<table>
<thead>
<tr>
<th>No.</th>
<th>Section Title</th>
<th>Page Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>5 – 12</td>
</tr>
<tr>
<td>2</td>
<td>Highlights of the Situation Analysis</td>
<td>13 – 25</td>
</tr>
<tr>
<td>3</td>
<td>Mapping the Technology</td>
<td>26 – 37</td>
</tr>
<tr>
<td>4</td>
<td>Company Positioning &amp; Business Models</td>
<td>38 – 52</td>
</tr>
<tr>
<td>5</td>
<td>Considerations for Strategy Development</td>
<td>53 – 64</td>
</tr>
<tr>
<td>6</td>
<td>A Farmer-Centric Strategy</td>
<td>65 – 98</td>
</tr>
</tbody>
</table>
This project does not endorse any specific company or service.

This project aims to provide facts and a conceptual framework that enables an understanding of this rapidly evolving and complex area.

This project is not designed to advise farmers and ag retailers on the use of specific products and/or services in their operation.

This report does not include policy recommendations, but information developed in this project may be used to inform policy discussions of AgState members.
Abbreviations Used in Presentation

- **APIs** – Application Programming Interface – in computer software an API allows software and hardware developed by different companies to “talk” to each other. An critical link to make the technology easier to use.

- **ATPs** – Agricultural Technology Providers – companies that sell highly technical products and services to farmers.

- **CPC** – Crop Protection Chemicals

- **FTE** – Full Time Equivalent employees, i.e., two half-time employees equal 1 FTE.

- **IT** – Information Technology – the science of managing information with computers

- **ODA** – Open Ag Data Alliance – an organization that seeks to encourage open sharing of data among ATPs.

- **PCAST** – President’s Council of Advisors on Science and Technology.

- **UAVs** – Unmanned Aerial Vehicles – drones.
Introduction
Purpose of this Project

To develop the most appropriate strategy and tactics for row crop farmers to utilize Agricultural *BIG Data* to enhance the productivity, efficiency, and choices of American farmers while also protecting their farm data and intellectual property.
Major Stakeholders of this Project

- Farmers
- AgState Members
- National Agricultural Organizations
Big Data in Agriculture: A very broad term that is used differently by different people. We are using this confusing term less than we did previously in favor of more precise terms.

Big Data is data whose scale, diversity, and complexity require new architecture, techniques, algorithms, and analytics to manage it and extract value and hidden knowledge from it.

The key term we suggest to use is **Digital Agriculture** which is broader and more comprehensive than the term **Big Data**.
Major Data Sets Used in Row Crop Agriculture

Agriculture will not totally convert to Big Data. Below we provide examples of “Big Data” and “Not Big Data.” Some “Not Big Data” will always be important.

**Big Data by Definition**
- Weather data sets -- historical, current and forecasts.
- Satellite imagery of large farming areas.
- Machine data from tens of thousands of farm machines.
- Crop insurance records for counties and states.
- Aggregated farm level data from hundreds of thousands of acres.

**Not Big Data, Farm Level**
- Yield maps for fields and management zones.
- As planted maps for fields and management zones.
- Soil samples on a grid basis.
- Machine data for individual machines.
- Logistics and work scheduling.
- Farm financial, marketing, & risk management records.
Digital Transformation refers to the changes and challenges associated with digital technology application and integration into all aspects of agriculture. It is the move from the physical to the digital.

Digital Agriculture: A family of activities related to farming that includes Precision Agriculture, Prescription Agriculture, Enterprise Agriculture and depends on the collection, use, coordination, and analysis of data from a multiplicity of sources with the goal of optimizing productivity, profitability and sustainability of farming operations.

- Farmers will have more effective decision-making tools with Digital Agriculture.
- Digital Agriculture uses Big Data and some data that is NOT Big Data.

Advanced Farming: The research activities that are designed to advance Digital Agriculture to achieve improved productivity and sustainability over the long-term, e.g., predictive phenomics.
The Major Components of Digital Agriculture

**Precision Agriculture**

**Definition**
Use of new tools that give farmers better operational control.

**Examples**
- Auto-steer
- Yield monitors
- Variable rate machinery
- Weather stations

**Prescription Agriculture**

**Definition**
Detailed prescription of agronomic practices to maximize yield or profit per acre using computer algorithms.

**Examples**
- FieldScripts
- Encirca
- Answer Tech
- Ag retailer scripts

**Enterprise Agriculture**

**Definition**
Integrated, computer platform including: planning; agronomy; labor; work orders; purchasing; risk; inventory; logistics; machinery; marketing; profit per acre.

**Examples**
- Granular
- Conservis

Many services in-between

Plus many other data components
Advanced Farming Research Concept

- Genetics
- Genomics
- Phenomics

- Digital Agriculture

- Environment, Risk Management, Sustainability

- Precision Ag
- Prescription Ag
- Enterprise Ag

- Computer Sciences
- Information Sciences
- Robotics & Sensors
Highlights of the Situation Analysis
Leading experts at the MIT Center for Digital Business say:

“We are convinced that we are at an inflection point – the early stages of a shift as profound as that brought on by the Industrial Revolution. Not only are the new technologies exponential, digital, and combinatorial, but most of the gains are still ahead of us.”

Digital Transformation of Agriculture
Past-Present-Future

1. Product
2. Smart Product
3. Smart, Connected Product
4. Product System
5. System of Systems

Progress Report – Not for Distribution
Copyright © 2014 by The Hale Group, Ltd.
1. Product

2. Smart Product

3. Smart, Connected Product

4. Product System

4. Product System

5. System of Systems

Digital Agriculture Data Loop

Sharing data, decisions, & implementation plans with the right people, machines, & vendors at the right time.

Remote Sensors & Farm Machines

Extraction & storage of private, public, agronomic, machine & weather data

Secure Cloud-Based Network

Machine & Human Networks

Data Visualization for Human interpretation of insight and Information

Big Analytics

Computer-based algorithms & data analysis

Farm-Specific data system, reporting, & accounting.
Tom Vilsack: “There are 3x farmers over 65 as under 35 today.”

- **Human Capital**: Farmers need to be **Tech-Savvy** and to have access to **IT skills** for use of data in decision making.

