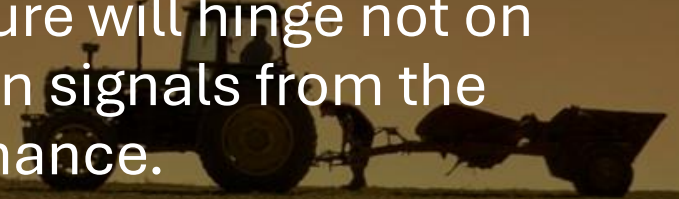


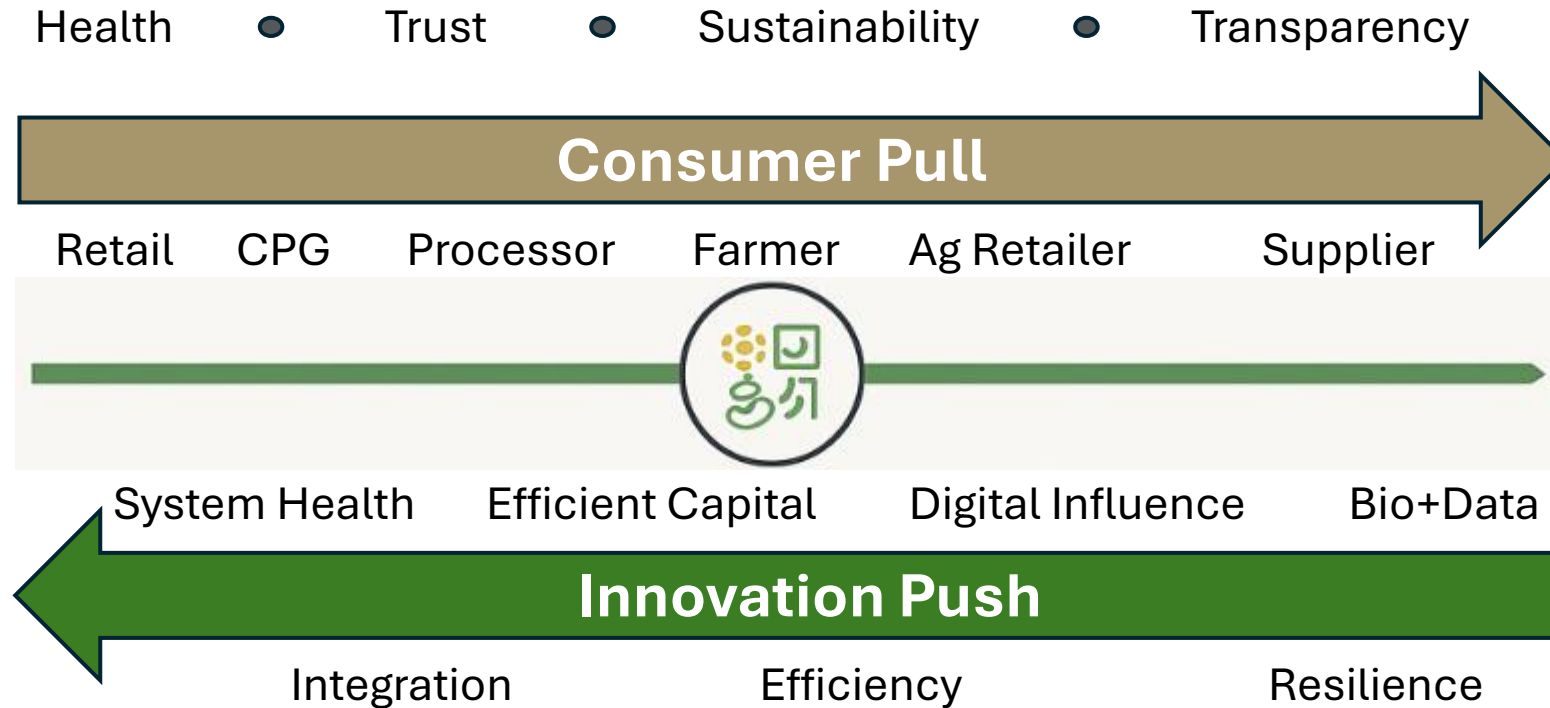
# Drivers of Change: The Future of Farm Production

The next decade's competitiveness in agriculture will hinge not on technology adoption, but on readiness to turn signals from the market into system-level performance.



