Digital agriculture: from technologies to food systems changes

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#DigitAg
A digital revolution in agriculture?

• For agriculture, digitalization is an exogenous innovation (similar to machinery (19th century) and chemistry (20th century))

• Digital agriculture is transformative
  • Technical and technological transformation
  • Organisational transformation
  • Social and societal transformation

• Data are transformative
  • Because of massive production and automation, data become increasingly available at very low cost
  • Data reconnect actors through ICT

• Digital meets key farmers’ expectations
  • Economic performance
  • Environmental performance
  • Social issues

• And impact the whole agri-food system
  • Block chain technologies
  • Agri-food systems 4.0
Creating and sharing added value

On the various dimensions of sustainability: production, economics, environment, social issues
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Machine system
- Breeders
- Crop protection
- Constructors
- Farmers

Smart connected machine
- Precision farming
- Decision tool kits
- Smart machine
- Tractor

Creating and sharing added value
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On the various dimensions of sustainability: production, economics, environment, social issues
Heterogeneities exist within and among entities managed by farmers: fields, animal herds.

Ensuring the most precise and the most adapted action at each point of these entities.

- Locally adapted crop management
- Individual diet for animals
Capturing local heterogeneities is also true for high-throughput phenotyping.

Emphasis project, Inra platform in Clermont -Ferrand

They use the same sensors, and the same algorithms as those used for high throughput phenotyping: Joint technological Unit Capté (Avignon): Inra and Arvalis
Connected livestock systems

- Milking robots
- Sensors for calving
- Genotyping cows and sire choice
- Automatic individual feeding and supplementation
- Genotyping bulls
- Genomic selection
- Herd management and grazing management
- Sensors for calving
- Monitoring grass growth

Emergence of industrial consortia for integrated on-farm services
ICT – from the farm gate to the consumer

**Eco-conception / circularity:**
Online control of molecules / biomarkers on raw products or by-products for improvement of processing conditions, for developing cascading use.

**Safety:**
Smart packaging – Biosensors

**Quality:**
Virtual reality to improve sensory quality – user experience

**Social impact** of ICT on consumers (Food and Health domains)
How to make it possible to meet...

- **Farmers’** demand for decent incomes & decent working conditions
- **Increasing consumers’** demand for organic or low-input food products, variety, nutritional quality at reasonable prices
- **The society** demand for the preservation of the environment
- Any combination?
Levers that help agriculture to evolve

Systemic approaches

Agro-ecology

Bioeconomy

New technologies

Robotics

Autonomous, adaptive machines

Digital agriculture

Mobilisation of digital tools (sensors, IoT, cloud, models, deep learning, smartphones) for improving both the agricultural production and the social inclusion of farmers
DA for improving agricultural production

Digital agriculture

Building up a holistic approach with complex decision making (new time, spatial & business frontiers); integrating individual & collective strategies; building up new knowledge.

Precision agriculture

Precisely addressing plant / animal needs

Decision Aid Systems

New Breeding Technos + High throughput phenotyping

(Climat)e-smart agriculture

Creating & sowing adapted varieties

(UAV) Satellite

IoT – internet of things

Smartphone

Data sharing

Deep learning

(Low-cost) RFID monitoring

Traceability

Observation

Action

Diagnosis

Recommendation

Control loop
DA for improving farmers’ social inclusion

A better connection to the markets
- Breaking information asymmetry (market prices, risk coverage)

A better inclusion into the territories
- Traceability as an evidence for quality
- More resilient Ag. Territories (e.g., sharing water)

Direct connection to consumers (direct sale, participatory food design « C’est qui le patron? »)
- P2P knowledge exchange

Higher incomes
- Knowledge manufacture
- P2P data sharing
- Participatory sciences

Bioeconomy (Valorizing agric. wastes; Ex Organix)

Ecosystemic services (traceability, quantification)

Higher social value

More resilient Ag. Territories
- Territorial intelligence (traceability, crowd sourcing)

« C’est qui le patron? »
- Traceability as an evidence for quality

P2P knowledge exchange
- Participatory sciences

Higher social value
- Knowledge manufacture
- P2P data sharing

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Robotics: not only an economic gain

- Environmental benefits
- Less pesticides
- Weeding
- Scouting
- Precision spraying
- More security
- Confort at work (attractivity)
- Knowledge building (Data collection)
- Time saving (attractivity, economy)
- Social benefits

Less soil compaction (preserving soil fertility)
Why encouraging DA & robotics?

- DA allows to embraces bigger spatial, time & value chain scales to make decisions & sell
- More resilience
- Da & Robots => Precision: the best waste is the one which is avoided
- More attractivity
- Robots free the farmer: more time, less danger, more productivity
- DA fosters farmers’ inclusion in the society
- DA & robots may serve all agricultures, including organic production
- Beware of risks!
Risks

- The digital divide
- Loss of autonomy
- Monopolisation of the data (& subsequent knowledge)
- Two-tier system (adoption issues)
- Upsetting advisory organisations (& other social impacts)
- Debt Overload (robots)
- Dashed hope (technology unkept promises)
Risk mitigation

The digital divide

Invest in the network coverage *(private)* & help farmers to invest *(public)*

Loss of autonomy

Monopolisation of the data (& subsequent knowledge)

Data sharing for open innovation

Encourage dvpt of low-cost robots & of agri service contractors

Debt Overload *(robots)*

Two-tier system *(adoption issues)*

Education *(incl continuing education)* & information *(of farmers, advisors, dealers)*

Upsetting advisory organisations (& other social impacts)

Research

Dashed hope *(technology unkept promises)*

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AgGate

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Thank you for your attention!

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