

Digital Innovation for Sustainable Food Systems

Sjaak Wolfert & Krijn Poppe, Wageningen Economic Research

'Implications of Digitalisation in Agriculture', 4 Sep. 2019, ETH, Zürich

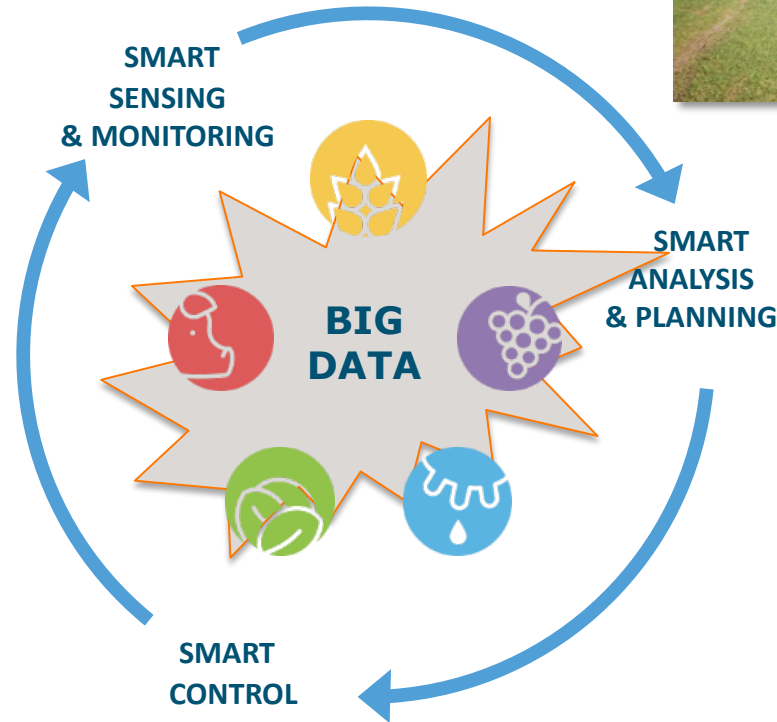
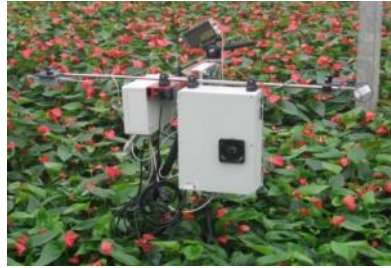


The grand challenge in food:



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

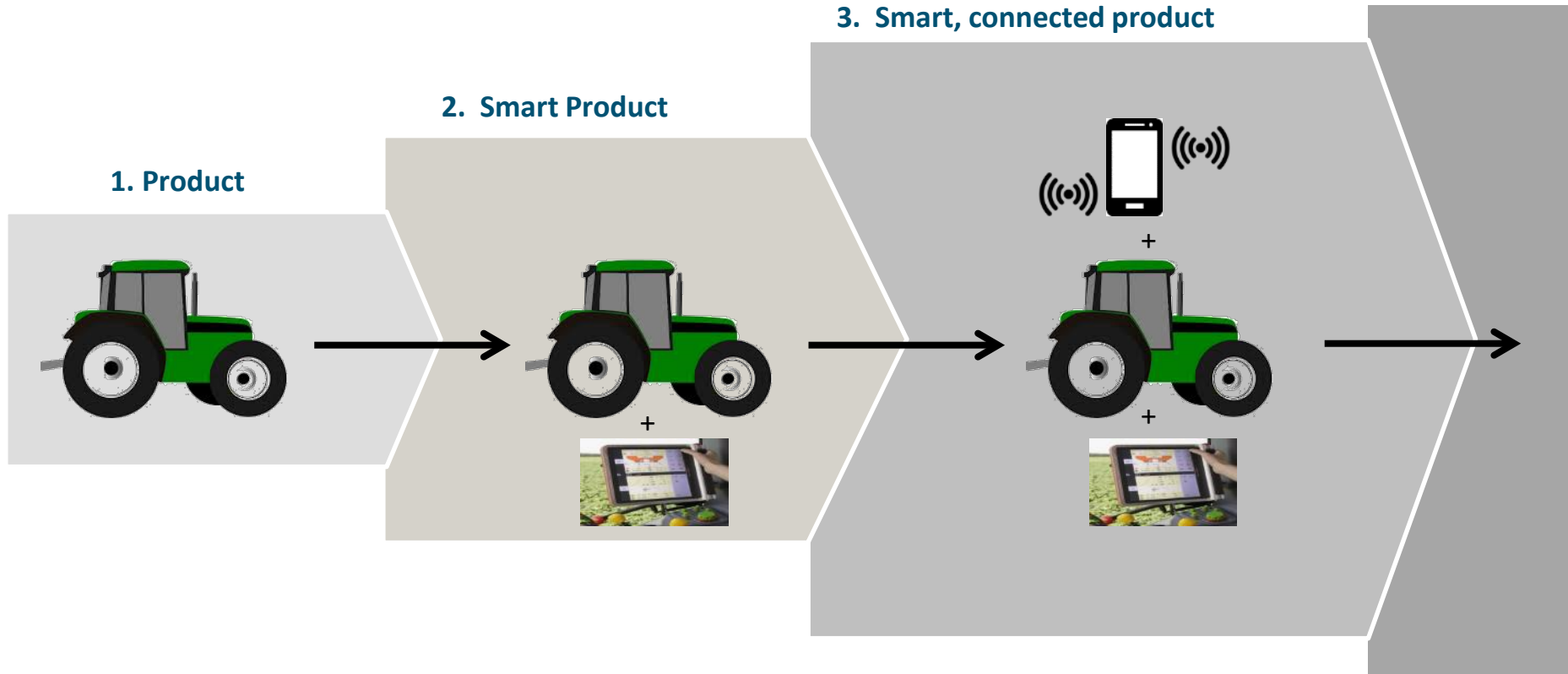
Science: we learn more on body & brains

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

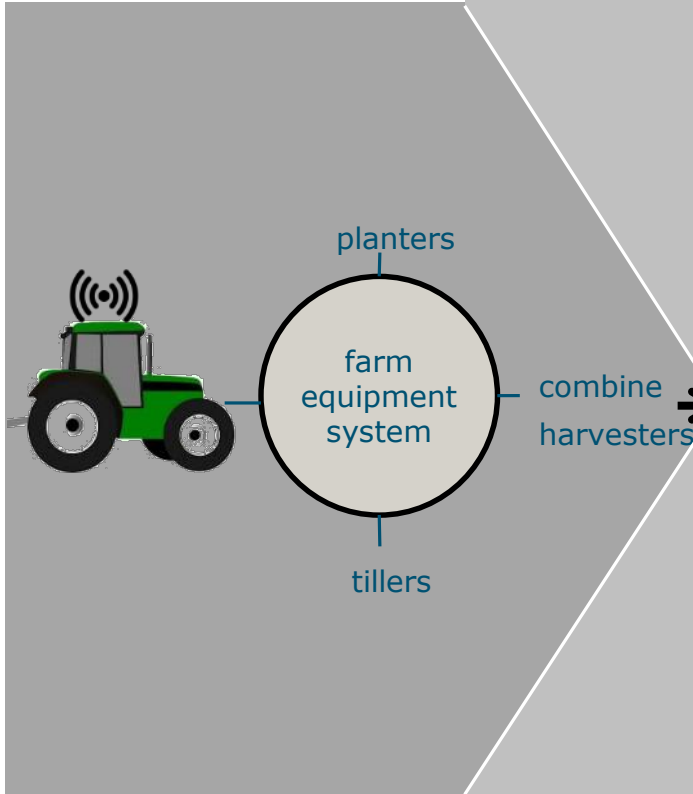
Policy coherence: integration needed

- 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

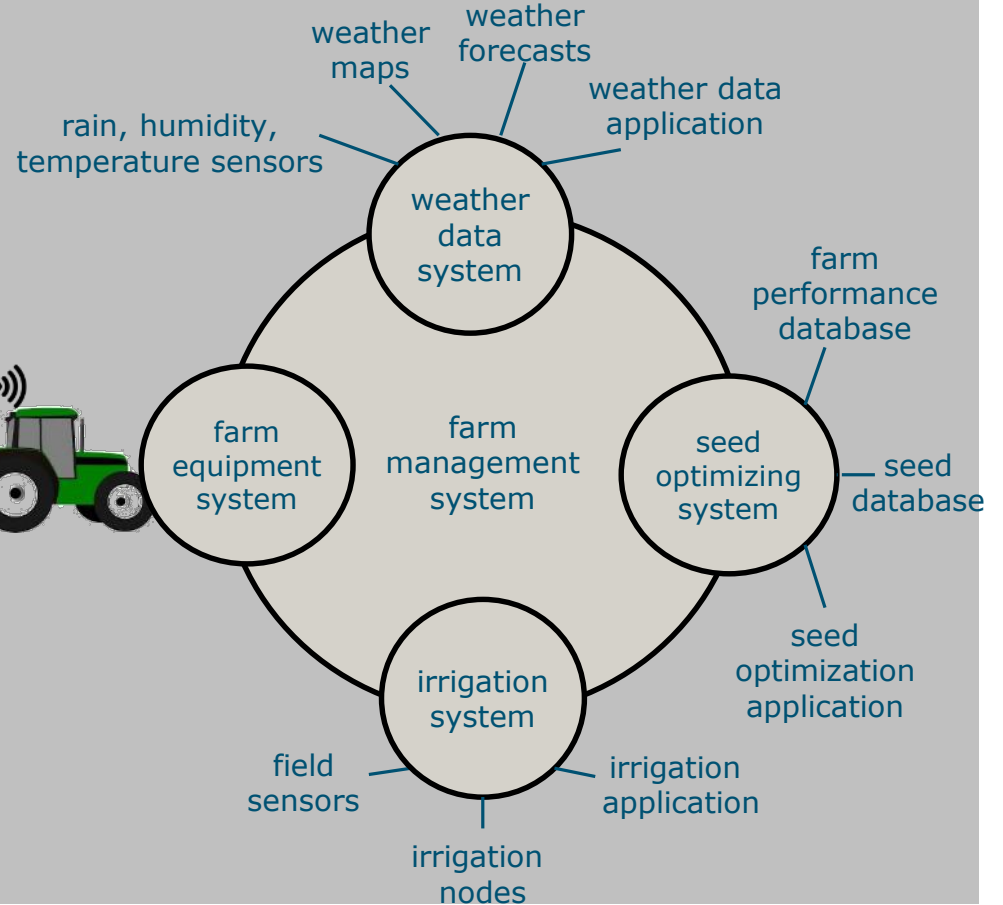
