Digital Transformation in the Agriculture Machine Domain

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Full-line / Multi-brand Company

FENDT

MASSEY FERGUSON

VALTRA

GSI

Challenger

LELY

santal

CIMBRIA

Global Presence

4,050 Dealers

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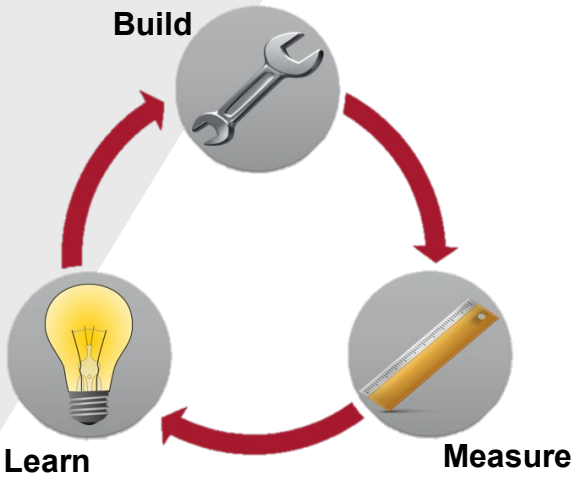
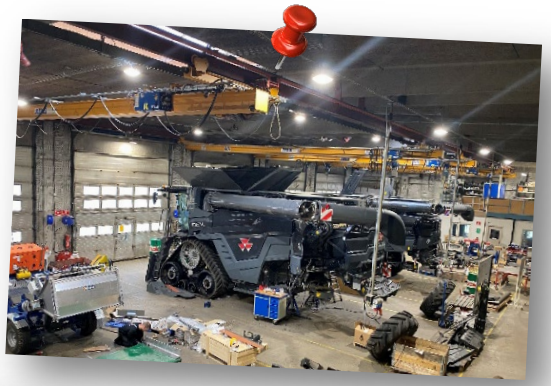
AGCO Randers at a glance

- Innovation facility supporting the global organization across product lines
- Brand, product line and production independent
- Industry leading lab facility for functional test and validation
- Concurrent development of mechanical and software solutions
- Concurrent Research, Advanced Engineering and Product Implementation
- Agile end-to-end delivery of smart solutions
- 50 Employees
- Industrial and academic partnerships





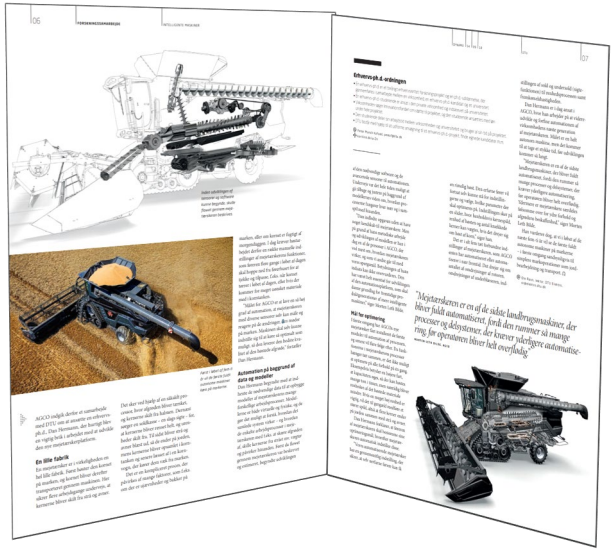
"Work Hard,
Have Fun,
Make History"

Jeff Bezos

Academic Partnerships

Transformation of Engineering disciplines in Randers enabled by academic partnerships

- Academic partnerships to spark and kick start new technology domains
- Industrial partnerships for accelerated technology scaling
- Gradual implementation of internal resources for long-term growth of competences



