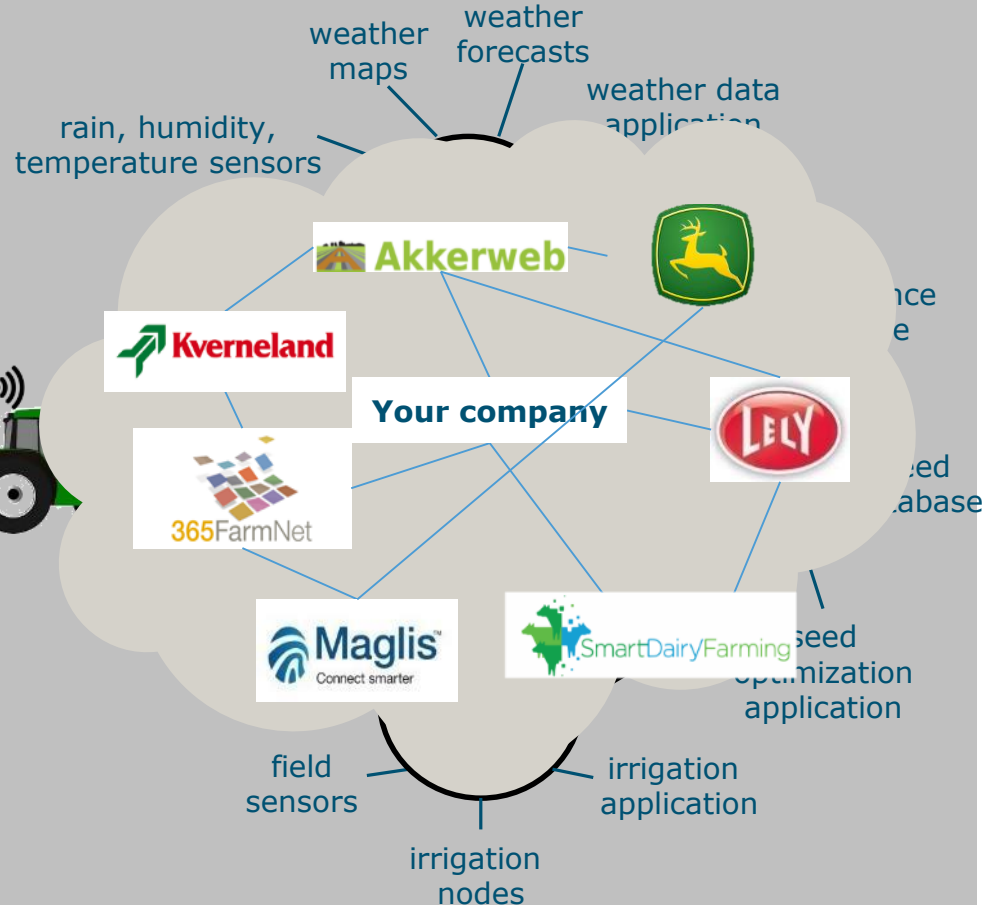
## 5. System of systems



## 4. Product system

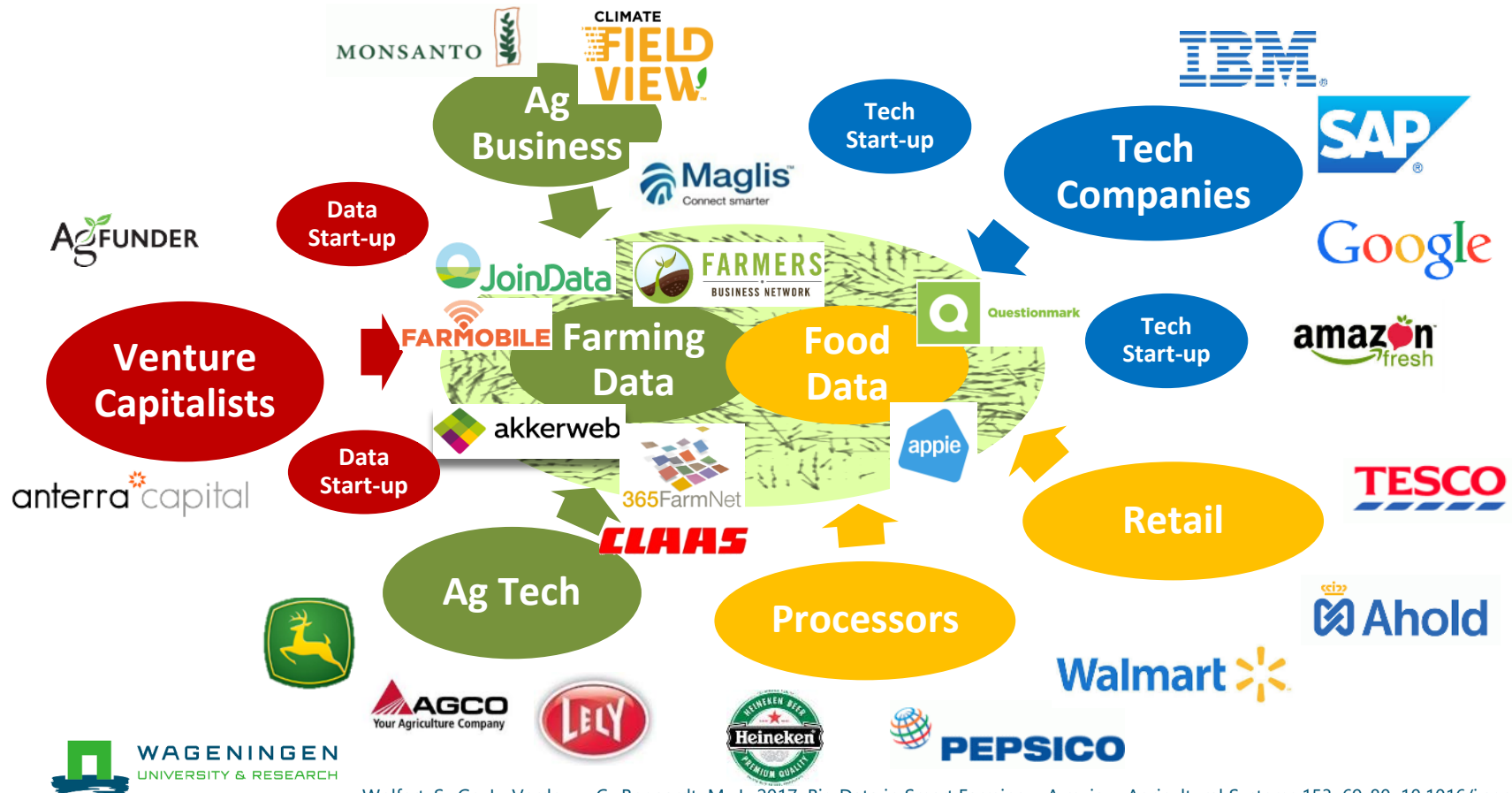


## 5. System of systems

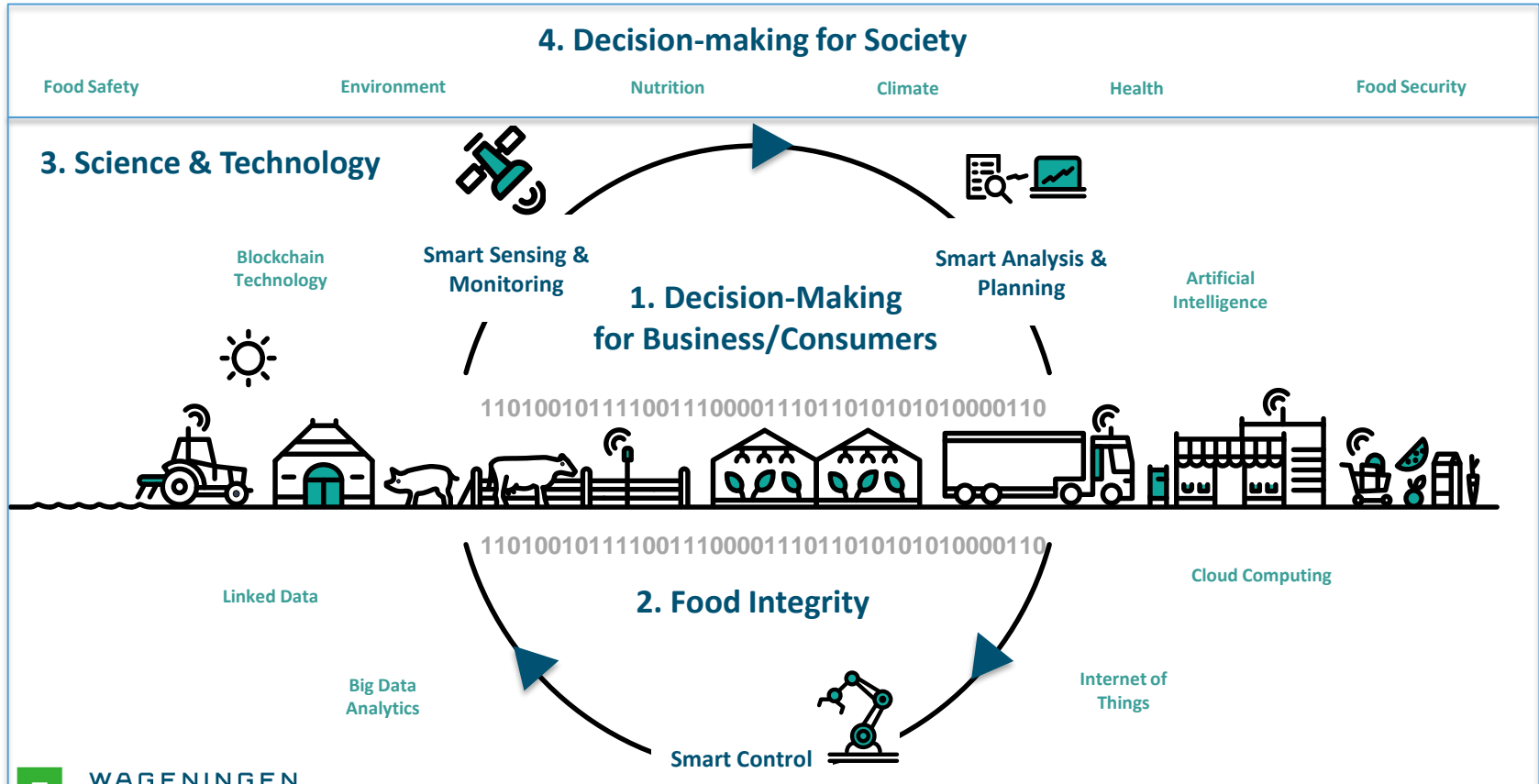




# The Battlefield of Data for Farming and Food



# Digitization of Agri-Food: 4 areas coming together



# Innovation challenge and issues to be solved

How to create infrastructures and ecosystems that utilize the potential of digital data to address the grand challenges of agriculture and food production?

