

Choosing the Right Technology for Your Barn Upgrade or Renovation

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Why Technologies?



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What Technologies...

Can Do

- Enable more precise management at the room, pen, or individual pig level
- Improve human and animal productivity and interactions
- Improve sustainability
- Reduce production costs
- Plug & Play

Cannot Do

- Be fully autonomous, maintenance-free, and perfectly accurate forever
- Differ from what we tell them to do
- Fully replace human caretakers
- Overcome poor husbandry and management

How Tech Can Help With Conversions

- Different housing styles result in different pig behaviors
- Greater overhead costs per individual pig space
- So much walking!

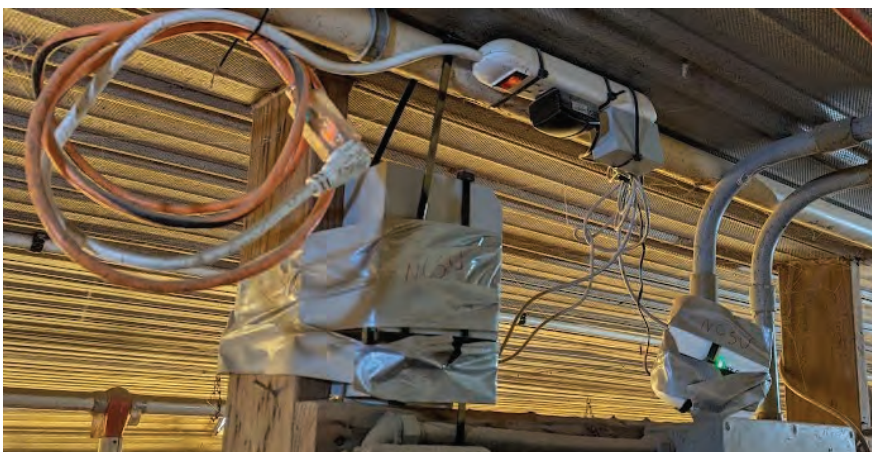


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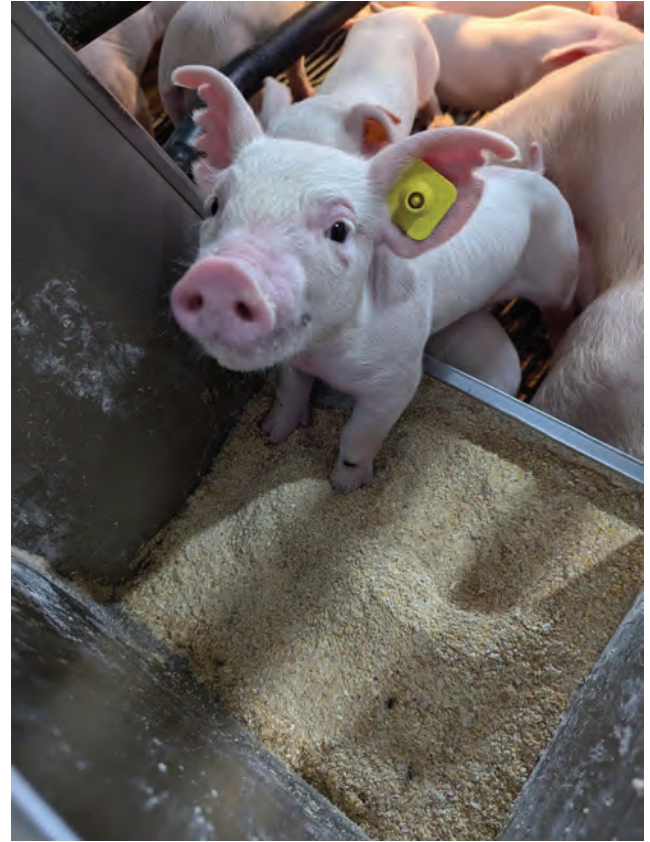
Technologies for Swine

- Outdoor or livestock use
- Know your expected ranges or desired limits
- Connectivity can be challenging



Feed Bin Monitoring

- Commercial Data: audit of 46 barns across 5 Wean-Finish sites
 - 1.3% Feed Outage in Week 1
 - 4.6% Feed Outage in Week 17



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Feed Bin Monitoring

- Estimates amount of feed in bins
 - Sensor type and function vary
 - Lidar, radar, or temperature probes
 - Cannot detect individual feeder clogs
 - Most suspended from top of bin
-
- Can integrate directly with feed mill, alert systems



