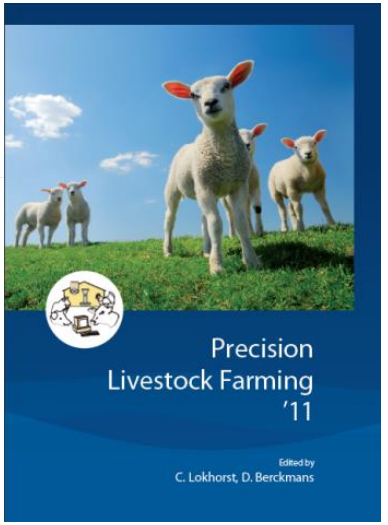
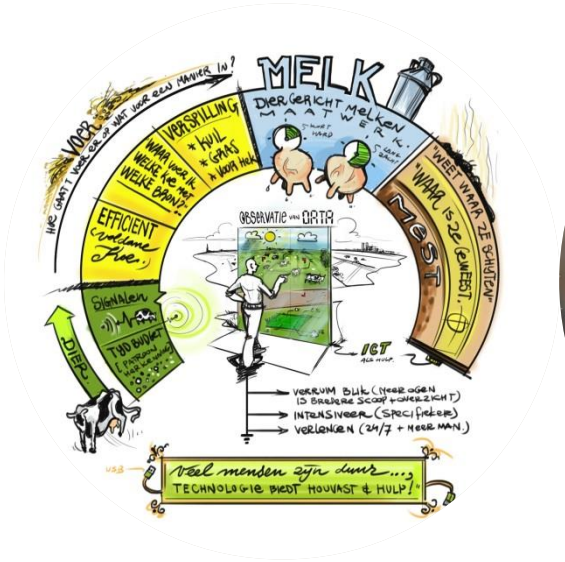
# Smart Dairy Farming




Kees Lokhorst

24 April 2014, Dairy Cattle Symposium, Kayseri/Turkey

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# Content

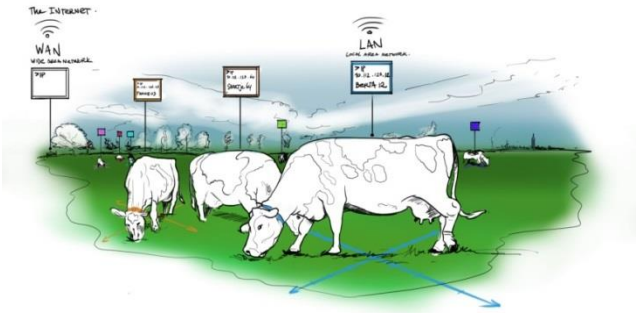
Introduction

Trends

Precision Livestock Farming

Examples

Challenges




Our mission
Breaker
campina
MAERSK LINE
...To explore the potential of nature
to improve the quality of life...

# Wageningen UR stands for ..

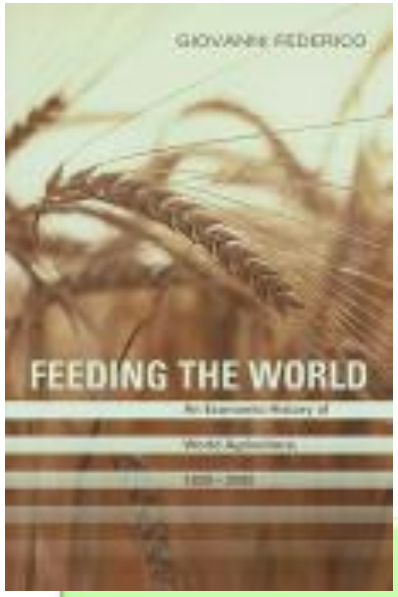
.. reinforce our clients' efforts to innovate and initiate new developments

.. base our work on highly specialised scientific knowledge

.. translate our knowledge into custom applications for our clients

.. are a leading international authority in our field and we take an innovative approach