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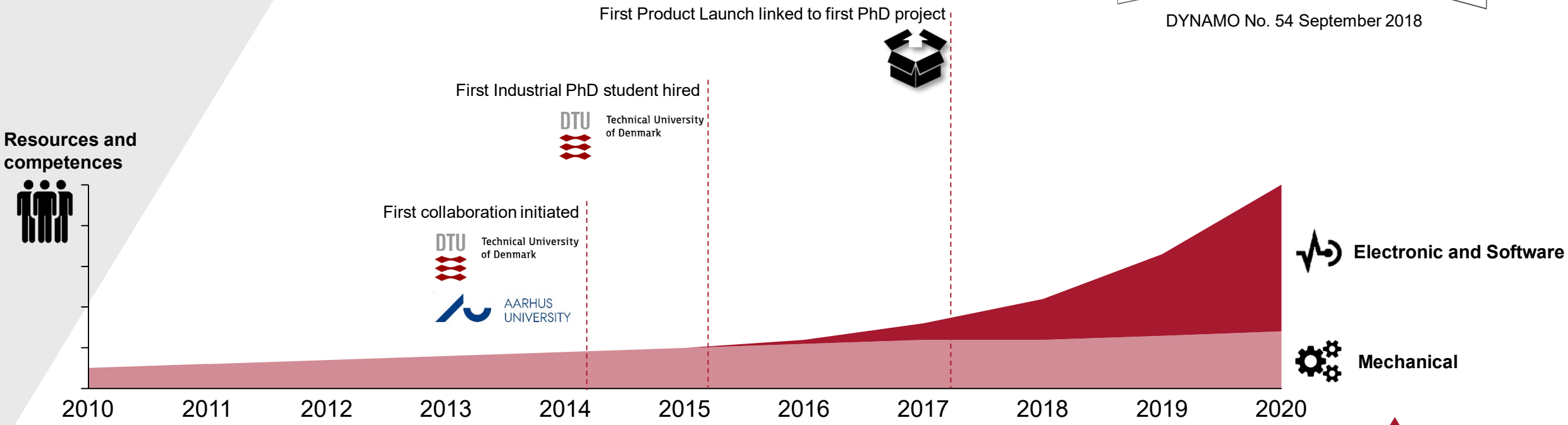

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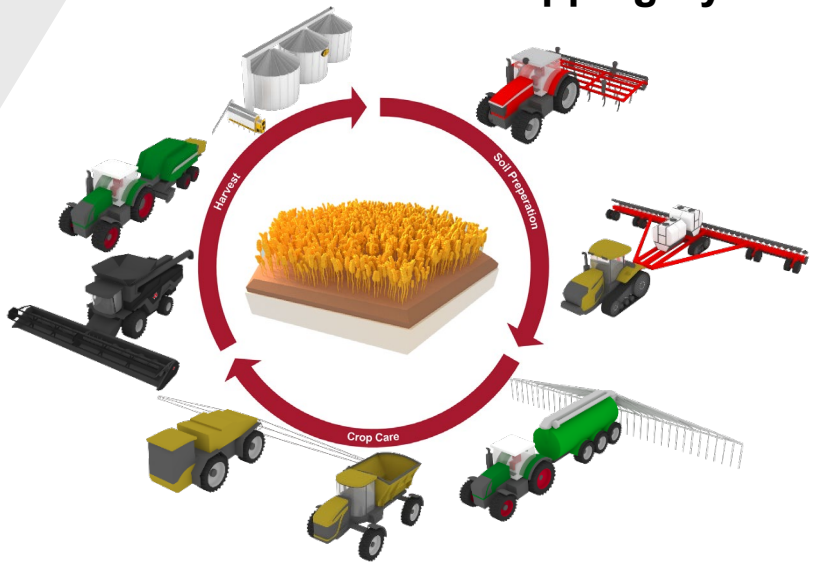
Autonomy Definitions

Smart Machines

Agricultural machine Systems that observe, think and act to Enable the optimum task outcome with intelligent Automation.

Automation Across the Cropping Cycle



Driverless Vehicles

Mature autonomous Systems to boost Farm Productivity, mitigate Risks of scarce Labor and enable new Opportunities.

New Opportunities from new Vehicle Forms

- Reduce Soil Compaction
- Shared Workload across multiple Machines
- Support high precision Crop Care
- Scalable and flexible capacity and machine investment
- Support new agronomic practices towards increased biodiversity
- Enable Pay-Per-Use business models