Redefining Industry Boundaries



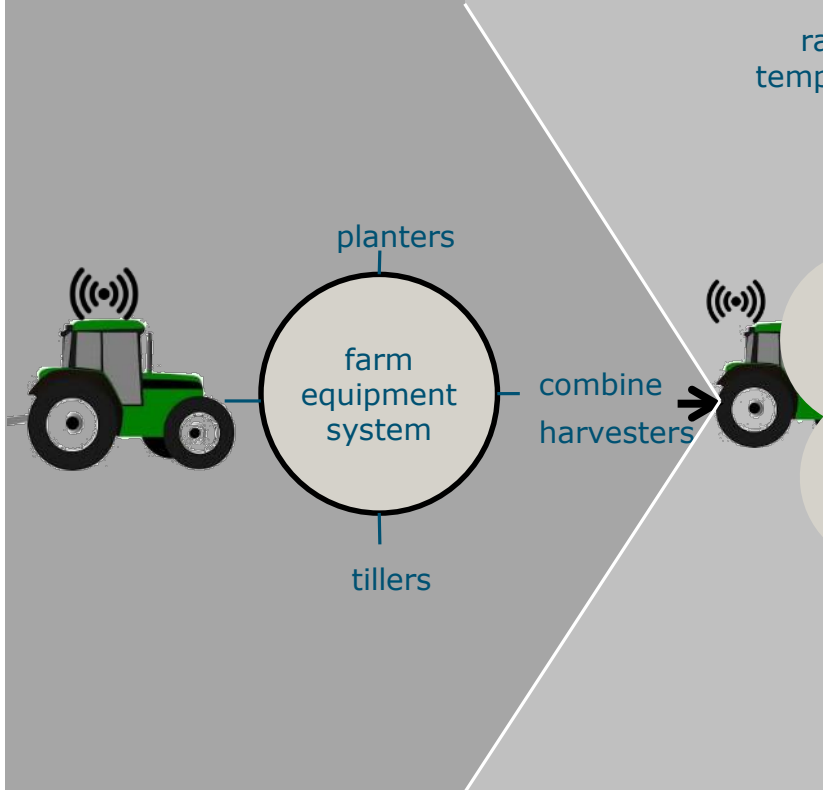
4. Product system



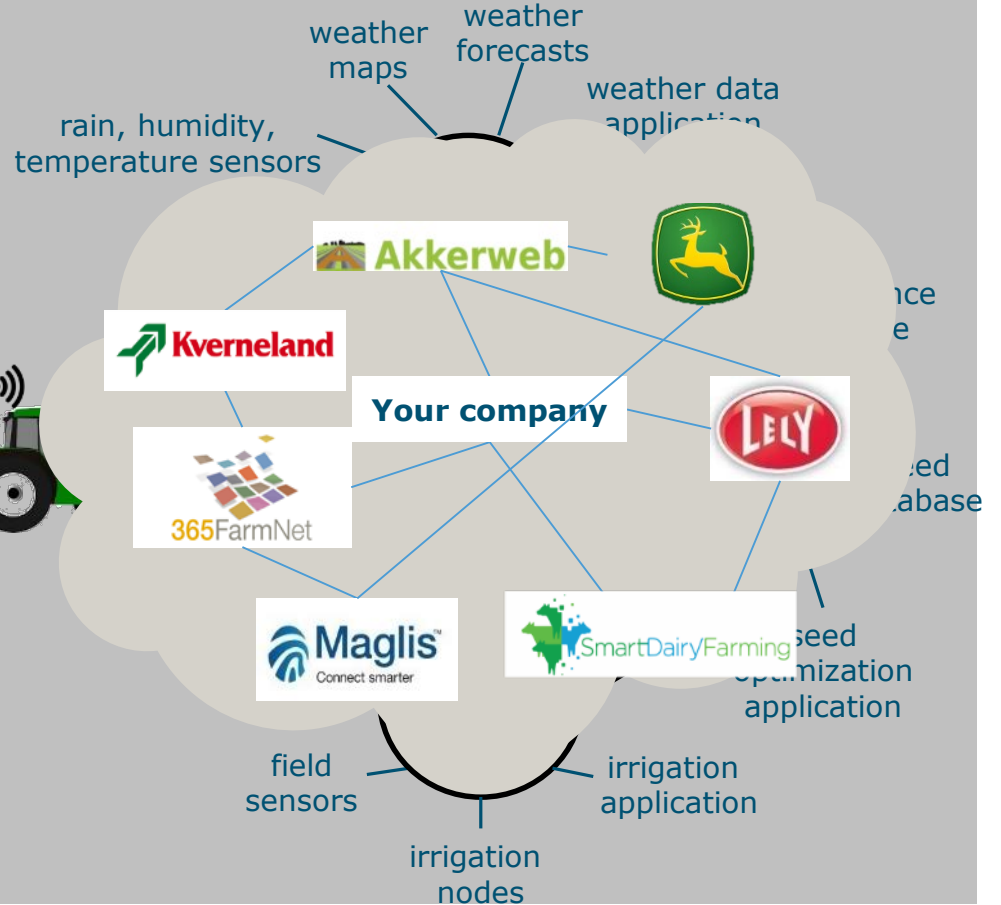
5. System of systems



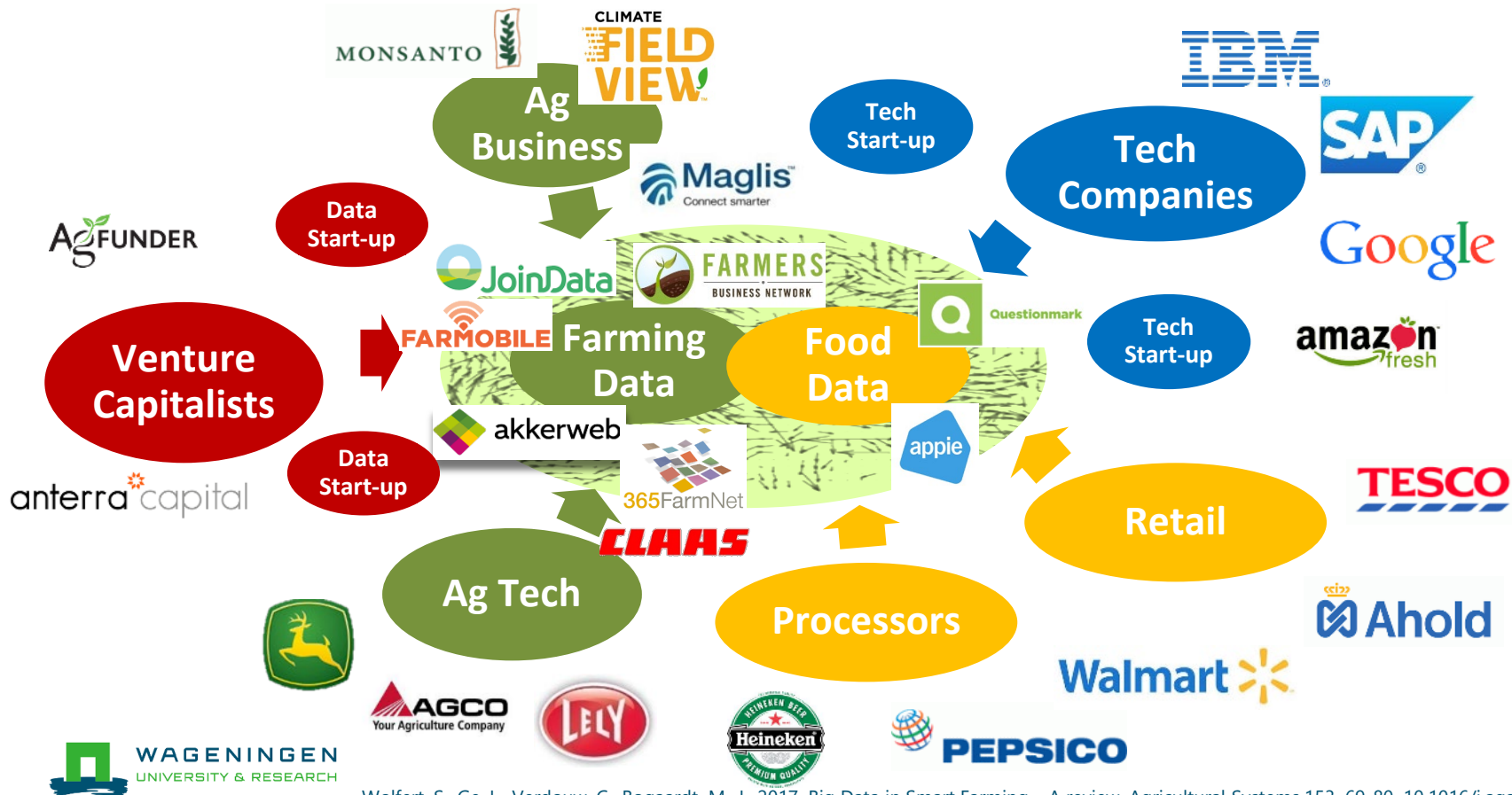
4. Product system



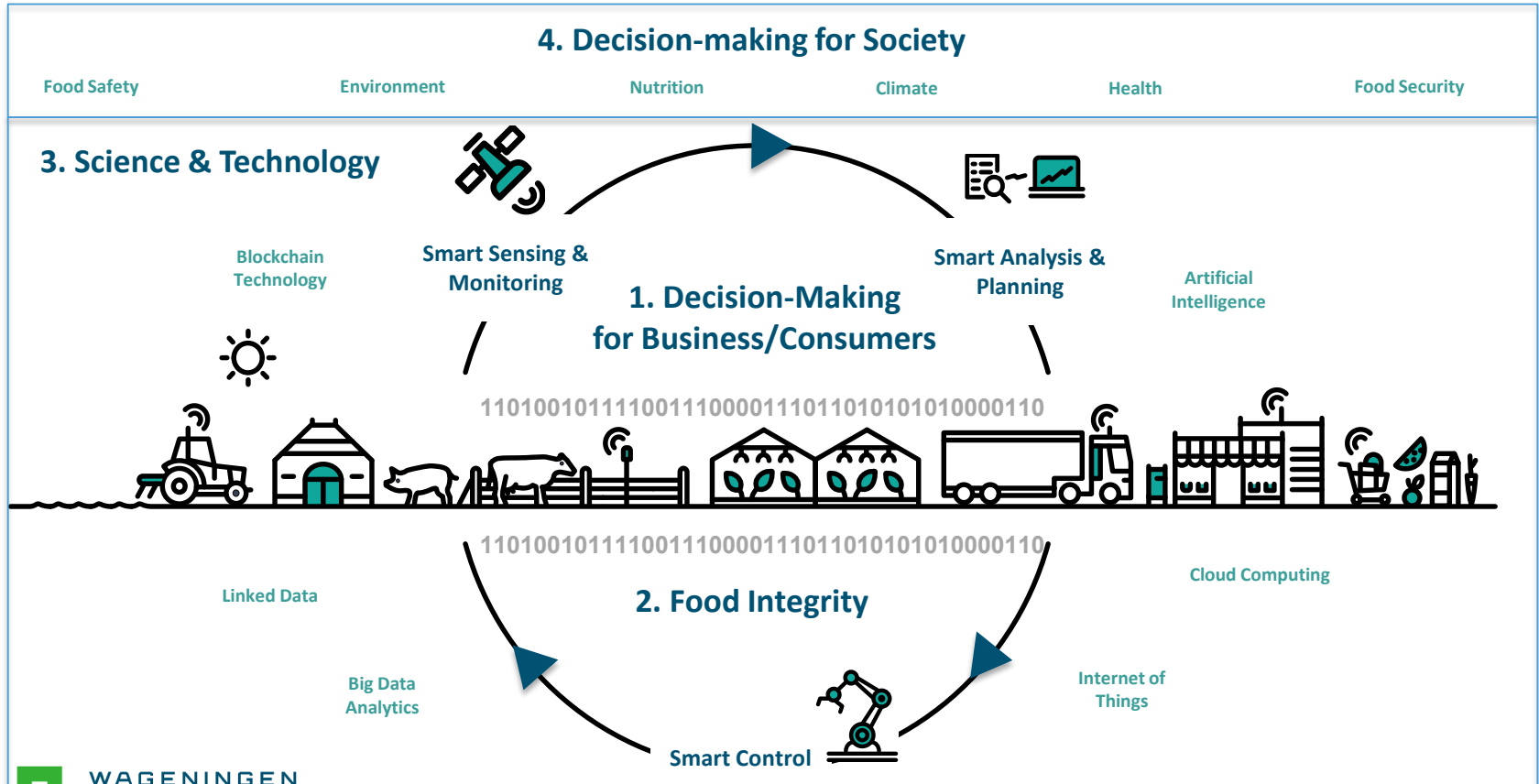
5. System of systems



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