# Agriproduction 21th century – challenge !!



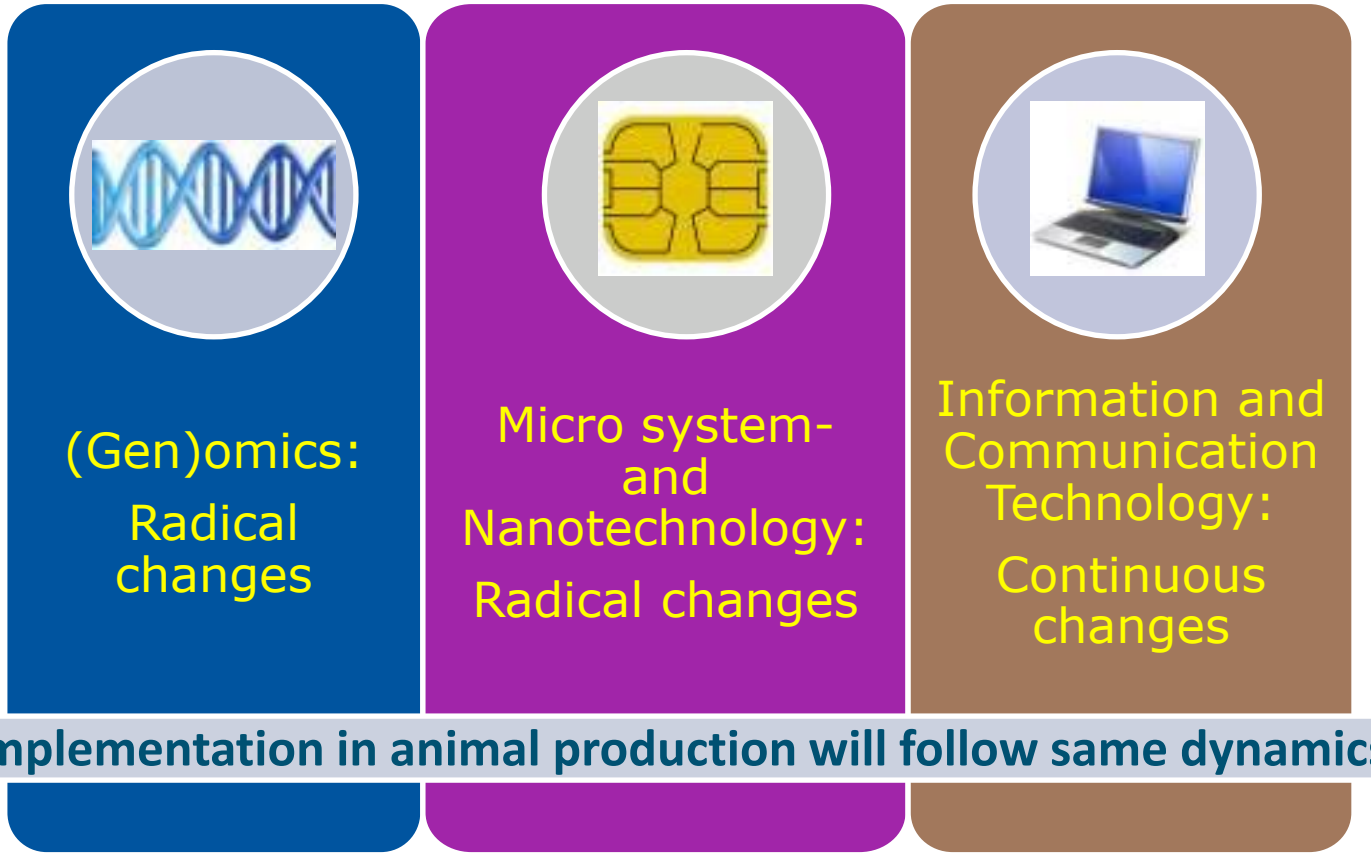

*Feeding the world*
*within the carrying capacity*
*of planet earth*


**2 x 2**

- Doubling Production
- Halving Ecological Footprint

# Mainstream technologies to bring the changes

## Applied technologies

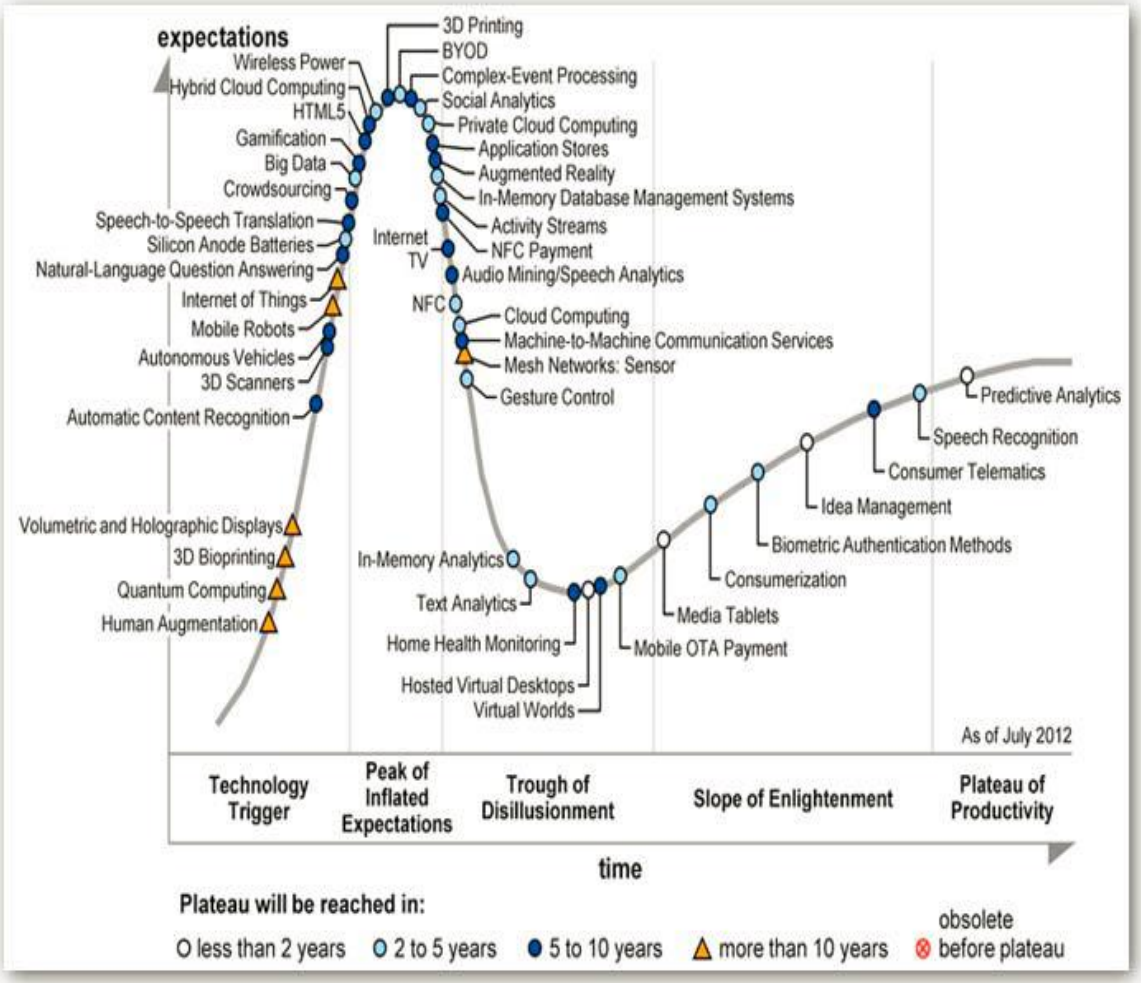





'Leo den Hartog: presentation BioBusiness'

# ICT trends:

- Internet of Things (connectivity, interoperability)
- BIG Data
- Social Media
- Location awareness
- Wireless
- Remote access and control
- Sensor swarm
- Security
- ..

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# Why Precision Livestock Farming?

## Intensification
*Major trend*

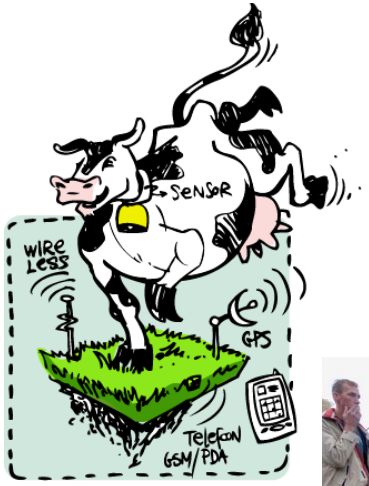
## Animal welfare
*Full in discussion*

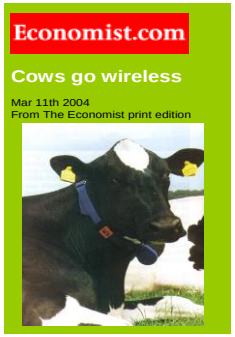
## Animal health
*From curative to preventive*