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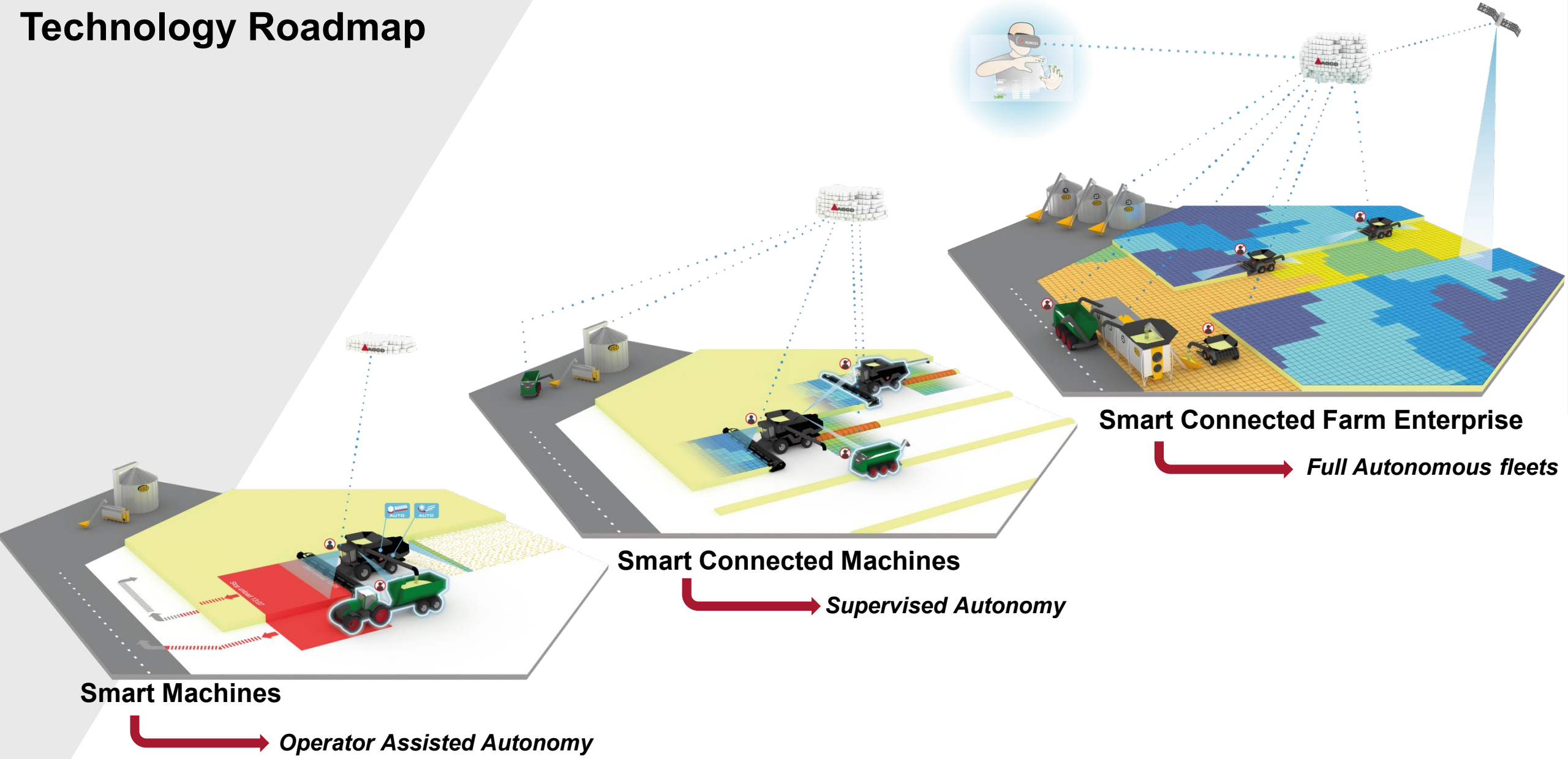
Technology Roadmap



Smart Machines

Operator Assisted Autonomy

Smart Connected Machines

Supervised Autonomy

Smart Connected Farm Enterprise

Full Autonomous fleets

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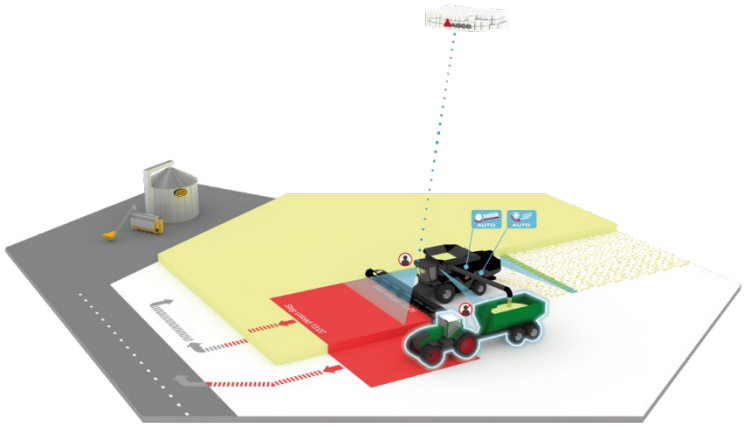
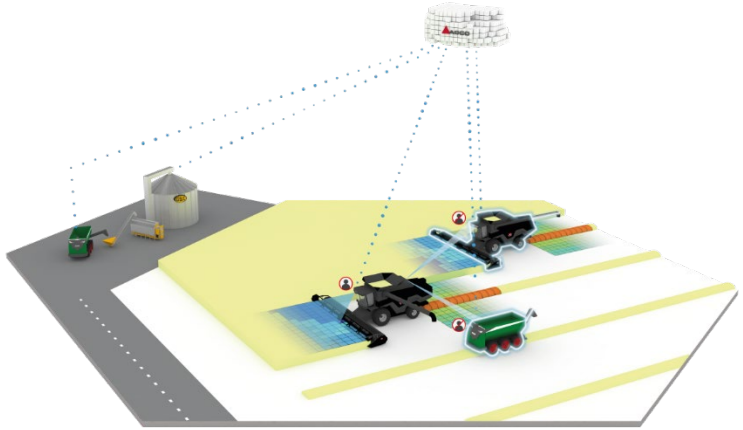
Current Technology Examples