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Water Meters

- Commercial Data: audit of 46 barns across 5 Wean-Finish sites
1,492 water nipples measured
 - 0.3% no water flow
 - 10% below 1 L/min at first cut
- Detect disease, heat stress, management issues
- Some offer real-time reporting
- Challenges with mineral, iron deposits



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Environmental Management

- Temperature, relative humidity, gas concentrations
- Configured directly into ventilation controller or kept separate
- Automated recording and alerts



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Environmental Management

- Humidity cheaper and more reliable to measure long-term
 - Related to carbon dioxide (CO₂) and ammonia (NH₃) under “normal” operation



DOL 139

- Temperature, relative humidity, carbon dioxide
- 0-10V or 4-20 mA



DOL 53

- Ammonia
- 0-10V

Environmental Management

- Limited lifespan and high purchase cost of most electrochemical gas sensors
- Watch for self-calibration or fresh air purge requirements
- Pressure washing and condensation
- Placement in barn
 - 38 inches above floor for finishers



Records Management Software

- Used to enter and maintain production data electronically
- Reduce or completely replace paper records
- Most use direct electronic entry
- Health, production, husbandry information



PigFlow



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Records Management Software

- Data storage: locally (PC, hard drive) or remotely (on cloud)
- User levels of read-only, editor, owner
- Simultaneous vs one-at-a-time users
- Potential for incorrect entry increases with tech non-natives, fatigue, multi-tasking

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Weight Estimation Cameras

- 3D camera scans pig body shape
- Ceiling mounted above a pen
 - Provides pen average
 - Or, number of pigs ready for market
- Handheld
 - Provides individual pig weight estimate
 - Requires specific pig orientation

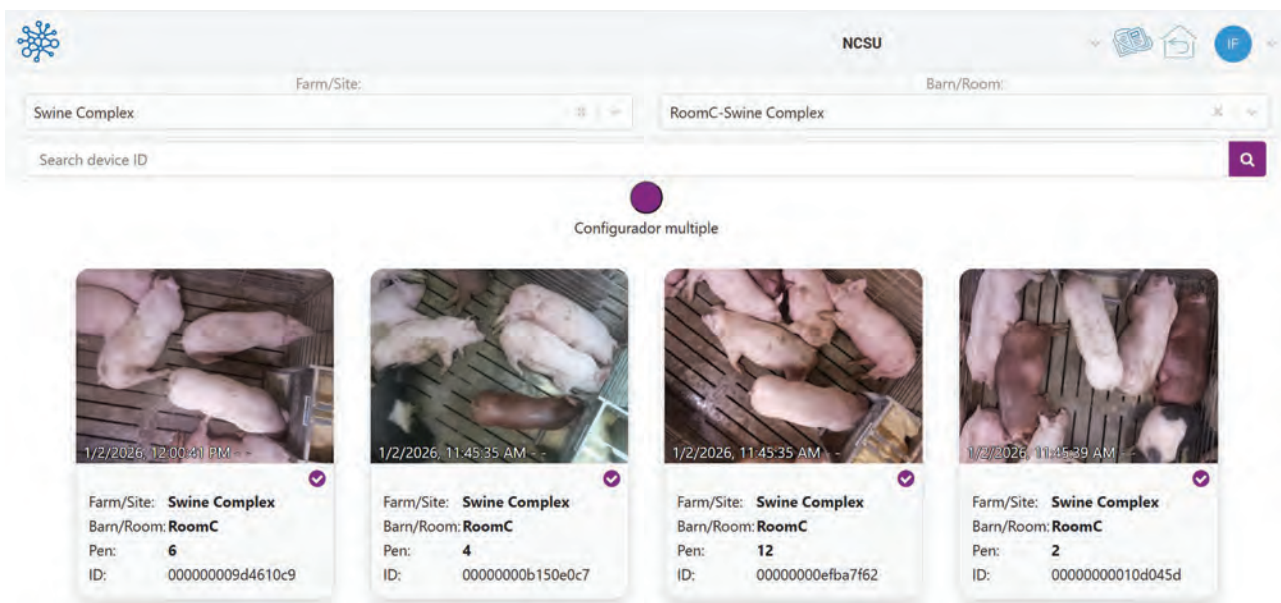
- Most state 2-5% accuracy
 - 5-13 lb for 275 lb pig
 - 2-5 kg for 125 kg pig



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Weight Estimation Cameras: Asimetrix PigVision