- **Quality Data**: The majority of Data generated currently is not useable due to poor quality, e.g., lack of calibration.

- **Data Access**: Much of the Data is on cards, sticks, hard drives or in binders of printed documents, and is very hard to access.

- **Better Analytics** are required to automate the analysis of imagery and maps.

- **Agronomic Data held by Ag Retailers** is not easily available for farmer use and aggregation in a broad manner.
The Adoption of Digital Agriculture: Enablers

- More Embedded Knowledge in the equipment, devices or systems required. Easy to use, intuitive, meeting expectations, e.g., iPhone.
- More Standardization across the vast range of products, services and systems being offered.
- Validation Processes for services offered and business models.
- Effective Security for data held both on-farm and off-farm.
- Technology Pull process that empowers farmers to define problems and influence innovation.
- User Training that works for the broad population of farmers.
- Attracting Data Scientists, Software Engineers and Computer Scientists to the sector.
Digital Agriculture Involves a Complex Mix of Human & Computer Factors in Decision-Making

### Analysis

<table>
<thead>
<tr>
<th>Human Driven</th>
<th>Analytics Driven</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Human</strong></td>
<td><strong>Computer</strong></td>
</tr>
<tr>
<td>- Aerial imagery</td>
<td>- Automated image analysis</td>
</tr>
<tr>
<td>- Yield maps</td>
<td>- Prescriptions</td>
</tr>
<tr>
<td>- Hybrid performance charts</td>
<td>- Management zone P&amp;L</td>
</tr>
<tr>
<td>- Vendor relationships</td>
<td>- Weather forecast</td>
</tr>
<tr>
<td>- Worker selection</td>
<td>- Work order optimization</td>
</tr>
<tr>
<td>- Most current seed selection</td>
<td>- ROI</td>
</tr>
<tr>
<td>- Crop planning</td>
<td>- Crop advisory</td>
</tr>
</tbody>
</table>
Skeptical and/or Fearful of the New Technology – 65%

- The biggest concern is misuse of farm data by:
  - The ATPs
  - Activist groups
  - Grain traders
  - The government
  - Computer hackers
- Fear that it favors the large farmers.
- Prescriptions will recommend only some products, i.e., are biased.
- It doesn’t work. Agriculture is a complex biological system.

Neutral or Nuanced in Attitudes – 19%

- It has potential, but must be implemented carefully.

Embracing the New Technology – 16%

- The technology is here to stay. Let’s embrace it and make it work for us.
- No one that is highly profitable today is doing it with only their own ideas and crop data.
Farmer Groupings

These farmers don’t need help.

These farmers need technical information and support.

These farmers will eventually follow.

2.5% Innovators
13.5% Early Adopters
34% Early Majority
34% Late Majority
16% Laggards

Source: The Hale Group and LSC International

These farmers don’t need help.
These farmers need technical information and support.
These farmers will eventually follow.
Policy Issues Receiving Major National Attention

- Farmer ownership of data
- Farmer control of data
- Disclosure of data usage
- Farmer choice for use of data
- Portability of data
- Security from misuse
- No vulnerability to FOIA
- Compatibility of systems
- Protection of GPS
- Regulation of UAVs
- Use of aggregated data
- Consistency of agreements
- Simple language
- Transparency and consistency

Farmers expressed concern about all of these issues.
Guidelines governing data ownership and usage between:

- Land owners and renters (or farm management companies)
  - *Cash rental agreements*
  - *Share crop agreements*

- Farm operators and ag retailers

- Farm operators and other service providers
  - *Chemical and fertilizer applicators*
  - *Custom harvesters*
  - *Drone services*
  - *Crop consultants*

- Current land renters *versus* potential land renters

**All of these relationships need guiding principles.**
Mapping the Technology
A Technology Map in the form of a 3x6 matrix has been developed to present a sample of the very large number of products, services and technologies being offered to the market.

The Horizontal Axis includes 6 categories of products and services.

The Vertical Axis includes 3 key Technology Drivers.

A sample of companies is presented to illustrate the activity in each of the 18 cells in the matrix. Due to the range of products and services offered a company may appear in several cells.

Each of the vertical cells tends to be a highly specialized silo with sophisticated products and services being developed for specific applications. This drives the high level of complexity experienced at the farm level.
The Technology Map is designed to present companies in the appropriate cells based on their offerings and position in the market.

### Products and Services

<table>
<thead>
<tr>
<th>Precision Ag Equipment</th>
<th>Data Warehouse</th>
<th>Ag Retailer Software</th>
<th>Smart Data Deterministic Models</th>
<th>Probabilistic Models</th>
<th>Farm Enterprise System</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technology Drivers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Generation &amp; Capture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cloud &amp; Computer Processing Capacity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delivery Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: The Hale Group, LLC and LSC International, Inc.
Technology Drivers are captured under three major categories. Below are the sub-categories that create each major driver.

**Data Generation & Capture**
- Sensors
- Machine Data
- Yield Data
- Geospatial Data
- Weather Data
- Imagery

**Cloud & Computer Processing Capacity**
- APIs
- Visualization
- Analytics
- Security
- Encryption
- Aggregated Data

**Delivery Systems**
- Mobile Devices
- Decision Support Models and Apps
- Benchmarking
- Prescription
- Agriculture

*Science & Physics Driven*  
*Moore’s Law Driven*  
*Annual Crop Cycle Driven*
## Technology Drivers

**Data Generation & Capture**
- John Deere
- Trimble/Case IH
- Raven
- 640 Labs
- Ag Leader

**Cloud & Computer Processing Capacity**
- MyJohnDeere.Com
- Trimble
- Ag Leader

**Delivery Systems**
- Trimble
- BASF

Includes:
- On Farm Data
- Telematics
- Yield Monitors
- Smart Machines
- Precision Ag Tools

---

Source: The Hale Group, LLC and LSC International, Inc.
Progress Report – Not for Distribution
Copyright © 2014 by The Hale Group, Ltd.
## Data Warehouse