- Data Infrastructure & Analytics
- Business models
- Governance and Ethics



# Addressed by European project line on digitalization

## Future Internet PPP



## Industry 4.0



**Network of  
Digital  
Innovation Hubs**

## Food & Nutrition

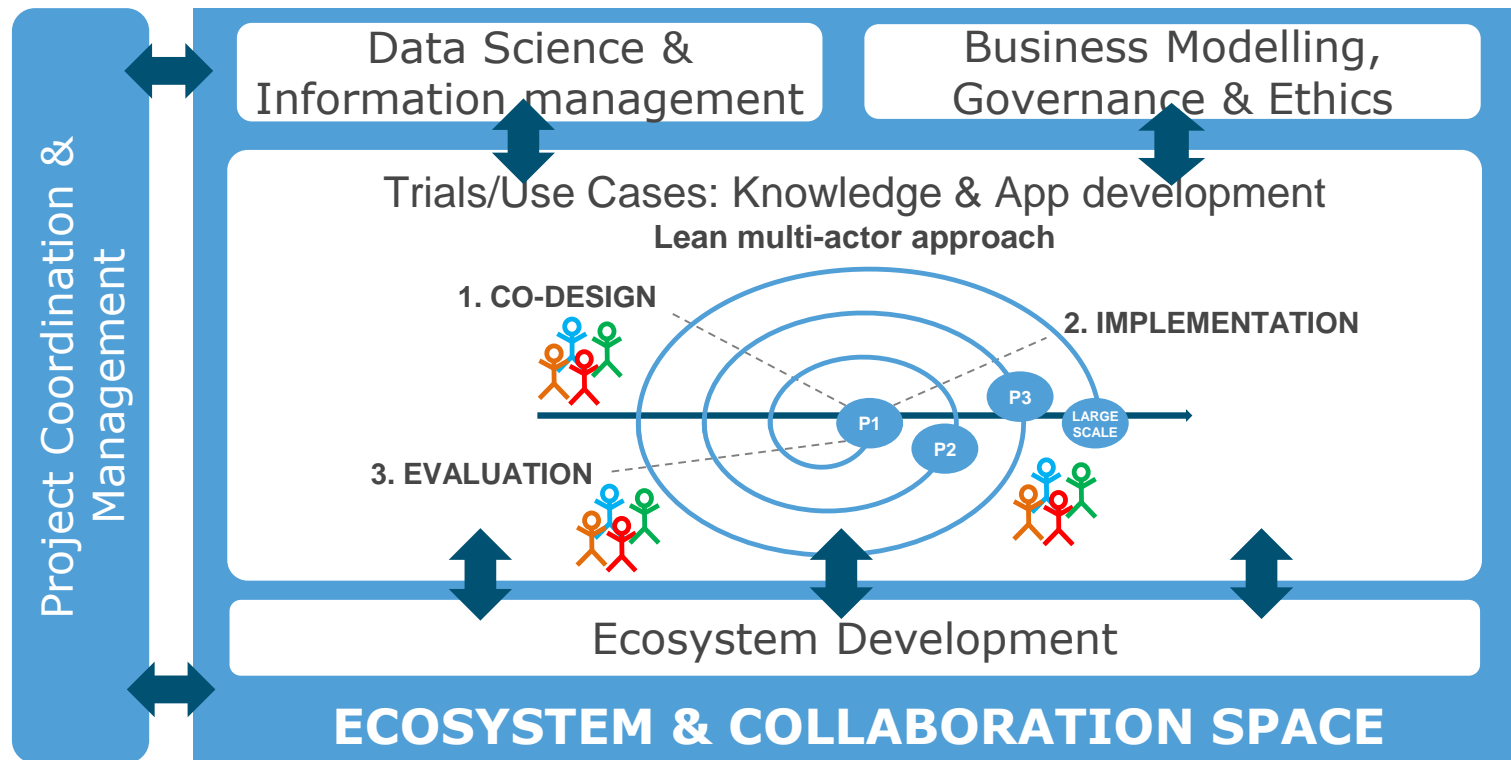


**Food, Nutrition & Health**



*Boost rural  
economies  
through  
cross-  
sector  
digital  
service  
platforms*

# A multidisciplinary, collaborative, agile approach



# Internet of Food and Farm 2020

Innovation Action: 2017 - 2020

30 M€ funding by DG-CNCT/AGRI

## Objective:

**Large-scale uptake of IoT** in the European farming and food sector

- Business case of IoT
- Integrate and reuse available IoT technologies
- User acceptability of IoT
- Sustainability of IoT solutions





## TRIALS

- DAIRY
- FRUITS
- ARABLE
- VEGETABLES
- MEAT
- All kinds
- Organic
- Integrated

19 + 14 use case projects



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# UC1.1. WITHIN-FIELD MANAGEMENT ZONING

Soil map based variable rate applications and machine automation in potato production

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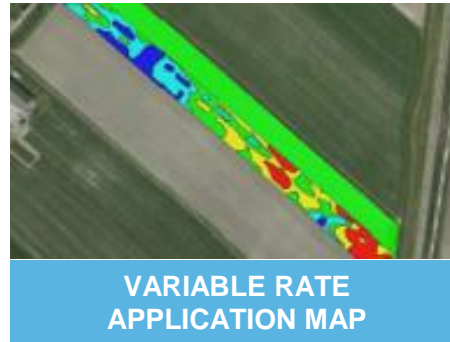
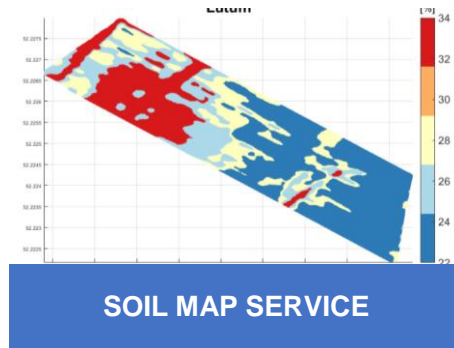
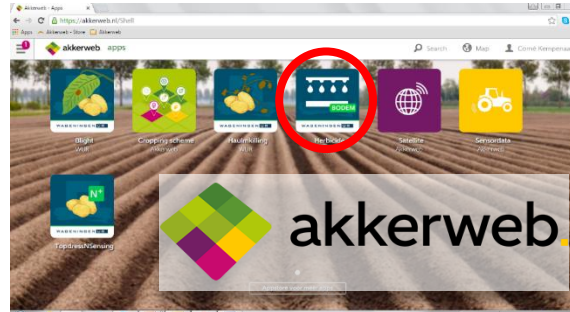
Coordinators: Peter Paree (ZLTO) & Corné Kempenaar (WUR)



Bayer CropScience



# Product Impressions



# Product Factsheet

High spatio-temporal **monitoring dashboard**

## Service

### Variable Rate Application Map Service

Smart application of resources: seeds, pesticides, fertilizers

Customer & Provider

## Business model



Farmers and advisors



Price per unit



Data-, service,  
infra-, knowledge  
providers

## Major Challenge

Existing variable rate maps are often based on tweaking expert judgement and lack a certain level of precision in tasking / lack of validation.

## Core Product Features

## Minimum Viable Products



**Variable planting distance map** –  
Validation in 2017 and 2018. Nov. 2018  
portal where maps can be ordered.



**Variable rate herbicide use map** -  
Validation in 2016 and 2017. May 2018  
portal where maps can be ordered.



**VRA additional N spraying**  
June 2018 on Growth + Soil Maps.

## Added Value

Here is what we aim to improve (KPIs)

