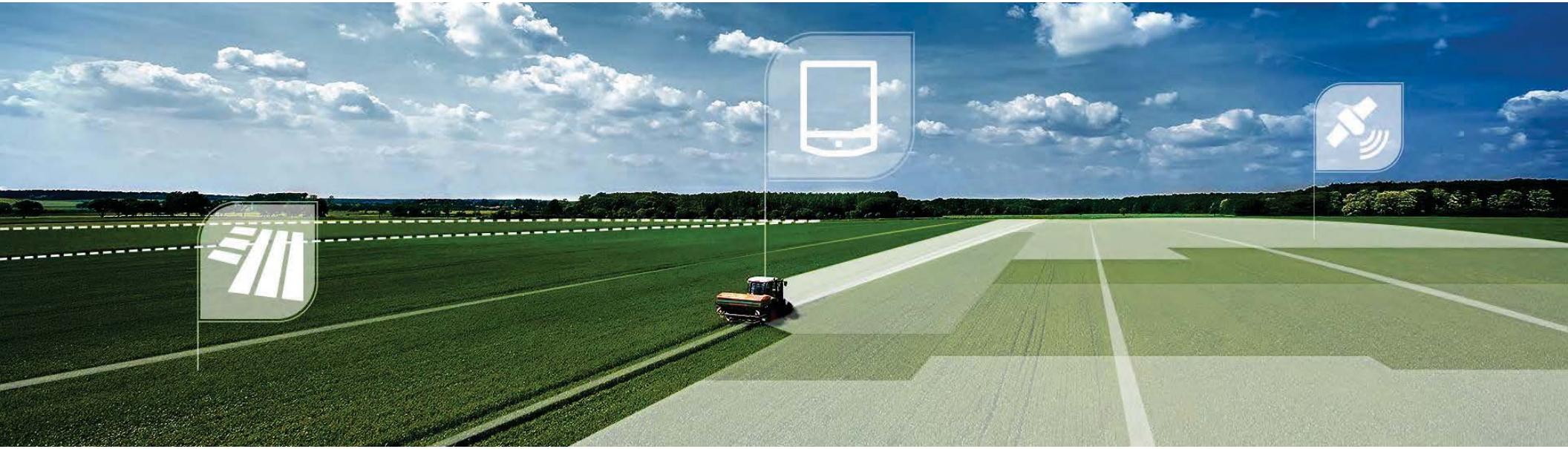


Agriculture machinery, processes and digital options as part of Farming 4.0

IEEE IoT Vertical & Topical Summit for Agriculture, Paris, May 21st , 2017

Dr. Joachim Stiegemann

Head of Product Management
CLAAS E-Systems

CLAAS at a glance

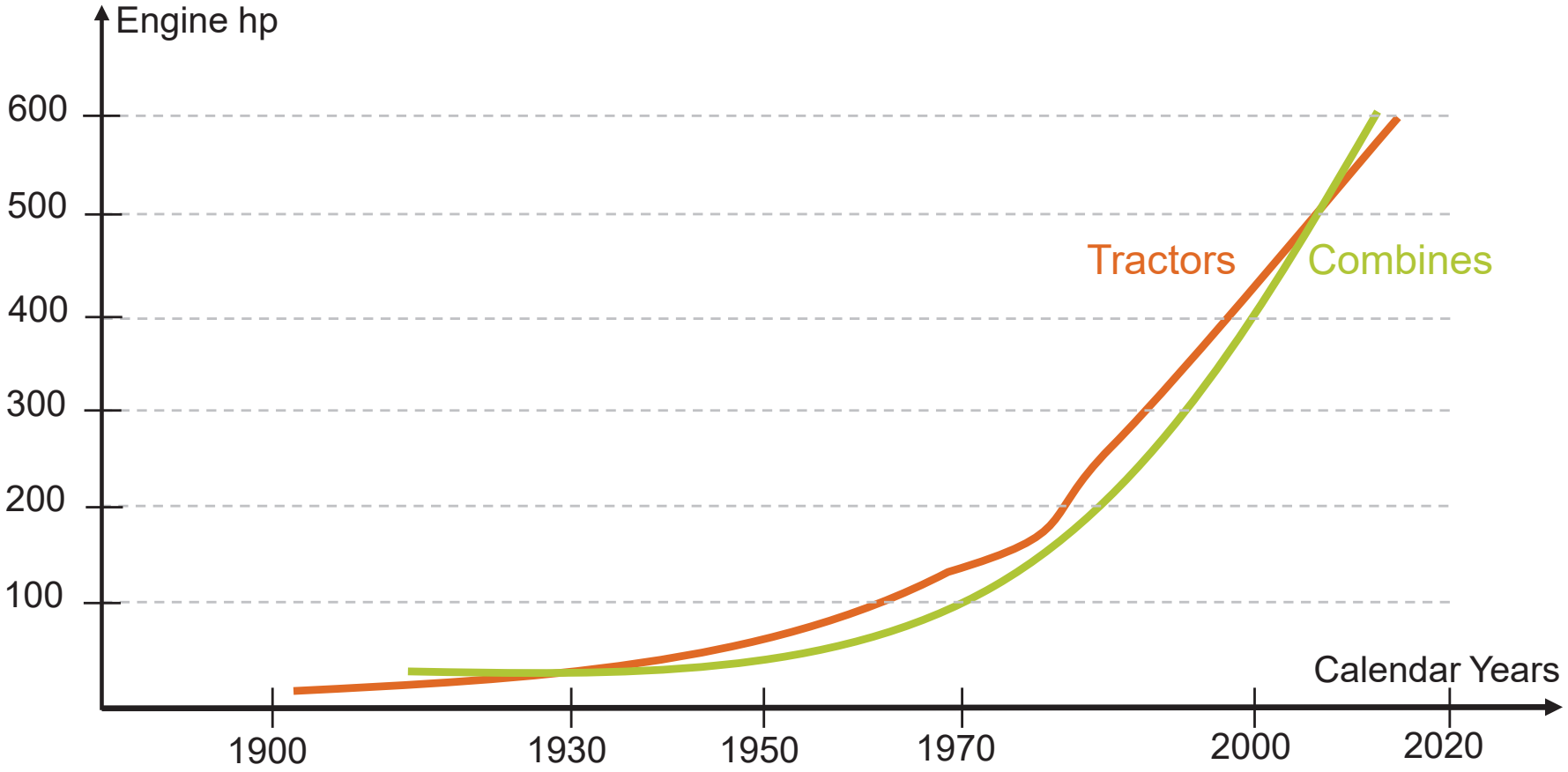
Legal form	KGaA mbH
Supervisory Board	Cathrina Claas-Mühlhäuser (Chairwoman)
Shareholders‘ committee	Helmut Claas (Chairman)
Sales 2016	€3.6 thousand million
Income before taxes	€93.5 million
Foreign sales	78,6 %
Employees worldwide	11.300

Strong core business

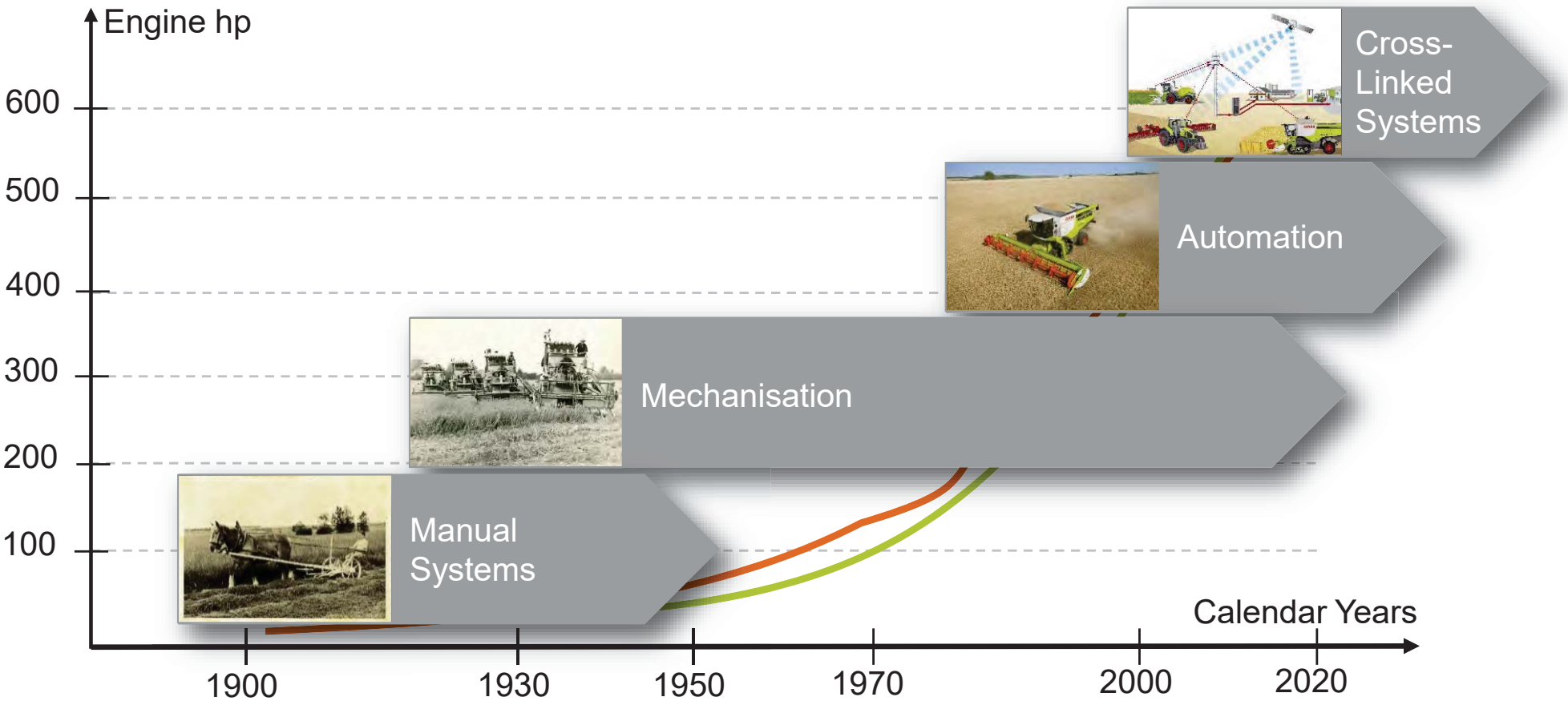
Core Business

What are the next steps: Getting Bigger ?