## Ecological footprint
*LCA and sustainability*

## Technological improvement

*Innovation and knowledge economy*
*Intersectoral and international*




***'Empower farmers to reach the full potential of their animals'***

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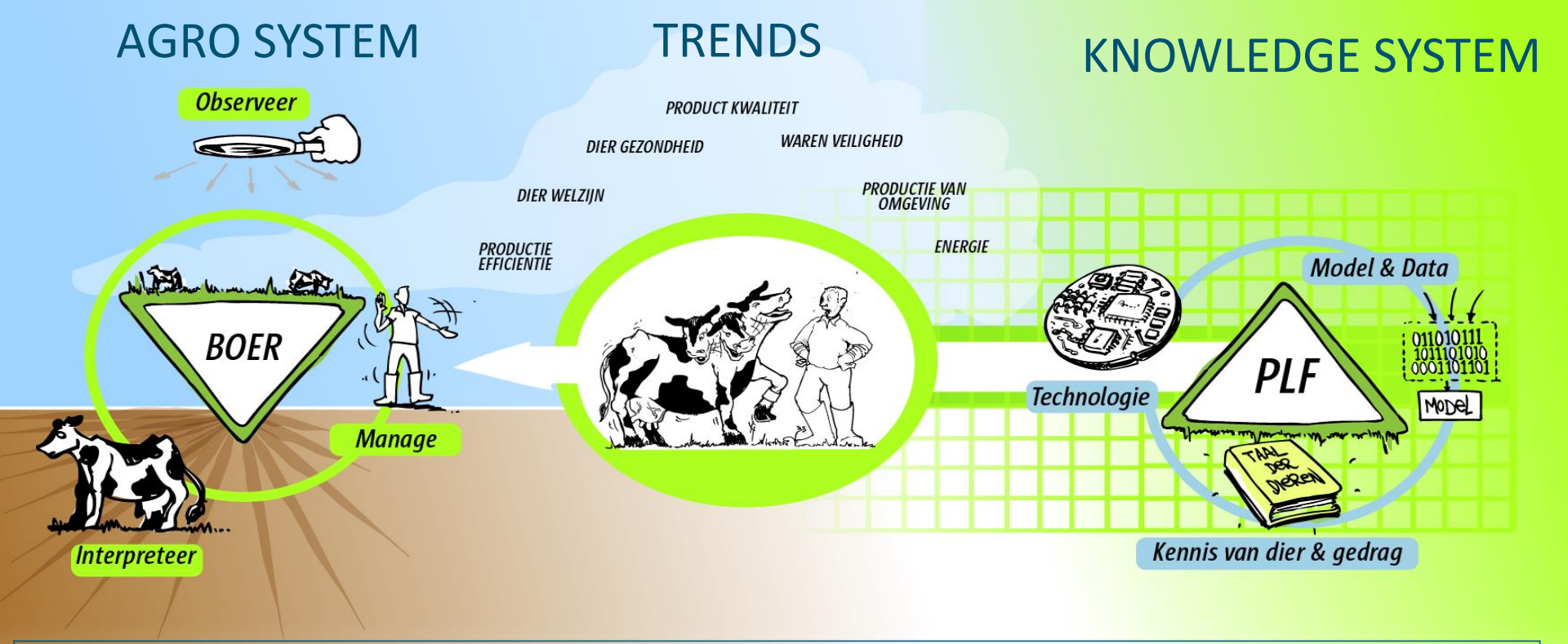
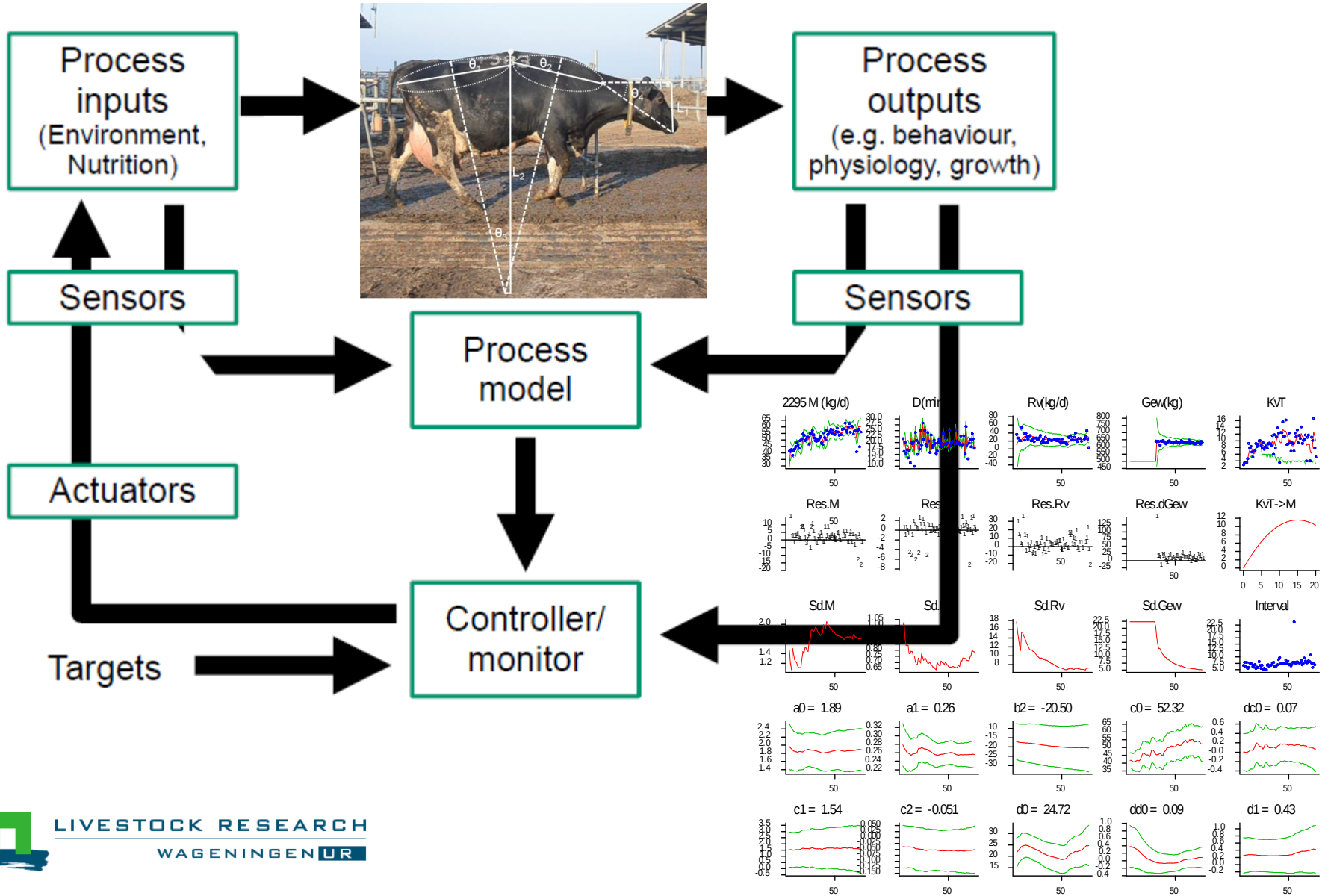



