



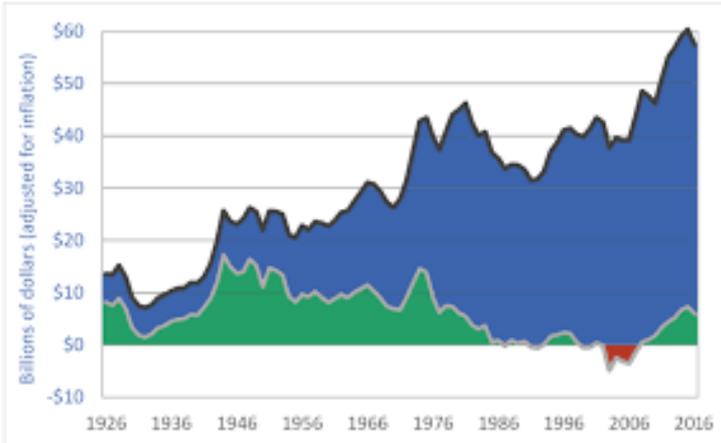
Smart Farming and Glimpse into the Future

Top Crop Manager Plant Health Summit
Saskatoon, SK
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Some of Agriculture's Challenges...



Farm profits in Canada
Blue: gross revenue
Green: net revenue

In Canada - the ag and food sector is expecting a shortfall of 114,000 jobs by 2025.

The Canadian Agricultural HR Council



What is the Value of “Smart” Agriculture?

Technology and data can help producers make management decisions that account for:

Weather/climate change

High and fluctuating cost of inputs

Market volatility

Complex relationship between soil, plant, water, air

Long-term impacts of cropping on soil health

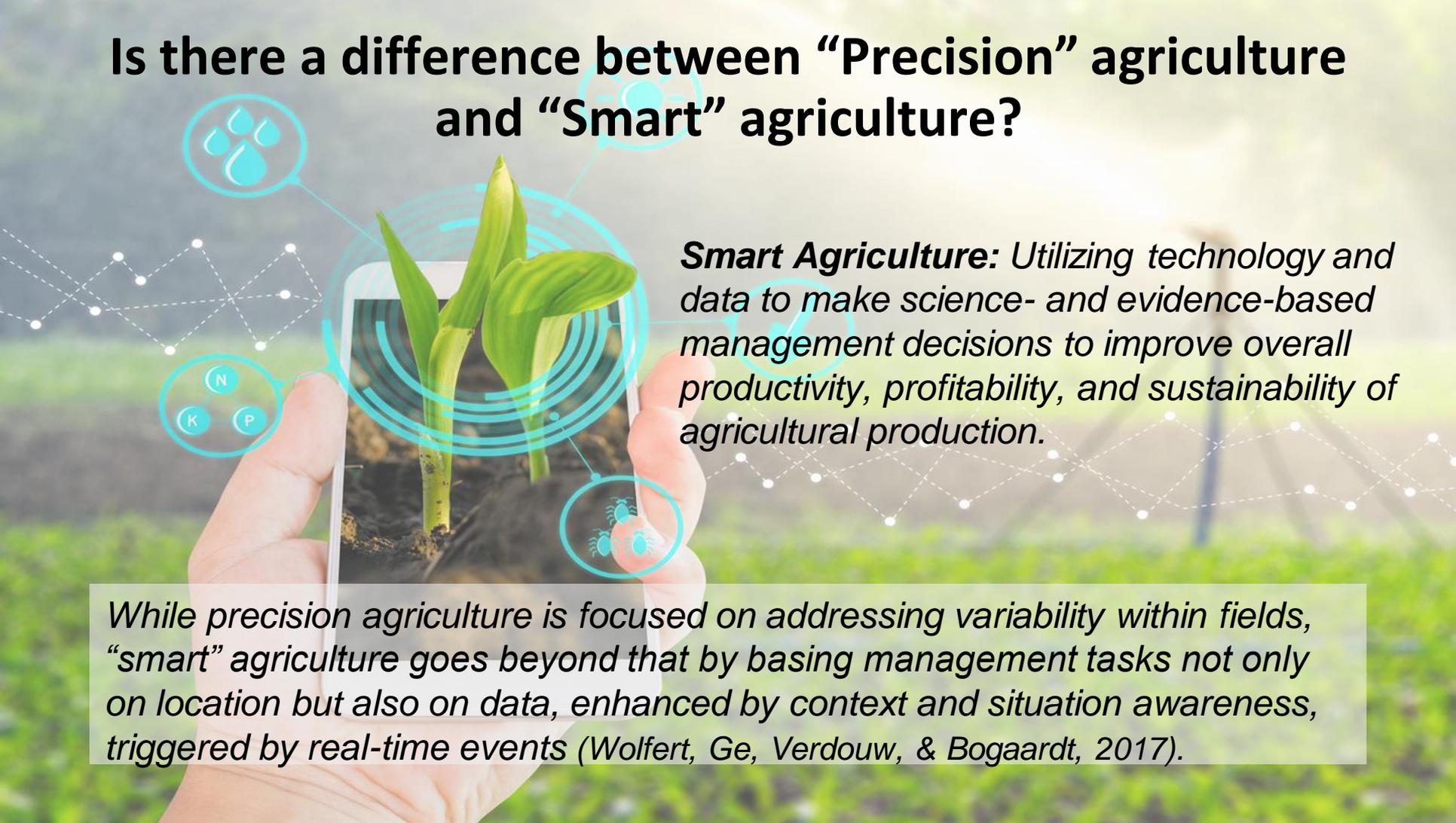
Labour shortages

Logistical challenges

Etc...

Technology and data can help crop and livestock producers *manage risk*

Is there a difference between “Precision” agriculture and “Smart” agriculture?



Smart Agriculture: Utilizing technology and data to make science- and evidence-based management decisions to improve overall productivity, profitability, and sustainability of agricultural production.

While precision agriculture is focused on addressing variability within fields, “smart” agriculture goes beyond that by basing management tasks not only on location but also on data, enhanced by context and situation awareness, triggered by real-time events (Wolfert, Ge, Verdouw, & Bogaardt, 2017).

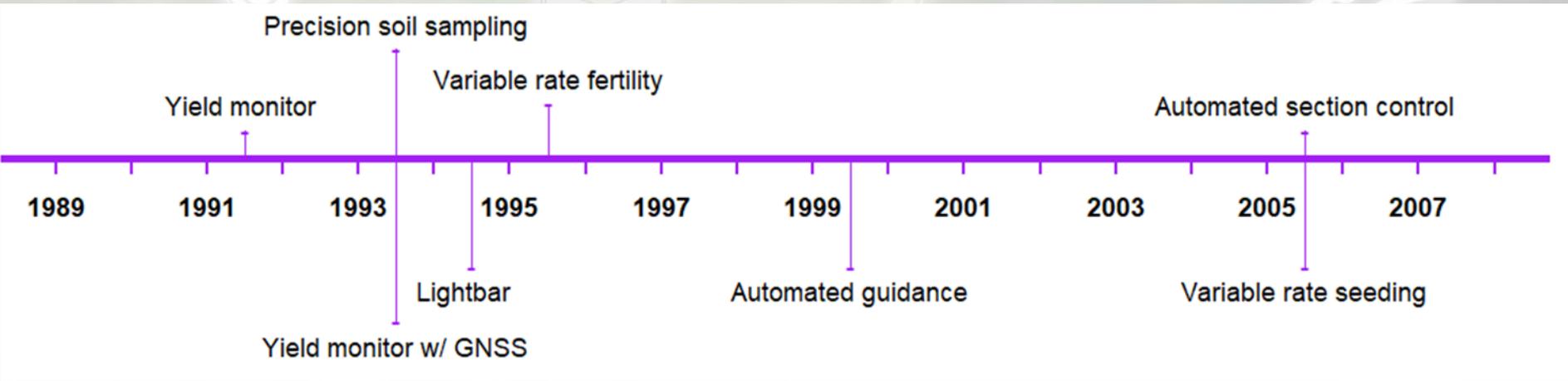
A few words on “big” data



Big data is only useful if the little data hasn't been ignored for decades.

For example, if you don't know your own cost of production, you shouldn't be focused on “big” data.