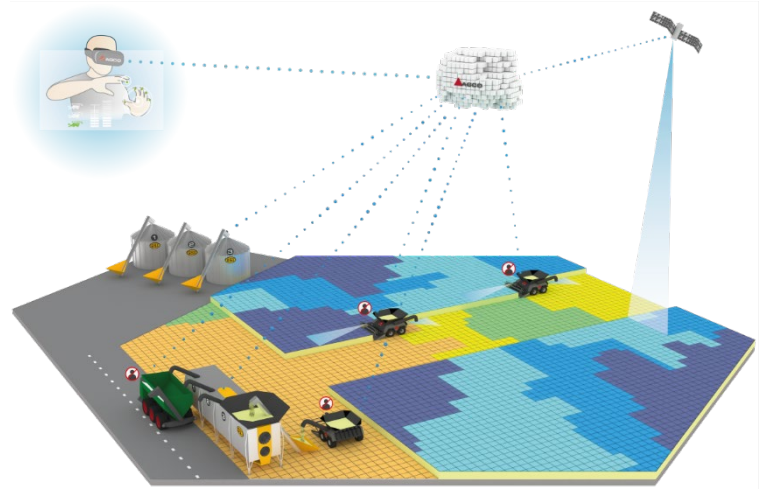
Smart Machines

↳ *Operator Assisted Autonomy*



Smart Connected Machines

↳ *Supervised Autonomy*



Smart Connected Farm Enterprise

↳ *Full Autonomous fleets*

IDEALharvest

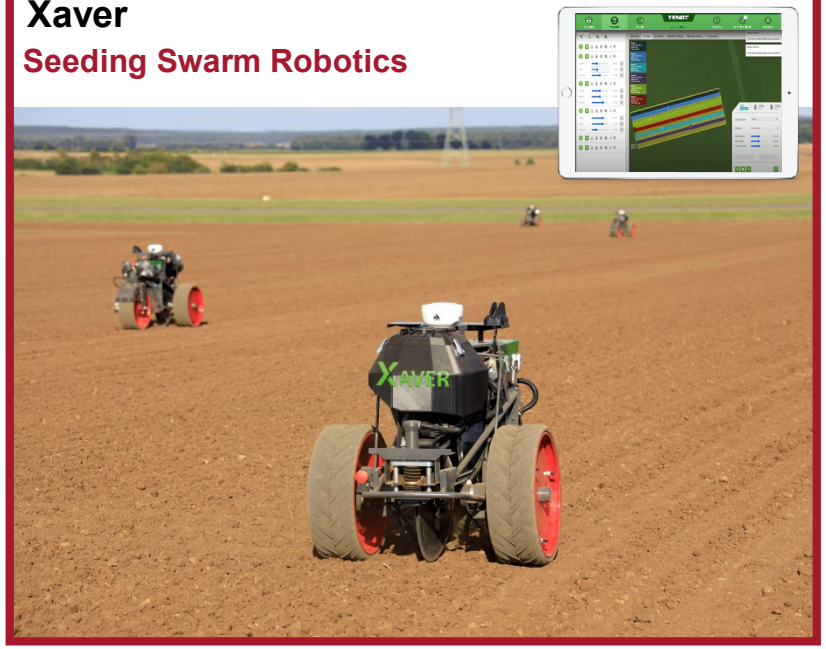
Combine Automation

GuideConnect

Tractor Leader Follower

Xaver

Seeding Swarm Robotics



Smart Machine Technology Layers

”As an operator i need to…”	Smart Machine Features
“…monitor and react to malfunctions, vibrations, smoke, electronic errors”.	HEALTH MANAGEMENT
“…take process decisions, and control settings of implement, processor etc”.	PROCESS AUTOMATION
“…make sure not to hit obstacles or get stuck in wet spots”.	OBSTACLE AVOIDANCE
“…precisely follow a swath, a crop edge, a row or specific landmarks”.	LOCAL NAVIGATION
“…steer, brake, set the throttle and start or stop the machine system”.	VEHICLE CONTROL
“…decide about the optimum field routes to perform my task today”.	ROUTE PLANNING