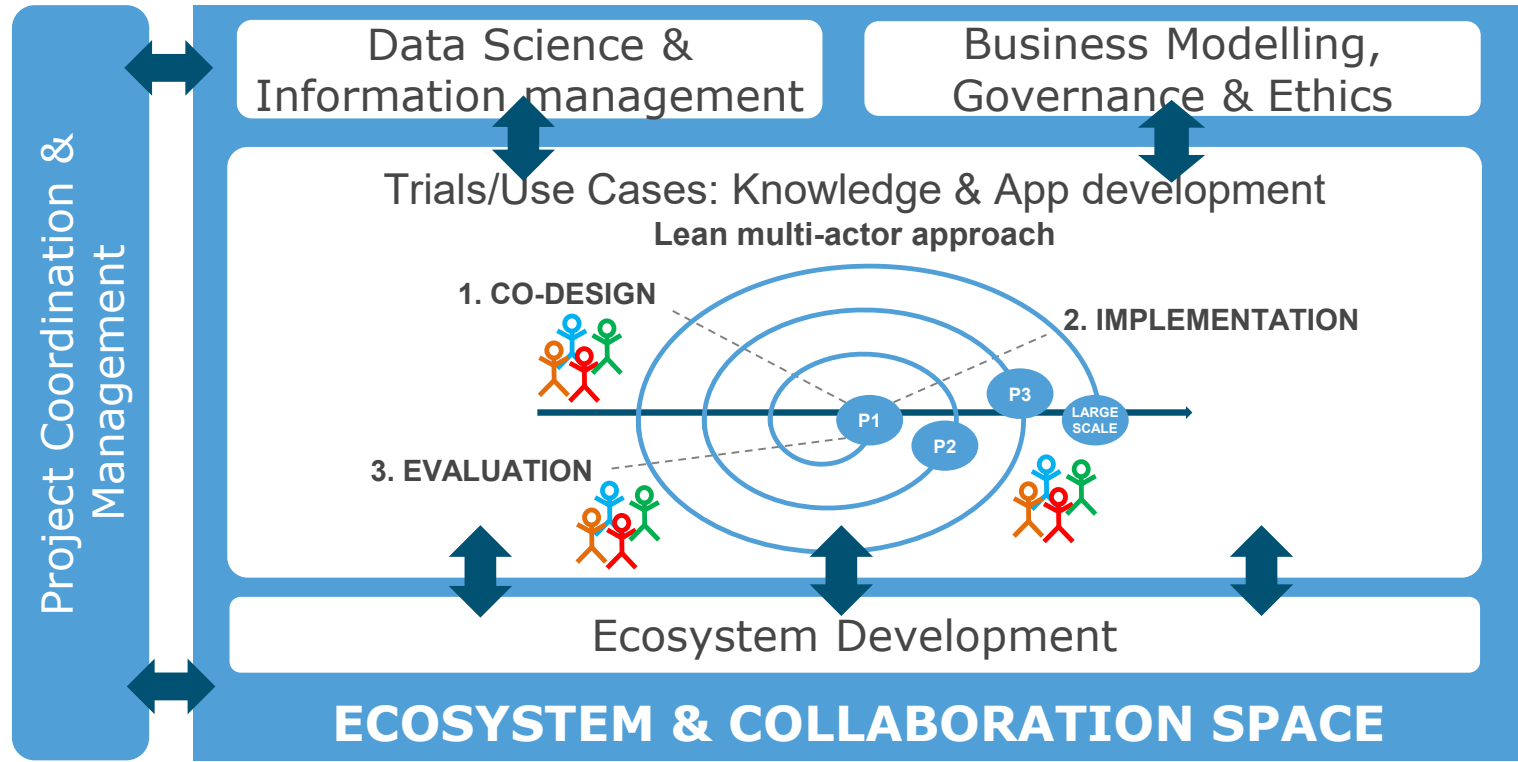


Food, Nutrition & Health



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



UC1.1. WITHIN-FIELD MANAGEMENT ZONING

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

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

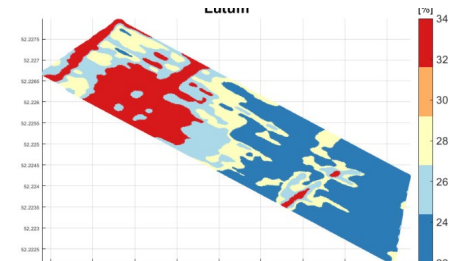
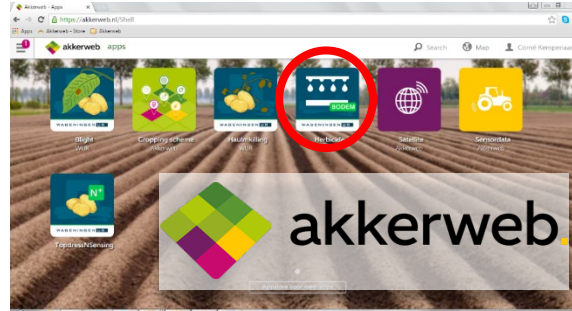