# From Downstream Pull to Upstream Readiness

Consumer expectations are flowing upstream; competitive advantage now depends on how quickly the production system adapts.



Competitive readiness depends on translating consumer signals into upstream capability faster than competitors.

70% of food companies cite supply chain collaboration as their top sustainability challenge (BCG, 2024)

# Driver 1: Biological + Data Convergence

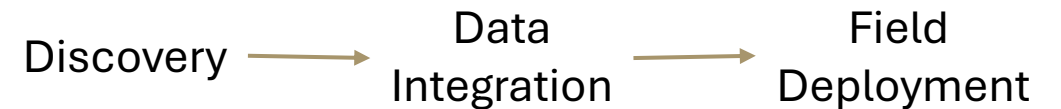
Why it matters: The fusion of biology and data is collapsing the distance between discovery and deployment

## Biology Meets Data



- AI-enabled genomics and digital phenotyping shorten breeding cycles and optimize trait selection
- Precision ag evolves from efficiency tools to integrated intelligence systems
- AI-guided breeding reduces crop development timelines by 30-50% (Hayes et.al., Nature Biotechnology 2023)

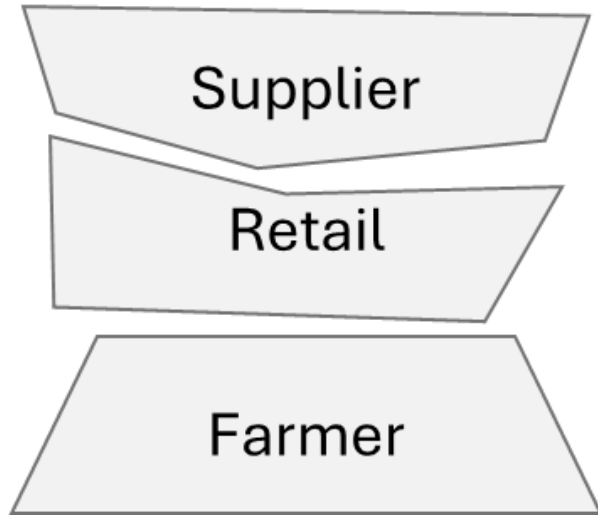
## The Impact on Production Systems



- Faster trait validation enables region-specific seed and biological solutions
- New partnerships between biotech, analytics, and retailers redefine R&D pipelines
- Data interoperability will decide which innovations reach the farm first

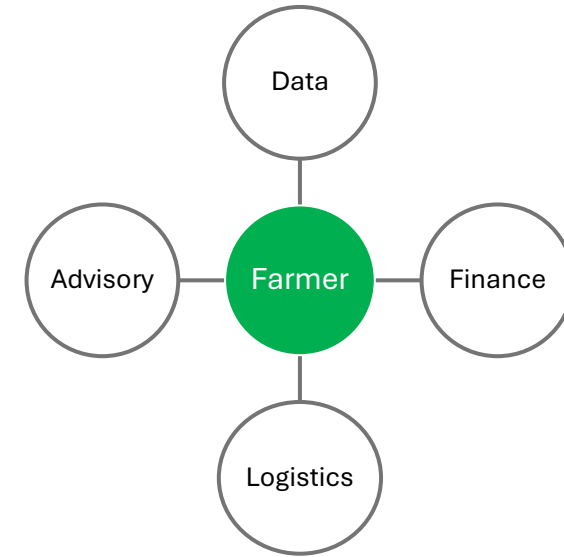
# Driver 2: Digital Markets – Where Data, Trust and Value Converge

Fragmented channels, concentrated trust, and new rules for engagement



## The Old Stack is Breaking Apart

- Input and advisory services unbundling across digital platforms
- Traditional retail margins eroding through subscription marketplaces, volume reductions and embedded finance models
- Farmers interact with multiple digital platforms per season. *(McKinsey 2024)*