<table>
<thead>
<tr>
<th>Technology Drivers</th>
<th>Data Warehouse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Generation &amp; Capture</td>
<td>- Geosys-Land O’ Lakes&lt;br&gt;- GeoVantage&lt;br&gt;- SST Software</td>
</tr>
<tr>
<td>Cloud &amp; Computer Processing Capacity</td>
<td>- Winfield Data Silo&lt;br&gt;- Mapshots&lt;br&gt;- Amazon&lt;br&gt;- SST Software</td>
</tr>
<tr>
<td>Delivery Systems</td>
<td>- Answer Tech: R7+Apps+Climate Pro&lt;br&gt;- Mapshots&lt;br&gt;- SST Software</td>
</tr>
</tbody>
</table>

Includes:
- Cloud stored data
- Storage of farm data from many sources used for decision-making and data sharing

Source: The Hale Group, LLC and LSC International, Inc.
## Ag Retailer Software

### Products and Services

<table>
<thead>
<tr>
<th>Technology Drivers</th>
<th>Ag Retailer Software</th>
</tr>
</thead>
</table>
| Data Generation & Capture | - SST Software  
- Ag Junction  
- SMS-Ag Leader  
- Premier Crop  
- Raven |
| Computer Processing Capacity | - SST Software  
- Ag Junction  
- Premier Crop  
- Raven |
| Delivery Systems | - Ag Retailer agronomists: SST  
- Farmer’s crop advisors: Premier Crop |

Specialized software packages used by ag retailers & advisors to serve farmers and for internal logistics & work orders.
## Smart Data Deterministic Models

### Products and Services

<table>
<thead>
<tr>
<th>Technology Drivers</th>
<th>Smart Data Deterministic Models</th>
</tr>
</thead>
</table>
| Data Generation & Capture | • Farmer Data to Vendor Cloud  
• Seed company data  
• Public Data-Weather & Soils  
• Market Data |
| Computer Processing Capacity | • DuPont Pioneer-Encirca *  
• 360 Yield Center  
• My Farms |
| Delivery Systems | • Encirca-DuPont Pioneer *  
• My Farms  
• Beck’s Seed |

* Elements of the Encirca model are probabilistic

- Smart Data is good quality, corrected farm data
- Key variables with point estimates based on averages

Source: The Hale Group, LLC and LSC International, Inc.
Progress Report – Not for Distribution
Copyright © 2014 by The Hale Group, Ltd.
## Probabilistic Models

### Products and Services

<table>
<thead>
<tr>
<th>Technology Drivers</th>
<th>Probabilistic Models</th>
</tr>
</thead>
</table>
| **Data Generation & Capture** | - Farm Link/True Harvest  
- The Climate Corp  
- AGSOLVER |
| **Computer Processing Capacity** | - The Climate Corp  
- Farm Link/True Harvest  
- IBM  
- Farmer’s Business Network |
| **Delivery Systems** | - Farm Link/True Harvest-Benchmark  
- Climate Basic  
- AGSOLVER  
- Farmer’s Business Network |

• Outcome is a probability distribution.  
• Models learn over time.  
• Data science is a critical input.

Source: The Hale Group, LLC and LSC International, Inc.
## Farm Enterprise System

### Data Generation & Capture

- Integrated software applications with a common process. Includes:
  - planning
  - purchasing
  - field operations
  - inventory
  - marketing
  - accounting & financial

### Computer Processing Capacity

- Farmer current vendors and buyers
- Farm accounting system
- Machine Data in future
- Ag Retailer Data

- Conservis
- Granular
- Farmlogs
- MyAgCentral

### Delivery Systems

- Advisors to farmer
- Vendor IT customer support

Source: The Hale Group, LLC and LSC International, Inc.
Our Assessment is based on each companies **Completeness of Vision and Ability to Execute**.

- **Leaders** execute well against their current vision and are well positioned for tomorrow.

- **Visionaries** understand where the market is going or have a vision for changing market rules, but are still at an early / beta stage.

- **Niche Players** focus successfully on a defined segment.

- **Challengers** are executing on their vision but still need to establish a position in the market.

Source: Definitions by Gartner as modified by THG and LSC for this project.
Assessment of Key Players

Completeness of Vision

Challengers
- AGCO
- CaseIH
- Mapshots
- Raven
- Trimble

Leaders
- Deere & Co.
- Dupont / Pioneer
- Monsanto / TCC
- SST Software
- WinField / LOL

Niche Players
- AgJunction
- AgLeader
- Conservis
- GeoVantage
- MyFarms

Visionaries
- AGSOLVER
- Beck’s Hybrids
- Farm Link / True Harvest

Source: The Hale Group, LLC and LSC International, Inc.
Company Positioning & Business Models
Data is a strategic focus for JD with about 600-800 staff for this effort and about $1 Billion investment. Target 20%+ of total revenues.

Have been focused on data capture from the JD machines with a proprietary system being developed:
- Machine data is for JD internal use only
- With farmer permission, production data can be shared with others

Open to partnering with whoever wants to partner – conditions of the agronomic partnerships are not public at this point.

JD is not an agronomic company and does not provide agronomic advice to its customers. Dealers may have agronomists at the local level. MyJohnDeere.com and dealers are the connection to farmers.

Future priorities are further development of wireless data collection and use of sensors for in-season crop management.

In August a new set of Data Privacy policies were announced.
New data-based services are a strategic priority for Pioneer with a target of $500 million in 10 years.

It is estimated that 100-200 staff are devoted to this effort including Encirca and Mapshots.

The Encirca service business is separate in the U.S. from the Seed sales system and is brand neutral for seed and equipment.

Encirca is focused on the technical and economic aspects of farming with the positioning being to have an impact on productivity and profitability.

A substantial amount of the backend has been developed with public and private sector partners. Data collection is via equipment partners and the Encirca sales agents.

Data Privacy Policies have not changed since 2012. Grants Pioneer a license to the data.
Dupont Pioneer: Backend and Frontend

- Farmer data via Deere
- DTN
- USDA & Universities
- Pioneer Agronomy & Encirca Tech
- AGCO & Raven

Dupont Pioneer

- Encirca Sales Agents
- Encirca.pioneer.com
- Pioneer Seed Agents

Farmers
The Monsanto-Climate Position

- Major strategic priority for MON with about $1.25 Billion invested and over 400 staff.