Yield by better  
plant distribution  +4%

Quality by better  
plant distribution  +5%

Reduction  
pesticide use  -23%

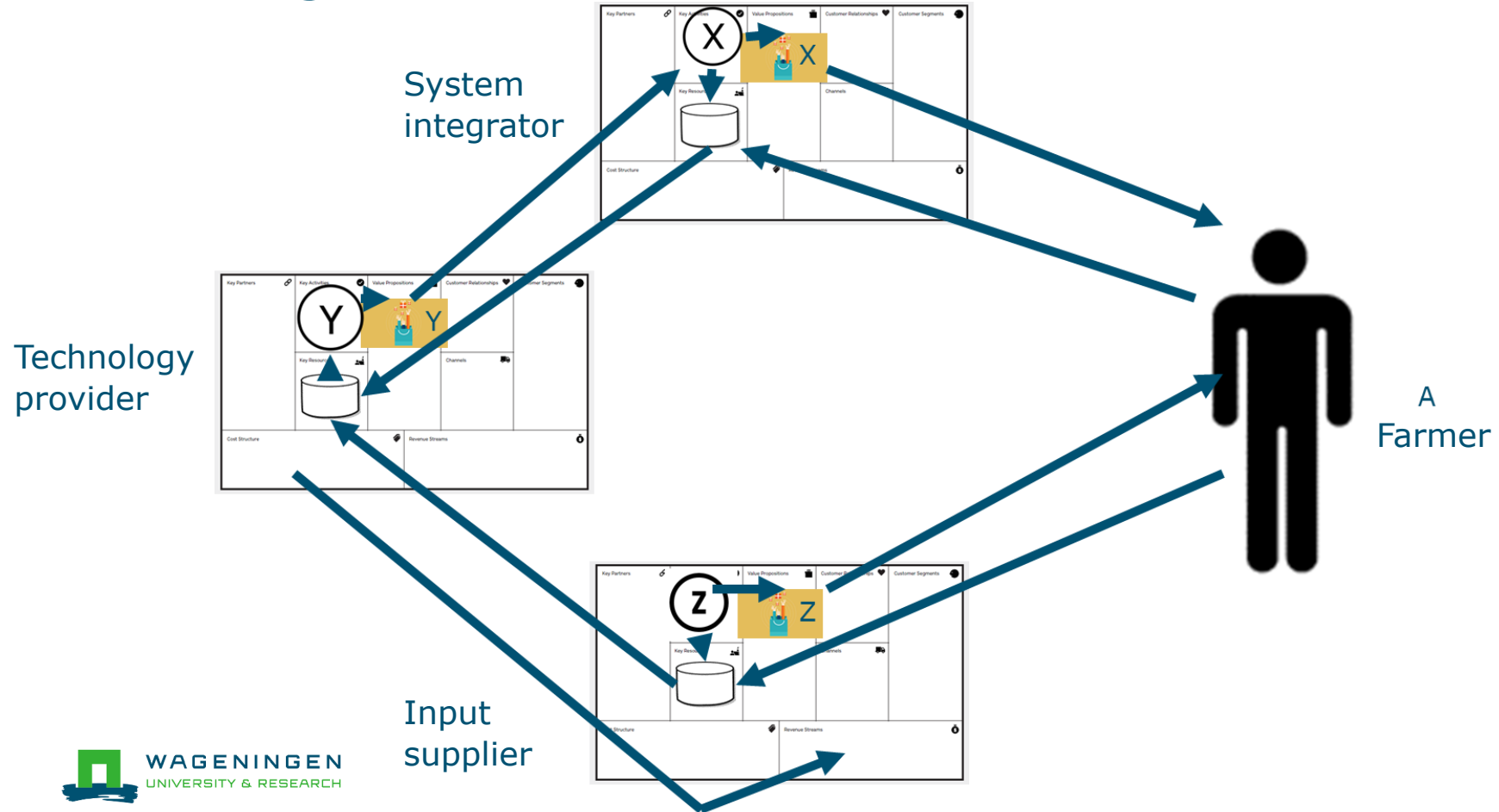
Reduction  
fertilizer use  -10%

*Better distribution of plants leads to +5% kilos and +5% better quality (more potatoes in desired size). Taking soil characteristics for weed growth into account: -23% less herbicide and +2% more yield.*

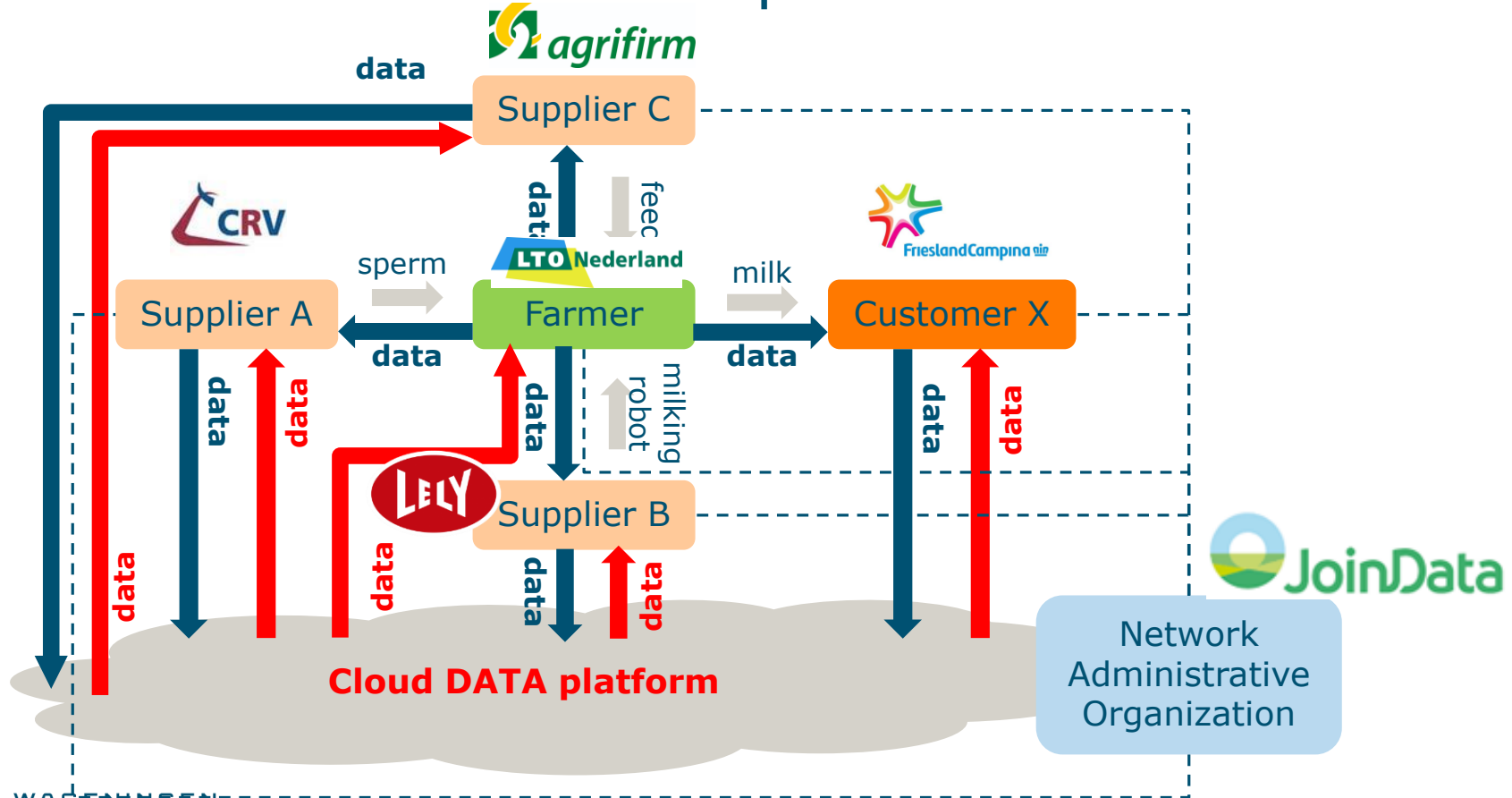
*Enriching canopy index with soil characteristics lead to -10% less additional N fertilizer (2<sup>nd</sup> phase).*