animal <> group [paradigms] variation <> uniform

control <> manage

‘Management of livestock farming by automated real-time monitoring/controlling of production/ reproduction, health, welfare and environmental impact of livestock (Berckmans)’

# Process and data orientation: do not be scared

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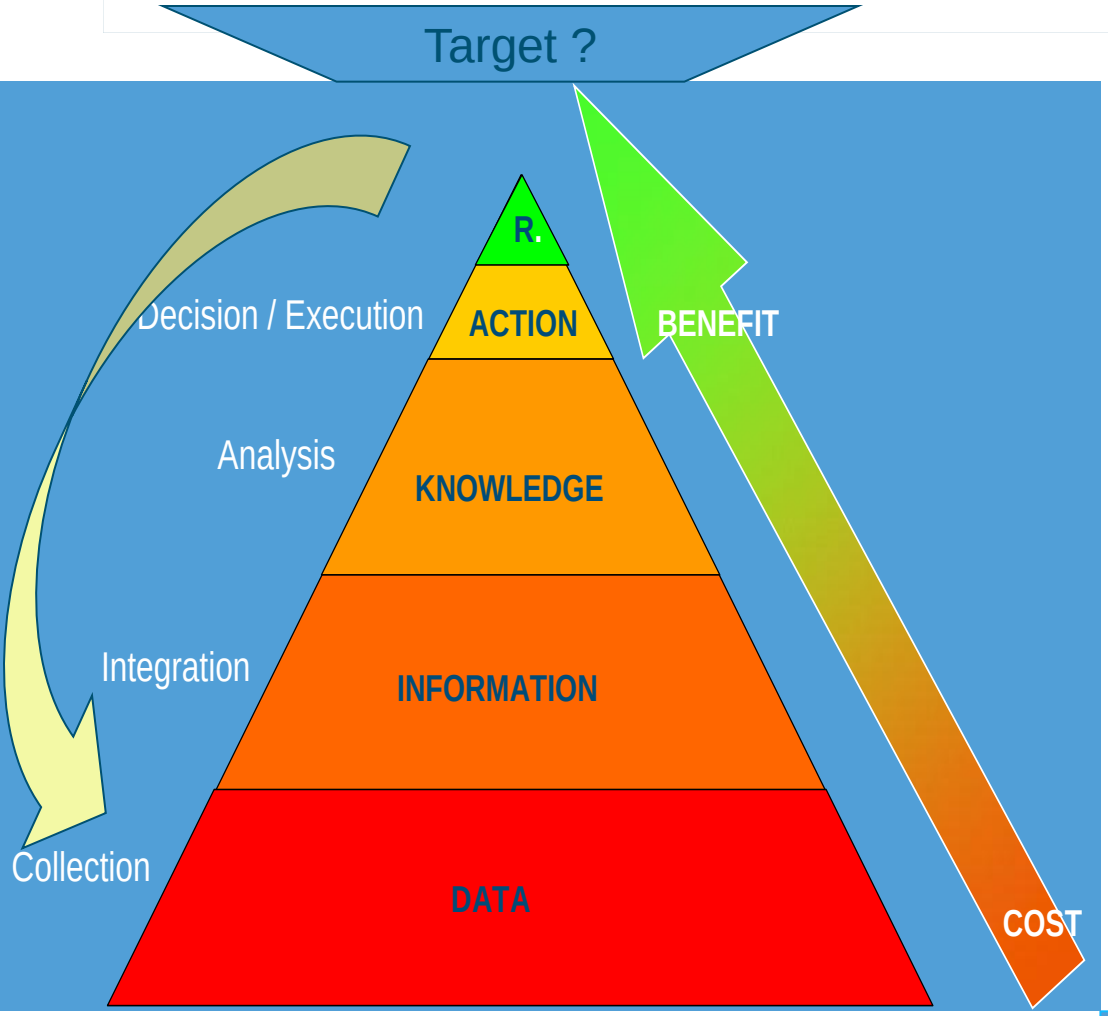
# SMART → from sensing to decision support and action plans