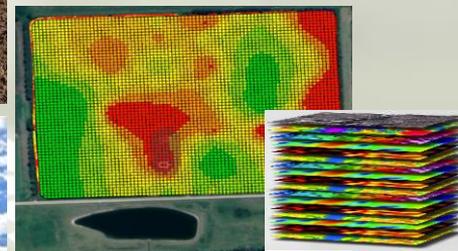
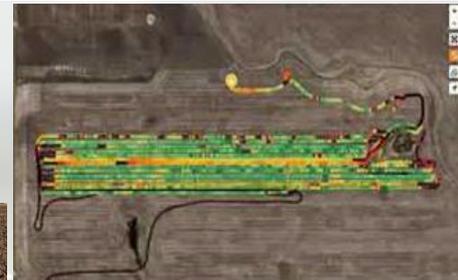
Evolution of Agriculture Technologies



Courtesy of Dr. Terry Griffin, Kansas State University

Ongoing Evolution of Agriculture Technologies

Past to current	Current to near future	5 to 10 years out
Yield monitoring	Yield mapping	Mapping and analytics of yield and quality of crop
Scouting for pest and disease monitoring	Micro-climate and crop sensors. RPAS scouting	Robot agronomist?
Blanket application of herbicides	Variable rate, targeted application of herbicides	Autonomous swarms of micro-bots that kill weeds without herbicide
Soil sampling	Precision soil sampling with improved analytics	Real-time, continuous sensing of soil constituents
Automated guidance	Smarter guidance	Autonomous operation
Variable rate prescriptions based on single data layer	Multi-layer data for prescription mapping	Real-time mapping based on current soil status, topography, and forecasted weather



Ongoing Research in Smart Ag: Ag data management platform comparisons

Comparing:

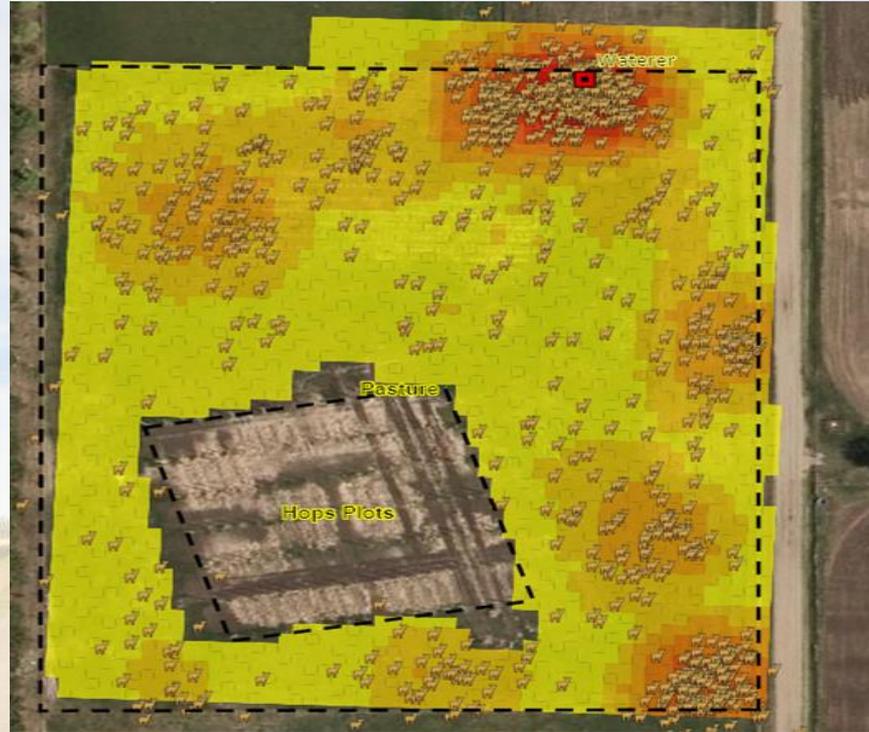
- Scouting & data analytics
- Ease of setup & use
- Financials & yield vs profit
- Connectivity to equipment
- Variable rate prescription creation
- Syncing/Cloud based storage
- Stability of platform
- Security



Key question: which tool is the best fit for different applications?

Ongoing Research in Smart Ag: Mapping movement of cattle and sheep

- Using **GPS Collars** to track cows and sheep on the farm.
 - live tracking
 - animal density maps
 - time slider maps
- A tool to better understand grazing patterns, animal health and range variability.



Key question: can animal behavior be easily monitored and managed to improve herd health?

Ongoing Research in Smart Ag: Soil and climate sensor validation



Key concerns: connectivity, robustness, quality of data, accuracy of data, value of data, applicability of technology for western Canada, effect of method of installation on readings, required density of sensors for management decisions, etc.

