
Challenges and opportunities of digitalisation in the agricultural value chain: a governance perspective

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Starting point

- Digitization: conversion of information into a digital, i.e. computer-readable format
- Digital network technologies enable remote cognition, communication and cooperation
- Digitalization means ...
 - ... the application of these technologies to economic, social or organisational practices, as well as ...
 - ... the processes that transform the affected practices, organisations, sectors and communities.
- Digitalization implies several converging technologies, in particular
 - Information processing
 - Sensor technology
 - Robotics
 - GIS and GPS
 - Genomics

Visions of the digital future

The promises of digitalization

- Environmental and climate solutions
- Transparency and traceability
- Animal welfare
- Digital experimental fields: plant production and animal husbandry
- Labour saving technological progress (increased labour productivity)
- More attractive jobs in agriculture for high-skilled labour

Alternative visions

- Spot farming, building on robotics, centred on the plant
- Open source software, e.g. for community-supported agriculture

Context: Digital capitalism

Digital capitalism (Schiller 1999, Fuchs 2013, Pace 2018)

- Digital technologies enable transnational value and production chains
- Private ownership of digital networks
- Proliferation of a management style organized around digital networks
- Transformation of labour: increasing share of cognitive, communicative and cooperative labour that is mostly mediated through digital technologies
- Conversion of human cognition, communication and co-operation into new products and services

Four transformative dimensions of digitalization

Digitalization creates:

- New ontologies – novel objects
- New epistemologies – novel ways of knowing
- New practices – novel ways of doing
- New relations – novel ways of connecting and interacting

→ Fundamental transformation of the social and material world

Digitalization – the building blocks

- Information collection and digitization
 - Analytical methods, e.g. digital genomics
 - Sensors and imaging technologies
 - Remote sensing, GIS and GPS
 - Search and other behaviour of digital user interfaces
- Connected data management systems
 - Data storage, data analysis and data-based learning
 - User-oriented data management
 - Enterprise Resource Planning (ERP) systems, business intelligence software, financial controlling
 - Data mining
 - Artificial intelligence and machine learning
- Creation of new uses, products and services
 - See next slide

Creation of digital products and services (1)

- Remote work and control systems
- Automatisations of routine processes
 - Product handling
 - Visual monitoring activities
- Digital communication (many-to-many, one-to-many, many-to-one)
 - Farmer-to-farmer networks
 - Farmer-to-consumer networks
 - Digital trading platforms for farm products and inputs

Creation of digital products and services (2)

- Transparency, monitoring and surveillance systems
 - Product traceability systems
 - Employee administration software
 - Problem detection applications (e.g. disease detection, deviance prediction)
- Digital links to financial services
 - Digital credit rating linked to performance and compliance data
 - Insurance services, e.g. new climate risk insurance models
- Learning and advice systems
 - Online expert systems
 - Benchmarking
 - Advice based on machine learning

Emerging opportunities in agriculture

Plant production

- Use of remote sensing data
- New plant production systems: combination of autonomous machines, small robots, sensor technology (on the ground and drones)
- Genomics
- Proteomics
- Phenotypization

Animal husbandry

- Management of individual animals
 - E.g. sensory technology for fertility monitoring
 - Camera-based diagnosis of lameness, aggression, weight
- New animal husbandry systems, e.g. mobile poultry production
- Emission management and reduction

→ Demand for integrated solutions

Emerging opportunities in agriculture (2)

Food

- Traceability for food authenticity, safety and quality
 - QR codes, blockchain technology
- Reducing food waste
- Digital monitoring of diseases – one-health concept

Monitoring

- Spatial risk assessments based on geo-referenced data
- Integrated regulatory monitoring
- New areas of monitoring

Open data management

- E.g., EFSA data warehouse
- National data platforms
- National research data infrastructures