Bayer CropScience

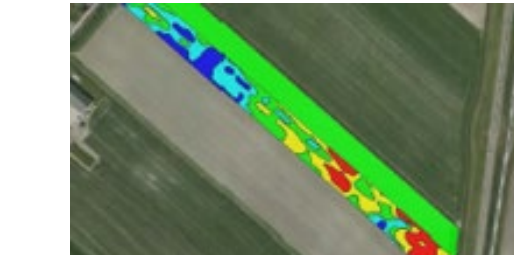
GRIMME



Product Impressions



SOIL MAP SERVICE



VARIABLE RATE APPLICATION MAP



AUTOMATION & MACHINE COMMUNICATION

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%

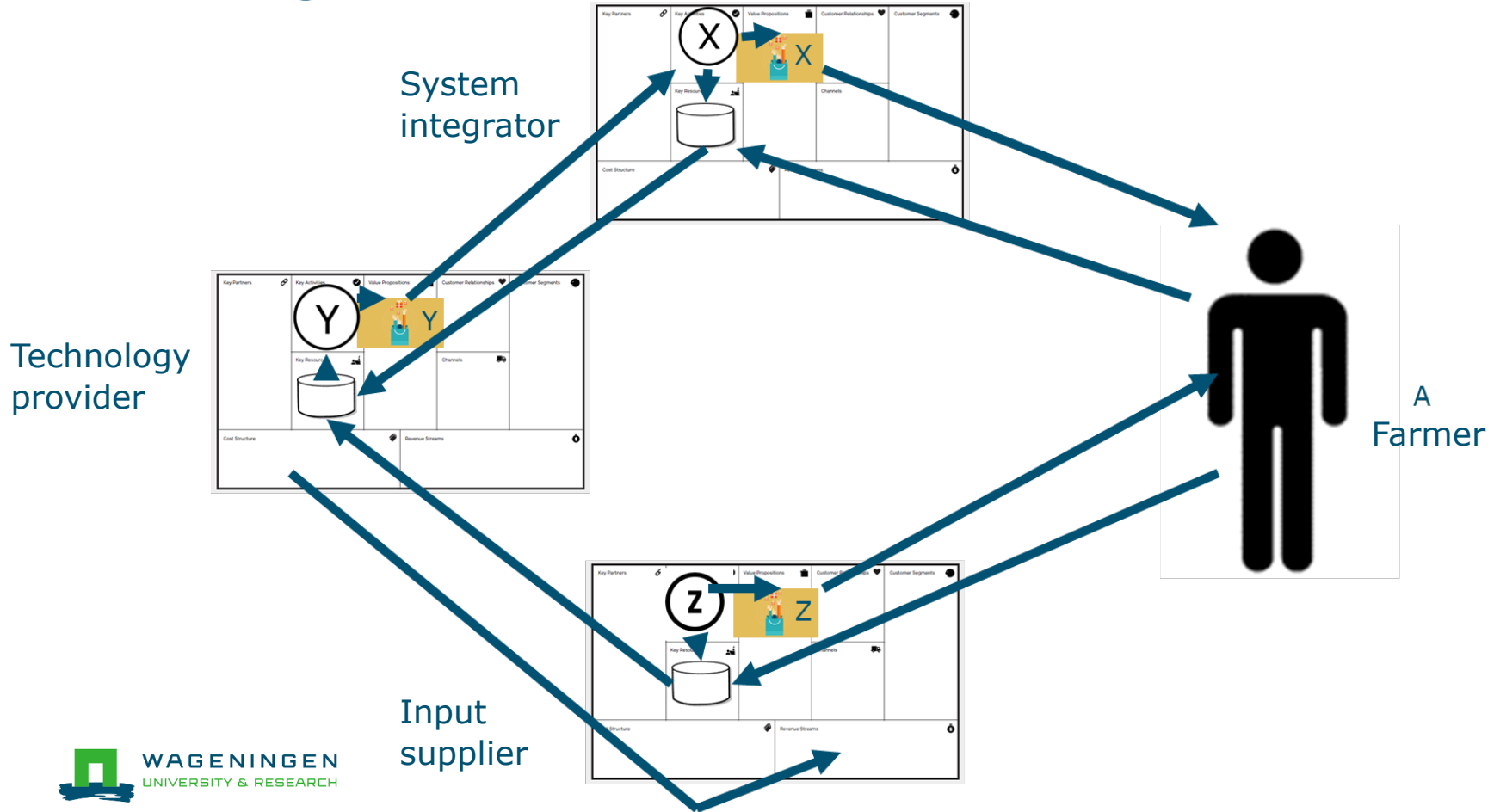
Reduction fertilizer use  -10%

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.

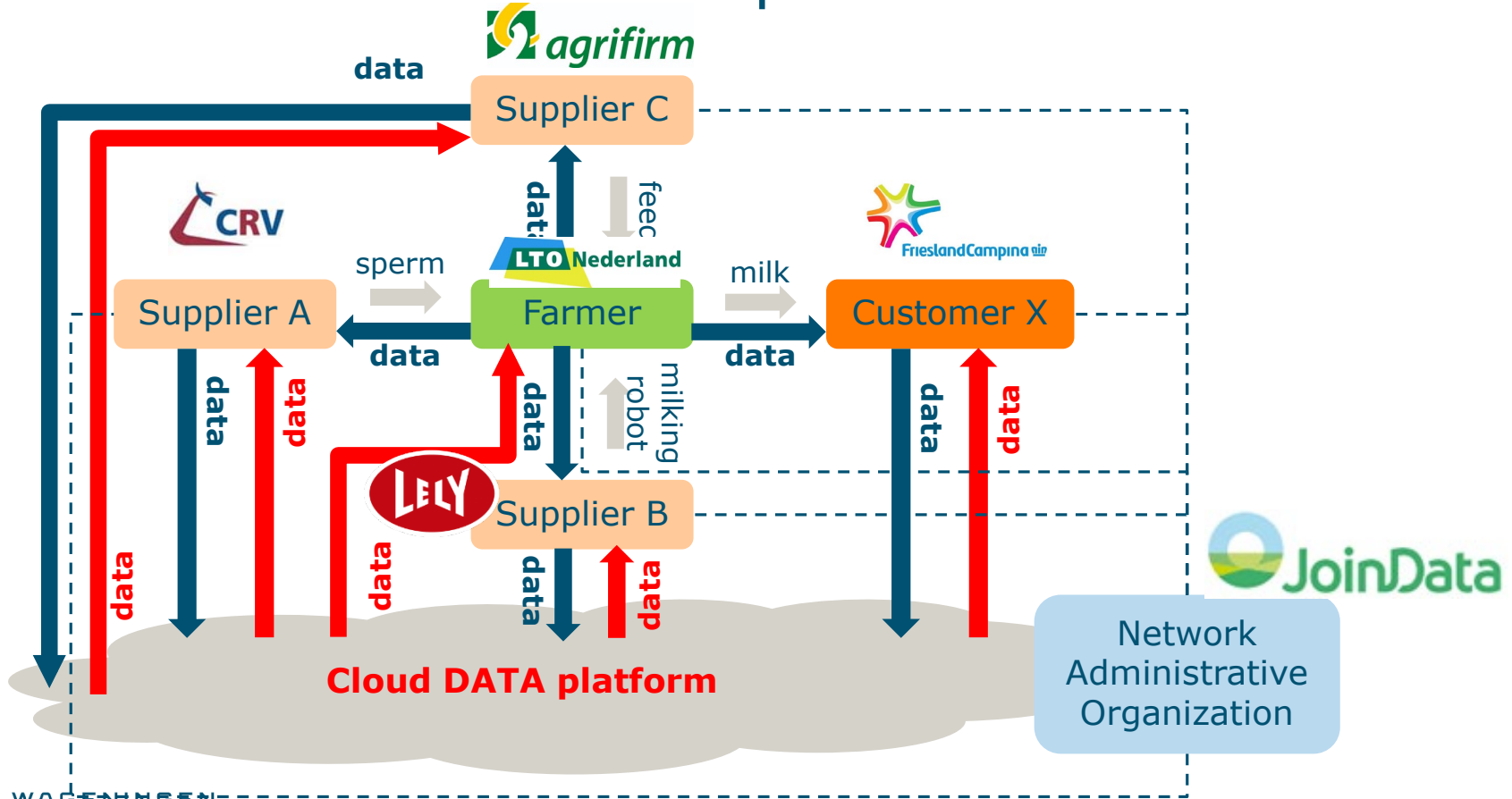
Enriching canopy index with soil characteristics lead to -10% less additional N fertilizer (2nd phase).