- Key elements of the approach are (1) Measurement of the farming world; (2) Proprietary Models; (3) Tools to deliver insights and recommendations to farmers. Wish to compete on the basis of tools and apps. Do not benchmark. Want a very open system.

- Most of the data used is public or Monsanto proprietary but the models will work better with actual farmer data.

- Route to market is via the ag retailers who sell seed and CPC.

- Willing to collaborate with everybody – even competitors.

- Data Privacy policies revised in June: no longer a license. Restrictions on sharing within or outside MON.
Monsanto-Climate: Backend and Frontend

Climate Corp
- 2-300 IT staff
- Precision Planting
- Monsanto Seed Group
- AgGateway & OADA
- Case IH

Climate Corp.

Helena GrowMark CPS
- Climate Agronomy Reps
- Climate.com
- WinField LOL
- Crop Insurance Agents
- Ag Retailers

Farmers
SST is technology company focused on providing IT technical infrastructure and Data Processing to agronomic service providers at the retail level. Have 75 employees and in business for 20 years.

Globally touch 100+ million acres with 82 million acres in the U.S.

Fertility models for ag retailers and local co-ops are a key product – can be customized for each retailer and put under a private label.

Data Privacy: “Whoever puts the data into the system is the Administrator and thus controls the data.” Would like to see farmers take data ownership, but that is not likely to happen soon.

Customers can “opt-in” for data aggregation and a benchmark system has been developed.

AgX is new system that overcomes the current issues with lack of standards, incompatibility, and fragmentation of services to farmers.
SST Software: Backend and Frontend

- SST Software (75-100 staff)
- Data Warehouse
- AgX Platform
- Raven Slingshot
- AgGateway

SST Software

Ag Retailer A
Ag Retailer B
Helena
Crop Consultants
Co-op A
Co-op B

Farmers
WinField is the leading customer for the major seed companies except Pioneer. Support for the seed and proprietary product businesses.

Major moves have been the purchase of Geosys, R7 and the recently announced Answer Tech portal and app store, WinField Data Silo, and Climate Pro by WinField.

The route to market is via the local cooperatives with a dedicated team using a “training the trainer” approach. Are supporting the retailers in introducing the technology to the largest growers.

Use remote data (Geosys) and public data to start the conversation with the farmer and identify management zones.

The business model is evolving.

The WinField polices have not been disclosed because they are considered confidential B2B agreements.
WinField: Backend and Frontend

- Climate Corp
- Geosys Answer Plot R7 Tool
- Answer Tech Winfield Data Silo
- AgGateway
- OADA

WinField/Land O’Lakes

- Co-op A
- Co-op B
- WinField.com
- Ag Retailer A
- Ag Retailer B

Farmers
Farmers need solutions with clear value.

<table>
<thead>
<tr>
<th>Clear Value</th>
<th>Tools</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Auto steer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Variable rate seeding/fertilizer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aerial imagery</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Telematics</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unclear Value</th>
<th>Current prescription models</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nitrogen management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Farm Enterprise System</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Benchmarking</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yield maps</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UAVs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Local weather</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scouting apps</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Multi-hybrid planting</td>
<td></td>
</tr>
</tbody>
</table>

Source: The Hale Group, LLC and LSC International, Inc.
The companies are attempting to use established business models for the type of service provided and/or models that are well established for other products in the ag sector.

There is a great deal of experimentation currently and a common response is that “our business model is in a state of flux.”

At the farmer level it is difficult to establish the value of the services being offered. Potential sources of value:

- Agronomic Value
- Operational Management
- Logistics
- Regulatory Compliance
- Information Sharing
- Crop Budgeting at sub-field level

It is necessary to define value before sustainable business models can be established.
## Criteria to Evaluate Business Models

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Evaluation Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Economic Value Generated</td>
<td>• Yield increase</td>
</tr>
<tr>
<td></td>
<td>• Reduction of input costs</td>
</tr>
<tr>
<td></td>
<td>• Other cost savings</td>
</tr>
<tr>
<td>• Cost of the Product or Service</td>
<td>• Subscription &amp; software fees</td>
</tr>
<tr>
<td></td>
<td>• Cost per acre with a minimum.</td>
</tr>
<tr>
<td></td>
<td>• Share of value generated</td>
</tr>
<tr>
<td></td>
<td>• Share of yield per acre</td>
</tr>
<tr>
<td></td>
<td>• Investment amount</td>
</tr>
<tr>
<td>• ROI for Products and Services</td>
<td>• DCF or economic payback</td>
</tr>
<tr>
<td>• Transparency of Pricing</td>
<td>• No hidden fees or costs</td>
</tr>
<tr>
<td>• Standalone or Tied Product / Service Offer</td>
<td>• Bundled / unbundled with other products or services.</td>
</tr>
<tr>
<td>• Data Ownership, Use and Control</td>
<td>• Farm data: Permission to share</td>
</tr>
<tr>
<td></td>
<td>• Aggregated data: Farmer access</td>
</tr>
<tr>
<td>• Vendor Independence</td>
<td>• Product / service agnostic</td>
</tr>
<tr>
<td>• Software approach by ATP</td>
<td>• Closed proprietary or open source</td>
</tr>
</tbody>
</table>
The “Innovators” indicate that using the best available Digital Technology in combination with high quality data it is possible to achieve a yield gain of 5-10 bushels of corn per acre.

- At $3.50/bushel: Potential of $18-$35 per acre gross
- Yield + input savings: Potential of $43-$65 per acre.
- Less $3-10 per acre for ATP services:
- Potential gain with current Digital Technology: $33-$62 per acre
- These gains are in addition to savings from use of precision planting and application equipment.
Considerations for Strategy Development
Overall Assessment

- This technology will continue to improve rapidly.
- Tech savvy farmers are already adopting it with enthusiasm.
- There is likely to be a major turnover in farm operators due to:
  - The current age of farmers.
  - The prospect of low crop prices for the next several years.
- The farmers that adopt this technology may have an advantage in renting land and will expand.
- There is a significant gap between those farmers who are prepared to adopt this technology and those who are skeptical and/or fearful.