Governance challenges: value chain level

- Connected data management systems and market power
 - First mover advantages
 - Network effects and data monopolies
 - Lock-in effects
 - Data ownership and participation in value added
 - Counter-vailing power through farmer cooperation, maybe in connection with the state?
- Vertically integrated data management
 - Combination with AI – “remote control production”
 - Vertical integration from the seed sector – combination of genomics, agronomic data and patents

Governance challenges: value chain level (2)

- Digital service providers and market power
 - Often new players in agriculture
 - Farms buy in knowledge, software, cloud services through subscriptions
 - Hardware (machines, vehicles, stables) depend on software
 - limited time horizon of software updates
 - designed obsolescence
 - Lock-in effects for farmers once they have entered the universe of one manufacturer
 - Increasing dependence and potential for market power

Governance challenges: Platform level

- Platform effects on diversity
 - Digital platforms include only specific crops, varieties and products
 - Digital support only for selected crops, varieties and products
 - Economics of information shapes the choice architecture: Cheap information upfront nudges towards the featured products
- Effects on structural change
 - high capital demand
 - many applications work only for large patches
 - homogenization push through e.g. algorithms
- Maintaining the space for alternative niche segments
 - Traditional digital-free
 - E-commerce for regional specialties

Governance challenges: Network level

- Market power and the arrival of new players in the agricultural sector
 - Google, Amazon, Microsoft, Bosch, Alibaba, ...
 - New struggle for control over the global food system
 - asymmetry in digital capacities and skills between private and public sector
 - Messy interplay with geo-political power struggles
- Run-away private governance
 - E.g. Global Food Safety Initiative
 - Access for SMEs questionable
 - Effects on design space for public governance
- Sustainability
 - Energy use
 - Sustainable data management

Digitalization affects identities and social relations fundamentally

Example from animal husbandry

- Production system on the farm is completely transparent for the veterinarian and the bank
- Shift from personal to systemic and institutionalised trust
- Perceived (and actual) loss of control vs. entrepreneurial identity

Automatization

- Relieve of simple tasks, in particular on-field
- But many farmers see these as part of their identity, e.g. connecting to the soil
- Perceived alienation from “nature”

Societal valorisation of agricultural products

- Economic value added shifts to digital data ...
- ... and away from the living component

Labour relations

- Labour relations and labour conditions
 - Surveillance and productivity monitoring
 - E.g. surveillance of tractor driver through sensors
 - E.g. benchmarking for machines → drivers work through rest time, loss of social time and interaction
 - Seasonal workers → loss of control over harvest yields
 - Administrative software is coupled with asparagus cutter, if the machine does not move, wage is deducted automatically
- Loss of autonomy of workers, feeling of alienation and objectification
 - “Big brother is watching you.”

The transparency dilemma

- Transparency vs. business secrets
- Link of private transparency systems to public monitoring, reward and sanctioning systems
- Personalised nutrition: demands for data by health insurers, medical sector etc.

What governance architecture?

- Privacy, surveillance and data security issues directly affect personal and potentially public security
 - Domain of the nation state
 - International cooperation and coordination – legal basis?
 - Role of international institutions: FAO, WTO – any initiatives?
- Data use and transfer in transnational value chains
 - Harmonization demands
 - Interplay of public and private standards
 - Conflict resolution in private systems – meta-governance
 - Access to data, to market platforms, to products and services
 - Market power and competition policy
- Limited digital capacity of the state
 - Do we have an early warning system to identify and address problematic developments?

Democracy: How do we decide what we want from digitalization?

- Public and private surveillance: What is desirable and undesirable, acceptable and unacceptable?
 - Ongoing societal negotiation
 - But what are appropriate fora and arenas for these societal negotiations?
- Rationality of algorithms (Miles 2019)
 - Implicit or explicit normativity of algorithms
 - Rationality is not reasoning.
 - Who decides?
- Value of data – data ownership, data access, remuneration
 - What is fair? What works?

Many thanks for your attention!

Do we want digitalization to shape our societies and communities through evolutionary processes, or do we want to shape digitalization through coordinated action?

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Caspar David Friedrich / Hamburger Kunsthalle

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