Ongoing Research in Smart Ag: Compilation and utilization of data layers

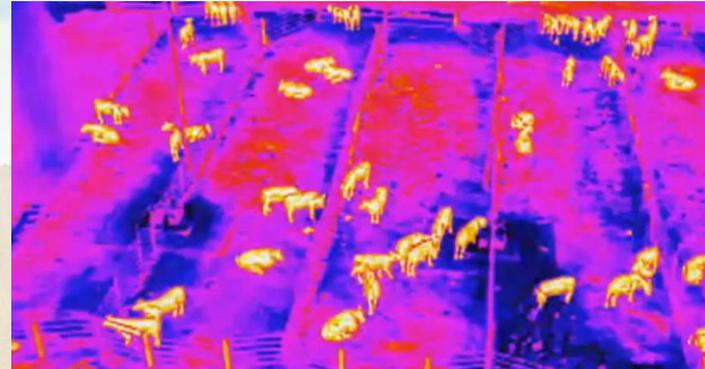


Key questions: can we create a “calibrated” soil to validate and optimize agriculture technologies as well as define zones and strips for in-field trials?

Ongoing Research in Smart Ag: Remote sensing using RPAS



- Thermographic imagery
- Multispectral
- Hyperspectral
- NDVI, RGB
- Ground penetrating radar



Upcoming Research in Smart Ag: Autonomous equipment operation



Key questions: how will autonomous equipment compare to traditional equipment with respect to capital and operating costs, environmental impacts (e.g.: compaction), labour requirements, training requirements, efficiency, troubleshooting, regulatory hurdles, etc?

Upcoming Research in Smart Ag: Optical spot spray technology



Key question: what is the chemical use reduction and accuracy and performance of spot spray technology for western Canadian conditions (stubble type, travel velocity, size/type of weeds, etc.)?

Upcoming Research in Smart Ag: Real-time soil constituent analysis



Key concerns: connectivity, robustness, quality of data, accuracy of data, repeatability of data, value of real-time soil constituent data?

How to “measure” the ROI of ag technologies?

Ultimately, most on-farm decisions boil down to \$\$

Relatively easy to assign \$\$		Hard to assign \$\$
Cost to dry	Cents per bu	Availability of propane or heating fuel
Cost of cables and monitoring tech	\$ per bin	Overall risk of spoilage
Penalty for hauling tough grain	Cents per bu	Bin space and/or dryer capacity
Cost of spoilage (revenue and hassle/labour)	\$\$\$\$	Value of being able to harvest a week earlier
Cost of renting a second combine to finish harvest	\$\$ per day	Market for tough grain
Cost of grain losses to just “push through” and finish this field	\$ per acre	Ability to haul grain (available labour)
Cost of products to speed up stand establishment	\$ per acre	Labour/time to monitor/turn grain
Cost of mapping and VRT	\$ per acre	Value of peace of mind

“Value” of a technology (or practice) needs to be broader than just \$\$

How to “measure” the ROI of ag technologies?

Ultimately, most on-farm decisions boil down to \$\$

“Value” of a technology (or practice) needs to be broader than just \$\$

Even if we can define a measurable value (e.g.: yield increase), the spatial and temporal variability of yield make it very difficult to “measure” ROI.

Most likely, ROI will need to be a range of values. E.g.: payback period of 3 to 7 years.

What Are the Challenges of Ag Tech Evolution?

Imperfect Matching

Tools



Problems

What Are the Challenges of Ag Tech Evolution?

Translation Challenges

A hand holding a white smartphone, positioned on the left side of the slide. The phone is held horizontally, and the hand is visible from the wrist up to the fingers.