The farmer organizations and the ag retailers should assist their constituents in closing the gap.
The Problems to be Addressed in the Strategy

<table>
<thead>
<tr>
<th>Unequal Market Power</th>
<th>Complexity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers do not have equal negotiating power with major ATPs</td>
<td>Farmers find the hardware, software, and business models hard to understand</td>
</tr>
<tr>
<td>Information asymmetry puts farmers at a major disadvantage</td>
<td>Hardware and software is not fully compatible across ATPs</td>
</tr>
<tr>
<td>There are few places a farmer can turn for detailed information</td>
<td>Many companies are marketing “tools” rather than “solutions”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Legal Obstacles</th>
<th>Unclear Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some user agreements limit farmers’ choices</td>
<td>There is a mixture of fact and hype in the marketplace</td>
</tr>
<tr>
<td>Some legal documents are hard to understand</td>
<td>The economic benefit of some products is not quantified</td>
</tr>
</tbody>
</table>
Four Strategic Questions

1. Will all of the components of Digital Agriculture combine to create a major “inflection point” similar to the introduction of hybrid corn many decades ago?

2. Will Digital Agriculture Technology cause the row crop sector to become integrated, i.e., coordinated through contracts with farm operators by:
   - a few large ATPs, or
   - a handful of large corn and soybean customers?

3. How rapidly will consolidation occur within the row crop sector?

4. Will the sophisticated agronomy models allow computers to provide agronomic advice with little local agronomic input?

All four questions are difficult to answer. We provide our opinions on the following slides.
### Incremental Change or Inflection Point

<table>
<thead>
<tr>
<th>Inflection Point</th>
<th>Incremental Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not likely at this time since the value gain has not been established.</td>
<td>Given rapid changes in Digital Technology and the age profile of farmers an inflection is likely in the 2019-2023 period.</td>
</tr>
<tr>
<td>Most likely for the next 4 years since neither a dramatic breakthrough nor clear value have been developed as yet.</td>
<td>Most likely if the value created is at the current modest level of +/- 5%.</td>
</tr>
</tbody>
</table>

![Graph showing years 0 to 8 with increments of 4 years]
The Case for Integration by Major ATPs

**Likely**
- Major ATPs could help farmers use the new technology.
- Major ATPs already have a substantial integrated seed production system.
- The exit of older farmers will create opportunity for integration.

**Not Likely**
- Improving pork quality was part of the motivation for swine industry integration. ATPs do not have this motivation.
- The asset base for row crop production is much greater than for hog production.
- Volatility of crop prices would create huge risks for ATPs.

At this time we believe full-scale integration by large ATPs providing agronomic prescriptions is not likely in the next 8 to 10 years.
### The Case for Integration by Major Customers

#### Likely
- Some farmers may need help using the new technology. Large corn and soybean users might fill the gap.
- The exit of older farmers will create opportunity for integration.
- Large feed, ethanol, soy processors, and other industrial users could control genetics and quality for greater product consistency and quality.

#### Not Likely
- Large independent farmers will resist such arrangements.
- Weather and the volatility of crop prices creates huge risks for integrators.
- If Prescription Agriculture produces only modest benefit.

Integration by large customers cannot be ruled out if Prescription Agriculture is proven to be successful.
### What Will Be the Rate of Farm Consolidation?

<table>
<thead>
<tr>
<th>Current Speed</th>
<th>Accelerated Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>- If adoption of Digital Agriculture is slow due to complexity human constraints.</td>
<td>- The prospect of low crop prices provides incentives to leave farming.</td>
</tr>
<tr>
<td>- If the ATPs can’t demonstrate value.</td>
<td>- Aging farmers retire and high tech, low cost producers capture land rentals.</td>
</tr>
<tr>
<td>- If the data security issues become more severe.</td>
<td>- This technology is simplifying operations for large-scale farmers.</td>
</tr>
<tr>
<td>- Caps on total farm payments under Farm Bill may limit consolidation in low price environment.</td>
<td>- Large farmers can hire people with specialty skills, e.g., IT and agronomy.</td>
</tr>
<tr>
<td></td>
<td>- The data privacy fears and concerns are mitigated through company action and experience.</td>
</tr>
</tbody>
</table>

We believe that because of Moore’s Law, the technology will develop quickly and farm consolidation will accelerate.
How far will this trend go?

Obviously the actual trend is not a straight line – the graphic is directional only. It’s too early to tell how far this technology will go.
The role of the Farmer Organizations is defined by their ability to respond to the needs of members and to provide leadership on emerging issues facing the members. The Status Quo Risks are:

- A **loss of relevance** if the organization is seen to be behind the times on an emerging issue that will have a major impact on the structure of farming.

- A **perception that the organization lacks** the determination, skills, resources, and knowledge to deal with a very complex and dynamic situation.

- **Being slow to react** and thus lose the opportunity to shape the introduction of the new technologies in a fair and equitable manner.

- The **loss of the most progressive members** who migrate to other organizations and structures providing leadership on the issues of the new technologies.
The Risk of the Status Quo for Ag Retailers

The new technology will change the way farming is conducted and the way agronomic advice is provided. Therefore, the greatest risks to ag retailers is:

- The “balance of power” for agronomic advice may shift to the seed / biotech companies from local ag retailers.
- New service opportunities will become available to those ag retailers who are far-sighted.
- Unless they are proactive, ag retailers could become “the UPS for farmers” – a logistics company with minimal service offerings.
- Ag retailers will continue to consolidate, and non-aggressive retailers may be forced to exit.
- Very large farms will continue to bypass ag retailers.
When thinking about the resources needed to implement a strategy, most people think of money.

Some of the following strategic initiatives do, indeed, require money to implement.

However, another asset that AgState members have that can and should be deployed to implement the strategy is…

**… INFLUENCE**

AgState should not underestimate the power of its collective influence as organizations that represent the farmers of Iowa.

Furthermore, AgState should develop a plan to solicit the support and collaboration of similar organizations in other states as well as the national organizations with which they are associated.

A collective “voice” backed by collaborative action is a major strength.
A Farmer-Centric Strategy
American row crop producers that are globally competitive, through continuously increasing yields, reducing costs, and protecting the earth, while maintaining their business independence, choosing among many input products and services, and controlling the use of their farm-specific data.
Mission of AgState Members for Digital Transformation

To assist Iowa farmers during the Digital Transformation of Agriculture while fostering a business environment that is highly competitive and provides farmers with many business options.