*These values derive from comparison of a standard farm's performance prior to the installation of our system and after.*

# Challenge: shared business models around data



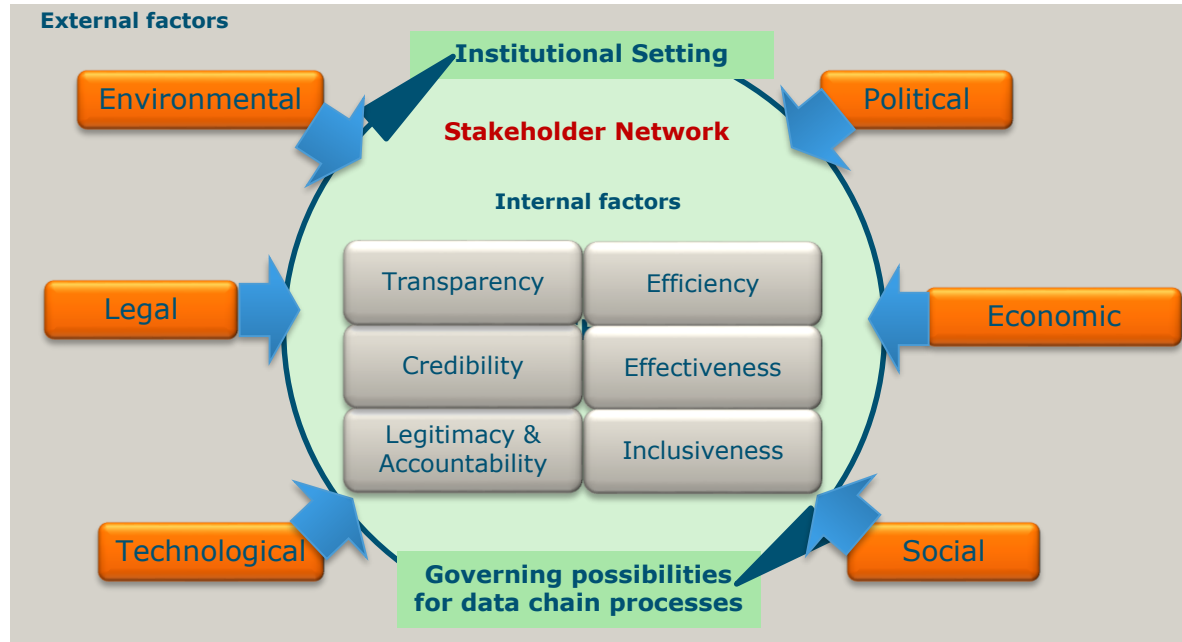
# Value net creation – example of JoinData





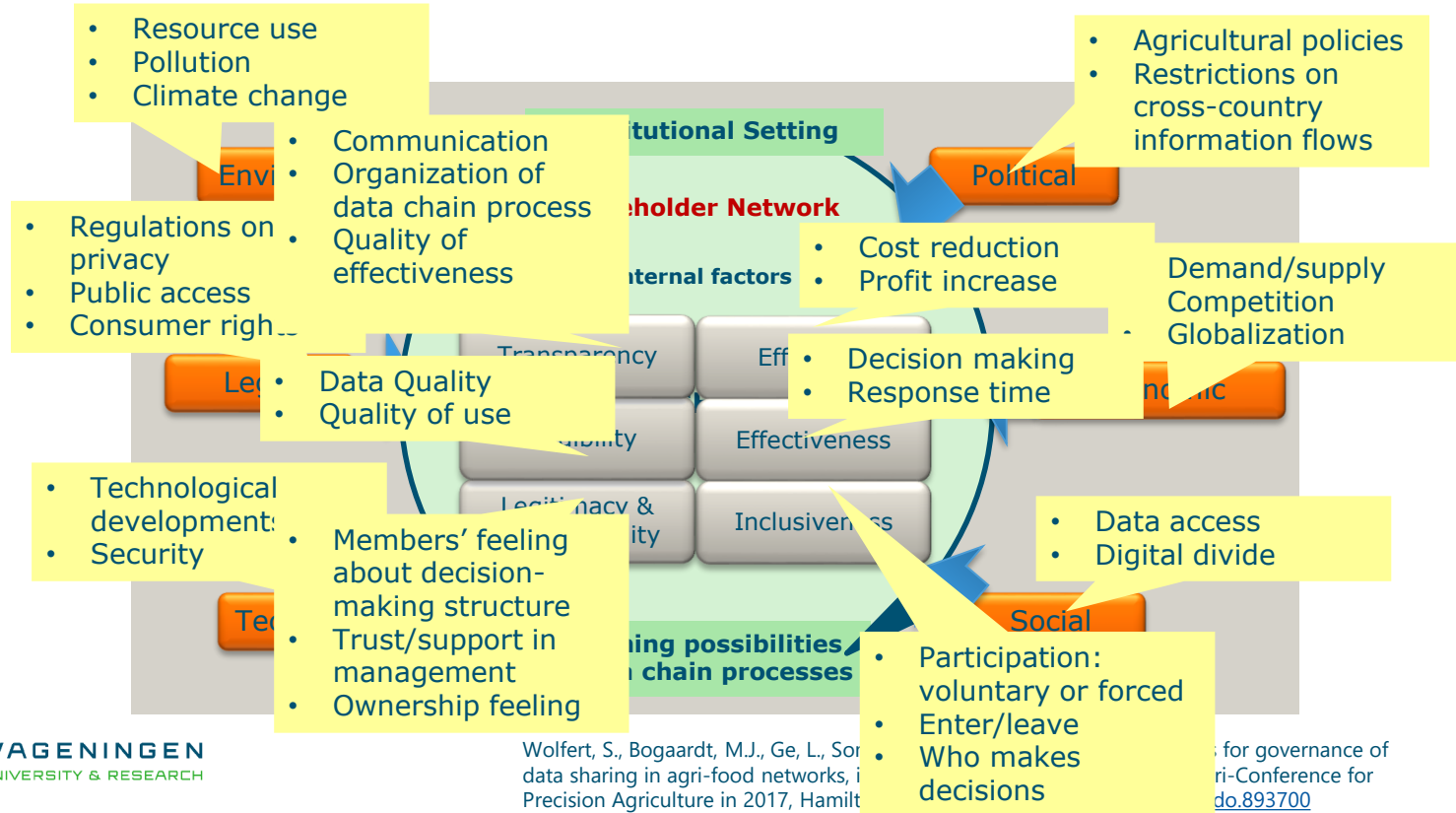
# Framework for Governance of data sharing