- Right questions (self assessment and goals)
- Animal – group - farm - chain
- Early warning
- Combination of data
- Risk and economics inclusion
- Action list integrated in farm practices
- Principle should be simple and easy to explain
- Trust

Management by Exception

# Udder health – mastitis

| Sensor | Place | Data/parameters | Status |
|---|---|---|---|
| **EC sensor** | In-line | Electrical conductivity | Available (AM systems) |
| **Colour sensor** | In-line | Colour | Available (AM systems) |
| **Viscosity sensor** | On-line | SCC | Available (Sensortec, Lely) |
| **Biosensor** | On-line | LDH | Available (DeLaval) |
| **Reticular temperature bolus** | In-cow | Temperature (in bolus RFID) | Available (Bella Health System) |
| **SPR instrument + CM5 chip** | Off-line | Haptoglobine, NAGase | Research (off line lab. - Biacore) |


# Fertility – oestrus detection

| Sensor | Place | Data/parameters | Status |
|---|---|---|---|
| **Pedometer** | On-cow | Movement counts (legs, head/neck) | Available |
| **3(2)D accelerometer** | On-cow | Behaviour (lying, standing times) | Available |
| **Biosensors** | On-line | Progesterone in milk | Available (DeLaval) |
| **Pressure sensors** | On-cow | Mounting behaviour | Available (HeatWatch) |
| **Temperature bolus** | In-cow | Temperature in rumen | Available (Bella Health System) |
| **Microphone** | On-cow | Vocalization rate and class | Research (patent) |
| **Temperature transducer** | In-cow | Electrical resistance | Research (implant) |
| **Video camera (Oestrus detection-strip on-cows)** | On-line | Video image (removal of paint) | Research (NZ) |



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# Locomotion

| Sensor | Place | Data/parameters | Status |
|---|---|---|---|
| **Weight/force/pressure sensor** | Off-cow | Weight/force/pressure distribution | Available, research |
| **Pedometer** | On-cow | Movement counts (legs, head/neck) | Available ? |
| **3(2)D accelerometer** | On-cow | Behaviour (lying, standing times) | Available ? |
| **3D accelerometer** | On-cow | 3D - step analysis | Research |
| **Video camera** | Off-cow | Video step analysis | Research |

**Gait**

**Uneven Gait**
**Reluctance Bear Weight**
Short Strides
Tracking-up
Affected Leg Evident
Abduction-Adduction
Joint Flexion
Tenderness