To assist Iowa ag retailers to: (1) capitalize on the new business opportunities; and (2) mitigate the threats to a strong rural business environment posed by Digital Transformation.
Five Components of a Farmer-Centric Strategy

A Farmer-Centric Strategy

- Education
- Data Warehouse
- Assessment
- Technology Pull
- Research
Five Strategic Initiatives

1. **Education**: Provide continuous, on-going education for farmers, ag retailers, other local businesses, and policy makers that will enable them to make informed decisions.

2. **Data Warehouse**: Create an independent, farmer-controlled data warehouse for farm level data and aggregated agronomic data which can be used to better serve farmer participants.

3. **Assessment**: Create mechanisms to provide an assessment of the many products, services, and business models in the market while promoting uniform, agreed-upon industry standards and guidelines.

4. **Technology Pull**: Drive a “technology pull” strategy focused on products and services that provide solutions to farmer problems rather than just complicated tools.

5. **Research**: Create a center for inter-disciplinary research that will position Iowa farmers to be at the cutting edge of digital technology for generations to come.
Initiative #1 – Educate Farmers, Ag Retailers, Local Businesses, Policy Makers

Provide continuous, on-going education for farmers, ag retailers, other local businesses, and policy makers that will enable them to make informed decisions:

a. Distribute The Hale Group report.
   - *Short and long PowerPoint presentations*
   - *Executive Summary Report*
   - *Short articles*

b. Conduct state-wide and regional workshops and webinars for farmers, ag retailers, and other businesses on Digital Agriculture:
   - *Intensively in 2015*
   - *Addressing new topics thereafter*

c. Provide the AgState Board with regular updates on the Digital Transformation of Agriculture developed for this project.
Provide continuous, on-going education for farmers, ag retailers, other local businesses, and policy makers that will enable them to make informed decisions:

d. Create short videos on specific topics:
   • Provide short videos on a specific topic so farmers and retailers can learn and apply the knowledge immediately.

e. Educate State and Federal policy makers
   • Provide timely information about Digital Agriculture to policy makers on any issues which affect farmers and the rural economy.
The emerging technology is highly complex and changing rapidly.

Not all farmers and local businesses are equipped to learn the technology and adopt it in their business without assistance.

The demographics of the Iowa farmer population presents a major challenge since older farmers need to learn several new skills in a short period of time or will miss out on the next wave of technology.

This is an area of potential collaboration and cooperation with the ATPs.

Farmers and ag retailers will expect their organizations to assist them in this way.

Of all of the potential actions that AgState members could take in response to the emerging technology, educating its constituents is the “no-brainer.”
## Pros and Cons of Initiative #1

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Given the complexity of the subject, information and education is critical.</td>
<td>The cost of monitoring new technical and commercial developments in the area will be considerable.</td>
</tr>
<tr>
<td>The issue of data use and confidentiality is a much larger societal issue – not just an agricultural issue.</td>
<td>A dedicated education staff will be required due to the specialized nature of the subject matter and very broad needs.</td>
</tr>
<tr>
<td>Therefore, agriculture may be able to “piggy back” on the broader societal concerns to achieve many of its objectives.</td>
<td>The development of a funding formula will not be easy.</td>
</tr>
<tr>
<td>The agricultural sector has proven itself to be very effective in policy advocacy.</td>
<td></td>
</tr>
</tbody>
</table>

Given the complexity of the subject, information and education is critical.

The issue of data use and confidentiality is a much larger societal issue – not just an agricultural issue.

Therefore, agriculture may be able to “piggy back” on the broader societal concerns to achieve many of its objectives.

The agricultural sector has proven itself to be very effective in policy advocacy.

The cost of monitoring new technical and commercial developments in the area will be considerable.

A dedicated education staff will be required due to the specialized nature of the subject matter and very broad needs.

The development of a funding formula will not be easy.
Create an independent, farmer-controlled data warehouse for farm level data and aggregated agronomic data which can be used to better serve farmer participants.

a. Develop guidelines for the ownership and use of data among land owners, farm operators, ag retailers and local businesses.

b. Define the scope and scale of the agronomic data sets currently held by farmers, ag retailers and their software providers.

c. Define the costs and capital requirements for the establishment of a cloud based data warehouse for farmers that is coordinated with ag retailers. Potential options include SST and Amazon Web Services.

d. Evaluate business structures that would enable both farmers and ag retailers to collaborate in an independent data warehouse entity.
Initiative #2 – Create a Grass Roots Data Warehouse

Create an independent, farmer-controlled data warehouse for farm level data and aggregated agronomic data which can be used to better serve farmer participants.

e. Develop a set of Privacy, Use and Control polices that fully protect the interests of the farmer while providing a high level of security.

f. Establish the required API’s to facilitate access on a permission basis for trusted advisors and ATPs.

g. Prepare a pilot program that could be tested in 2016 with at least several hundred farmers.

h. Develop a strategy to optimize the value of local data if the results of the pilot project are positive and establish feasibility.
Farmers and ag retailers would have far more negotiating power with the ATPs if they created an independent data warehouse for both farm and ag retailer data.

The development of standard guidelines regarding data ownership and usage between land owners, farm operators, and local businesses could preempt costly litigation and avoid inappropriate court decisions.

Much of the ag retailer agronomic data has already been standardized by a small handful of software companies that serve the ag retailers, e.g., SST Software.

With farmer ownership participation in a data warehouse, the guidelines for use and control of data would be favorable to farmers.

Anonymous data potentially could be monetized on behalf of farmers on a scale that could not be done by individual farmers.
## Pros and Cons of a Farmer-Friendly Data Warehouse

**Pros**

- The farmer will have full control of the farm data and can allow access by a permission system.
- Provides legal clarity for local relationships with regard to data related issues.
- Farmers can aggregate their data both for benchmarking and potentially sale to third parties.
- The farmer will be independent of vendors with regard to data storage and security.
- The costs of a data warehouse are likely to decline over time.

