Internet of Food & Farm

IoT and Transparency: Transparency in the Meat Supply Chain

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Wageningen University & Research

Wageningen University & Research is made up of:
- Wageningen University
- 9 research institutes

![Diagram of Wageningen University & Research structure]
Statistics…

1 faculty
5 departments
85 chair groups

19 Bachelor’s programmes
Animal Sciences
Biology
Biotechnology
Communication Sciences
Economics and Governance
Environmental Sciences
Food Technology
Forest and Nature Conservation
Health and Society

28 Master’s programmes
Animal Sciences
Applied Communication Science
Aquaculture and Marine Resource Management
Bioinformatics
Biology
Biotechnology
Climate Studies
Development and Rural Innovation
Earth and Environment
Environmental Sciences
Food Quality Management
Food Safety
Food Technology
Forest and Nature Conservation
Geo-information Science
International Development Studies
International Land and Water Management
Landscape Architecture and Planning
Management and Consumer Studies
Molecular Life Sciences
Nutrition and Health
Plant Sciences
Soil, Water, Atmospheric
Tourism (joint degree)

Rankings
WUR ranking in
QS World University Rankings 2016-2017
Agriculture and Forestry
1

WUR ranking in
QS World University Rankings 2016-2017
Environmental Sciences
4

WUR ranking in
National Taiwan University Ranking, World Universities 2015-2016
Agriculture
1 (3 years running)

Wageningen worldwide

Wageningen University & Research is active in many regions of the world. From China to Chile and from Ethiopia to the Arctic, we work together with partners in research programmes.
IoT: From Object to Smart-and-Connected Object

- Farm object
- Smart farm object
- Smart-and-connected farm object
IoT: Farming system-of-systems

- Smart-and-connected farm object
- Sensors on/in Animals
- External Databases
- Systems for managing animals, pens, stalls
- Systems for farm equipment
- Systems for crop/field mgmt.
- Farm Management System
- Systems for products, seeds
- Sensors
- Actuators
- Field Sensors
- Weather Data
- External Databases
- E-market place
IoT: How to realize smart-and-connected objects

Identity & “badge”  Common “language”  Software/solution

- conceptualization
- scientific underpinning
- software architecture
- initiate projects
- link with farm industry
- link with service industry
IoT applications

Productivity

Transparency

Smart-and-connected farm object

Consumer wants to know... **labels and apps**

Customer/retailer wants to know: **certification**
IoT and EU
IoT is a Key Research Area within EU
EU invests large in Large-Scale Pilots (LSPs)

... based on Real-Life Use Cases (UCs)

<table>
<thead>
<tr>
<th>Project</th>
<th>Partners</th>
<th>Budget</th>
<th>UCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIVAGE</td>
<td>49</td>
<td>€20M</td>
<td>8</td>
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<tr>
<td>AUTOPILOT</td>
<td>44</td>
<td>€20M</td>
<td>5</td>
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<tr>
<td>IoF2020</td>
<td>70+</td>
<td>€30M</td>
<td>19</td>
</tr>
<tr>
<td>MONICA</td>
<td>29</td>
<td>€15M</td>
<td>20+</td>
</tr>
<tr>
<td>SynchroniCity</td>
<td>39</td>
<td>€15M</td>
<td>3</td>
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<tr>
<td><strong>Total</strong></td>
<td>~ 230</td>
<td>~ €100M</td>
<td>~ 60</td>
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OTHER LARGE-SCALE IOT PROJECTS IN EUROPE

- **Activage** (Activating innovative IoT smart living environments for ageing well)
- **AutoPilot** (Automated driving progressed by IoT)
- **Monica** (Management of networked IoT wearables – very large-scale demonstration of cultural and societal applications)
- **Syncronicity** (Delivering an IoT enabled digital single market for Europe and beyond)
- **IoF2020** (Internet of Food and Farm 2020)
IoF2020 use case locations

- The Internet of Arable Farming
  - Within-field management zoning
  - Precision Crop Management
  - Soya Protein Management
  - Farm Machine Interoperability
- The Internet of Dairy Farming
  - Grazing Cow Monitor
  - Happy Cow
  - Silent Herdsman
  - Remote Milk Quality
- The Internet of Fruits
  - Fresh table grapes chain
  - Big wine optimization
  - Automated olive chain
  - Intelligent fruit logistics
- The Internet of Vegetables
  - City farming leafy vegetables
  - Chain-integrated greenhouse production
  - Added value weeding data
  - Enhanced quality certification system
- The Internet of Meat
  - Pig farm management
  - Poultry chain management
  - Meat Transparency and Traceability

Coordinator: Wageningen University and Research (NL)     Website: www.iof2020.eu
Use Case: Transparency in MEAT

What should be the objectives, the products...?

Transparency app? Visibility to sensor data? Something else?