Development of engine power in tractors and combines (1900 – 2015)

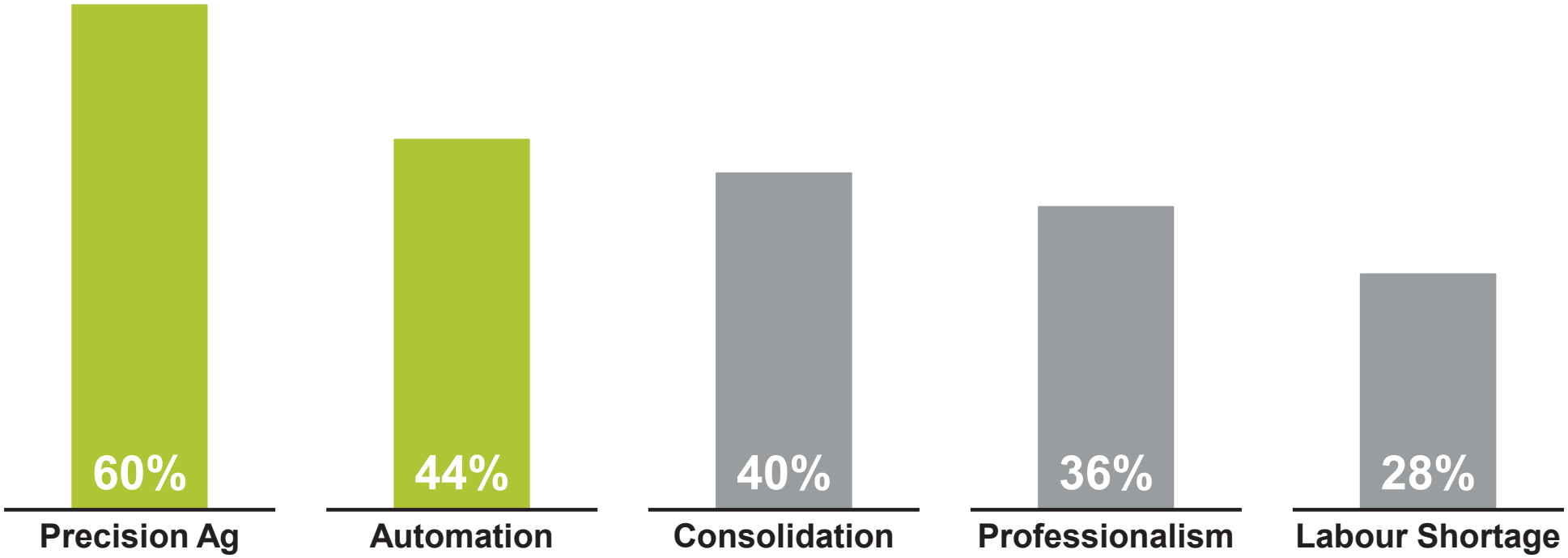


Technology development



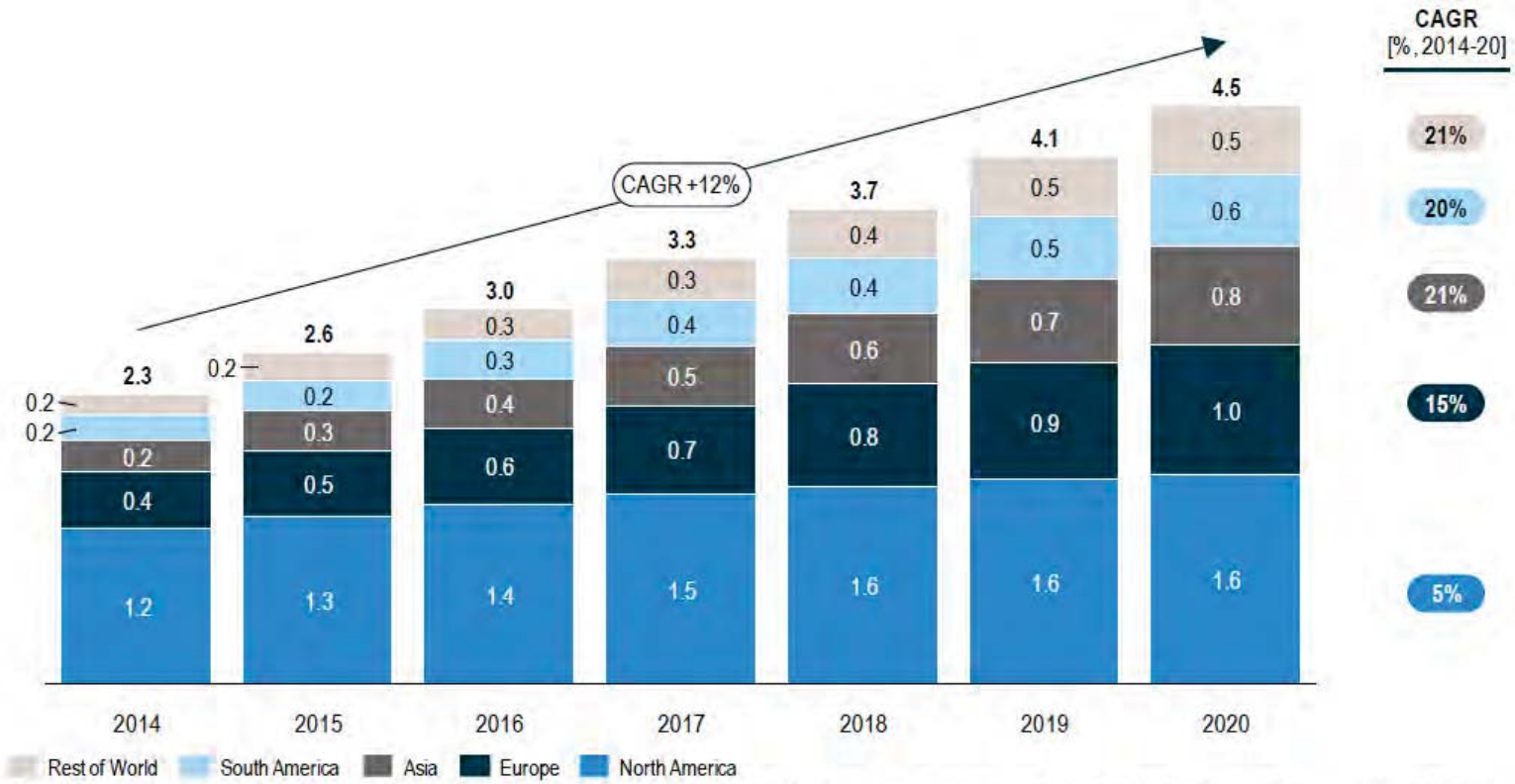
Trends in European Agriculture (2030)

60% Farmers cited Decision / Precision Ag as an Influential Trend



Source: BCG Interviews with Farmers in France, Poland and the UK

Compound annual growth rate in „Precision Farming“ from 2014 to 2020 per region [in Billion Euro]



1) Market estimation includes software (e.g. data management systems, advisory services) and hardware (e.g. automation and control systems such as: guidance steering, displays, flow control devices; sensing and monitoring such as: yield monitor, soil sensors)

1) Roland Berger July 2015 Will big data feed the world in the future

Strong core business – enhance capabilities

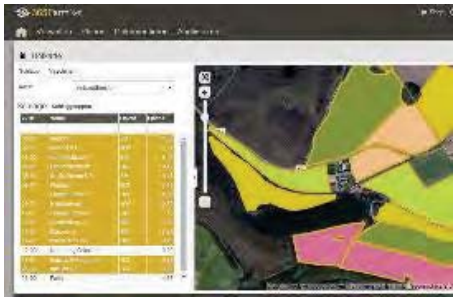
Electronics

- Sensor Systems
- Optical Systems
- GPS based Systems

Core Business

Web Communication

- IoT
- TELEMATICS
- Data Service



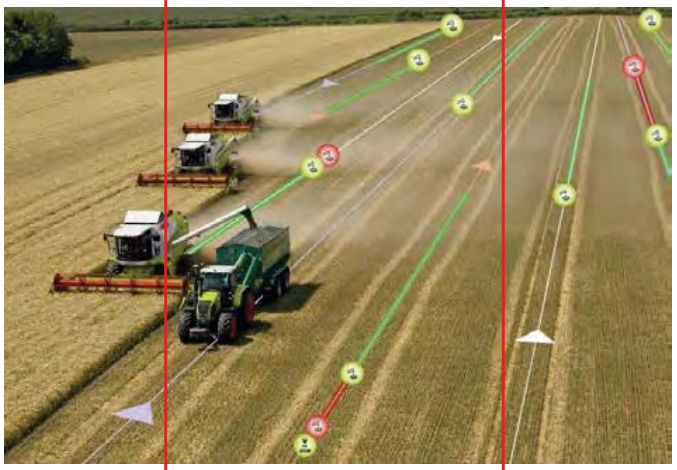
Digital Options: Communication/Positioning/Navigation