based on literature, a.o. PESTLE framework



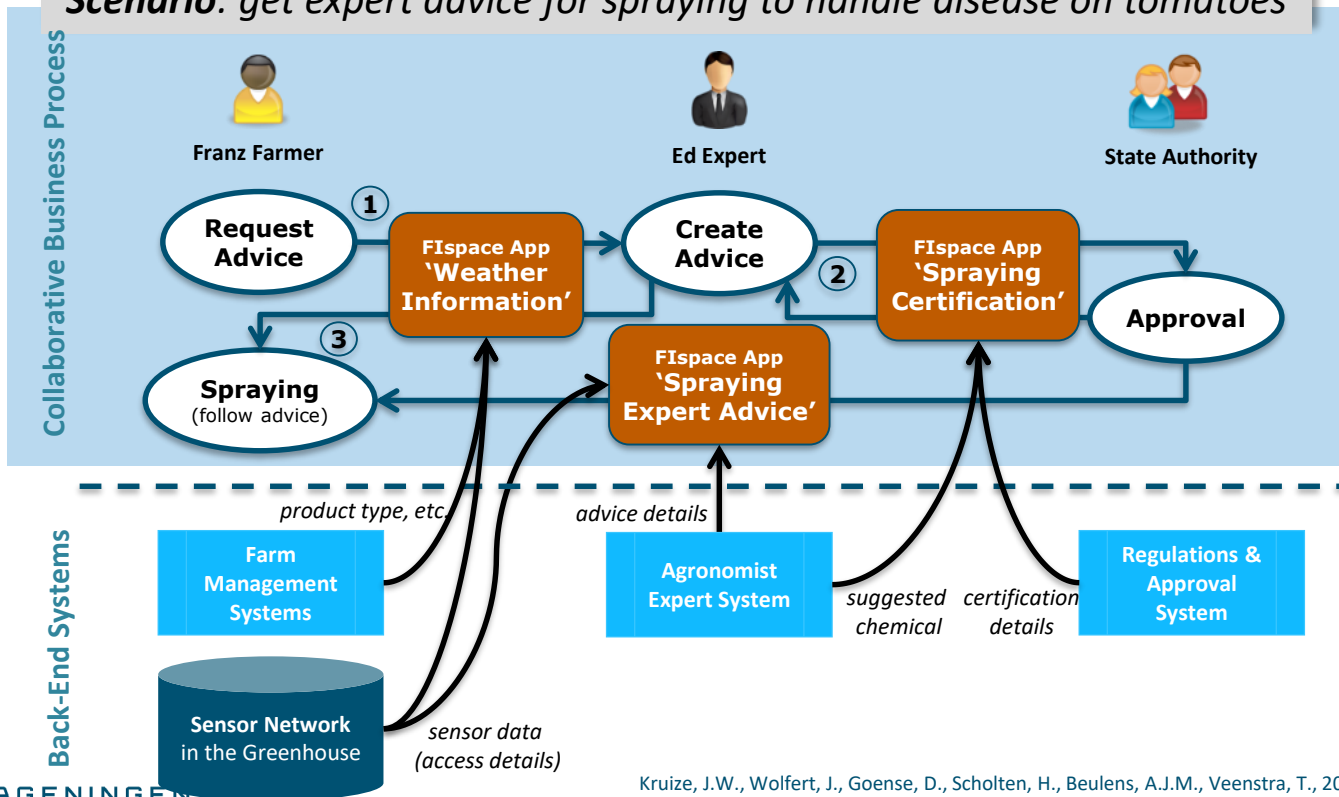
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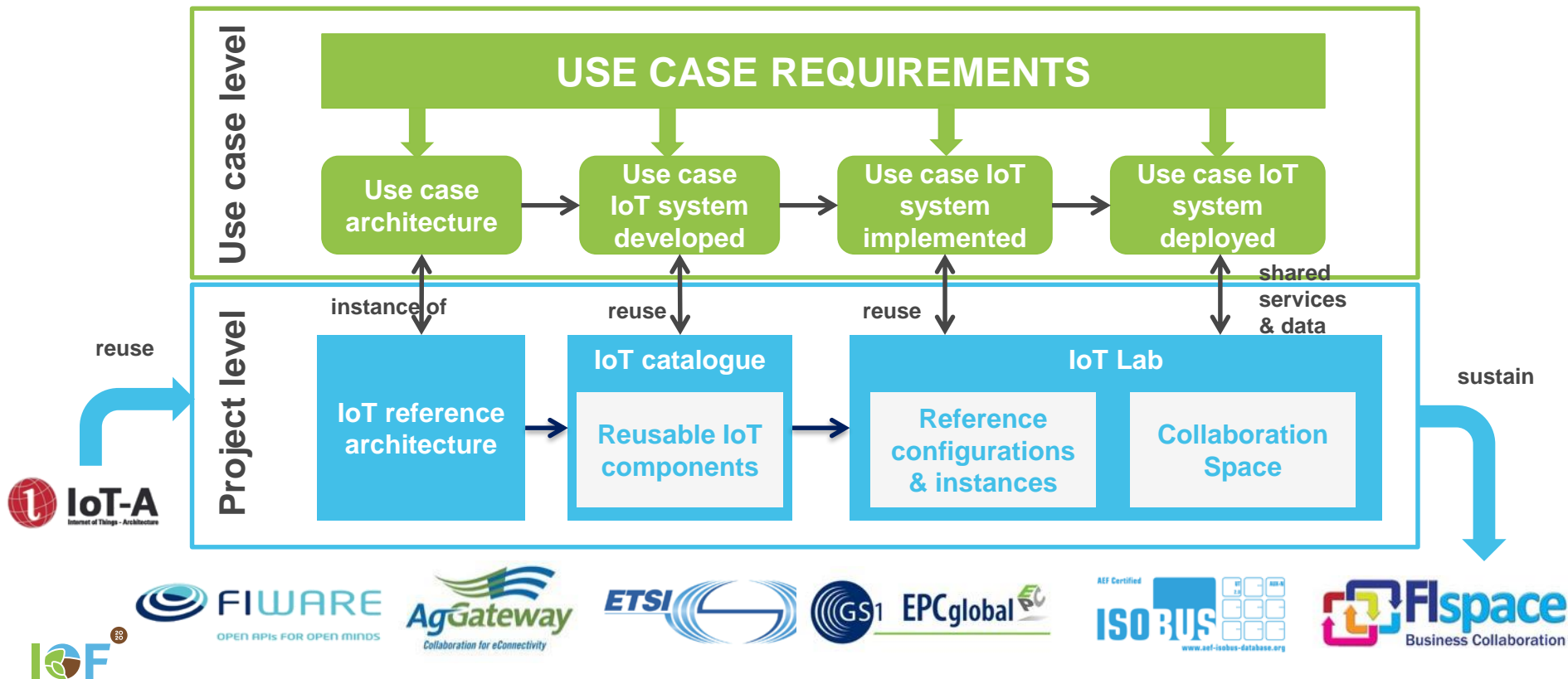


