Value Examples of IoT in Agriculture

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Topcon Agriculture
Agriculture, after Construction, is the Last Trillion Dollar industry to go **Digital Agriculture**
OT + IT = IoT

Operations Technology + Information Technology = Internet of Things

Source: Building the Internet of Things; Maciej Kranz
VIRTUAL FARM AS “DIGITAL TWIN”

Cloud-Based Analytics

April May June July August September October

TOPCON Agriculture

Kansas State University
Standards enable Data Interoperability
Data Streams beginning to flow to Data Lakes
From a single machine to a System of Connected Vehicles

- **Vehicle Mgmt**
- **Guidance**
- **Yield Monitoring**
- **Fleet Mgmt**
- **M2M, ISObus, TIM**
- **Application Control**
- **Farm Mgmt**
- **Autonomy**
- **Analytics**

**Agriculture Evolution**

- **Optimization of a Single Machine**
- **Efficiency by Agronomic Process**
- **Ecosystem Integrated by Precision Ag Data Flow**

**Phases**

- **Phase 1**
- **Phase 2**
- **Phase 3**

**Time**

**Categories**

- Tractor & Implement Sprayer Harvester
- Tractors, Harvesters Crop Protection & Hay & Forage
- All Vehicles and Systems
Steps to «Servitization»

**REACTIVE CARE**
- Fleet Management
- Maintenance
- Geofencing & Curfew
- On/Off Report
- Performance Report
- Automatic Reporting
- Fuel Consumption
- Engine parameters

**PROACTIVE CARE**
- Machine monitoring
- Maintenance alerts
- Schedule & Interval Management
- Warnings before Failure

**PREDICTIVE CARE**
- Predictive maintenance
- Predictive repairs
- Predictive Fulfillment

**FULLY INTEGRATED CARE**
Improve the Customer Experience

Reduce Costs and Deliver Better Service

Create Higher-margin Service Revenue

Transforming Service Centers into Profit Centers
TAP Remote Support

Benefits to Dealer & End User

- Improved Access during tight time windows
- Minimized time to resolution through control
- Reduce need for In Field support
  - Cost of an In Field support call
- Perform support diagnostics and training
- Improves dealer ability to serve the customer
TAP Fleet

Benefits of Logistics dashboard

- Monitor fleet in near real-time
- Create fleet operations reports
  - Operations, Scheduling, Performance
- GeoFence and curfews for management
- Monitor J1939 and CANBUS parameters
- Ability to measure performance amongst crews, equipment types, benchmarks
- Improved visibility for reduced reaction times
Find a Local Researcher that fits your Thinking & Strategy

Source: Ohio State University’s eFields report
Data and the Ability to Use it as the New Currency and the Chance to Create a defensible advantage in Value Chain

- Are you & your Business Ready
- Does it Fit to your Revenue Model?
- Are Your Customers Ready?
- How does it fit your Plan for Growth?
Extending sensor and data collection
To Visualizations & Insight from Aggregated Data Layers
Extending sensor and data collection Aggregated Data Layers to make Actionable Operational Decisions
Example of Precision Feeding Technology

- Inventory Management
- Ingredient Tracking

Real time alerts to farm manager

Pen Feeding
(Indoor, outdoor, guidance to autonomy)
Benefits

1,500 cow dairy in Michigan

- Data provided from TMR Tracker led to in-depth shrink analysis
- Discovered significant loss in handling commodities in shed/bay system so switched to upright bins instead
- Saved 1 semi load of bulk protein/month after switching
- Total savings on JUST protein >$60,000 annually
Easy to Calculate Your Farm Payback

Use this interactive tool found on: www.digi-star.com
Data Visualizations

- Ability to View Machine layers with Agronomics
  - Application Layers or Imagery
  - Prescriptions and Zones
- Machine to Machine coverages
- Guidance Lines
- Customizable Dashboards by User
Ingesting Rx from 3rd party platforms: Xarvio
Harvesting Operation

Requirements for accurate yield data

Combine Yield Monitor
  Needs a scale reading

Grain Cart Scale System
  Can be cal’d against elevator scale
  Moisture and Temp compensated

Backoffice access to data
  Data to go to Trusted Advisors
Topcon Harvesting Focus

Combine

As harvested Yield Maps to send to TAP.