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Driverless Vehicle System

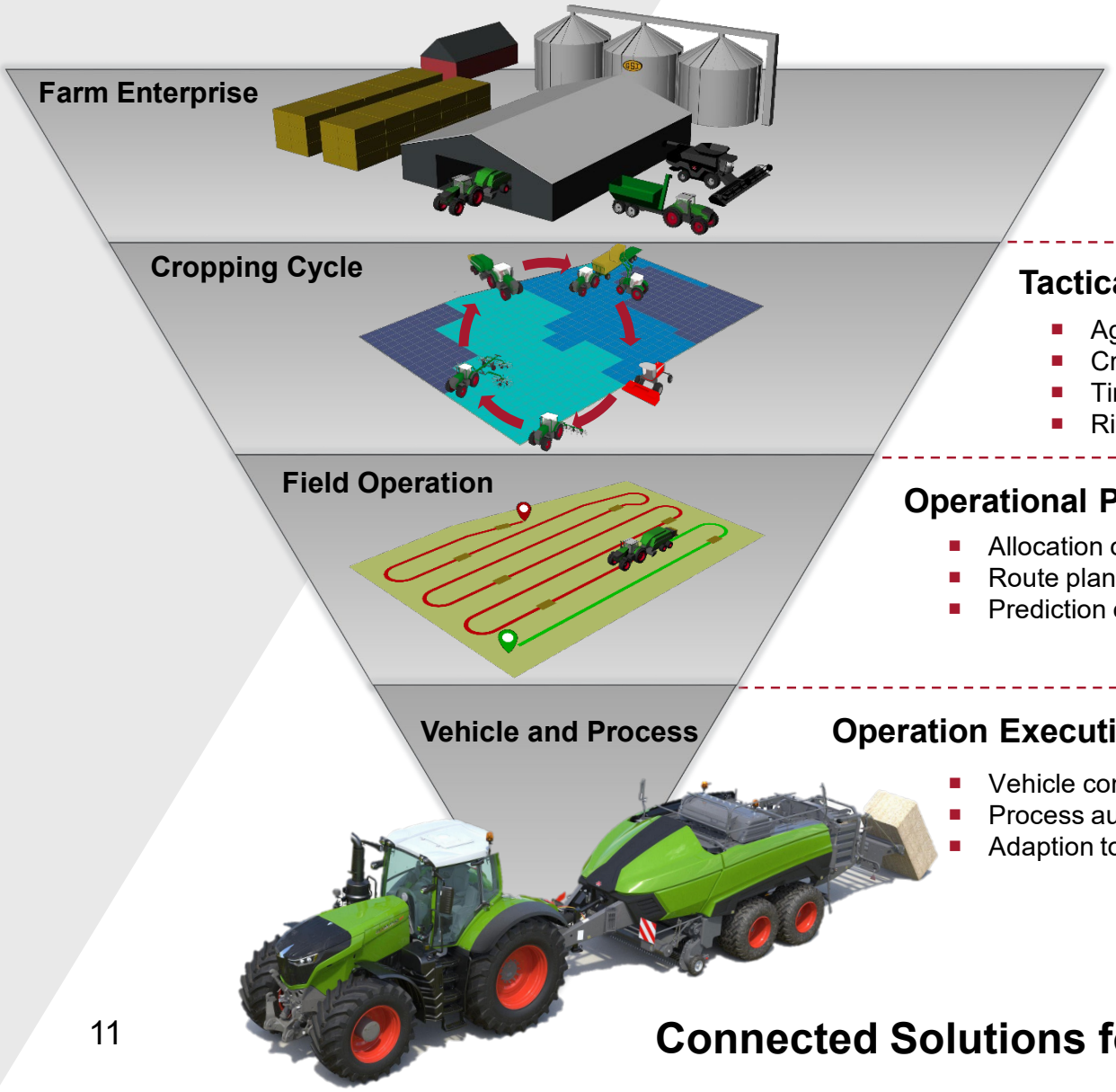
HMI AND UX

ARCHITECTURE

SECURITY

SAFETY

Operation Management Technology Layers



Strategic Planning (What)