From “PoKéMoN GO” to Precision Farming

Technical Basics for Precision Farming

GPS

Position



Navigation

Documentation

Operation

General Management

Machine Operation

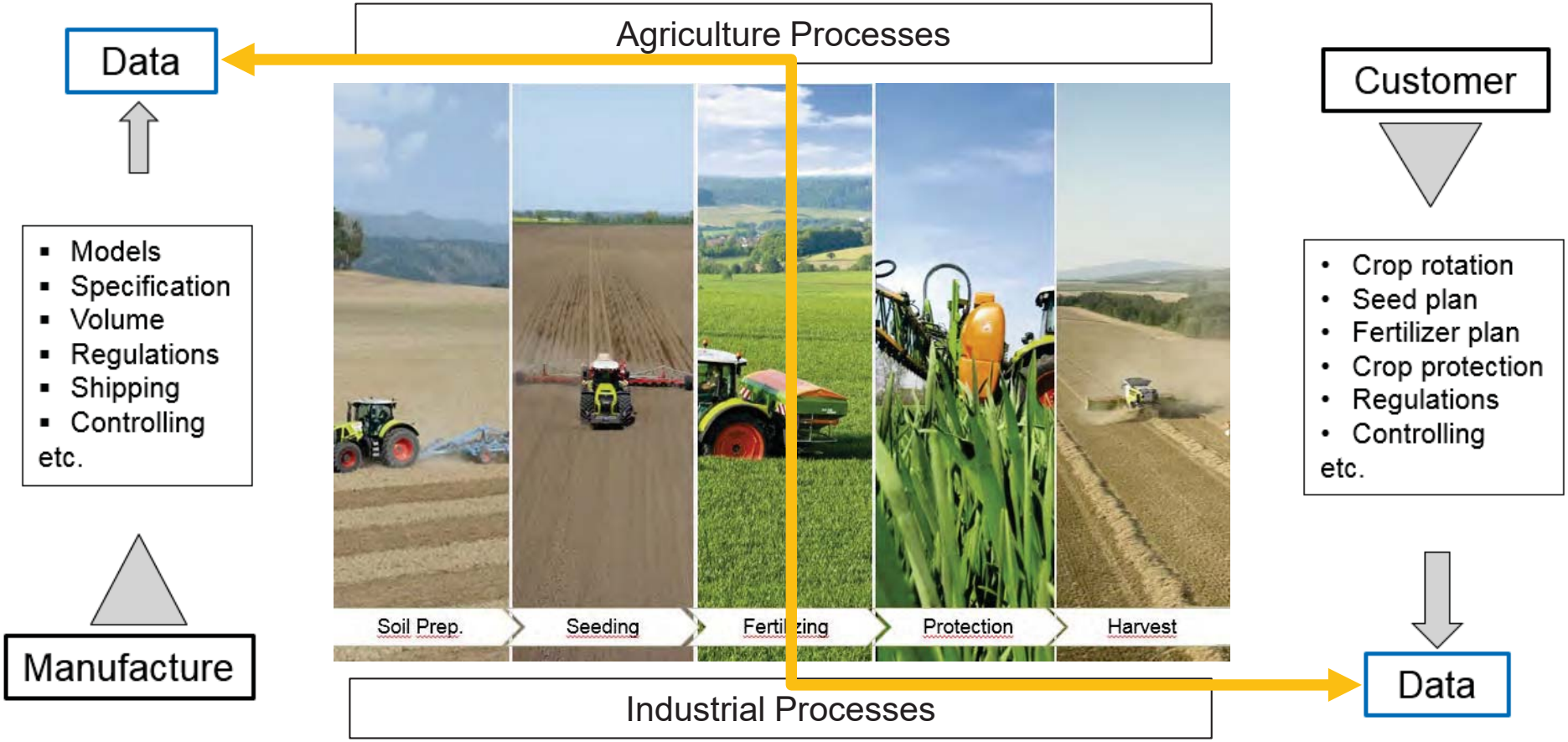
Single Vehicle

Vehicle Group

Vehicle Guidance

Fleet Management

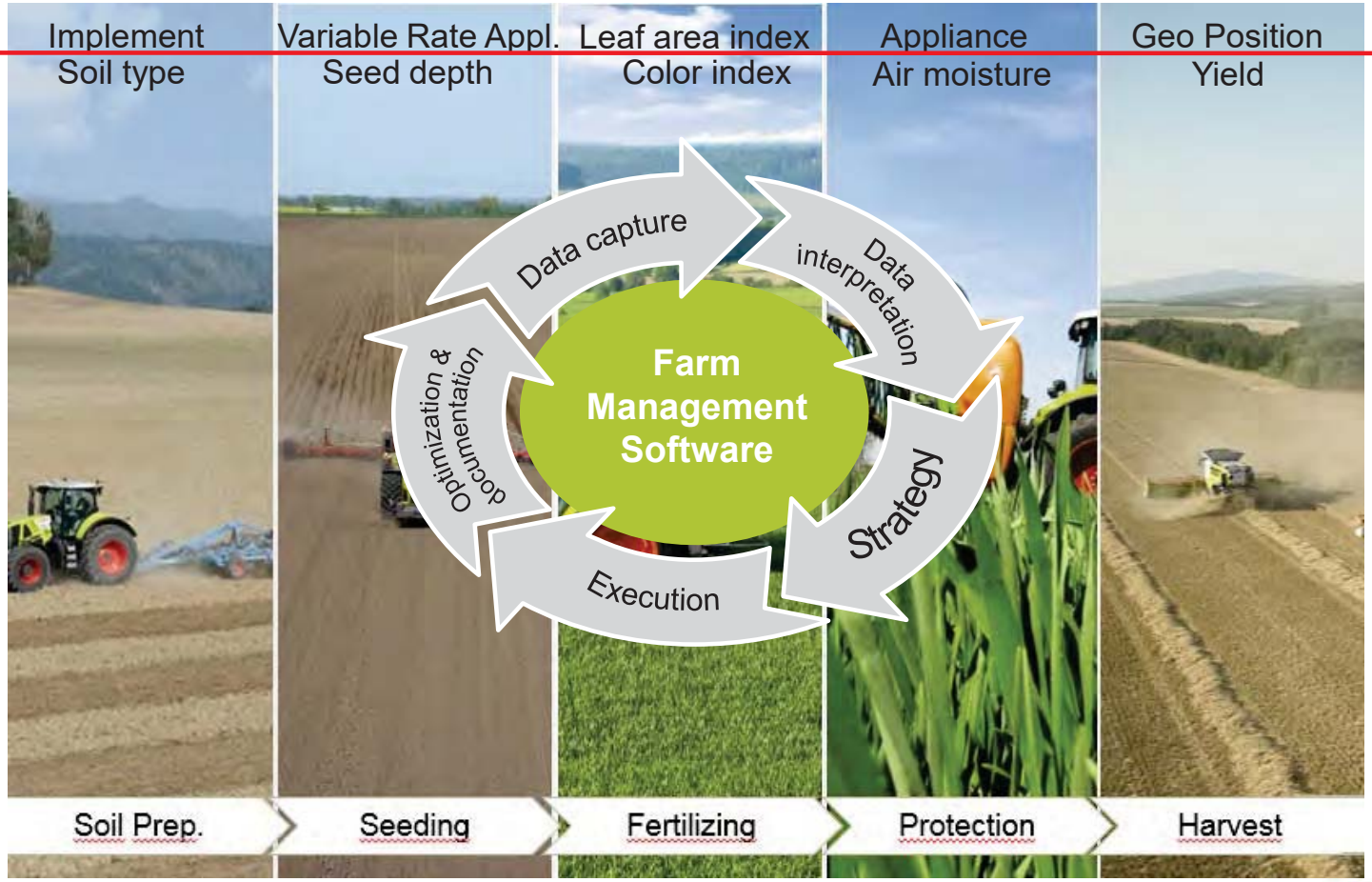
Data Sources from Agriculture Processes



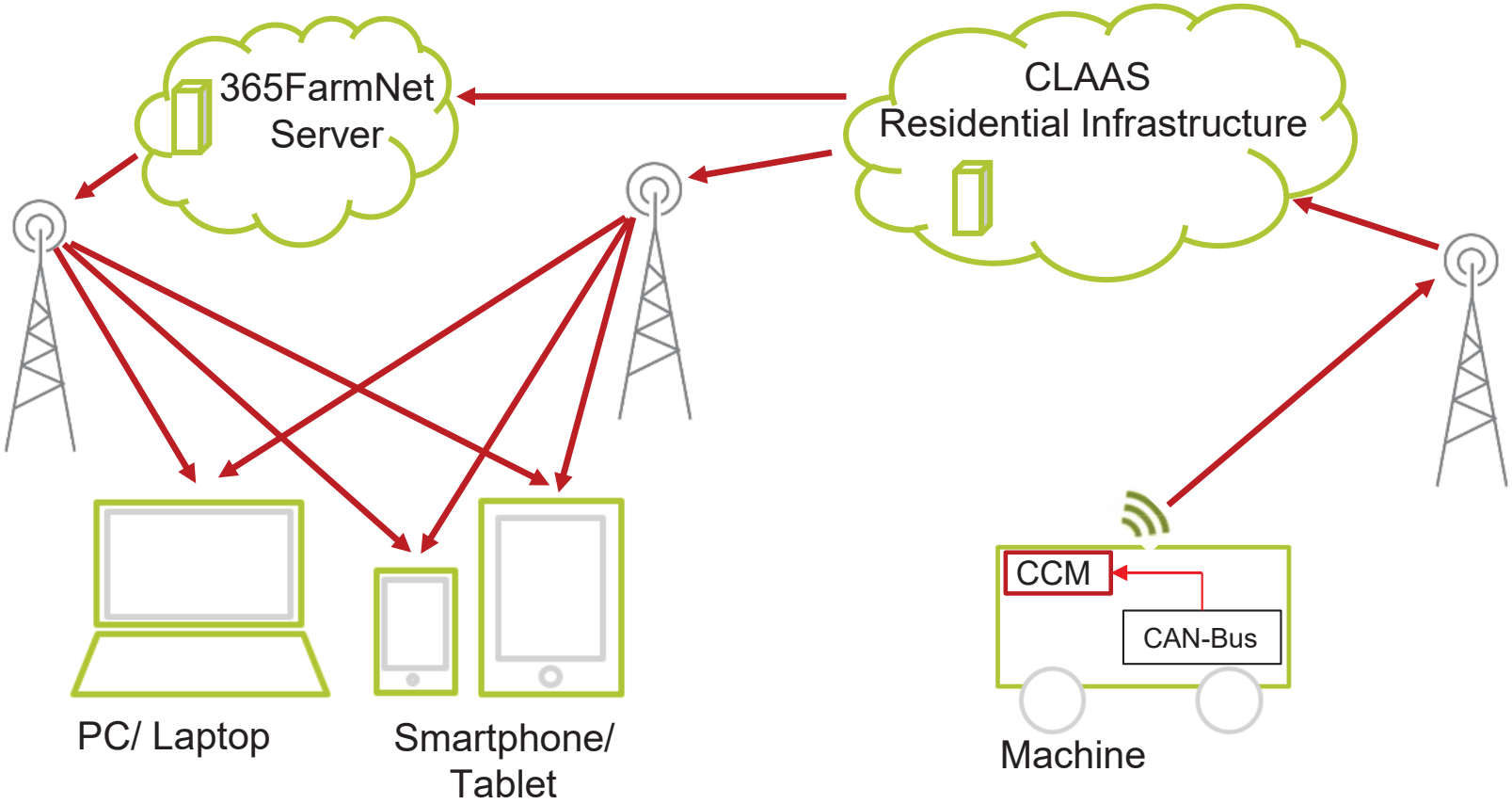
Plant production and data space

Data-Sets