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

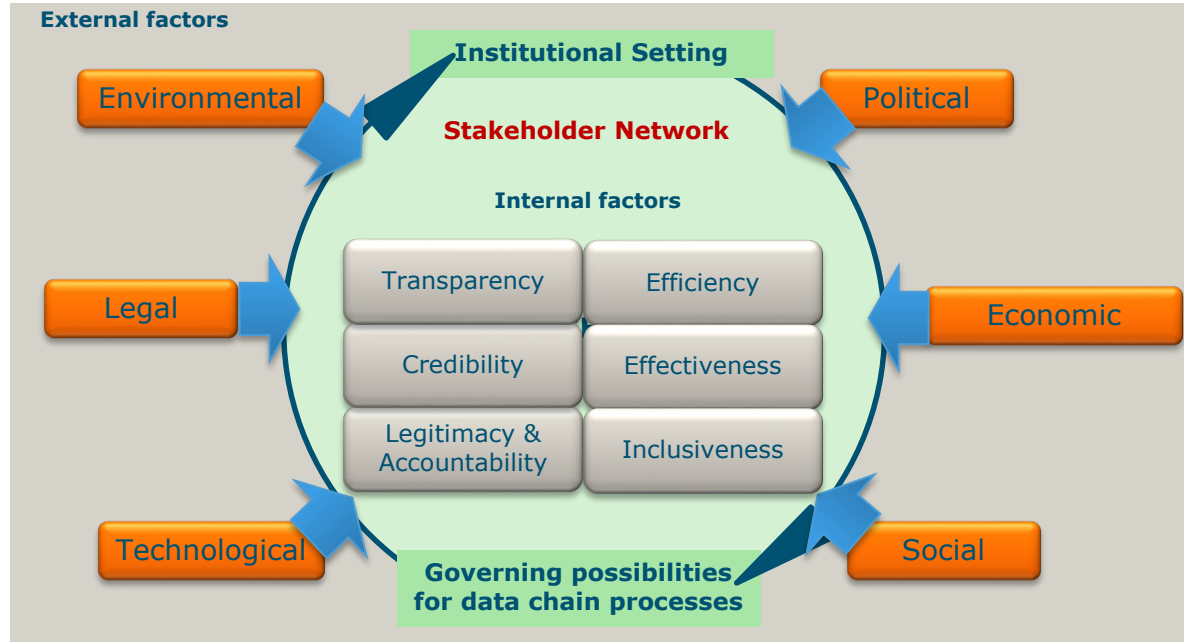


Value net creation – example of JoinData



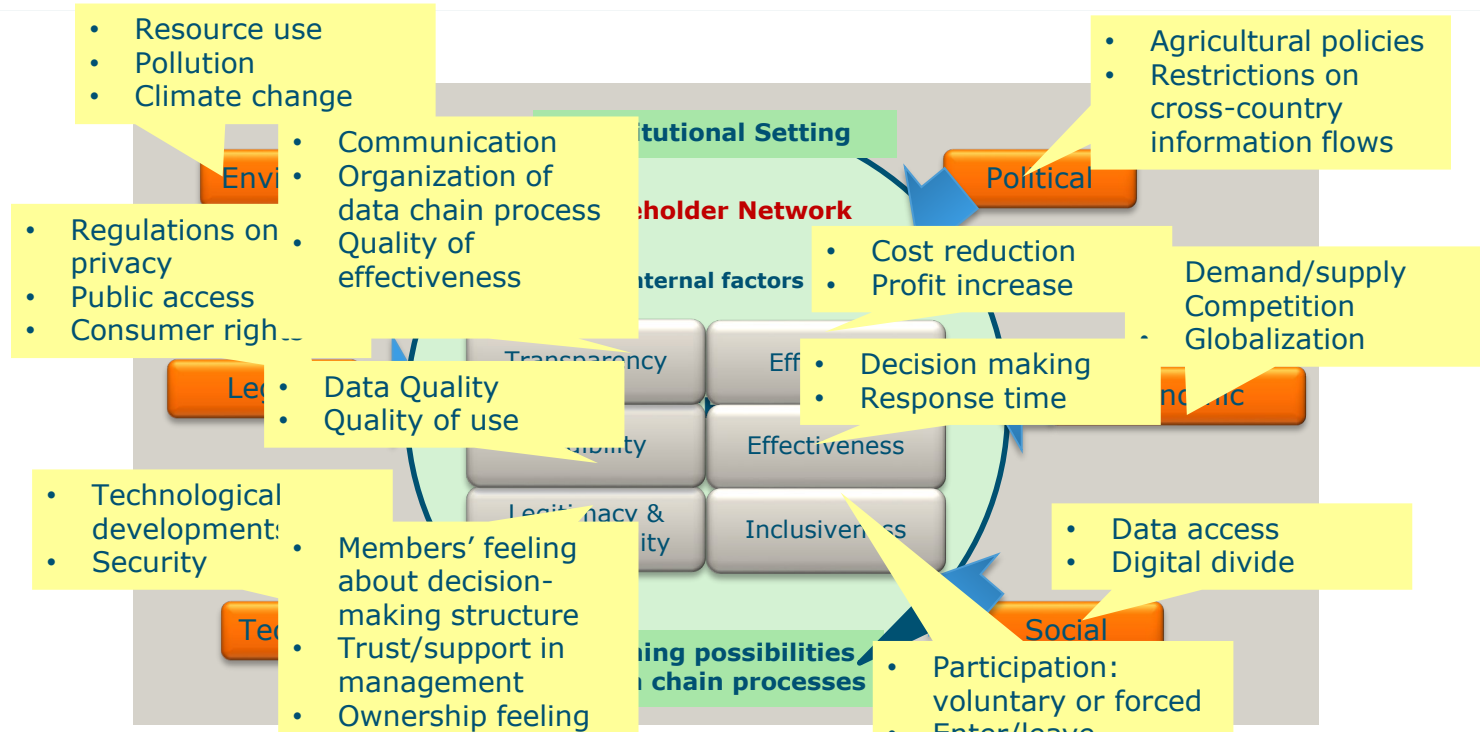
Framework for Governance of data sharing

based on literature, a.o. PESTLE framework



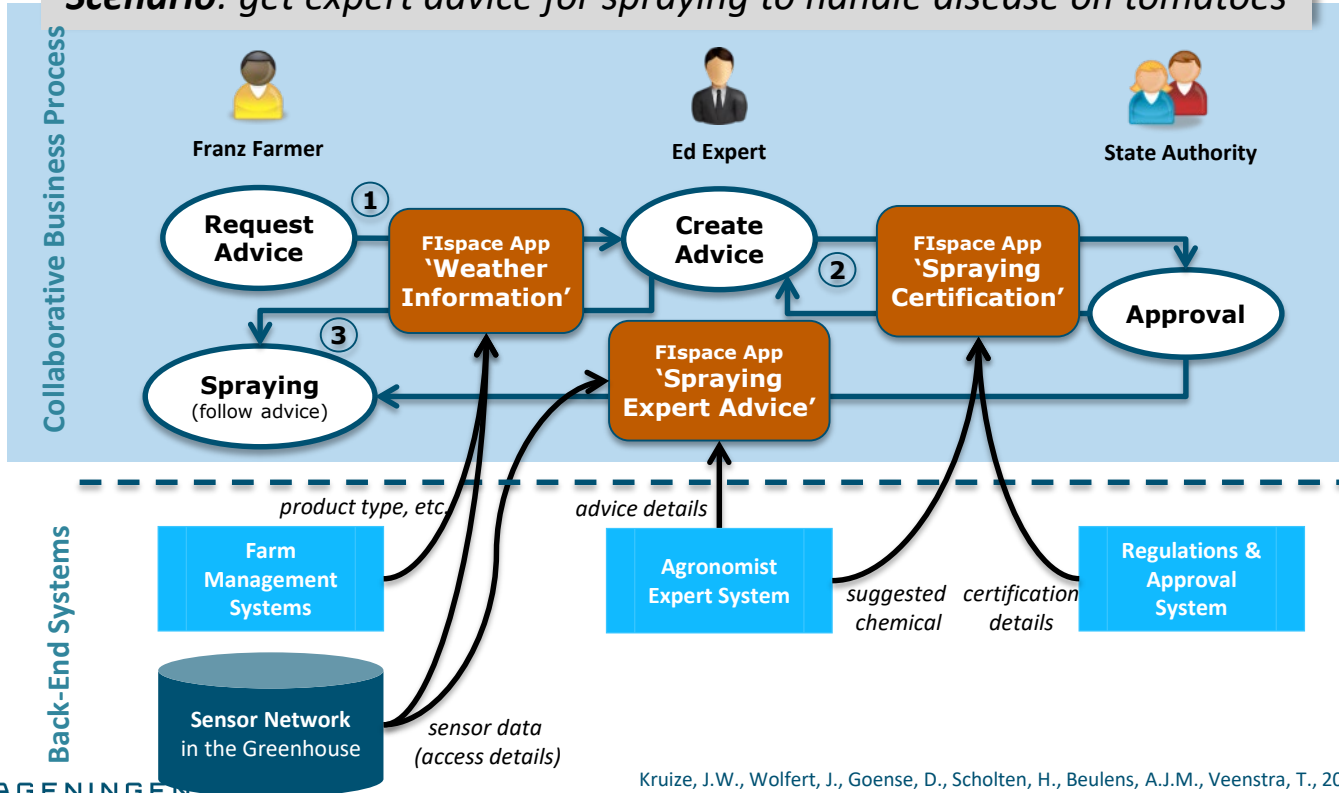
Framework for Governance of data sharing