- Business decisions
- Machine investments
- Cropping practices

Tactical Planning (When)

- Agronomic decisions
- Crop cycle
- Timing and prioritizations of operations
- Right place at the right time at the right rate

Operational Planning (How)

- Allocation of resources
- Route planning
- Prediction of operation outcome

Operation Execution

- Vehicle control
- Process automation
- Adaption to local conditions

Connected Solutions for Seamless User Experience

The Innovation Challenge

- Anyone can predict the future and set the long-term target
- Taking the right next step is the challenge

IN 1969…

Will your farm look like this in 2000?

The trend continues — more automation, faster production, earlier crop varieties. Pause for a moment in your day-to-day chores: is this what you see in just 30 years' time? One thing's for sure — the back-breaking, hard-sweat jobs won't be done by the manager-of-the-future.

Three-dimensional colour television in every farm office. . . automatic tractors . . . plastic domes over acres of cropland. . .

These are some of the amazing developments ahead in 2000AD.

Ford Motor Company quizzed ag experts across the world on the future of farming.

It discovered an almost unbelievable agriculture, using a bewildering range of management and production techniques.

This agriculture is just 30 years away. If the experts are right, it could come in your lifetime.

"The efficient farmer of the year 2000 will be a super-breed of farmer," declares Ralph Cudmore, general manager of Ford of Canada.

"The heart of his operation will be a control centre equipped with a wide array of electronic wizardry to help him produce crops two to five times more abundantly than today."

Imagine yourself as one of the next century's farmers.

Your farm office will be a business control centre equipped with closed circuit television sets, data telephones, 3-D TV and direct microwave circuits.

You'll need all these electronic devices to bring you the information you must have to manage a $1-million business—daily and long-range weather analyses, market figures, and research findings.

And you'll have special receivers to make printed copies of all this material.

Then you'll have a personal computer to aid day-to-day decisions, and a direct link to huge memory computers for tougher decisions.

And what will you manage? You'll have a farm grossing $300,000 or so each year, netting about $30,000.

You'll manage crops giving more than triple the present yields—800 bushels of corn, 175 bushels of soybeans, 30 tons of forage, 300 bushels of wheat per acre.

Cows will yield 30,000 pounds of milk each lactation, new techniques will allow a cow more than 1,000 calves in her lifetime, beef animals will reach 1,000 pounds at 10 months.

The machines and buildings to help get these yields boggle the 20th-Century mind. You'll drive electrically powered tractors with mobile cabs.

But the cab will be nothing like todays' cab—it'll be air-conditioned, with coffee maker, maybe even a washup sink.

Massive planting units will precision-seed at 10 or 20 miles per hour. Some tractors will run automatically. Hovercrafts will spray your crops, and booms will plough your fields.

This picture of the next century is perhaps a frightening one—but there's no denying it's an exciting one.

But frightening or exciting, it's coming. Our challenge is to adjust to it.

The farm management centre

1/Here's the cab of your future tractor, equipped with closed-circuit television, coffee-maker and sink. 2/This is your 21st-Century farm — a $1-million investment, although you'll own only one third, with $300,000 gross sales a year. 3/Huge steel-framed domes will cover high-value crops for precise environment control. 4/Space ships will spot insect and disease buildup long before they infest your crops. 5/Farmers will fertilize the air with carbon dioxide to boost yields of specially-bred crop varieties. 6/Next century's farmer will receive daily weather reports, market analyses in his farm control centre.

Farm operations affected, too

1/You'll grow livestock in fully-controlled environments, maybe like this high-rise structure, with different animals at different levels. 2/You may do some field work with this bridge-like machine. Work units travel along the bridge. 3/Self-propelled planters will speed along at 20 mph. 4/Fabulous machines with electronic eyes and computerized fingers will pick, sort and package crops. 5/The cab on this tractor can move front or back for maximum visibility. 6/Some machines will harvest and cultivate in one operation. 7/Engineers have already developed hovercraft for some spraying jobs. 8/It's possible that power will be supplied through each row unit, allowing enormous widths.