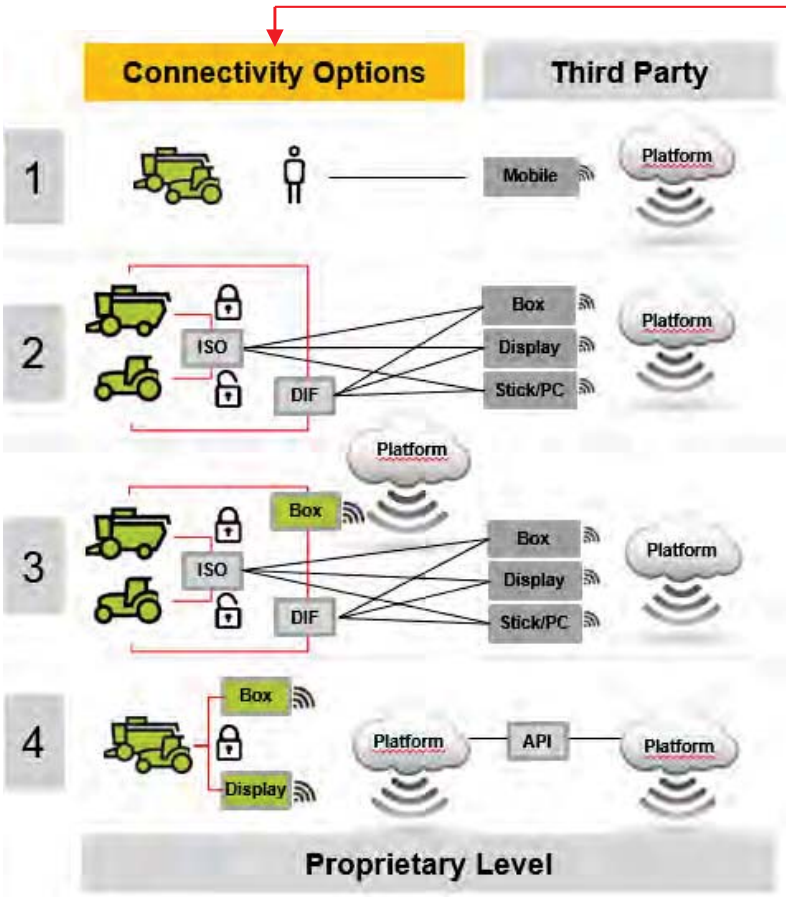
Algorithmen

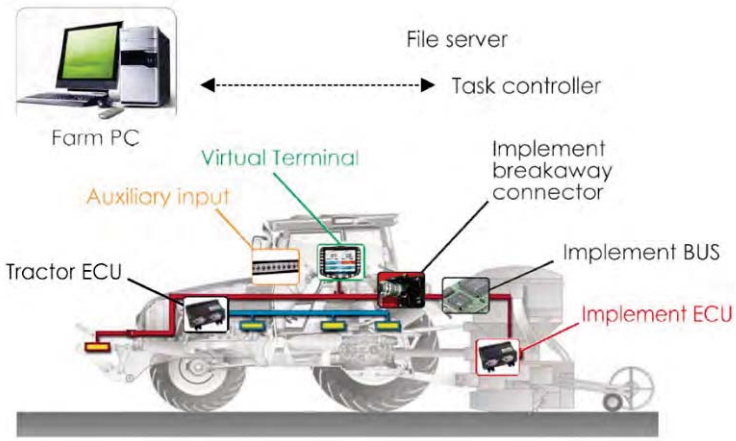


Digital Data Stream – Infrastructure Requirements



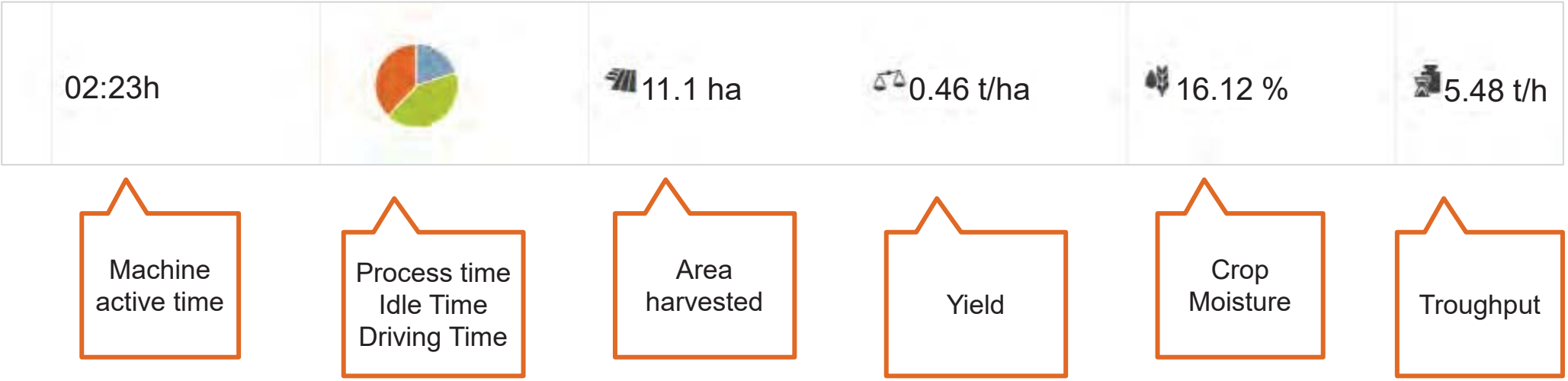
Connectivity Options





TELEMATICS: Information Dashboard

Information in detail



Operation in Sunflowers

Display of “in field” Operation: Combine settings and Operation Parameters

Dashboard/Machine data

- Settings
- Fuel consumption
- Speed
- etc.