based on literature, a.o. PESTLE framework

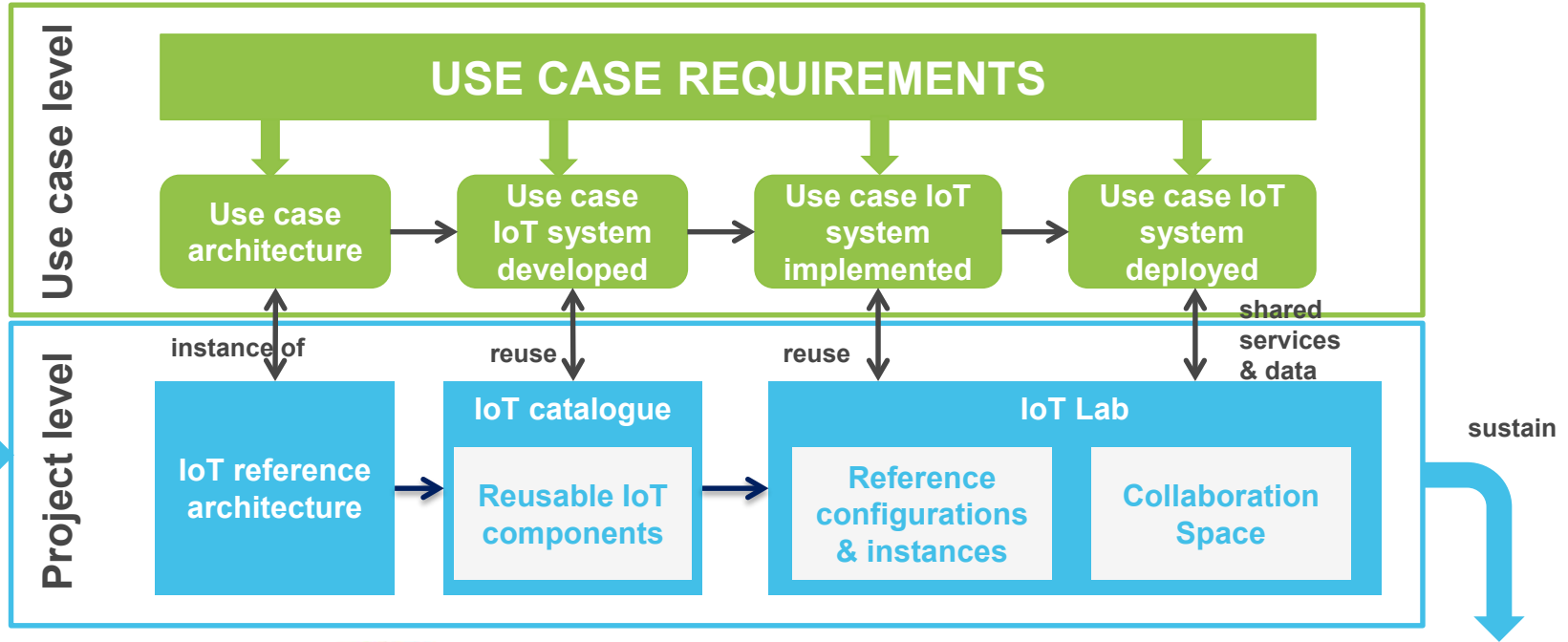


Creating a collaborative infrastructure

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



TECHNICAL / ARCHITECTURAL APPROACH





IoT CATALOGUE

www.iot-catalogue.com



FARMER



TECHNOLOGY
PROVIDER

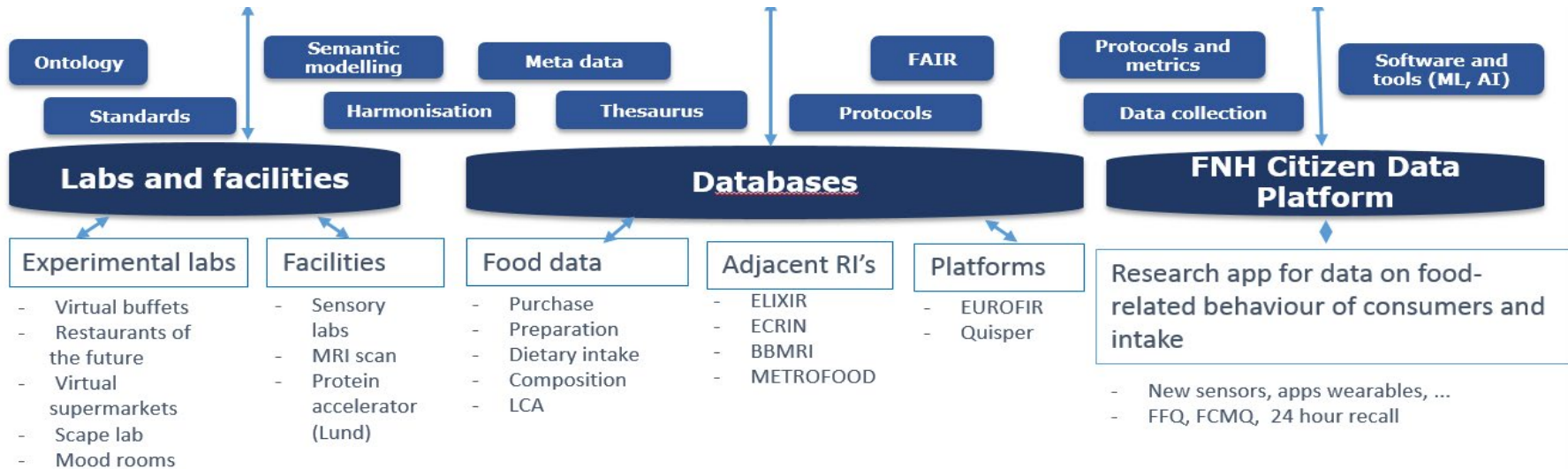
Food, Nutrition & Health Research Infrastructure