**Data
Collection**



**Actionable
Intelligence**

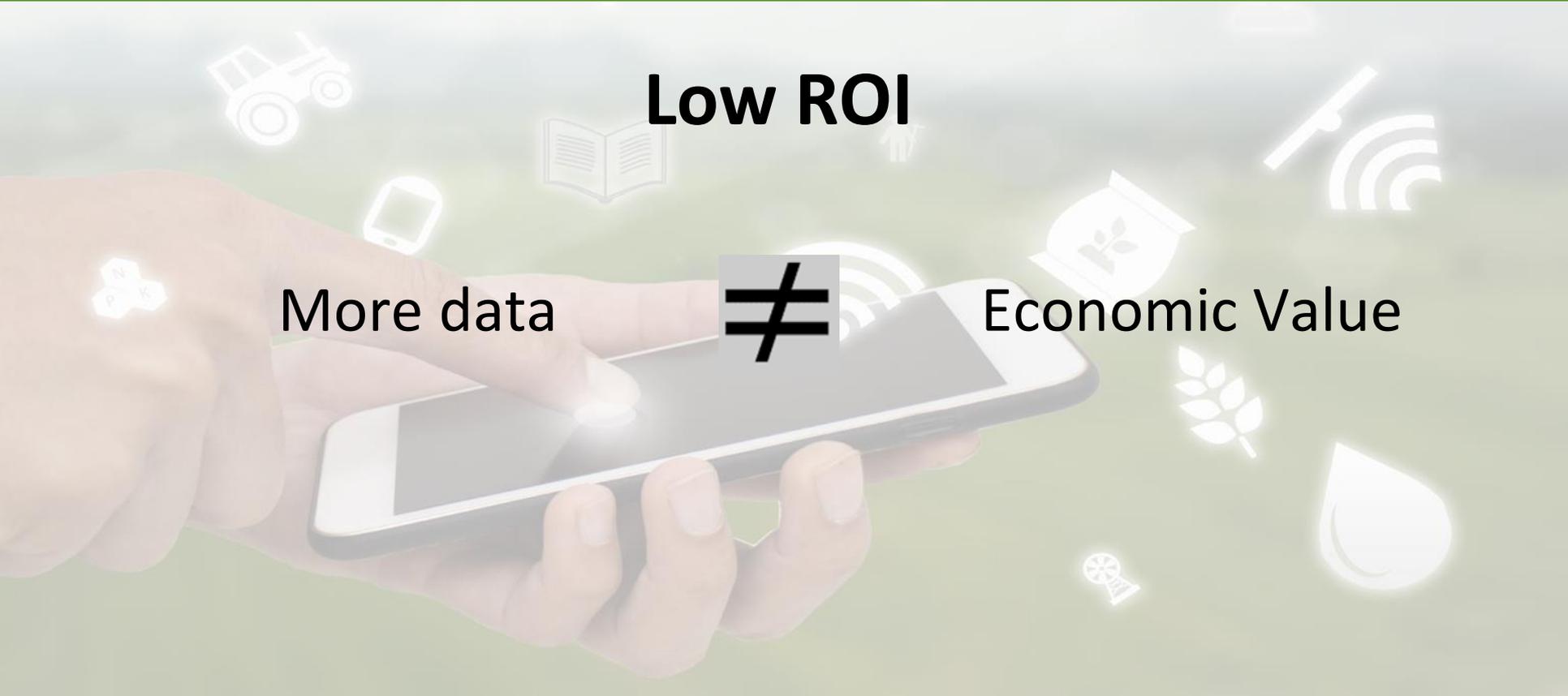
What Are the Challenges of Ag Tech Evolution?

Low ROI

More data

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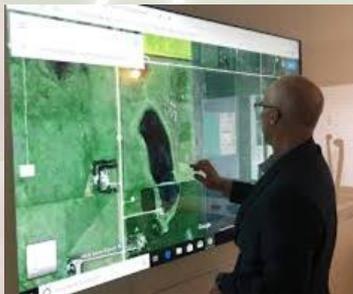
Economic Value



What Are the Challenges of Ag Tech Evolution?

Limited Access to Expertise

Idea



Commercial Product

What Are the Challenges of Ag Tech Evolution?

Limited Access to Training Opportunities

Evolving
Technologies



Dynamic
Learning

What is Olds College doing to address some of these challenges?



Smart Farm Operations

- 2,000 acre commercial farm land base along with beef and sheep herds
- Infrastructure for innovation, validation, demonstration, scaling
- Hub for pan-Canadian Smart Agriculture ecosystem

Applied Research

- Subject matter expertise
- Access to R&D funding
- Support for entrepreneurs and SME's via RIN

Academic programming

- Continuing education courses
- Certificate and diploma programs in ag tech integration and techgromy

Extension and dissemination

- AgSmart Expo
- Research reports, webinars, presentations



Canadian Agri-Food Automation and Intelligence Network (CAAIN Ltd.)

The Canadian Agri-Food Automation and Intelligence Network (CAAIN) was awarded \$49.5 million in 2019 to create a platform/network to pursue precision, productivity and premiums in agriculture and food.

