Opportunities in ICT for knowledge creation and communication in agriculture

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Thanks to Sjaak Wolfert, Lan Ge, Marc-Jeroen Bogaardt, Cor Verdouw, Jan-Willem Kruize
I hope that you can say something about the opportunities for development for new knowledge, flow of knowledge in AKIS between farmer, extension and research, and how ICT can be developed as a tool. What initiatives are taken? Where are the ‘holes’ today? If you can give examples it is good. What is going on in EU, in the Netherlands. What is needed most: development of knowledge or technology? How can ICT be developed as tools for advisors and as decision tool?
Disruptive ICT Trends:

- **Mobile/Cloud Computing** – smart phones, wearables, incl. sensors
- **Internet of Things** – everything gets connected in the internet (virtualisation, M2M, autonomous devices)
- **Location-based monitoring** - satellite and remote sensing technology, geo information, drones, etc.
- **Social media** - Facebook, Twitter, Wiki, etc.
- **Blockchain** – smart contracts

➢ **Big Data** - Web of Data, Linked Open Data, Analytics

*High Potential for unprecedented innovations!*
IoT in Smart Farming

smart sensing & monitoring

cloud-based event and data management

smart control

smart analysis & planning

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IoT in Agri-Food Supply Chains
IoT and the consumer

- Smart Farming
  tracking/& tracing
- Smart Logistics
- Domotics
- Health
- Fitness/Well-being
The opportunity for green growth

Degree of diffusion of the technological revolution

Installation period

Financial bubble
Decoupling in the system
Polarisation poor and rich

1971 chip ICT
1908 car, oil, mass production
1875 steel
1829 steam, railways
1771 water, textiles

Turning point

Deployment period

Crash
2008
1929
1893
1847
1797

Institutional innovation

MATURITY

Synergy

Last products & industries
Market saturation
Disappointment vs complacency

Golden age
Coherent growth
Increasing externalities

Frenzy

Unemployment
Decline of old industries
Capital searches new techniques

Irruption

Unemployment

Based on Perez, 2002
4 grand challenges: tomorrow’s business

- Food & nutrition security
- Climate change
- Environmental issues
- Healthy diet for a healthy life

Input industries → Software provider → Farmer → Logistic solution providers → Food processor → Retail / consumer

Collaboration and Data Exchange is needed!
There is a need for software ecosystems for ABCDEFs:
Agri-Business Collaboration & Data Exchange Facilities

- Large organisations have gone digital, with ERP systems
- But between organisations (especially with SMEs) data exchange and interoperability is still poor
- ABCDEF platforms help
Chain organisation changes (©Gereffi et al., 2005)
2 Scenarios, with significant impacts?

1. Scenario CAPTIVE PRODUCT CHAINS:
   - Farmer becomes part of one integrated supply chain as a franchiser/contractor with limited freedom
   - One platform for potato breeder, machinery company, chemical company, farmers and French fries processor.
   - Weak integration with service providers, government?

2. Scenario OPEN NETWORK COLLABORATION:
   - Market for services, apps and data
   - Common, open platform(s) are needed
   - Higher upfront, common investment??
   - Business model of such a platform more difficult?
   - More empowerment of farmers and cooperatives?
Dynamic landscape of Big Data & Farming

- **AgBusiness**: Monsanto, Cargill, Dupont, ...
- **AgTech**: John Deere, Trimble, Precision planting, ...
- **Data Start-ups**: Farm
- **AgTech Start-ups**: Farm
- **Venture Capital**: Founders Fund, Kleiner Perkins, Anterra, ...
- **ICT Start-ups**: ICT Companies
- **Ag software Companies**: ICT Companies
- **ICT Companies**: Google, IBM, Oracle, ...

