Making Precision Decisions
In the Era of Big Data

Thanks to:

CRESCO AG

Advantages of Aggregating Data

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Axioms

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- We make decisions based on feedback from what we can assume, sense or measure
- Data has no value (unless used to make a decision to make lives better)

History of Precision Ag Paradigm

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- Mountains of data
  - › Limited of decision-making information
- Advanced hardware & software
  - › Gaps in parts of decision-making process
  - › Limited third-party support
- Unprecedented adoption rates
  - › Data technologies lag automated technologies
- One-field-at-a-time analysis dominated
  - › Community data analysis likely solve these problems

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"just a bunch
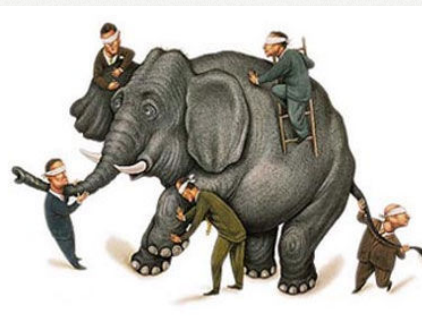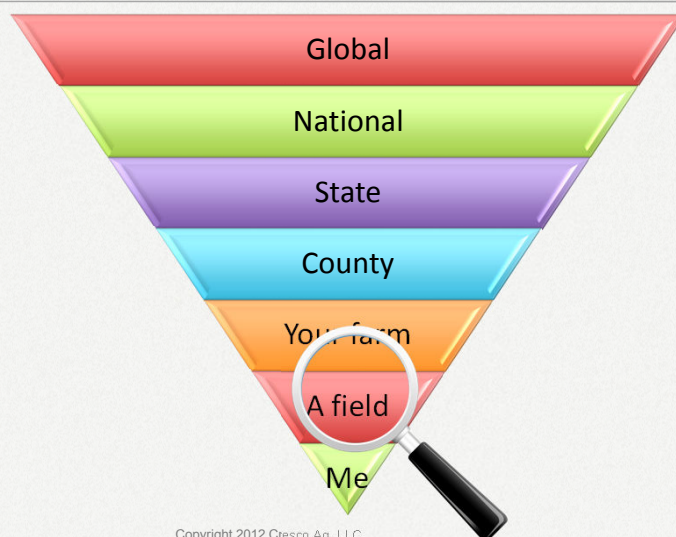of pretty maps"

"Big Data": From Popular Culture to Ag

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- Barcode scanner data (Wal-Mart, Target, Kroger)
  - › Small local stores do not directly benefit
- Google, Amazon
  - › number of clicks, browsing history
- Social networking
- In agriculture, historically weather
  - › University experiment stations
  - › USDA NASS and ARMS
  - › Commodity trading
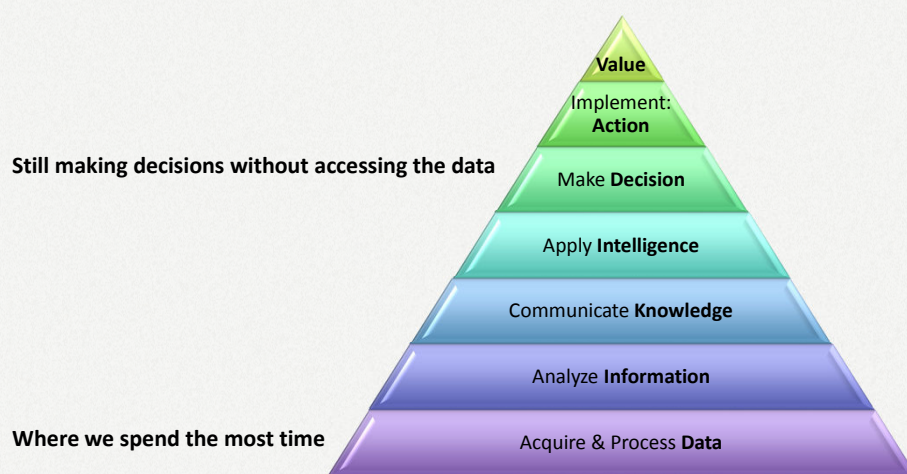 - › Precision agriculture

How Much do I Know About?

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Global
National
State
County
You... farm
A field
Me

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Data has no value…

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Value
Implement: Action
Make Decision
Apply Intelligence
Communicate Knowledge
Analyze Information
Acquire & Process Data

Still making decisions without accessing the data

Where we spend the most time

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Reasons to aggregate

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- Agriculture very large and complicated puzzle
  - › Individuals essentially view one single piece at a time
  - › Consultants concentrate in their domain
- Business intelligence
  - › Community data analysis helps level playing field
- Corporations rely upon "Big Data"
  - › When, what and how much

## Logic of participation

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- If my reaction is that I do not want my peers to benefit from my data, then:
  - › I prefer to not make the most of my own data for the sake of preventing peers from cooperatively benefiting
  - › I perceive expected benefits to be lower than the costs of my peers gaining
  - › I am not confident that I would be able to make a better decision than my peers with similar information
    - Counter example: commodity futures data
- Farm-level or field-level data has limited value if kept isolated, but greatest value to initial farmer obtained by converting data to information only when data is pooled and analyzed for the community of peers

Product x Environment x….. *M*?