**Cons**

- The ownership and control of farm data at the retailer level is not well defined at this time which could be a source of conflict.
- A broad agreement between retailers who compete with each other and farmers will be required to achieve scale.
- Conflicts could arise over data ownership that lead to years of litigation with uncertain outcomes.
- Other options could be simply easier for farmers to use.
Create mechanisms to provide an assessment of the many products, services, and business models in the market while promoting uniform, agreed-upon industry standards and guidelines.

a. Create a website where farmers share their assessment of specific Digital Agriculture tools similar to Amazon’s book evaluation.

b. Create a mechanism for timely technical assessment for complex products and services similar to the Nebraska Tractor Test, Profi in Germany or Underwriters Laboratory.

c. Engage with companies at early development stages so that the products launched receive early, practical feedback and reflect farmer priorities.

d. Create a mechanism for estimating the economic value of products and services to farmers.
Initiative #3 – Evaluate Products, Services, Business Models

Create mechanisms to provide an assessment of the many products, services, and business models in the market while promoting uniform, agreed-upon industry standards and guidelines.

e. Evaluate alternative business models used by industry participants in terms of clarity, benefits provided, and fee structure.

f. Simplify the technology through collaboration with standards organizations such as AgGateway and OADA.

g. Provide an assessment of the farmer-friendliness of legal documents used by manufacturers and service providers, by collecting, analyzing, and scoring the documents.
Farmers need an easy-to-use source to get a reliable assessment of a vast array of products and services.

This website would provide a standard set of criteria for assessing products and services, such as:

- Delivery of promised benefits
- Ease of use
- Compatibility with other tools or equipment
- Limitations of product or service
- Privacy, User and Control Agreements

It would provide the opportunity for evaluators to write unscripted comments, much like Amazon’s book reviews and submit a quantitative assessment – like 1 to 5 stars.

It would set up blogs for farmers to discuss the latest issues and concerns regarding Digital Agriculture.
### Pros and Cons of Farmer Evaluation

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>No farmer can experiment with every product or service available in the marketplace.</td>
<td>The set-up cost could be significant to be sure an effective system was developed.</td>
</tr>
<tr>
<td>Collectively, farmers can be an invaluable source of information and insight for each other.</td>
<td>On-going maintenance costs will be required.</td>
</tr>
<tr>
<td>Farmers trust farmers more than sales personnel.</td>
<td>One more website in an information overload environment.</td>
</tr>
<tr>
<td>Thousands of farmers evaluating tools would be a formidable force that prompts corrective action by manufacturers and service providers.</td>
<td></td>
</tr>
</tbody>
</table>
Some tools should be assessed on a highly technical basis that goes beyond the competence of any farmer, such as:

- Are yield monitors accurate under all conditions, e.g., high and low yields?
- Do agronomic models provide unbiased advice?

An organization like the Nebraska Tractor Trials is a good model for what farmers need.

- Third-party testing of technical issues.

At present, only a few products can document their economic benefit to the farmer.

Farmers need sound economic analysis to guide decision making on whether to adopt or not adopt new tools.

Farmer organizations could encourage farmers to pressure manufacturers and service providers to seek approval.
## Pros and Cons of Technical and Economic Evaluation

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers need assurance of accuracy.</td>
<td>The design and set up cost would be substantial.</td>
</tr>
<tr>
<td>Farmers need assurance of no “built-in bias.”</td>
<td>Manufacturers and service providers may resist.</td>
</tr>
<tr>
<td>Competent testing at a technical level will save farmers hundreds of millions of dollars.</td>
<td></td>
</tr>
<tr>
<td>Economic assessment is done much more economically for all farmers collectively than as individual farmers.</td>
<td></td>
</tr>
<tr>
<td>The economic benefit is the “bottom line.”</td>
<td></td>
</tr>
</tbody>
</table>
Business models and legal documents are currently in a state of flux.

Even the companies themselves are unsure of how they will charge for their products and services in the future.

At present it is not easy to compare the costs and benefits of alternative products and services across competitors.

Some business models currently on the market are fairly complex.

Some are easy to read and some are long documents in complex legalize language.

At present it is not easy to understand what a farmer is agreeing to when signing some documents.

With the shift from Analog to Digital the traditional handshake approach is no longer viable for important farmer data and documents.
## Pros and Cons of Business Models and Legal Documents

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers need assistance in evaluating business models and legal documents.</td>
<td>The cost could be significant since a high level of specialization will be needed due to complexity and rapidity of change.</td>
</tr>
<tr>
<td>Assessment by one centralized agency will allow a valid comparison across many competitors.</td>
<td></td>
</tr>
<tr>
<td>It will be more cost effective to have the task done for all farmers.</td>
<td></td>
</tr>
<tr>
<td>The agreements can be scored in a standard manner so the farmer understands the implications of what is being agreed.</td>
<td></td>
</tr>
</tbody>
</table>
A critical characteristic of the assessment organization is that it is heavily farmer funded to provide independence and objectivity.

Specialized staff will be required to deal with the technical, farm operations, economic and legal complexities.

The assessment organization must have no conflict of interest and avoid all appearance of conflict of interest.
Drive a “technology pull” strategy focused on products and services that provide solutions to farmer problems rather than just complicated tools.

a. Conduct focus groups and surveys to identify the key “pain points” for farmers which are not being addressed by the ATPs.
   - *Farmers decide by electronic ballot what is most needed*
   - *Define categories of products and services of most interest for farmers.*

b. Conduct outreach to the Tech Community and ATPs so that the needs of farmers are understood and can be taken into account during the design and development phase for new products and services.

c. Evaluate the potential for a “Challenge Award” process as a way to influence the direction of new technology development.
The problems and pain points are best defined by farmers as the users of the technology.

The incompatibility between products and services being offered could be the initial focus of this initiative. This would be a way to help the vendors understand the implementation challenges and problems faced by farmers.

The industry tends to offer “tools” rather than “solutions” so a strong focus could be put on the development of solutions with substantial embedded knowledge.