**Farming**
USA Start ups in different activities

The Agriculture Tech Market Map

Farm Management Software
- Farmeron
- FeedTrackur
- Farmnote
- fodjan
- scoutpro
- CropTrak
- VITAL FIELDS
- adapt-N
- trecker.com
- CropZilla
- Granular
- innovating Fields

Precision Agriculture and Predictive Data Analytics
- RESSON
- HydroBio
- Strider
- GeoVisual
- CropMetrics
- farmlink
- Phytech
- GROWERS
- AGIBLE
- aWhere

Drones and Robots
- RAPTOR MAPS
- AIRWOOD
- SkySquirrel
- BLUERIVER TECHNOLOGY
- SKYCISON
- LEADING EDGE TECHNOLOGIES
- mavrx
- ceres imaging
- TerrAvion
- PRECISION HAWK

Smart Irrigation
- SMART FARM.
- HydroPoint
- HORTAU

Sensors
- iONFARM
grownetics
pycn
- FieldIn
- amber AGRICULTURE
- Acuity Agriculture
- FARM DOG

Marketplaces
- AgroStar
- HUNGRY HARVEST
- LA RICHE DOIT NAIT

New Farms
- FREIGHT FARMS
- AeroFarms
ICT has effect on business models: how to earn money with data?

1. basic data sales (commercial equivalent of open data; new example: Farm Mobile)
2. product innovation (new tools, active machinery industry, e.g. John Deere, Lely’s milking robots)
3. commodity swap: data for data (e.g. between farmers and food manufacturers to increase service-component)
4. value chain integration (e.g. Monsanto’s Fieldscript for prescriptive farming)
5. value net creation (platforms to pool data from the same consumers each other or for others: e.g. AgriPlace)

See: Arent van 't Spijker: "The New Oil - using innovative business models to turn data into profit“, 2014
Farm data harvesting initiatives

- FarmersEdge™
- FieldScripts™
- 365FarmNet
- TERRENA
- FARM MOBILE
- AgDNA
- THE CLIMATE CORPORATION
- api-agro
- FarmLogs
- Precision Planting
- AGRIPLACE
- FARMERS BUSINESS NETWORK
- JOHN DEERE
- MyJohnDeere
- Wageningen UR
Fieldscripts: Monsanto (et al.)

Prescriptive Farming based on Variable Rate Application

Integrated Farming Systems™ Would Combine Advanced Seed Genetics, On-farm Agronomic Practices, Software and Hardware Innovations to Drive Yield

- Database Backbone
- Breeding
- Variable-rate Fertilizer
- Precision Seeding
- Yield Monitor
- Fertility & Disease Management

For quality of life
USA: Farm Mobile

“Farmers believe their trust has been violated”: their data go to multinationals, that announce big future income from big data, while they have pay for everything.

Farmers collect ‘crop stories’ and decide where they travel (and get a few cents per item?) (venture capital based)
USA: Farmers Business Network

Farmers’ owned, investment by Google Ventures

Summer 2015: FBN has aggregated data from 7 million acres of farm land across 17 states, and they’re growing 30% month over month. The platform is currently able to assess the performance of 500 seeds and 16 different crops. Costs farmer $ 500 / year.
What does this mean for the AKIS?

Big Data and other ICT developments will not only influence agriculture but also science, research and development and innovation processes in the AKIS. This goes much deeper than open access and linked open data sets in science. Where the past is characterised by doing research on data from one experimental farm or only a sample of farms (like in the FADN) that results into one set of advice for everybody, the future is characterised by doing research on data of all farms, in real time, that results in individually customised advice for individual farms. That blurs borders in AKIS between research and advice and advisors will need continuous training on these developments.

(c) EU SCAR AKIS Towards the future – a foresight paper, 2015
Reasons for government intervention in innovation:

- Public objectives including food security, and regional development are not automatically guaranteed by the market. More uptake of ICT could help.
- Many SMEs in agriculture, the food and the machinery industry that underinvest in knowledge. Pooling of funds makes sense.
- Systemic bottlenecks in collaboration between agriculture and ICT-sector.
- Need for common pool investments (infrastructure like ABCDEFs, standards for data exchange etc.)
- Negative external effects of ICT need attention: privacy, data ownership, potential discrimination by software algorithms, power balance in the food or software chain etc.
- Negative external effects in agriculture that could be more attractively solved by ICT than by regulation (e.g. precision agriculture should benefit the environment)
- Government is a user of ICT
Different objectives, methods, and public roles