**Posture**

**Arched-Back**
**Head-Bob**
**Hip Hick**

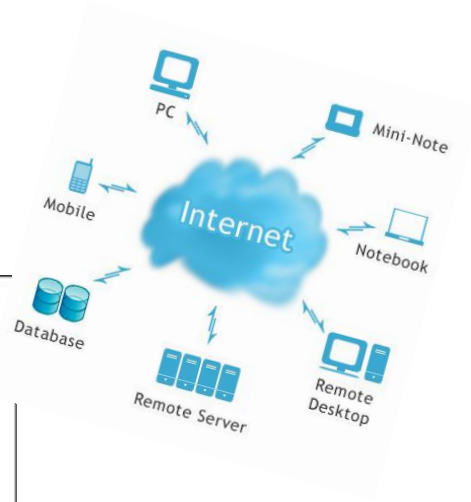
**Others**

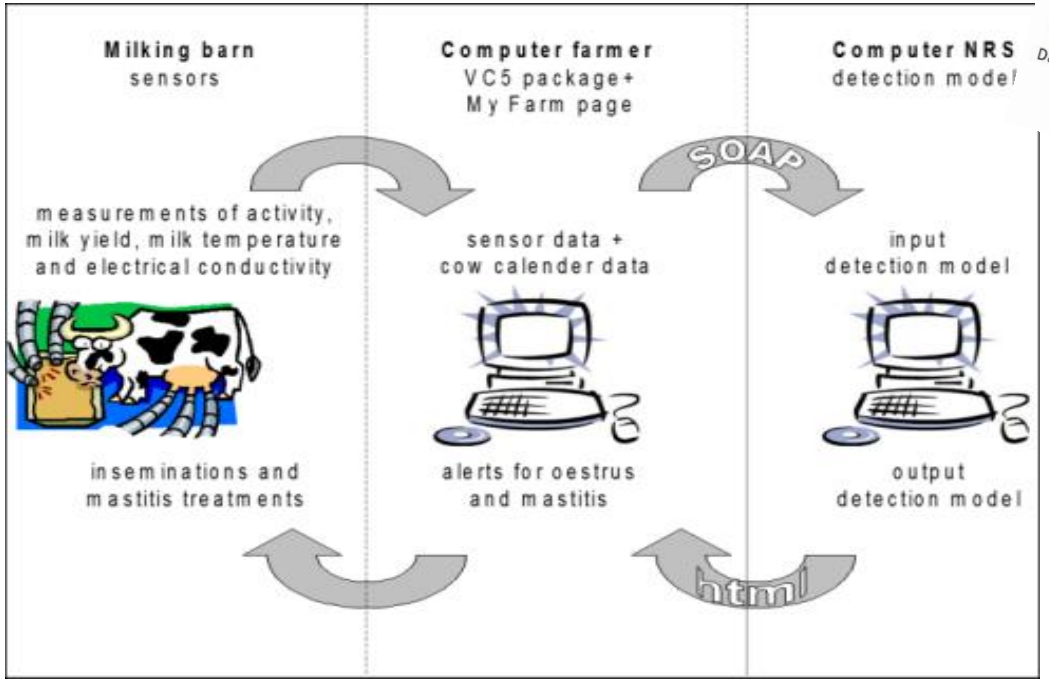
**Speed**
**Difficult turning**
**Difficult rising**
**Tenderness**
**Recumbent**
**Affected behaviour**

# Metabolism

| Sensor | Place | Data/parameters | Status |
|---|---|---|---|
| **pH-sensor** | In-cow | Rumen acidity | Available |
| **Pedometer** | On-cow | Movement counts (legs) | Available |
| **Rumination sensor (sound)** | On-cow | Rumination time | Available |
| **Biosensors** | On-line | Beta-HydroxyButyrate and Urea | Available (DeLaval) |
| **Reticular temperature bolus** | In-cow | Temperature | Research (also in pH sensor) |
| **Spectrophotometer** | On-line | Fat percentage in milk | Research |
| **Infrared spectroscopy** | On-line | Acetone and Beta-HydroxyButyrate | Research |
| **Thermal camera** | Off-cow | Digital temp. image – body condition | Research |