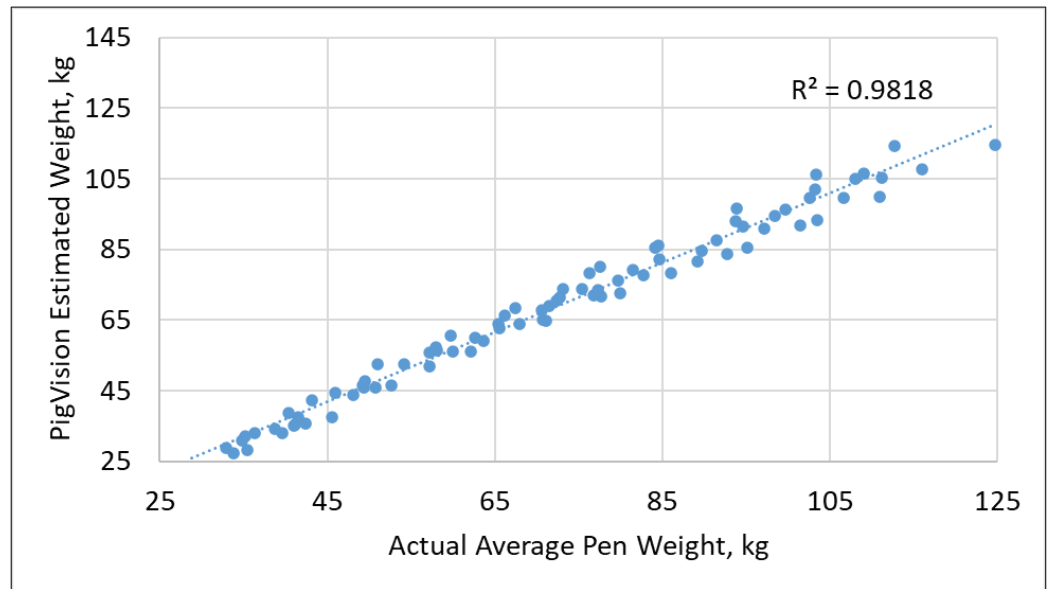
- 8 Cameras at NC State University for grow-finish pigs, mixed breed



Weight Estimation Cameras: Asimetrix PigVision

- On average, PigVision estimates 3.6 kg heavier than scale body weights

- Range (-3, +11) kg
- Software projected growth trends adjust
- Reliable hardware



Audio Monitoring

- Series of microphones hung in pig areas
- Continuously analyze audio signals to identify respiratory health indicators
- Health “score” and status notifications
- Analyze in real-time, no stored audio data



Fancom pig cough monitor



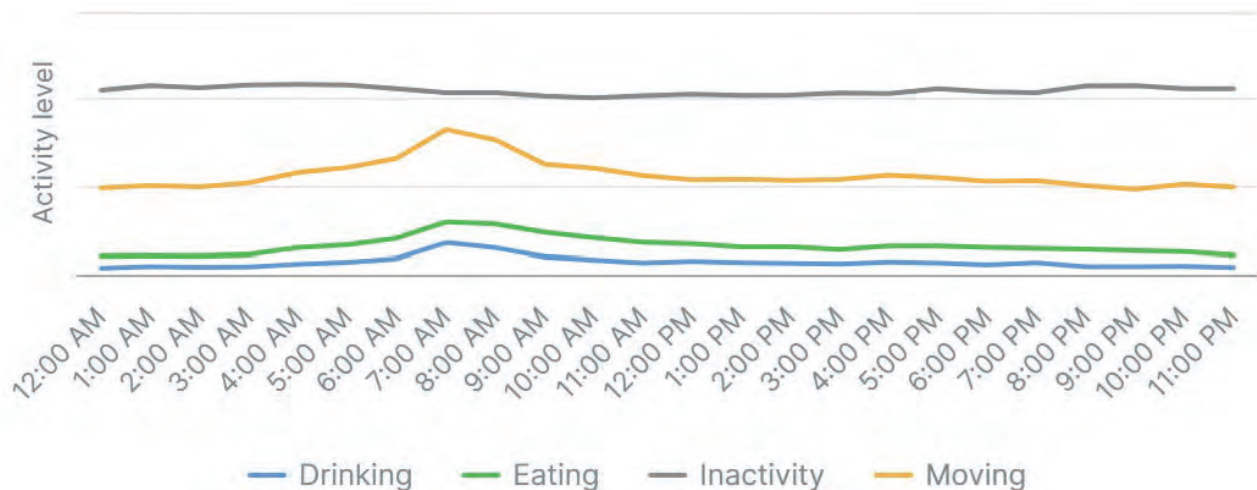
SoundTalks

Pen-Level Activity and Behavior

- Software to track individual pig location and movement
- Count pigs per pen
- Compatible with most cameras