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- Yield = product + environment + management
- **<u>Management</u>** impacts yield response
  › Planting date, seeding depth
  › Fertility levels, irrigation
  › Weed/insect/disease presence/intensity/control
- How technology interacts with *M*?
  › Identifying water issues
  › VR fertility, seeding, foliar applications
  › Input selection and rate optimization
- Requires many observations for P, E, M
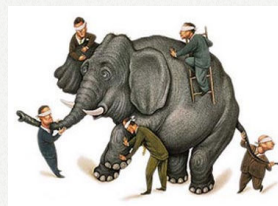
Isolated vs. Aggregated Data

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Data Source	Isolated	Aggregated
On-farm experiments	Detect yield difference for 2 or 3 treatments specific to field given my management	Multiple ExM. Most factors become variable: row spacing, planting data, seed population
Production data	Rank varieties by yield under my management	Rank varieties by yield and risk under many ExM across my cohort of peers
Try 40 ac of new product	Try to detect improvement or failure	Assess performance in PxExM context with yield, risk and significance level

Future of Precision Agriculture

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- Data from single farm has finite value to that farmer
  › Greatest value occurs in pooled community analysis
  › Advanced analysis of aggregated data; risk mitigation
- Individuals view single piece of very large puzzle
  › like the elephant in village illustration
- Business intelligence
  › helps to level playing field
- Corporations rely upon "Big Data"

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FROM FARM FINANCIAL STANDARDS 2013

Benchmarking Practices

- Must be similar, comparable & reliable
- Most common practice is to consolidate complex businesses (LCD)
- Compare trends of ratios/KPIs
- Benchmarking within peer groups

In Australia…

- 69 agricultural databases
- Similar accounting, inputs, system for classifying accounts, constructing financial statement, calculating financial ratios and measures (KPIs)

Compare:

- Previous year
- Base year
  - › Trends over multiple years
- Data from farm-to-farm comparisons
  - › How's my neighbor doing?
  - › Comparisons with averages of similar farms
- Ratios level the playing field
- Accounting perspective
  - › Statement of Financial Accounting Concepts #2 accounting methods are central to comparison to financial information
  - › Compromised by
    - Incomplete or inaccurate information
    - Inconsistency in accounting methods
- Farm type
  - › "Corn farm" if 70% revenue from corn
  - › Entity type and relationships

Benchmarking the Benchmarkers

- 16 states have databases, some searchable
- More variability within a peer group of farms than across all farms
- FBFM has 100 "sorts"
- Many traits are not "binary" or easily categorized
- Rapidly-changing business models
  - › Compare strategic strategies
  - › Evaluate internal efficiencies
- Easier to consolidate than parse
- The NPPC's goal
- 66% variance between cash and accrual

Benchmarks: Only the Start

- Ultimately benchmarks answer the **"who,"** **"what," "where"** and **"how much,"** but not the **"why"**
- Do identify:
  › The potential
  › Limiting factors
  › Opportunity costs
  › But don't isolate <u>your</u> marginal costs to adopt
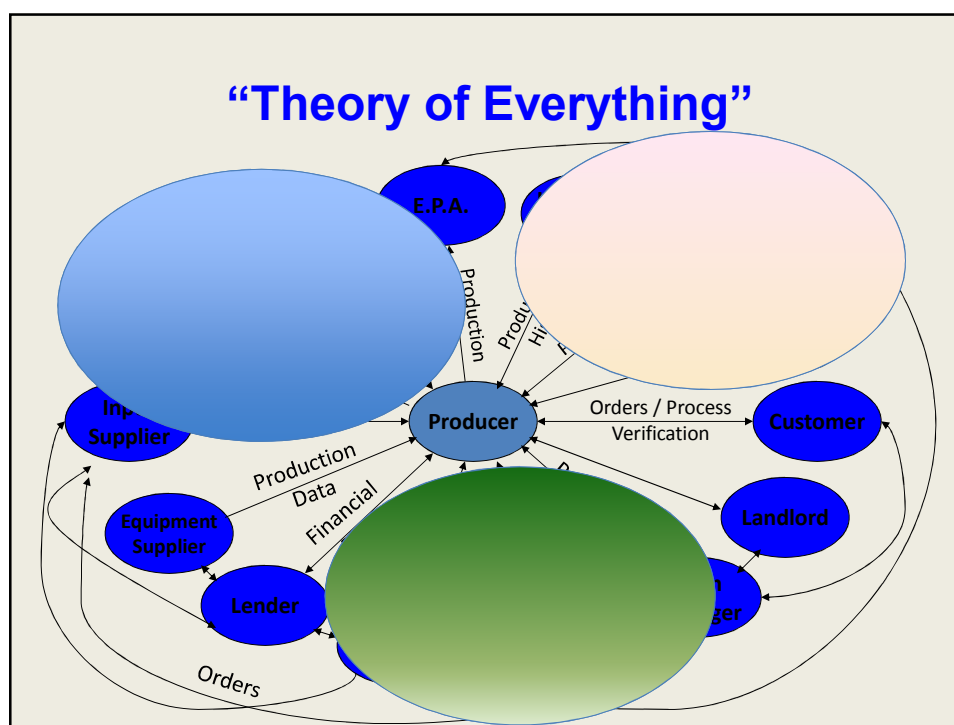
Too Focused?

"Theory of Everything"

E.P.A.

Input Supplier

Producer

Orders / Process Verification

Customer

Production
Data
Financial

Equipment Supplier

Landlord

Lender

Orders

Axioms—Revisited

F&S SYSTEMS INC.

- We make decisions based on feedback from what we can assume, sense or measure
  › Generally production traits (yields, PSY, # milk)
  › Plugged financial assumptions
  › Delivered by parochial specialists

Future Targets

- 3,000 variety of potatoes
- Commodity trading of water
- Tradeoff between driving costs down and robustness (yields vs. disease resistance)
- Track variation, quality
- This conference's example will be illustrated tomorrow afternoon