Coordinator: Ayalew Kassahun, WUR
Stal van de Toekomst

Start project: 2014

Doel: Ideeën onderzoeken en doorontwikkelen

De ontwikkelingen op het gebied van stalsystemen en bijbehorende technieken volgen elkaar snel op. We zagen bij de Hoeve Innovatie dat de systemen steeds meer centraal werden gezet, en de dieren zich moesten aanpassen. Daarnaast waren de technische oplossingen vaak gericht op one-
History is transparency research...
Identifying the objectives

• “Today food is all about communication. Consumers want to know what they are eating: is it healthy, safe, fresh, organic and locally produced? This use-case aims to increase transparency in the meat value chain.”

• We have to deal with stakeholders with concerns about:
  • Certifications (KDV)
  • Cost of auditing: decreasing the cost of auditing,
  • Quality of audits: increasing the correctness of auditing
  • Effectiveness of audits: promote proactive audits
Stakeholders’ concerns

- >240+ conventional farmers
- >300 farmers
- 60+ modern farmers

- KDV
- certification scheme
- get audited
- data gathering
- improve auditing
- detailed animal data from 60+ farms
- set quality criteria
- data gathering
- CUSTOMERS
4.1 Mother and Piglet
Perhaps the most important element of animal welfare is given to mother and piglet. Research clearly shows that investing in a hygienic and stress-free environment in this phase has a positive impact on the wellbeing of the pig for the rest of its life. This is not only good for the pig, but can also lead to less use of medication, better growth and meat.

Nest-building materials
All sows are given jute nest-building materials a day before they give birth.

Proactive rather than passive audits
No quality mark can exist without a watertight control system. All KDV farmers are therefore visited annually and checked by independent chain regulator De Hoeve Certificering. This gives us the assurance that each farm meets the criteria for the environment and animal welfare.

But again we want to take things a step further. We believe the best audit is achieved by means of a proactive approach rather than a passive, annual snapshot. We make sure we have continuous insight into the performance of our farms.

Regular vet
At least once a month the company is visited by a regular vet, who will be familiar with the company and KDV’s criteria, and will also be able to act quickly in case of any problems.

Salmonella
Categories 1 and 2 are permitted.

CERTIFICATION
- AUDITS
  • Entry check
  • Annual audit
  • Administrative check by means of a proactive approach
- SANCTION
  • Minor

CERTIFICATION
- AUDITS
  • Entry check
  • Annual audit
  • Access to the online database of Producert / Verin
  • Compulsory blood sampling at the slaughter line
Match KDV to a standard solution: EPCIS

**Event**: What happened?

| What      | Electronic Product Code (barcode, RFID, **SGTIN** or **GTIN + batch nr.**)  
|           | **Individuals** or **groups** (lot, batch) |
| Where     | Location data (**GLN**)  
|           | Facility, building, specific production or logistic location |
| When      | Event date and time  
|           | Record date and time |
| Why       | Name of business **process step** (e.g. shipping)  
|           | **Product state** (active, in transit, expired, et cetera) |
What we do and aim

- Go through the criteria and define EPCIS events
- Identify the data sources
- Get and work on a sample data set
- Study inspectors tasks
- Implement a standard transparency system
- Build a dashboard
When is data recorded
(our guess based on the criteria)

• Piglets are born
• Pigs are bought, farm takeover
• Pigs are dead, euthanized
• Pig(let)s are moved to a different pen
• Feed is bought
• Environmental cond. is measured
• Vet has visited
• Auditor has visited
• Pigs are shipped
• Pigs are received
• Pigs are slaughtered
• Organs are inspected
• Carcasses are inspected
Convert data to standardized data

- Why, *e.g.*
  - Identity
  - Sex
- When
  - Date
  - Time (optional)
- Where
  - Farm ID
  - Barn (if possible, when necessary)
- Why (context), *e.g.*
  - Pen, barn
  - Measured environmental condition
  - Vet ID
  - Health status
  - Disease
  - Subscription
  - Feed type
- ILMD
  - Mother
  - Father
System architecture

EPCIS-compliant transparency system

- Event repository
- Master data

data capture

- LeeO
- FMS
- SIS

piig farmer
slaughterhouse

Dashboard

data query

- customer
- auditor

?
Working towards a dashboard for auditors

EPCIS repository
- Event data
- Master data

Getting data (daily/weekly/...)
- Mother and Piglet
  - Birth
  - Pen-up
  - Vet-visit
- Living environment
  - Temp.
  - NOx
  - ...
- Health
  - Vet-visit.
  - Death
  - ...
- Environment
  - Ambient cond.
  - NOx
  - ...
- Treatment
  - Shipping
  - Transp.
  - ...

Dashboard for farmer/auditor/customers
- Mother and Piglet
  - nr.
  - April
  - May
  - June
  - ...

All criteria
- Farm: 123
- Criteria: KDV 4.1: Weaning
- Expected: May: 1
- Recorded: None

Farmer/SIS

KDV coach/inspector
Summary

- *Meat transparency and traceability* is all about providing transparency information to those actors who have interest and (commercial and other) necessity in transparency
  - ... these actors may not necessarily be the end consumer; they are, in general, his trusted retailers, caterers, *etc*.
- Synergy between transparency system providers and standardization bodies and certification bodies is needed to build effective transparency systems
THANK YOU!

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