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

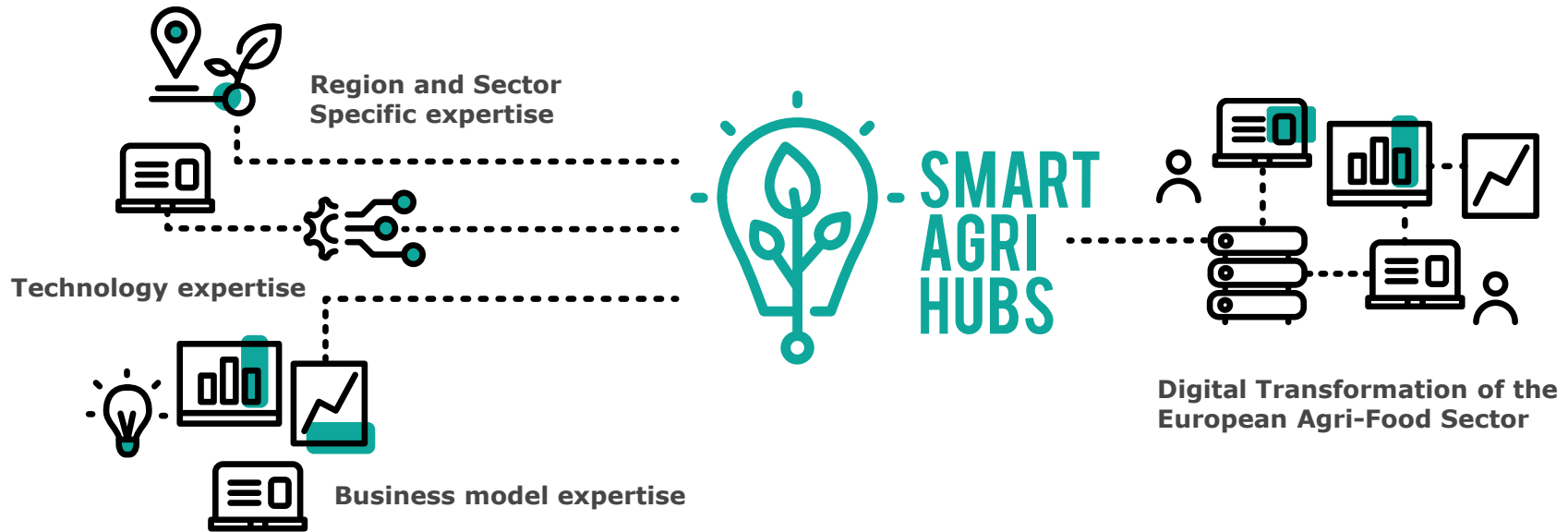


ETHICS

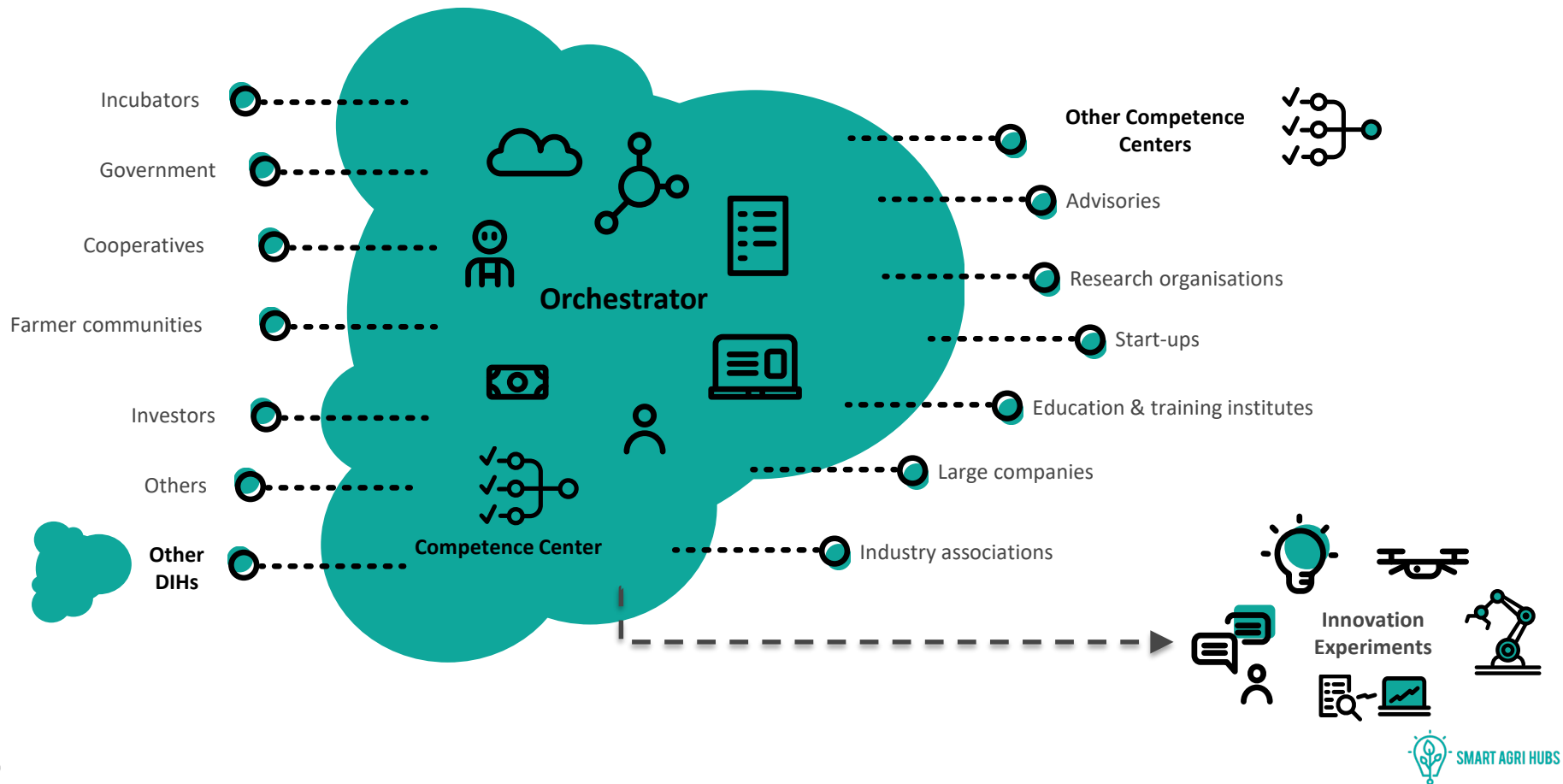
- Three dominant themes from literature analysis
 - Data ownership, accessibility, sharing and control
 - Power (re-)distribution
 - Expected substantive (hard and soft) impacts on the environment, on human and animal life and wellbeing
- Workshop format developed to stimulate the dialogue on these themes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

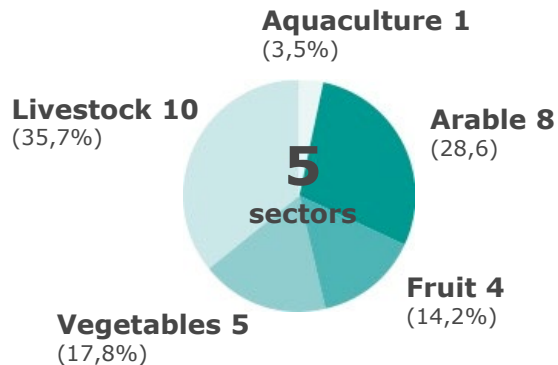


Open Calls

6M Euros distributed through Open Calls

75% Open Call budget to SMEs

70 New Innovation Experiments



Summary and conclusions

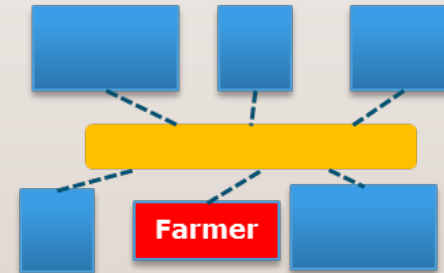
- There's a clear potential in digitalization of Food Systems
- Major shifts in roles and power relations among different players
- Infrastructure, Business Models, Governance & Ethics are important interrelated issues
 - Collaborative, multidisciplinary, agile approach
 - In-depth research
- Acceleration/expansion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

More information:

sjaak.wolfert@wur.nl

nl.linkedin.com/in/sjaakwolfert/

www.researchgate.net/sjaak_wolfert

Twitter: @sjaakwolfert

<http://www.slideshare.net/SjaakWolfert>