Science
- Science driven knowledge development
- Basic research
- Linear model
- Cross overs sectors
- Society sets agenda
- PUBLIC TASK

Market driven R&D
- Science for competitiveness or social issues
- Business sets agenda, helps to steer, uses results
- PRIVATE-PUBLIC PARTNERSHIPS

Innovation in partnership
- Prototypes // Localisation
- Change business models / finance
- Food chain is co-creator
- (De-)regulation, procurement etc.
- LEARNING AND INNOVATION NETWORKS
- INFORMATION BROKERS
What is going on in the EU (and Norway)

- EU SCAR AKIS Towards the future – a foresight paper, 2015
- ERA-NET ICT AGRI: strategic research agenda
- Future Internet PPP
  - Smart AgriFood
  - Fispace
  - Accelerator projects: Finish, SmartAgrifood2, Fractals
- H2020: Internet-of-Food-2020: Internet of Things
- European Innovation Partnership: seminar data driven data models (Sofia) + benchmarking
- DISH-RI en RICHFIELDS: consumer data on food, lifestyle and health
- Plus several other projects in H2020 where ict is an important work package (e.g. Valerie)
Building blocks for the Future

SOFTWARE THAT WORKS

INTERNET OF THINGS
- Things Abstraction
- NGSI IoT Events Triggering
- Data & Metadata Acquisition
- Seamless M2M Techs. Integration

DATA / CONTEXT
- BigData Analysis
- Events Composition & Subscription (NGSI)
- Location
- Video Analysis
- Semantic Tools

CLOUD
- OpenStack core
- Object Storage
- IaaS Service
- VMs provision to 3rd party trials

SECURITY
- Uniform OAuth2.0 access control
- Security Monitoring
- Secured Storage
- M2M-Specific Security Tools

DEVICE/NETWORK INTERFACES
- Developers’ Access to Terminal Capabilities
- Cloud Proxies Connection
- Open Networking Information and Control
- Access to Network Capabilities and Services

APPS ECOSYSTEM
- Services Repository
- Visual Services Composition
- Services Publish Support
- Business Models Support & Templates

Value Chain Proposition

FI-WARE splits the value chain making a flexible architecture where different pieces can be glued to build your service

Example Scenario

Shop placement

Safety alerts

Shopping & Parking recommendations

Traffic light Optimization

BIG DATA

EVENT COMPOSITION

NGSI

Mobile Network

People

Businesses

Apps/Services Provider

Apps/Services Developer

Platform Provider
Highly Integrated Service Solutions

- Event-driven
- Configurable
- Customizable
- Service model

Data (Standardisation) Services

EPCIS  Adapt

Accelerator companies

MyJohnDeere.com  farmpilot  FARMOBILE

Biz architect bundles apps in a platform

Business Collaboration Services - Based on Open Source Software

Data Standards to connect

Farmers

Accelerator companies

FIspace: business collaboration

Modules:
- Single SignOn
- Biz Collab.
- Event Proces.
- System-Data integration
- App repository

WAGENINGEN UR
For quality of life

Ecosystem to link platforms, apps, data
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Two platform examples from our work

- **Agriplace** – compliance in food safety etc. made easy

- **RICHFIELDS**: manage your food, lifestyle, health data and donate data to research infrastructure

Donate to (citizen) research
Elements for an Agri-ICT strategy

• Promote data-exchange (reduce administrative burdens, create value via combination, aggregation)
  • Standardisation for interoperability; e.g. AgGateway Europe, UN/CEFACT
  • Platform(s) for data exchange (NL: AgriTrust, EDI-circle; Danish solution)
  • Open data by government
• Promote innovation with new services
  • Especially ict-start ups, connect with farmers and companies (e.g. FIware 3 stage approach)
  • Internet of Things
  • Big Data (use of social media data, machine learning etc.)?
• Advisory service: “just” another player in data exchange + update own software
• Research: support this + real time agronomic models.
Thanks for your attention

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