# Creating a collaborative infrastructure

**Scenario:** get expert advice for spraying to handle disease on tomatoes



# TECHNICAL / ARCHITECTURAL APPROACH





# IoT CATALOGUE

[www.iot-catalogue.com](http://www.iot-catalogue.com)



FARMER



TECHNOLOGY  
PROVIDER

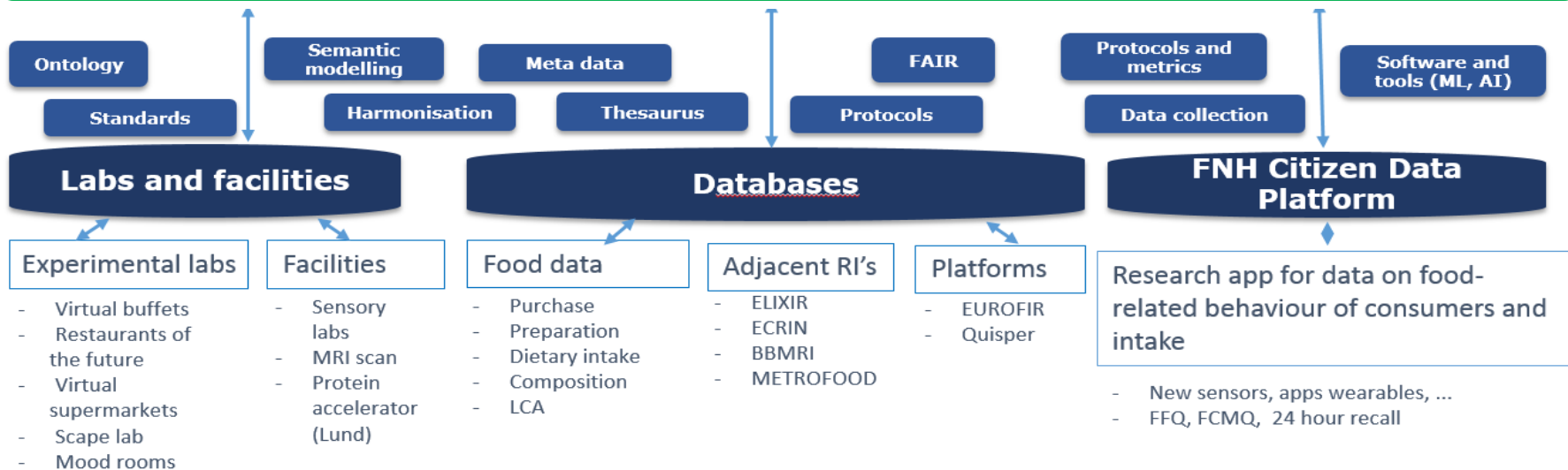
# Food, Nutrition & Health Research Infrastructure

FNH-RI services to

- Scientists (research)
- Public & private stakeholders
- Consumers / citizens

- DATA (upload & use of metadata, data-sharing, interfaces)
- FACT (access to research facilities, tools & models).
- TED: Training & Education, Dissemination & Co-creation