- Accurate overview of machine settings and performance
- Easy-to-read information to optimize performance

LEXION 760 TERRA TRAC

Basic data

Status

Type

Serial number

Total working hours	**56:51 h**	Threshing drum	**440 rpm**	Yield mapping status	**on**
Activity	**02:23 h**	Concave position	**51 mm**	Specific crop weight	**400 g/l**
Process time	**01:01 h**	Rotor / straw walker	**600 rpm**	Quantimeter calibration factor	**0.91**
Area	**11.1 ha**	Upper sieve position	**9 mm**	CEMOS status	**off**
Crop yield	**5.83 t**	Lower sieve position	**12 mm**		
Fuel	**67 l**	Fan	**990 rpm**		
Speed	**11.64 km/h**	Proportion of grain in the returns	**0 %**		
Engine speed	**1972 rpm**				
Engine load	**2 %**				
Yield	**0.36 t/ha**				
Grain moisture content	**18.7 %**				
Fuel consumption	**57.1 l/h**				
Average speed	**9.36 km/h**				
Rate of work	**13.94 ha/h**				
Fuel per area	**6.03 l/ha**				
Spec. fuel consumption.	**11.49 l/t**				

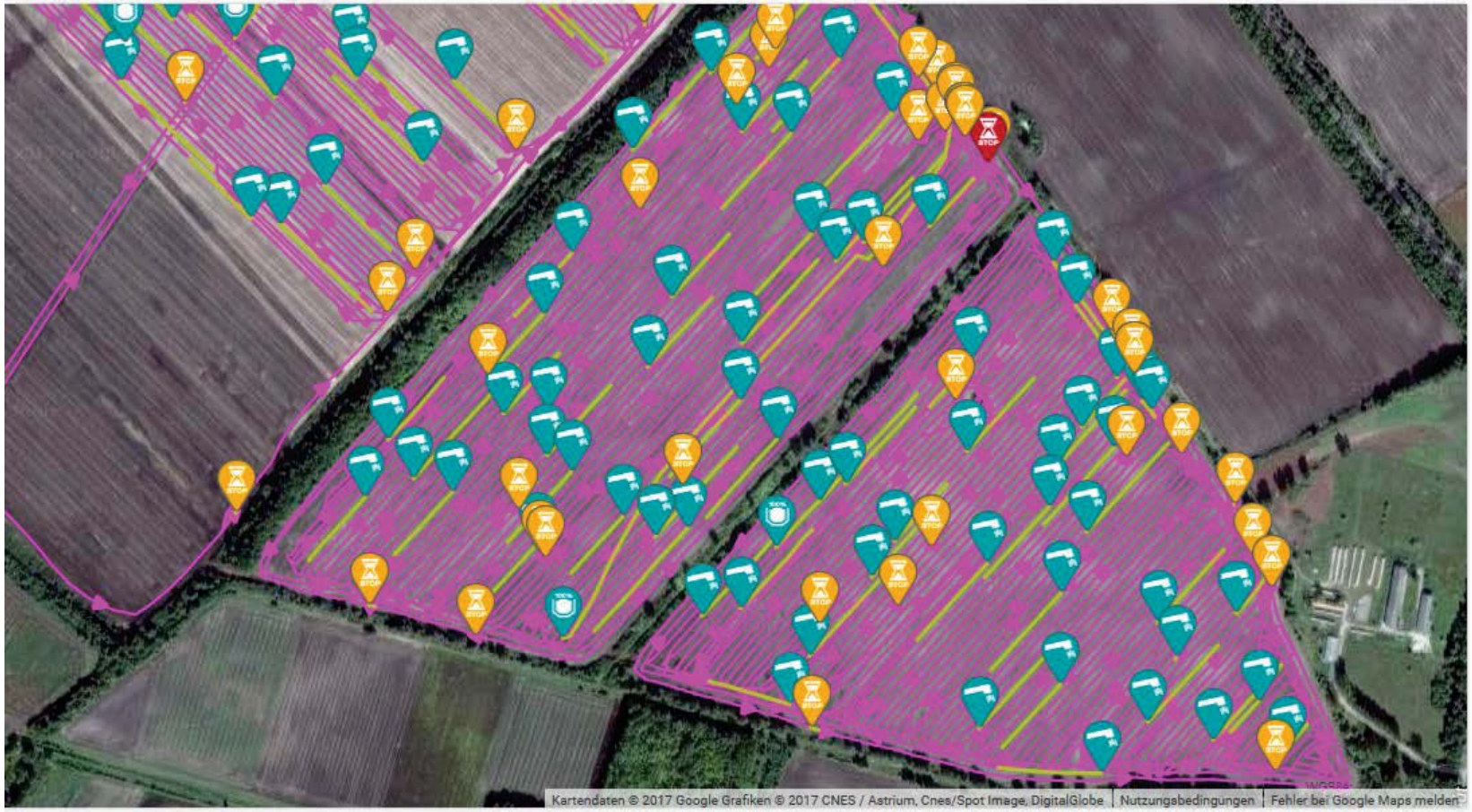
Operation in Sunflowers

Display of “in field” operation: Wheat harvest logistics

Map Screen

- Idle Times
- Unloading
- Full Grain Tank

- Analyze non productive times
- Identify route cause



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AXIÁL

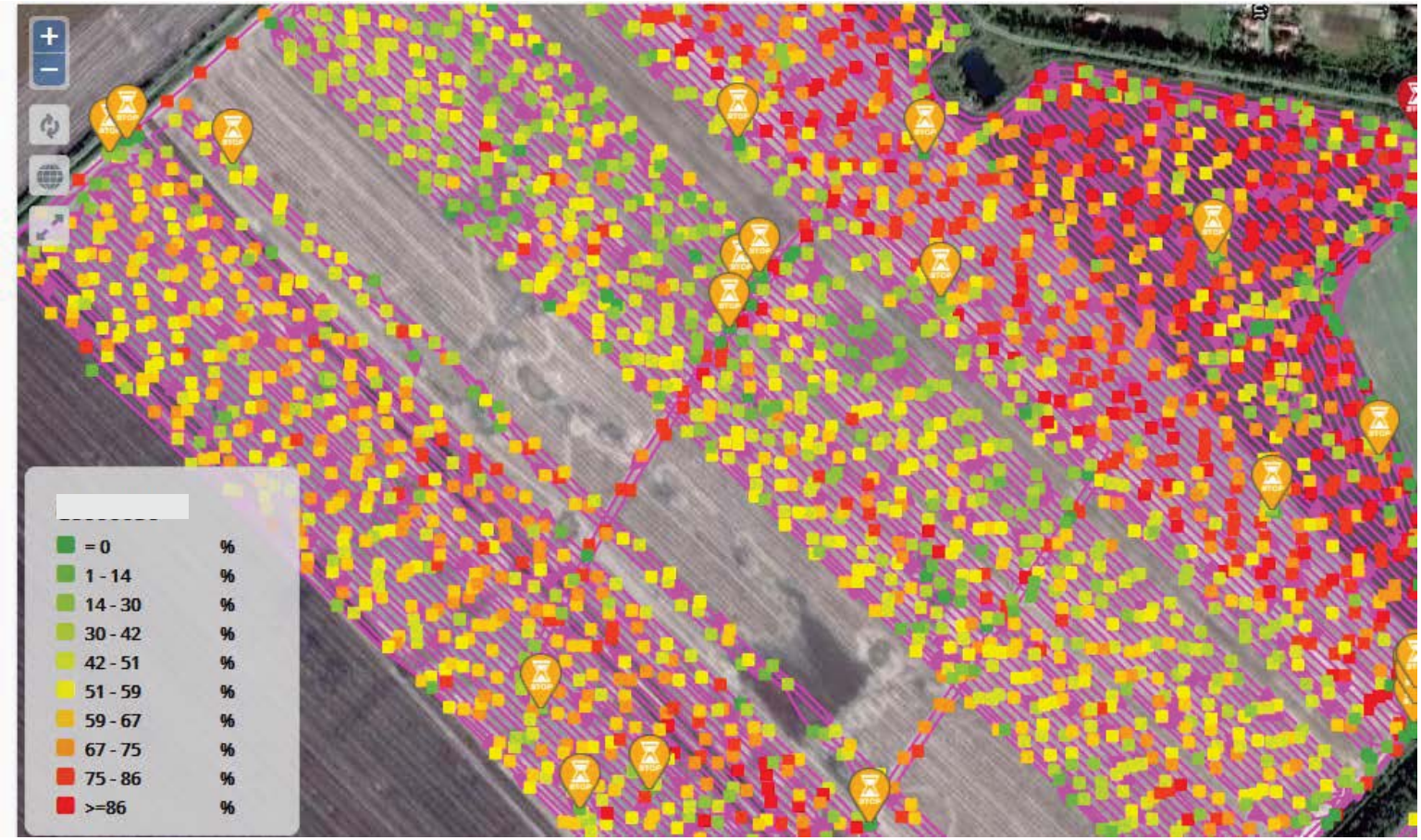
CLAAS

Display of “in field” operation: Combine capacity usage in wheat harvest

Map Screen

- Engine load

- Understand how exactly machines did work
- Reflects crop and field conditions



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CLAAS

Digital systems and algorithms do allow to track the harvest operation precisely