# Where can I find the intelligence?



# Who should be involved ? - Stakeholders

Government

Media

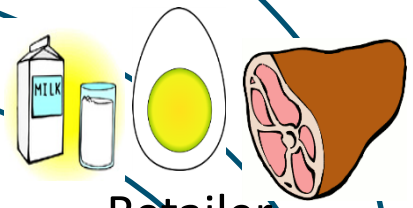
General public

Consumer


Slaughter house and milk processor

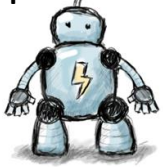
PLF Society


Certification body




Retailer

Technical Industry

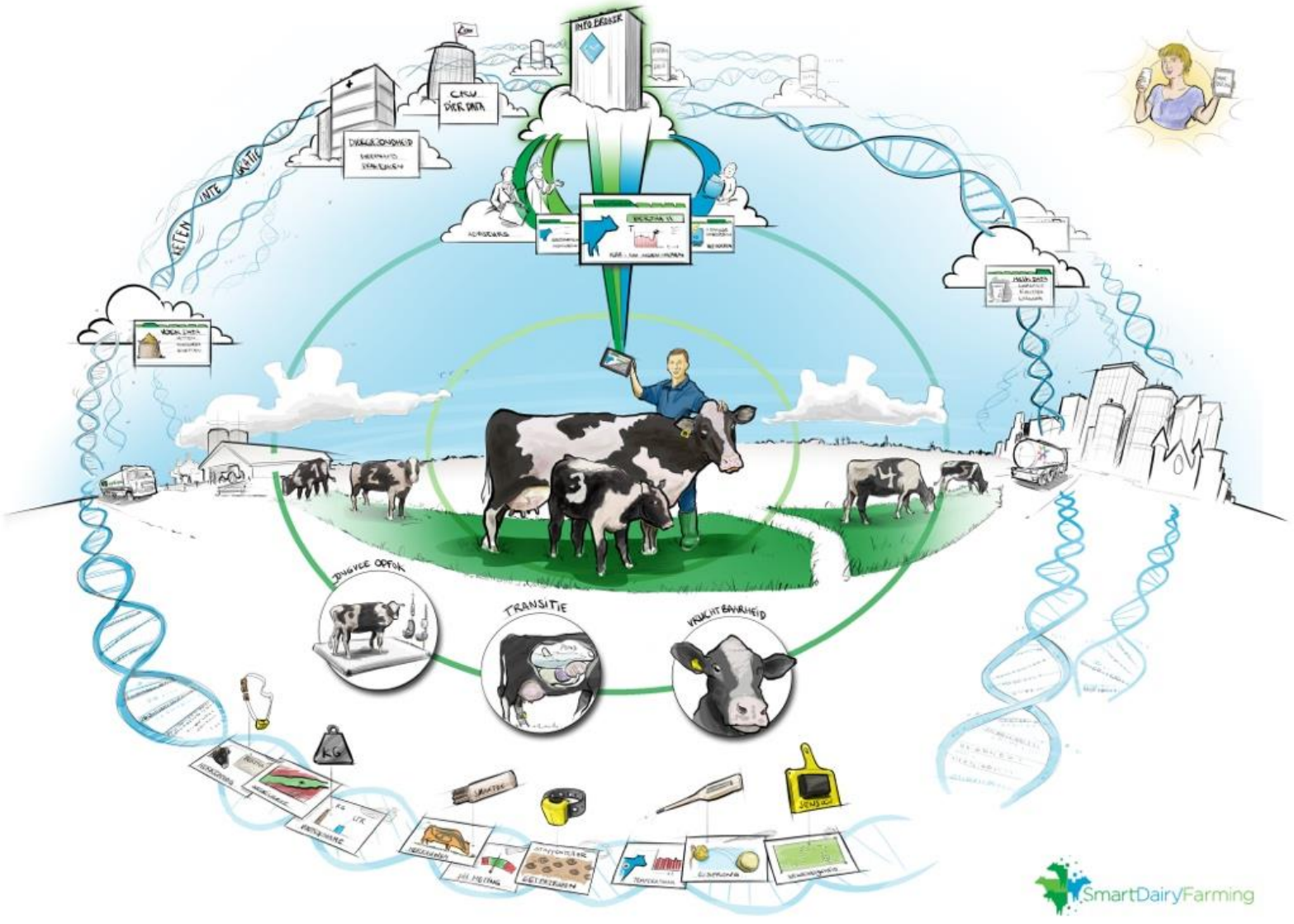


Veterinary

Farmer


Feed and Breed Companies

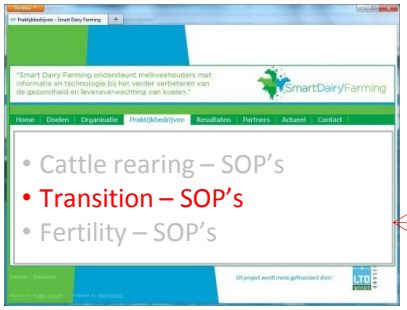
# Smart Dairy Farming



# Example of data stream

SmartDairyFarming

## Dashboard




## SOP-generation models

Change concentrate a/b
Change basic ration a/b
Extra observation
Ask feed advice

SOP-application
SOPs
CRV

Model Fertility
Model Transition
Model Cattle Rearing

## Data collection on the farm

135x nvt

| | | |
|---|---|---|
| Smaxtec | system q | Smaxtec Oostenrijk |
| SCR Activity /Rumination | 'Repeater' PC ??? | Hof_SCR_xxx.csv |
| DeLaval Manus Milk parlour | VC5 Rovecom q | Activiteit_xxx.csv, Melk_xxx.csv, Feed_xxx.csv |
| nedap Activity | | |
| nedap Concentrate feeder | | |
| GALLAGHER Weight 2x | loggers 2x q | |
| nedap Eating time | Nedap app + logger q | FTP server (temporary) |

## Sensor data logistics

tbd

InfoBroker
rovecom

levensnr

'repeater' q
S&S Systems

Match & Merge q
rovecom

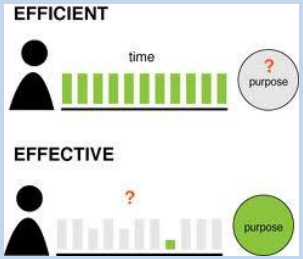
tbd

???_gewicht_xxx.csv
???_velosactivity#_xxx.csv
Vreettijd_xxx.csv (tdb)

Realtime sensor Data storage
sftp/nedap
sftp/scr
sftp/agrovision
sftp/rovecom
TNO

Static/ operational Data storage
CRV_EMM
CRV_Cowregistration
CRV_Diagnose
CRV_Treatment

# The future:
# is *a change in business model required?*




## Old model

- Maximise productivity
- Food security
- Productivity & Rationalisation

## Current model

- Optimise profitability
- Efficiency

## New model

- Optimise sustainable profitability
- Balance: Economy, ecology & society

*Sustainable*

*Precision*

*Livestock*

*Farming*

# Thank you for your attention

Thanks to cooperation with Claudia Bahr, Daniel Berckmans, Pieter Hogewerf, Bert Ipema, Rudi de Mol, Andres Schlageter, .....

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