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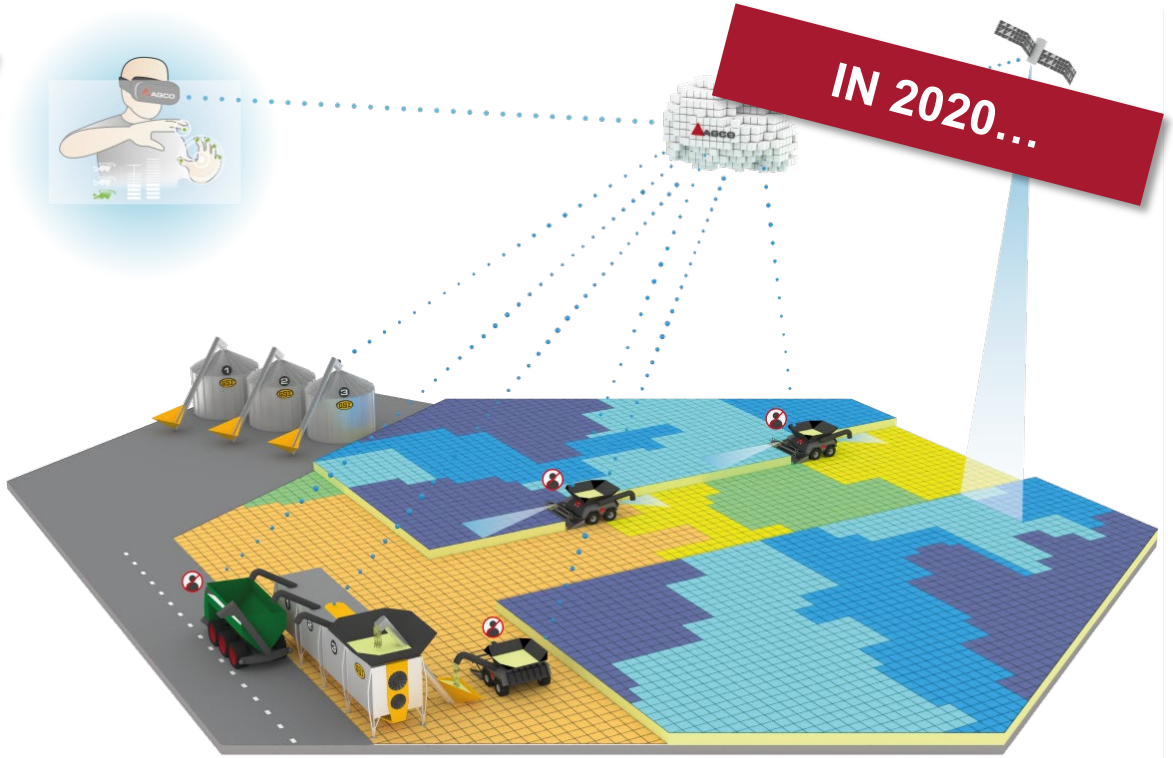
IN 2020…



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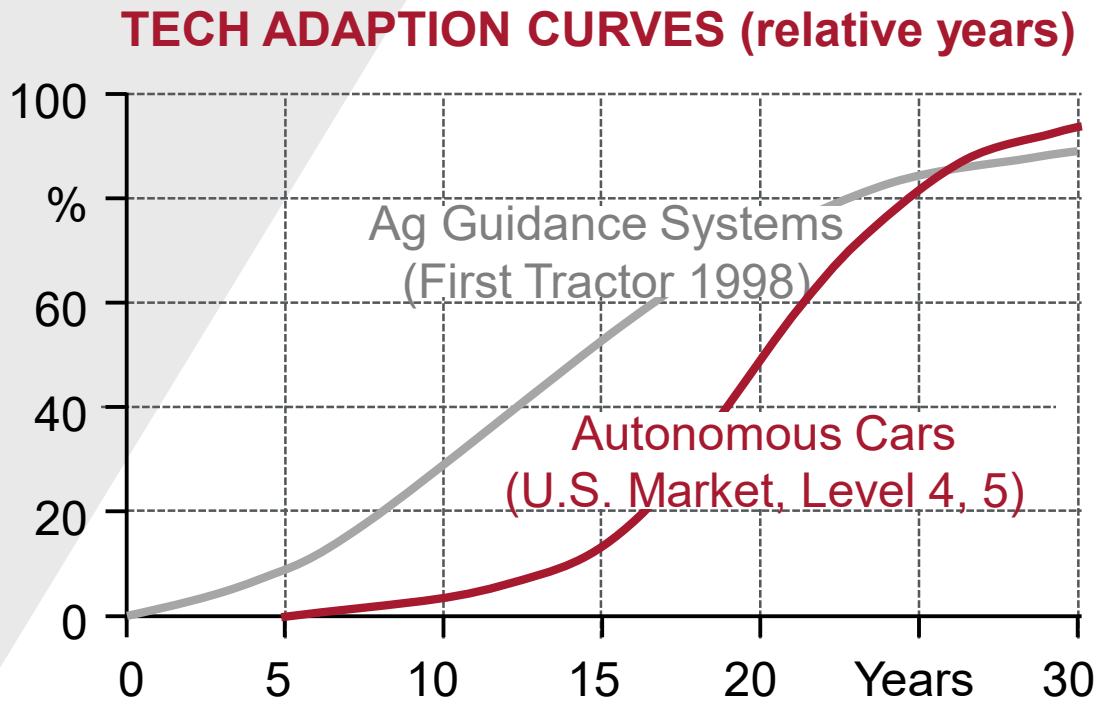
The Innovation Challenge