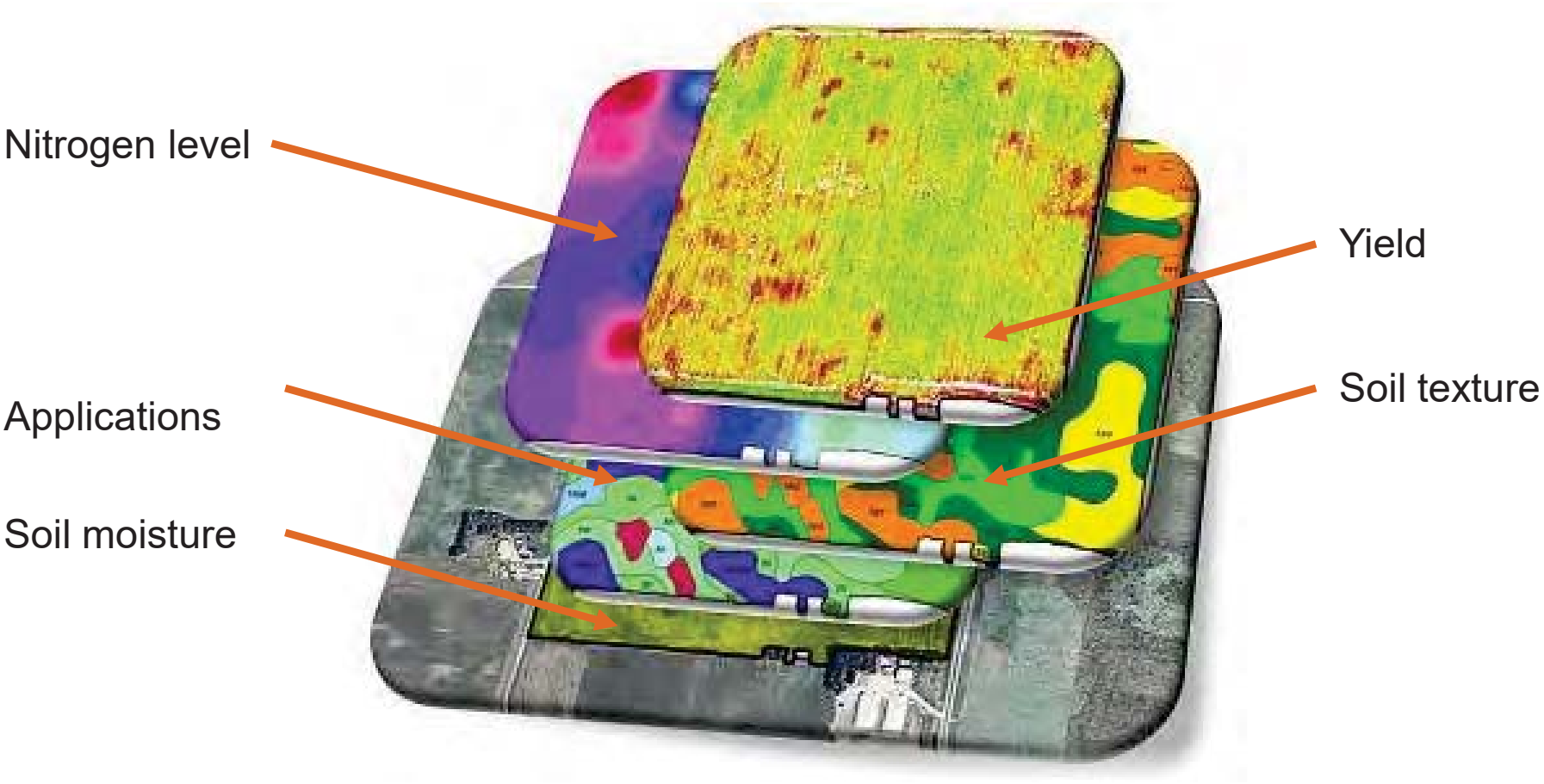
Process:
Yield mapping

- GPS-Position
- Time
  Yield
- Moisture
- Engine load
- Machine settings
- Fuel consumption
- etc.

Systems:
TELEMATICS
365FarmNet

- Phone Network
- Communication
- Modules
- Internet
- Computing Power
- Server Capacity

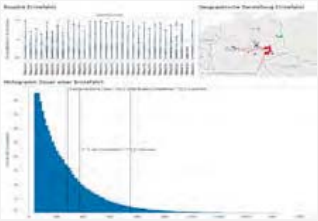
Layer management in a digital setup allows to analyze yield data and crop growth



Digital data base enhance options to optimize industrial products and services

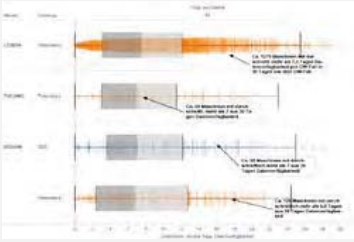
Assoziation Rules Mining

Test Bench Optimization

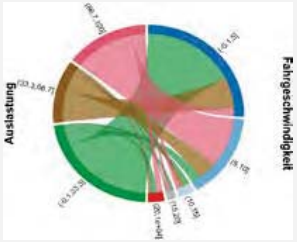


360 ° Customer

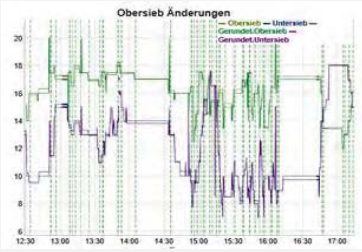
Predictive Maintenance



Machine Usage



Change Point Detection



Data and Mind-Set

$$\frac{24}{36}$$

Analog action in a digital environment

How Digital is Agriculture Today?

80%

facing the hump

20%

over the hump

Projected Precision Farming Revenue Sources for US Ag/Precision Farming Dealers

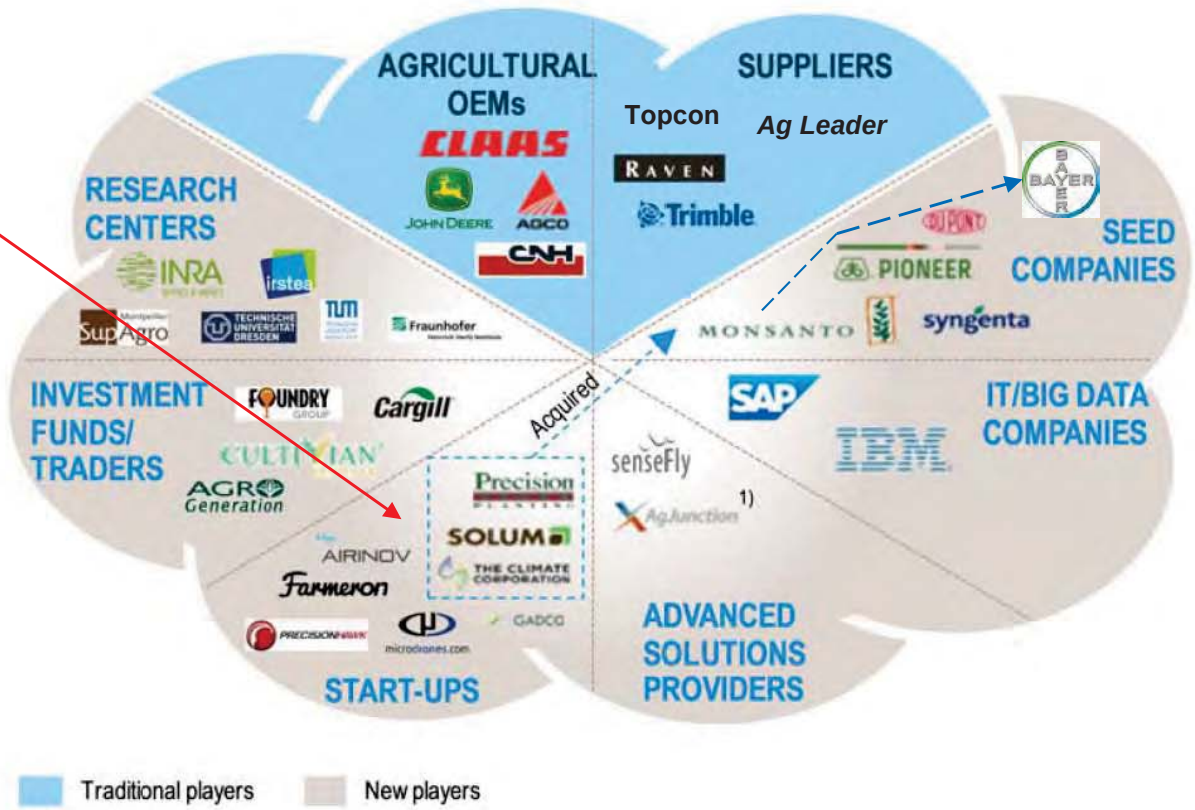
Revenue Source	Most Important or Important	Somewhat Important	Least Important	2015 Rank
1. Planter/Seeding Control Systems	60.3%	36.0%	2.7%	1
2. Application Technology Hardware	52.1%	42.5%	5.4%	2
2. GPS & Guidance Systems	41.9%	52.7%	5.4%	4
3. Variable-Rate Planting/Fertilizing	64.0%	26.7%	9.3%	2
4. Software Service	26.1%	61.6%	12.3%	5
5. Data Management Service	46.0%	40.5%	13.5%	3
6. Signal Subscriptions	37.0%	46.6%	16.4%	3
7. Agronomic Services	30.1%	27.4%	42.5%	6
8. Water Management	17.1%	34.3%	48.6%	7
9. Unmanned Aerial Vehicles	11.3%	36.6%	52.1%	8