Grain Cart Systems

Automated collection and sending of data
Growers don’t need to think about writing scale info

TAP

Automated receive of harvesting data
Combine
Grain Cart
Automated data cleansing
Telematics for traceability of grain field to bin site or point of sale.
Topcon Agriculture Platform (TAP) for Harvest

Central repository for data driven agriculture

Yield Maps from Combines
Geo-referenced weight data from the grain cart
Automated data cleansing

Next: Ability to submit to Crop Insurance Providers
GT560 and CL55

CL55 is a new connectivity device to stream harvesting data to TAP

- GPS
- Wifi/BLE/Cellular
- Automated data transfer
Water Accumulation v. Yield

Required data:
- Lidar or RTK
- Depression Identification
  - (Various SW providers)
- Yield

Impacts:
- Yield
- Unrealized Costs
- Sustainability

### Table

<table>
<thead>
<tr>
<th>Area of Interest</th>
<th>Acres</th>
<th>Yield (Bu./Ac)</th>
<th>Costs ($/Bu.)</th>
<th>Lost Yield</th>
<th>Unrealized Costs</th>
<th>Correlation</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>32.4</td>
<td>196</td>
<td>$2.55</td>
<td>(16)</td>
<td>($5,118)</td>
<td>84%</td>
<td>($105) ($849)</td>
</tr>
<tr>
<td>Well Drained Depression</td>
<td>8.1</td>
<td>180</td>
<td>$2.78</td>
<td>(42)</td>
<td>($59,240)</td>
<td>93%</td>
<td>($275) ($1,513)</td>
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<tr>
<td>Poorly Drained Depression</td>
<td>5.5</td>
<td>154</td>
<td>$3.25</td>
<td>(133)</td>
<td>($638)</td>
<td>87%</td>
<td>($871) ($1,046)</td>
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<tr>
<td>Deep Depression</td>
<td>1.2</td>
<td>63</td>
<td>$7.94</td>
<td>(196)</td>
<td>($1,019)</td>
<td>87%</td>
<td>($784) ($1,019)</td>
</tr>
<tr>
<td>Pothole, not Farmed</td>
<td>1.3</td>
<td>0</td>
<td>---</td>
<td>(255)</td>
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**Best Case**

<table>
<thead>
<tr>
<th></th>
<th>Bu./Acre</th>
<th>Revenue/Acre</th>
<th>$/Bu.</th>
<th>$/Acre</th>
<th>$/Revenue</th>
<th>%</th>
<th>$/Ac.</th>
<th>$/Area</th>
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<tr>
<td>Yield</td>
<td>130</td>
<td>(5,118)</td>
<td>(59,240)</td>
<td>($331)</td>
<td>(5,897)</td>
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## Water Accumulation v. Yield (3 yrs)

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### Lost Yield

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<th>Yield</th>
<th>Bu./Acre</th>
<th>Costs</th>
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<th>$/Acre</th>
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<tr>
<td>Other</td>
<td>194</td>
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<tr>
<td>8.1</td>
<td>154</td>
<td>$2.45</td>
<td>(59)</td>
<td>(325)</td>
<td>($1,298)</td>
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<tr>
<td>5.5</td>
<td>145</td>
<td>$3.45</td>
<td>(82)</td>
<td>(98)</td>
<td>($394)</td>
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<td>($1,061)</td>
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### Unrealized Costs

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<tr>
<td>Other</td>
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<td>(374)</td>
<td>($794)</td>
</tr>
<tr>
<td>8.1</td>
<td>$1.00</td>
<td>(375)</td>
<td>($795)</td>
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<td>5.5</td>
<td>$5.49</td>
<td>(391)</td>
<td>($415)</td>
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<td>97%</td>
<td>($65)</td>
<td>($2,090)</td>
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<tr>
<td>8.1</td>
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<td>($381)</td>
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### Water Accumulation Areas of Interest

**Primary & Secondary Water Flow**

**Stand Gaps**

**Water Accumulation Areas of Interest**

- Well Drained Depression
- Poorly Drained Depression
- Pothole, not Farmed

[Diagram showing areas of interest with corresponding color coding for water accumulation.]
Connecting the silos

Making it Easier for the Customer

Integrated Platform

- Irrigation
- Crop Care
- Damage
- Fertilization
- Yield Measurement

- Planting
- Irrigation Sensors
- Crop Care Chemical Companies
- Damage Insurance
- Fertilization Chemical Companies
- Banks and traders

Input Providers
Our Vision for Farming.