Pen-Level Activity and Behavior

- Assumptions about behavior based on location can be misleading
- Individual pig tracking, but not individual pig identification



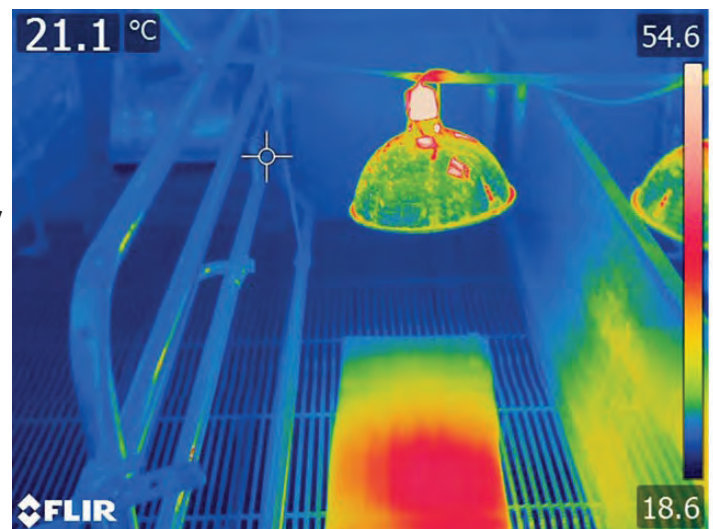
Testing at NCSU

- 8 grow-finish pigs per pen, 24 pens
- Flagged several pens as “at risk” during ileitis event
- Has not flagged tailbiting pens
- Comparing to human observer labels

PEN	ANIMALS	STATUS
B 1	8	Good
B 2	8	Good
B 3	8	Good
B 4	8	Good
B 5	8	Good
B 6	8	Good
B 7	8	At risk
B 8	8	Good

Thermal Cameras

- Measure surface temperatures
- Check piglet creep temperatures
 - Be aware of heat reflections, especially with lamps
- Cannot detect pigs with fevers
 - Most thermal cameras accurate to around 2°C (3.5°F)



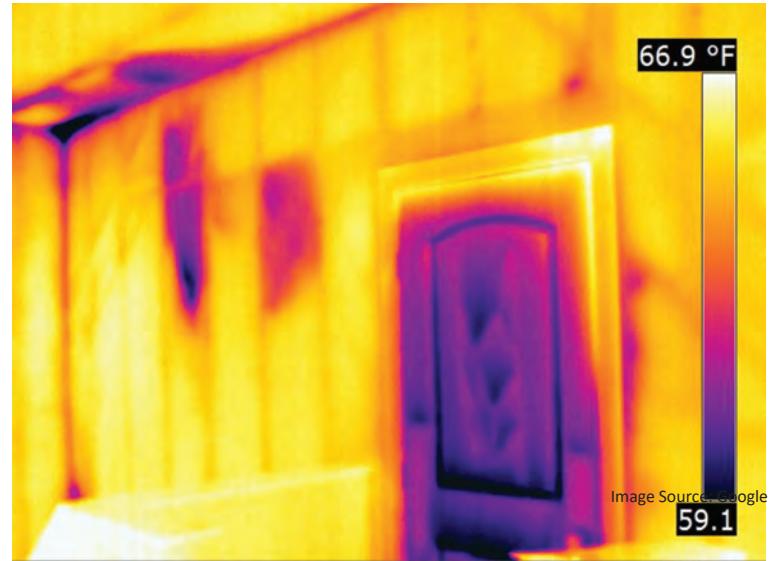
Thermal Cameras

- Facilities: to find cold spots/leaks, missing insulation, hot fuses
- Watch metal reflections

Ceiling in Summer



Wall in Winter



You Get What You Pay For (usually)

A photograph of a FLIR smartphone thermal camera setup. The smartphone is mounted on a silver FLIR base. The screen shows a thermal image of a wall. To the left of the smartphone is a small thermal image with a color scale from 0.0 to 1.0. The price "\$200" is displayed to the right of the smartphone. The NC STATE UNIVERSITY logo is in the bottom left corner.