Source: Precision Farming Dealer 2016 Benchmark Study

Emerging Actors in the Data Supply Chain

365FarmNet

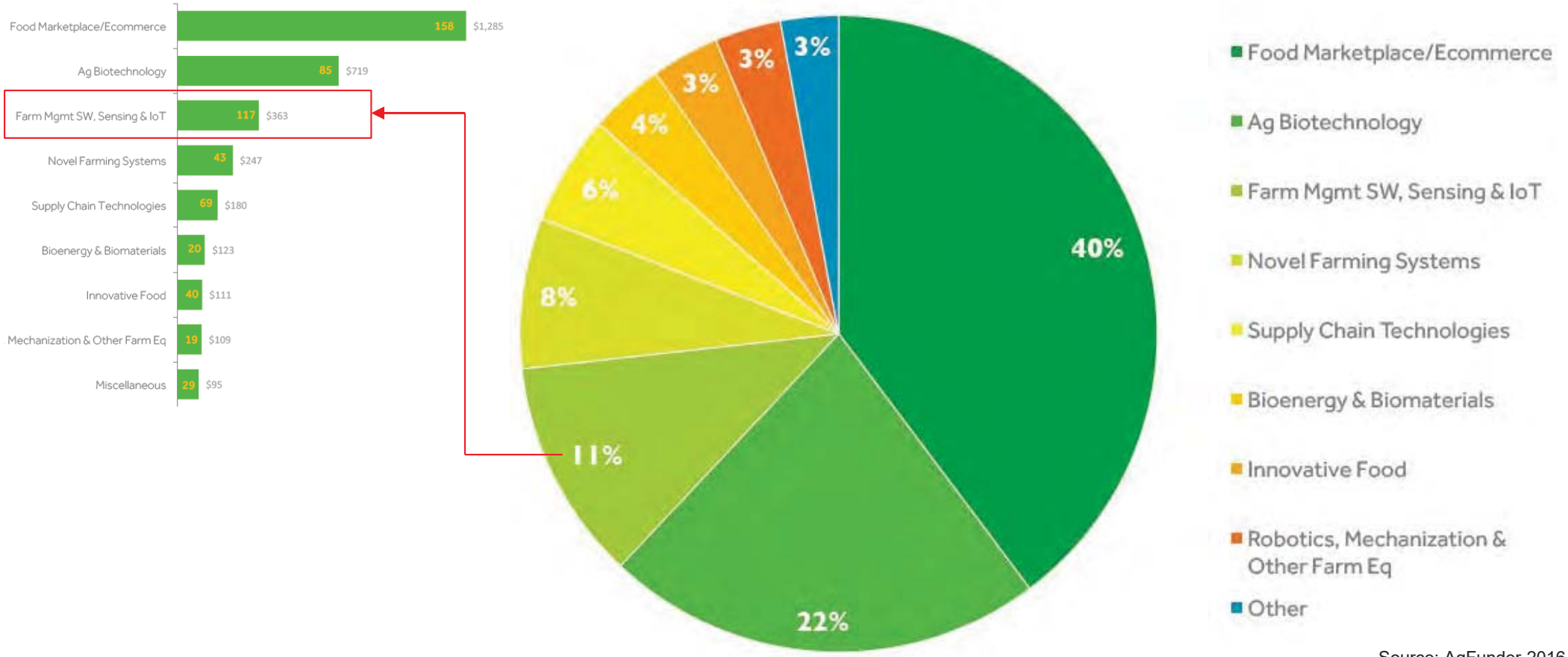
Conservis
Agroptima
FarmerEdge
Climate Corporation
Farmobile
Ceradis
LemnaTec
NEXT Farming
MapShots
Soil
ClearAg
VitalFields



1) Providing guidance system and cloud service at the same time

1) Roland Berger July 2015 Will big data feed the world in the future

2016 AG-Tech-Investments by categories



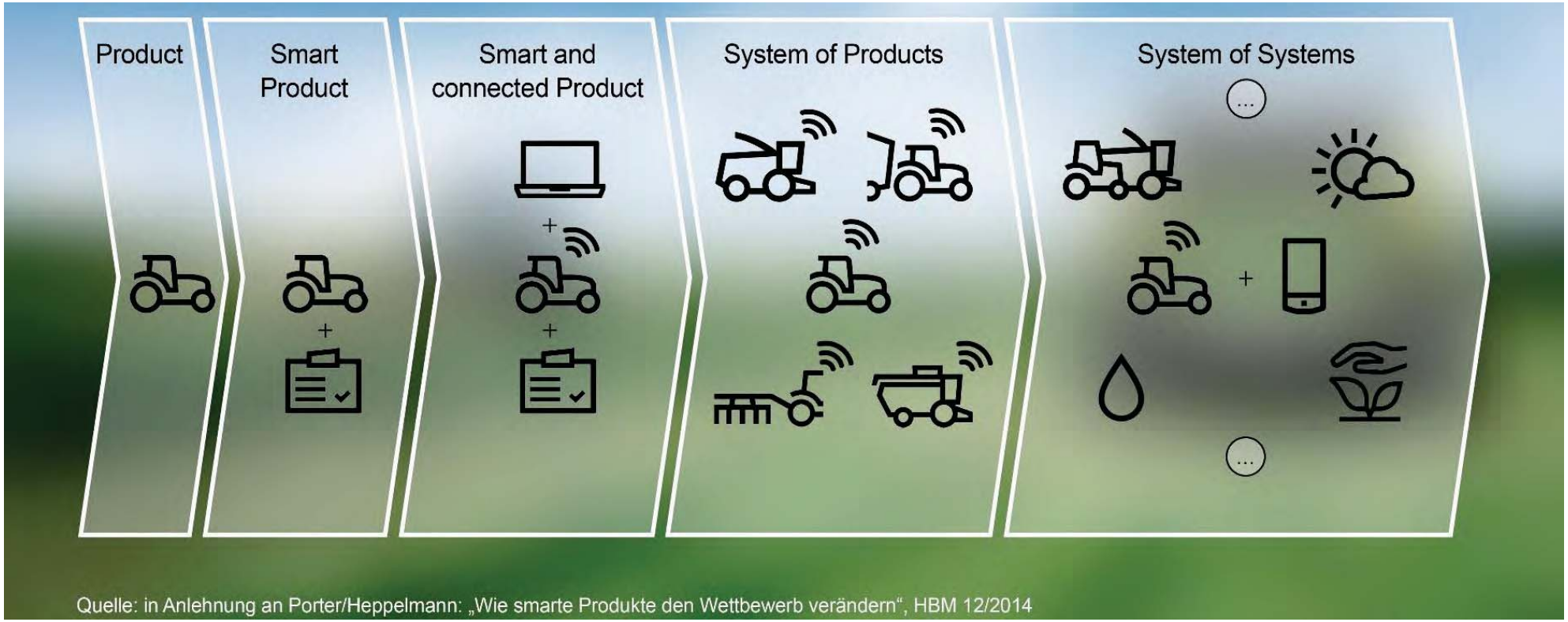
Source: AgFunder 2016

365FarmNet

Farming in a network

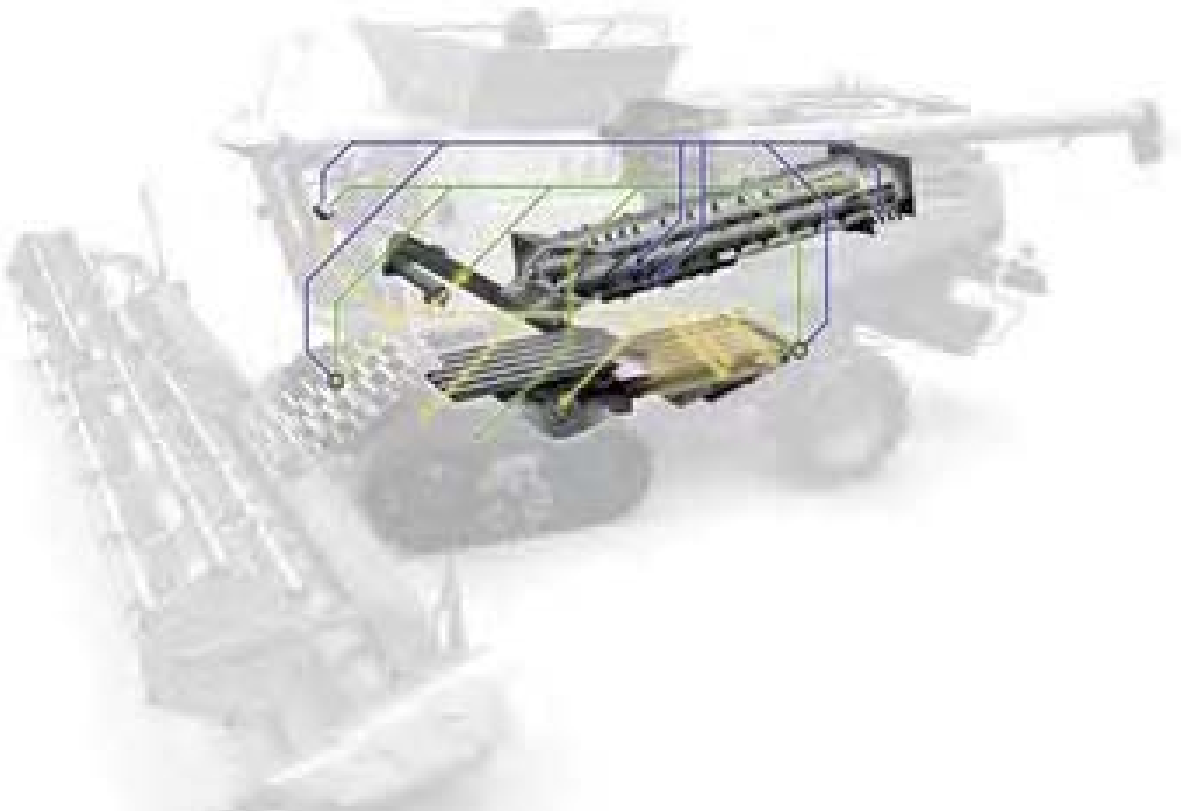
- All in one view
- Integration of all ag processes
- One user surface
- One navigations concept
- Base data set
- Planning, documenting and analyzing
- Plant & Cattle Production, staff, storage and energy
- Cross Compliance, Precision Farming
- Connecting Economy and Ecology