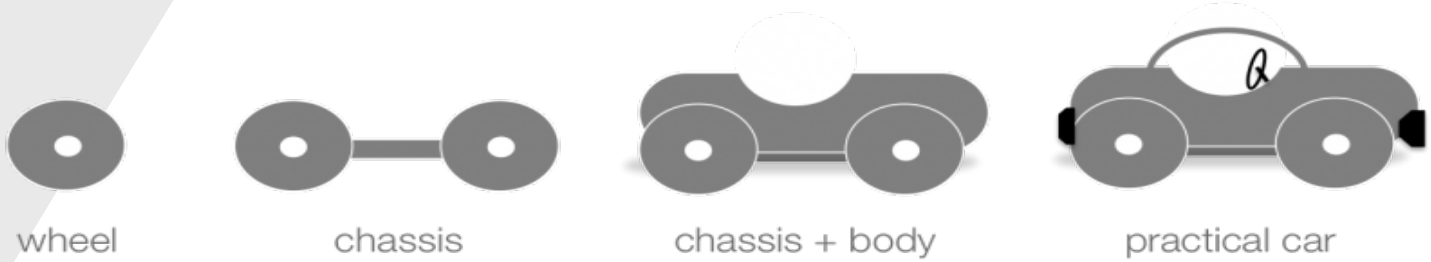
- Customer adoption as the bottleneck
- New technology need to work together with existing machinery and farming practices
- Proven value creation and trust drives technology adoption
- Adoption of auto steering took 30 years

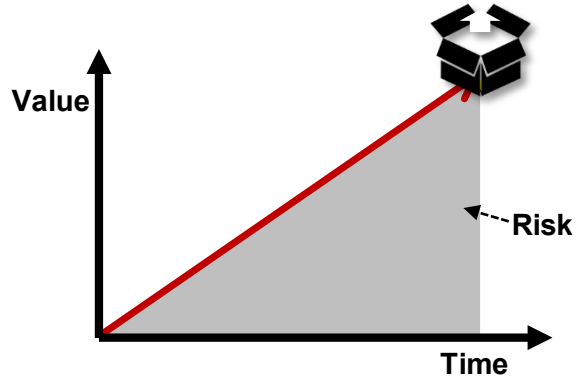


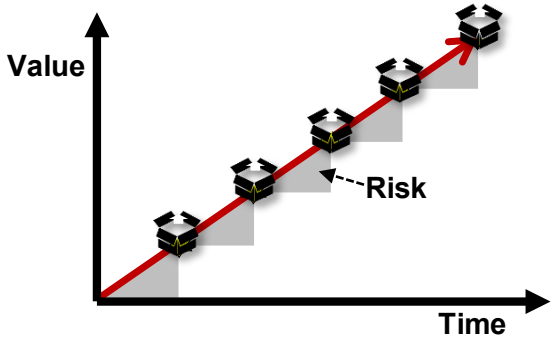
Sources: Silicon Valley Mobility LLC, July 2017 (modified)
Geotec Agronav, History of GPS, own data

The Innovation Challenge

- Don’t build the ladder to the moon
- Develop solution to customer problems rather than developing a solution and look for a problem to solve
- Gradual product implementation for early customer adoption and feedback







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Triangle of Innovation Success

Technology Feasibility

Customer Desirability

Technology Development

”Develop The Thing Right”

System insights

- System identification
- Modeling of dynamic and static system properties
- Controllability and observability analyses

Can the Company get Value from it ?

Business Viability

Product Design

”Develop The Right Thing”

Customer insights

- Define customer profile and segments
- Empathize with costumer and use cases
- Customer value proposition mapping

Thank You

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