A photograph of a FLIR professional thermal camera setup. The camera is mounted on a tripod. The screen shows a thermal image of a wall with a crosshair. The price "\$15,000" is displayed above the camera. The FLIR logo is in the bottom left, and the temperature "34.0 °C" is in the top left. A distance of "0.7m" is shown in the top left, and "47.5" and "21.8" are shown in the top right and bottom right respectively.

Drones and UAVs

- Limited use indoors
 - Dust and moisture
 - Positioning and navigation
- Outdoor uses
 - Dangerous or hard to reach places
 - Large areas
 - Paired with thermal imagery, wildlife and human locator
- Payload and battery life key factors



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General Considerations

Don't Overcomplicate Without Good Reason

- Could be done vs Should be done
- Consider long-term costs, storage, maintenance, replacement
- Good reasons to overcomplicate:
 - Future expansion or renovation plans
 - Value-added data
 - Job satisfaction

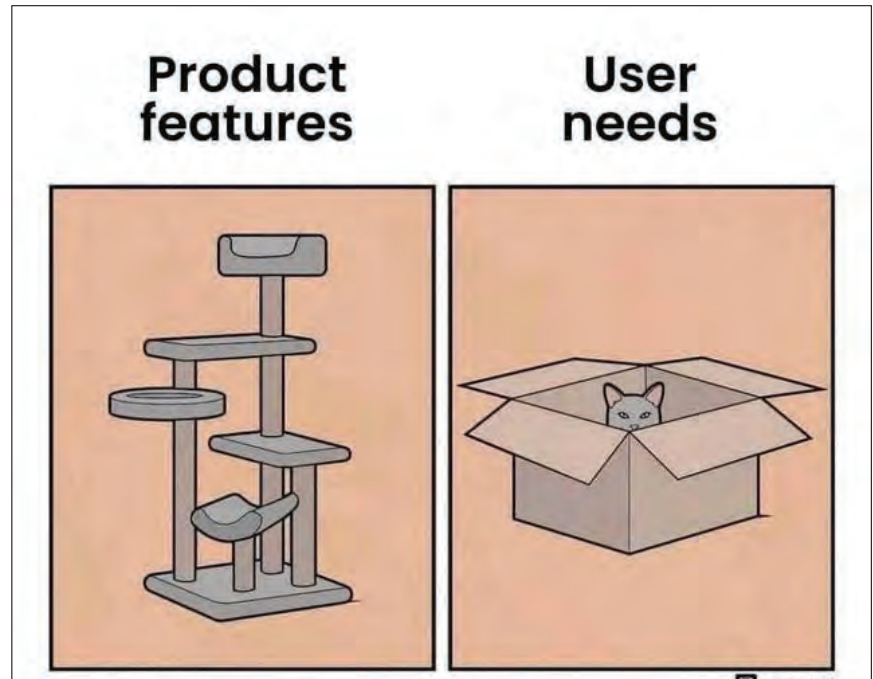


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Cleaning and Maintenance

- Reachable or removable
- Consider dust, moisture, gasses, corrosion
- Cleaning and disinfection
 - Timing
 - Frequency
 - Chemical and UV breakdown
 - If removed, need storage location



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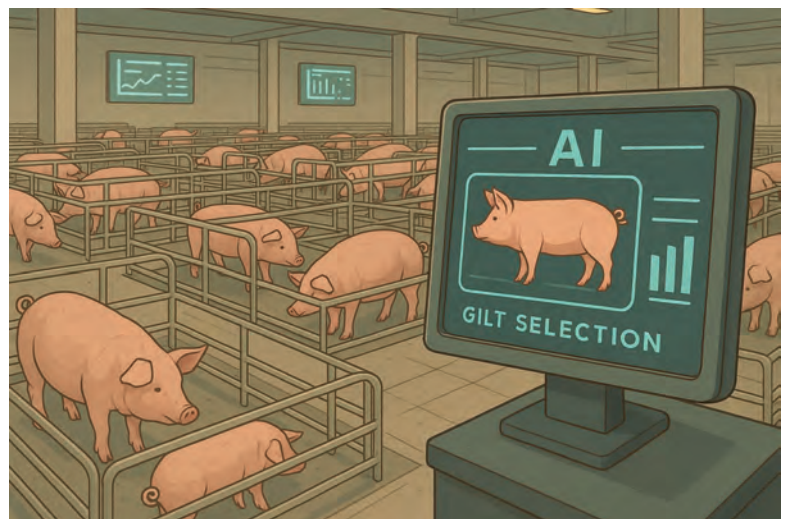
Software