Ag-Products getting embedded in the Digital Future



Quelle: in Anlehnung an Porter/Heppelmann: „Wie smarte Produkte den Wettbewerb verändern“, HBM 12/2014

Smart and Connected Product: CEMOS – AUTOMATIC on LEXION combines



- CRUISE PILOT
- AUTO CROP FLOW
- AUTO SEPARATION
- AUTO CLEANING
- AUTO SLOPE
- 4D Cleaning System

Algorithm based self-learning machine setting system to optimize combine through put capacity in various harvest conditions

System of Systems: „Controlled Traffic“

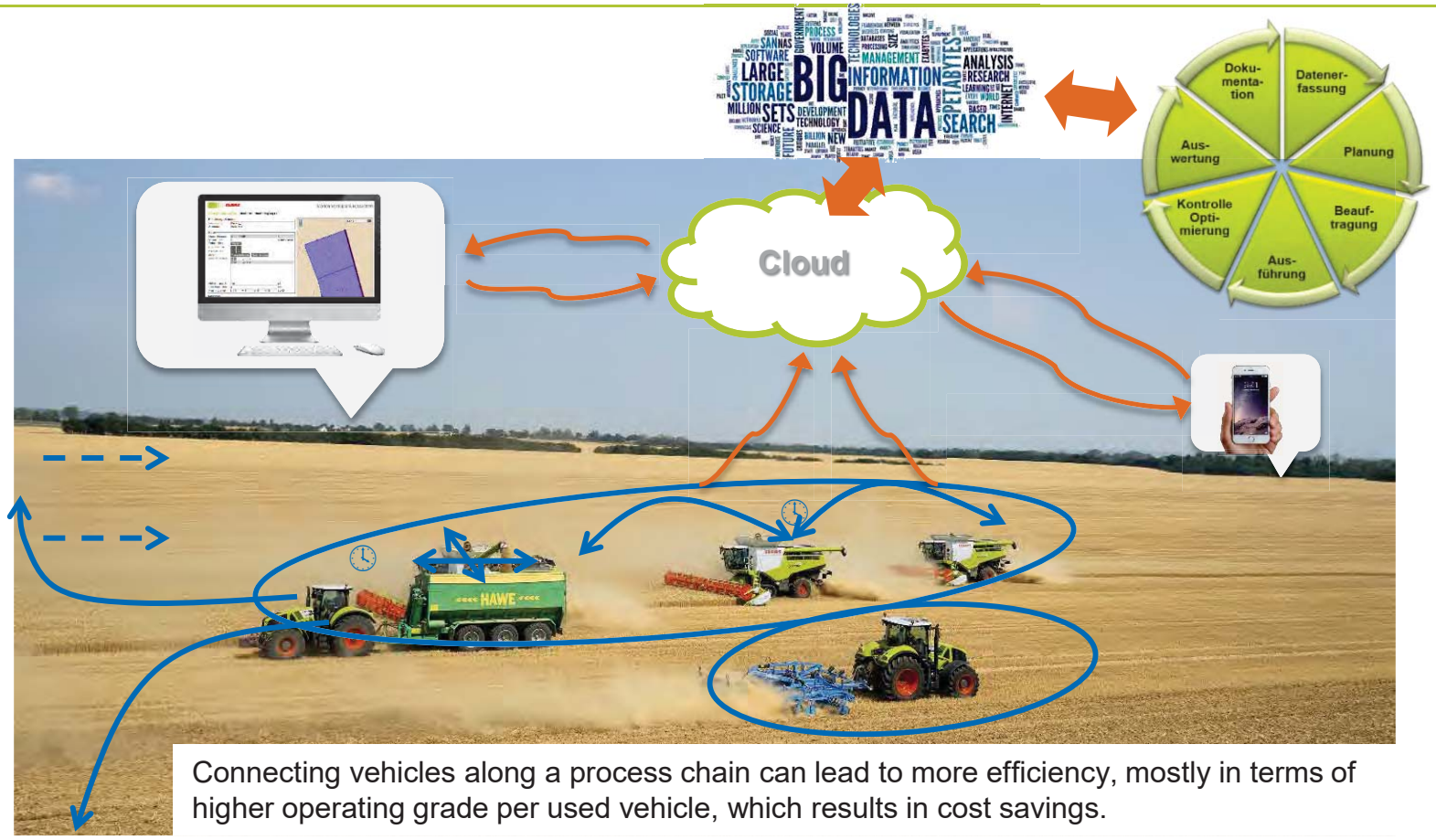
Header Dimension 12,30 m

Tramline Distance
12 m Center to Center

Track Width
3 m Center to Center

In a „Controlled Traffic System“ all vehicles are GPS guided – using at all times the same tracks in the field.

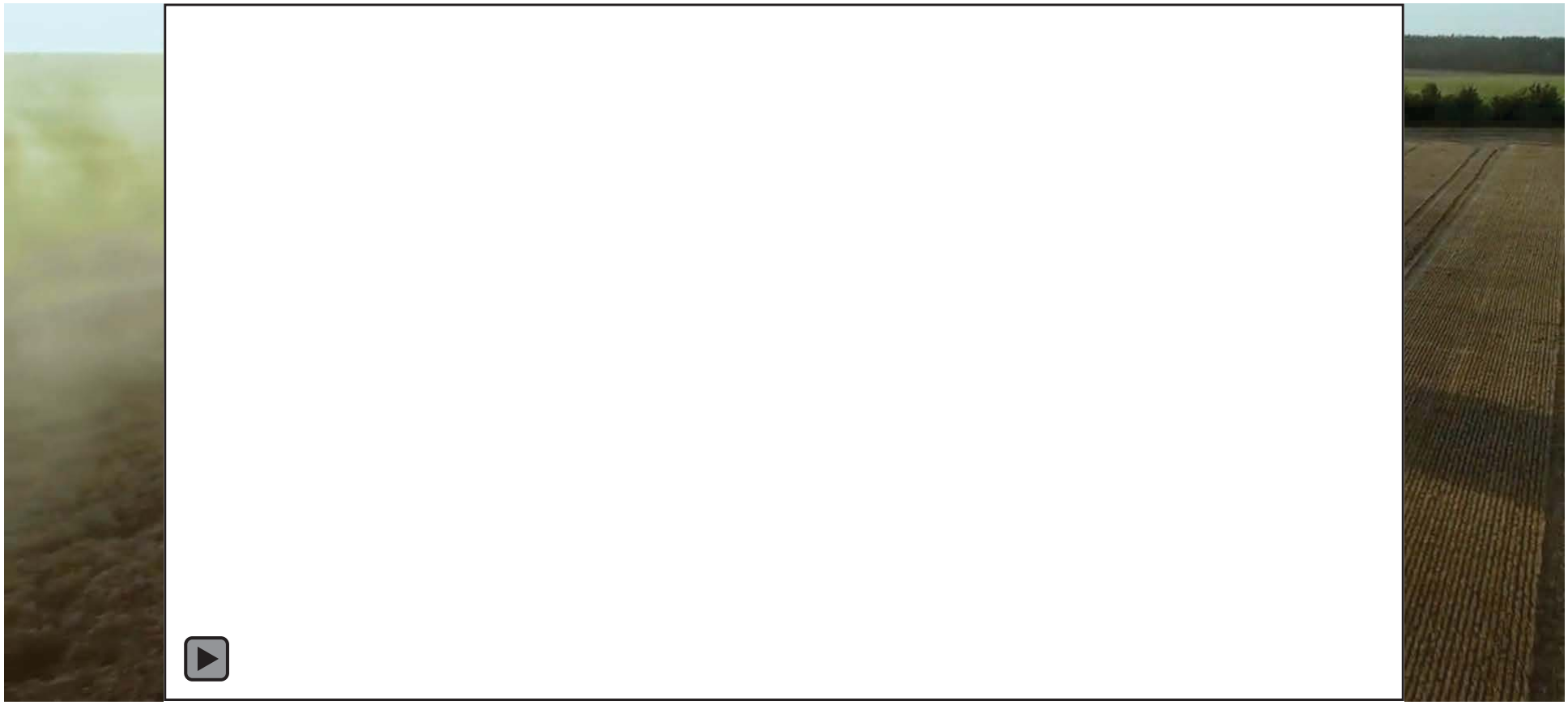
FLEETVIEW – Utilizing Data for Efficiency in Logistics



Connecting vehicles along a process chain can lead to more efficiency, mostly in terms of higher operating grade per used vehicle, which results in cost savings.

Connected Machines as a System of Products

Connected Machines as a System of Produts



think e-farming