The “challenge award” approach is an effective way to broaden the sources of technology and is tool or solution-agnostic, defining the challenge and incentivizing many teams to find the most effective tool or solution.
## Pros and Cons of Initiative #4

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>- This will allow farmers to have a significant voice in the technology that is developed by ATPs and others.</td>
<td>- The ATPs continue to be technology driven and do not respond.</td>
</tr>
<tr>
<td>- Puts the Ag State organizations at the center of the technology discussion.</td>
<td>- A deep understanding of the technology is required to effectively communicate with the ATPs.</td>
</tr>
<tr>
<td>- A “Challenge Award” approach can be tested to determine the level of interest and impact.</td>
<td>- Funding will be required to support the “Challenge Award” approach.</td>
</tr>
</tbody>
</table>
Initiative #5 – Create an Institute for Advanced Farming

Create a center for inter-disciplinary research that will position Iowa farmers to be at the cutting edge of digital technology for generations to come.

a. Commence the Development of an Institute for Advanced Farming that would be based on the White House Policy to create six large Innovation Institutes in the Agriculture Sector using the public-private partnership model. Leadership by ISU.

b. Define an inter-disciplinary research platform that includes Digital Agriculture, computer engineering, sensors, robotics, chemistry, genetics, genetic engineering, genomics, phenomics, and other non-traditional disciplines, supported by advanced simulation and predictive computer models.

c. Conduct an Advanced Farming Workshop at ISU that would bring together all of the interested stakeholders from within the University and across the State of Iowa under the sponsorship of Dr. Steven Leath, President of ISU, Dean Wendy Wintersteen, and Secretary Bill Northey.
Initiative #5 – Create an Institute for Advanced Farming

Create a center for inter-disciplinary research that will position Iowa farmers to be at the cutting edge of digital technology for generations to come.

d. Position the Advanced Farming Institute as the equivalent of the US Advanced Manufacturing Institutes which focus on the development of new opportunities in that sector.

e. Obtain the support of the USDA and the active support of Secretary Vilsack for this initiative. This will require an updating of the PCAST study done in 2012 before the importance of the Digital Transformation of Agriculture became apparent.

f. The Ag State members adopt a coordinated approach for this initiative and raise specific funding to support the development of an Institute at ISU.

g. Obtain the support of the National Farm Organizations since the research conducted at the Institute will be applicable across the Midwest Region.
There is a consensus that the Digital Transformation of Agriculture is going to be the next major technological driver.

The development of new digital technologies will shape both farming practices and the many research disciplines which support the Agricultural Sector.

The establishment of an independent data warehouse would provide a key resource for future research.

Given the many challenges facing Agriculture there is a need to focus on new approaches based on the exponential growth of computer capability, the shift from analog to digital and the combinatorial opportunities between disciplines.

To keep Agriculture at the cutting edge for new technologies and to assure a socially acceptable balance between long term productivity gains and environmental sustainability.
## Pros and Cons of Initiative #5

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>- To fully understand and develop the opportunity presented by Digital Agriculture a large scale multi-disciplinary approach will be required.</td>
<td>- The lack of understanding by policy makers regarding the opportunity for Digital Agriculture will present a real challenge.</td>
</tr>
<tr>
<td>- ISU and the State of Iowa can become global leaders in the Digital Transformation of Agriculture.</td>
<td>- To have a major impact, substantial financial and human resources will be required – hundreds of millions of dollars and staff who are in very high demand.</td>
</tr>
<tr>
<td>- Federal Policy is supportive and it fits with the Public-Private Partnership model.</td>
<td>- It is likely that other major agricultural states and land grant universities will be competitors assuming a competitive bidding process for funding.</td>
</tr>
<tr>
<td>- The Ag State members can establish leadership on a very important strategic issue for U.S. Agriculture.</td>
<td></td>
</tr>
</tbody>
</table>
1. Educate Constituents
2. Create Data Warehouse
3. Assess Products & Services
4. Create Technology Pull
5. Develop Advanced Farming Institute
### High Level Resources: Annual Budget Estimated Costs

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Launch Period</th>
<th>Establishment</th>
<th>Critical Mass Long-Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1: Education</td>
<td>2 FTE $400K</td>
<td>2 FTE $500K</td>
<td>2 FTE $750K</td>
</tr>
<tr>
<td>#2: Data Warehouse</td>
<td>5 FTE $1.25 MM</td>
<td>10 FTE $2.5 MM</td>
<td>20 FTE $5.0 MM</td>
</tr>
<tr>
<td>#3: Technical Evaluation</td>
<td>3 FTE $750K</td>
<td>5 FTE $1.25 MM</td>
<td>5 FTE $1.5 MM</td>
</tr>
<tr>
<td>#4: Technology Pull Program</td>
<td>1 FTE $250 K</td>
<td>2 FTE $500 K</td>
<td>2 FTE $750 K</td>
</tr>
<tr>
<td>#5: Advanced Farming Institute</td>
<td>2 FTE-Core $500K</td>
<td>10 FTE-Core $2.5 MM</td>
<td>10 FTE-Core $2.5 MM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$3.15 MM</td>
<td>$14.75 MM</td>
<td>$33 MM</td>
</tr>
<tr>
<td>TOTAL: $/year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL: FTE</td>
<td>13 FTE</td>
<td>29 FTE</td>
<td>41 FTE</td>
</tr>
</tbody>
</table>
## Responsibility for Implementation

<table>
<thead>
<tr>
<th>No.</th>
<th>Initiative</th>
<th>Initiative Leader</th>
<th>Strong Support Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Education</td>
<td>Farmer Organizations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ag Retailer Orgs</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Data Warehouse</td>
<td>Farmer Organizations</td>
<td>Ag Retailers</td>
</tr>
<tr>
<td>3</td>
<td>Evaluation of Products, Services, and Models</td>
<td>Farmer Organizations</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Technology Pull Incentives</td>
<td>Farmer Organizations</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Advanced Farming Institute</td>
<td>Iowa State University Iowa Dept. of Ag</td>
<td>Farmer Organizations Ag Retailer Orgs</td>
</tr>
</tbody>
</table>
Digital Transformation will create structural change in American agriculture.

We’re in the 2nd inning.

Farmers are still able to help shape the outcome.

This project must now “pivot quickly” to include national organizations and other state organizations.

The period between today and the hiring of full-time personnel to execute these initiatives is “the valley of death.”

This is not the end. It is the end of the beginning.
Thank you