- Cell phone app, tablet, computer, or screen?
- Accessibility features
 - Extra-large font
 - Multi-lingual or icon mode
- Single or multi-user
- Password protection, read-only access, and user tracking



Artificial Intelligence and Machine Learning

- Subset of software types
- Better able to identify and diagnose patterns or problems
- In some cases, limits understanding how/why
- Time and energy trade-offs



Internet Connectivity

- Anything with a “cloud”
- Broadband/fiber vs satellite vs Starlink vs cellular
- Sometimes built-in with product package/subscription fees
 - Site survey for coverage



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Data Security, Access, and Storage

- Raw data access
- Time and cost to store data, by technology company or yourself
- Online vs offline security
- Data breaches, ransomware, spyware



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Technology Selection Process

1. Needs and Wants Assessment
 - Keep an open mind!
2. Explore Existing Solutions
 - Ask around and Google it
 - Trade shows, fairs, exhibitions
3. Estimate Value
 - Range of effectiveness
4. Commit!
 - Time frame for decision making or implementation

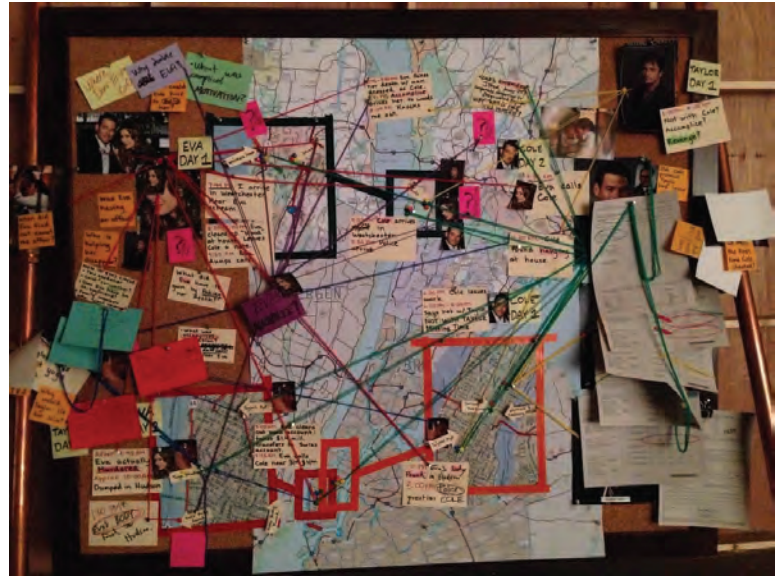


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Timing of Investments

- Cutting Edge vs Bleeding Edge technologies
- Subscription-based or updates continuously improve functionality and security
- Perfect is great, but finished is good too



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Set Yourself and Your Technology Up for Success

- Decide what “success” looks like with the tech
 - Time, profit, productivity, welfare, frustration, peace of mind
- Give it time, effort, patience, and courage
- Ask for help

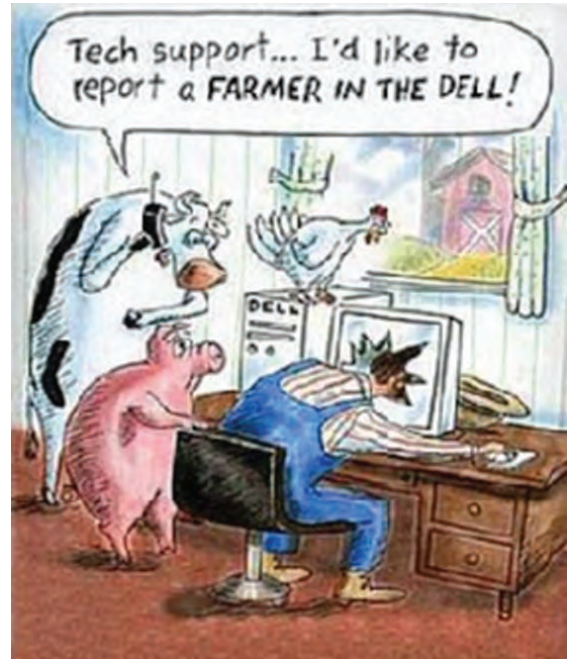


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What Technology Should I Buy?

- Solves a problem that you actually have
- Aligns with your current and future goals
- Benefit claims are backed up by third-party data
- Provides value



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