## Food, Nutrition & Health Linked Data Platform



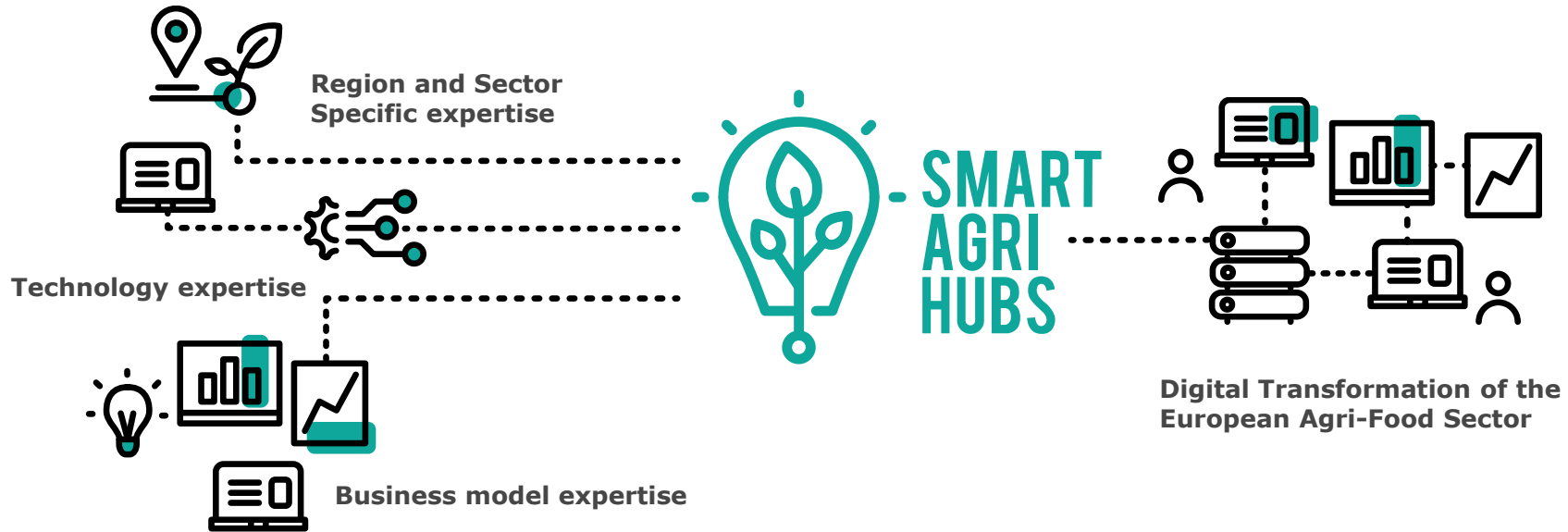


# ETHICS

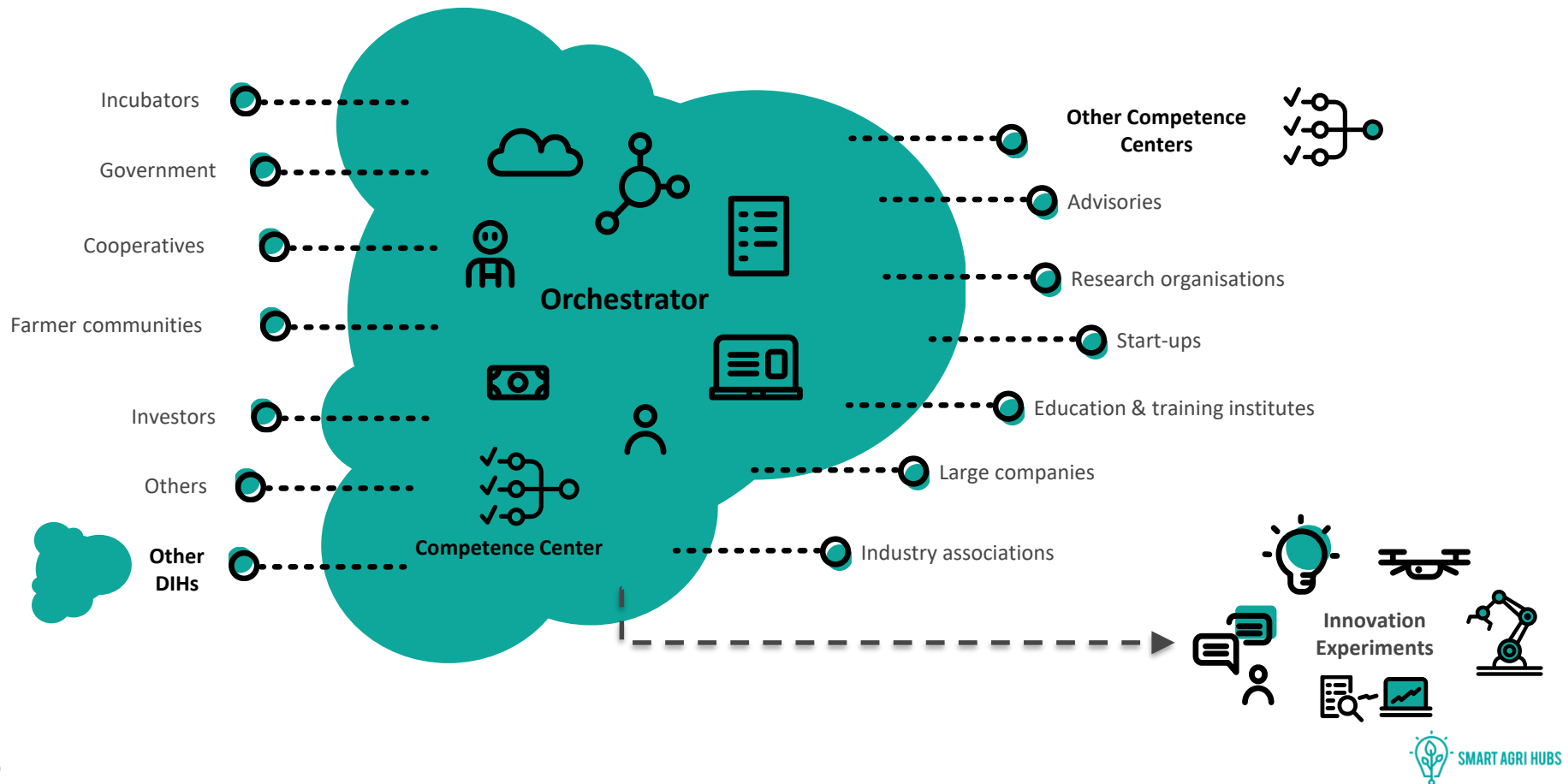
- Three dominant themes from literature analysis
  - Data ownership, accessibility, sharing and control
  - Power (re-)distribution
  - Expected substantive (hard and soft) impacts on the environment, on human and animal life and wellbeing
- Workshop format developed to stimulate the dialogue on these themes
  - Collecting more empirical evidence

# SmartAgriHubs' Overall Objective

Consolidate and foster EU-wide network of Ag Digital Innovation Hubs to enhance digital transformation for sustainable farming and food production



# Digital Innovation Hub: local one-stop shop



# SmartAgriHubs' challenge: expand!



## Ecosystem

**108+ Partners**

Involvement covering all EU

**68 partners** are SMEs

**54% of budget** allocated to SMEs



## Digital Innovation hubs

**140 DIHs** in the existing Network covering all **28 Member States**

Regional Approach

**9 Regional Clusters**

Attract **260 New DIHs**

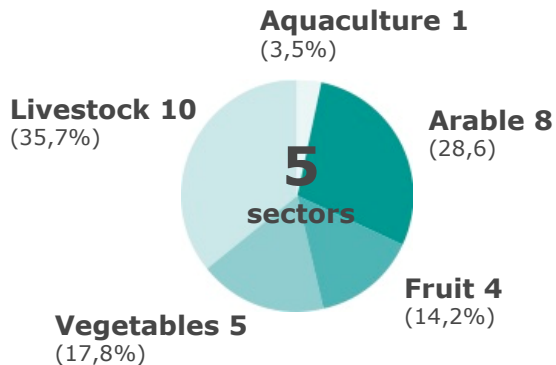


## Flagship innovation experiments

**28 FIEs**

**22 Countries** involved

**13 Cross-border collaboration FIEs** (47%)



## Impact

**30M additional funding**

Mobilized from other sources(public, regional, national and private)

**80 new digital solutions**

Introduced into the market

**2M Farms** involved in digitisation



## Open Calls

**6M Euros** distributed through Open Calls

**75% Open Call budget** to SMEs

**70 New Innovation** Experiments

# Summary and conclusions

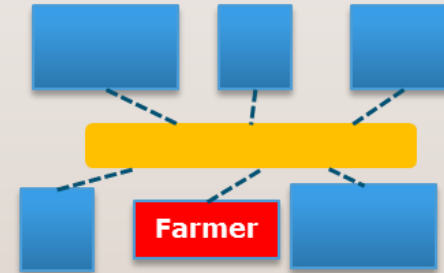
- There's a clear potential in digitalization of Food Systems
- Major shifts in roles and power relations among different players
- Infrastructure, Business Models, Governance & Ethics are important interrelated issues
  - Collaborative, multidisciplinary, agile approach
  - In-depth research
- Acceleration/expansion by creating common infrastructures and innovation hubs

Two extreme scenarios:

## 1. Strong integrated supply chain



## 2. Open collaboration network



***Reality somewhere in between!***

# Thank you for your attention!

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[www.researchgate.net/sjaak\\_wolfert](https://www.researchgate.net/sjaak_wolfert)

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