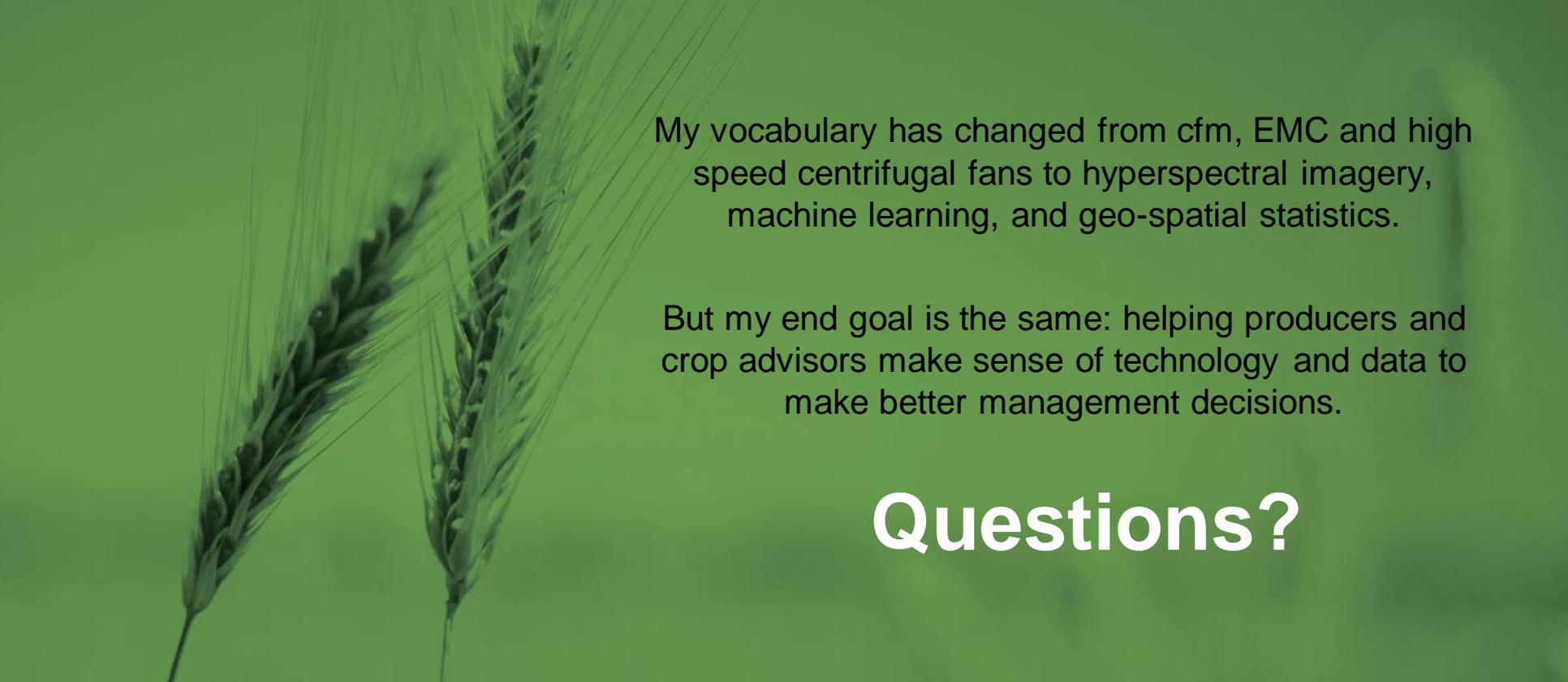
The network will use the [Olds College Smart Farm](#) as a hub to develop and test new technologies related to automation and data utilization for decision making in agriculture.

Core partners: Alberta Innovates, Olds College, Lakeland College, Vineland Research Group, MDA, Linamar, Viresco Solutions, TrustBix, DOT Technology Corp.



Take home messages

- Smart Agriculture focuses on using technology and data to make decisions that help manage risk
- Most technologies are applicable to primary agriculture. Some (e.g.: traceability) will benefit the broader supply chain
- Just because we CAN collect massive quantities of data, doesn't mean we SHOULD collect it ("Screw big data...focus on little data and use it well") Cory Willness
- The "ROI" of data and ag technologies is tricky to measure, but producers need to see value in technologies and data before investing in them
- There is a need for on-going training and dissemination of knowledge related to ag technologies



My vocabulary has changed from cfm, EMC and high speed centrifugal fans to hyperspectral imagery, machine learning, and geo-spatial statistics.

But my end goal is the same: helping producers and crop advisors make sense of technology and data to make better management decisions.

Questions?



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