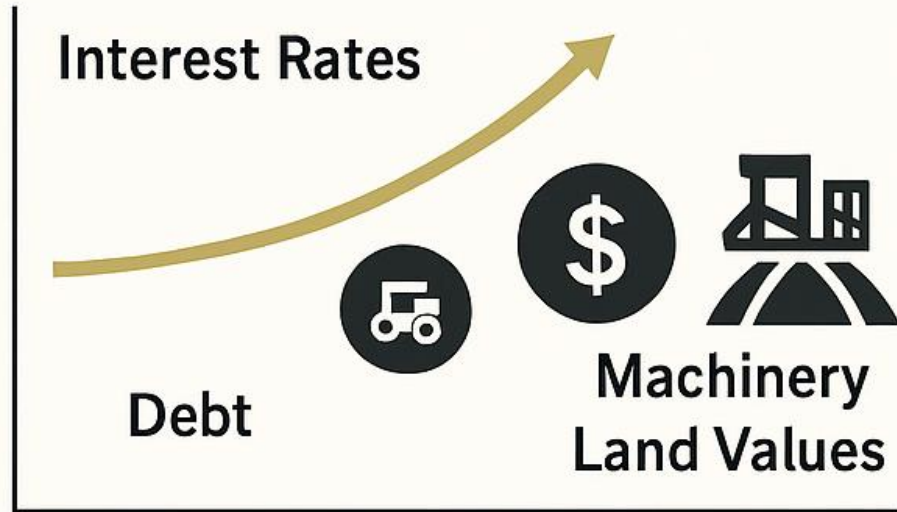


## Trust Becomes the Platform

- Digital ecosystems are reconsolidating around data ownership and interoperability
- By 2030, roughly 60% of ag retail interactions are projected to be digital or hybrid.
- **Winners will provide interoperable trust-verified recommendations, transparent pricing, and seamless financing.**

# Driver 3: Capital Efficiency and New Operating Models

Why it matters: Higher capital costs and asset intensity are reshaping how production systems scale and who controls innovation.



Shared  
Equipment



„As-a-Service“  
Platforms



Embedded Finance

**Capital cost reset.** Fed funds reached 5.5%, farm interest reached \$34.9B, fastest growing expense.

**Balance sheet pressure.** Midsize and large family farms produce most of the output and have most of the debt – dictating adoption.

**Asset inflation.** Farmland values continue to rise, tightening cash flow despite strong equity.

# Driver 4: Labor and Automation

## The Next Productivity Frontier

### Labor Challenge

Labor scarcity is no longer cyclical – it's structural

- U.S. farm labor supply has declined by **9% since 2015** despite increased wages. (*USDA ERS, 2024*)
- Average hired farmworker age now **exceeds 40**, with 75% foreign-born. (*NAWS Survey, 2023*)
- Labor costs rose **21% between 2018–2023**, outpacing productivity gains. (*ERS Farm Income Data, 2024*)

### Automation Response

Automation is moving from efficiency to autonomy

- **Autonomous tractors, robotic harvesters, and precision sprayers** now in pilot or commercial deployment across >25 U.S. states. (*AgFunder, 2024*)
- **Capital intensity rising:** average automation investment up **40% YoY** among large specialty crop producers. (*PitchBook, 2024*)
- **AI-driven labor optimization** tools reducing in-field labor hours by **20–30%** in early trials. (*Western Growers Center for Innovation, 2023*)

Human + Machine Integration

**Labor is no longer a cost center – it is a constraint shaping technology adoption, capital allocation**



# Driver 5: System Health as the new Performance Metric

From climate compliance to measurable outcomes in soil, crop, and human health

## From Compliance to Capability

- Climate markets pushed measurement, system health makes it actionable
- Soil organic matter, nutrient cycling, and resilience link to yield and nutrition
- Early studies show improved micronutrient and phytochemical levels under soil-health systems (Frontiers, 2021)

## Turning Health into a Measurable Output

- Expanding use of MRV tools for soil carbon, biological activity, and nutrient mapping
- Integration of lab + digital phenotyping links agronomic data to nutrition data



# From Drivers of Change to Decisions on the Farm





# Final Thought: The Next Decade Belongs to System Health



Competitive advantage shifts  
from efficiency to resilience  
and learning



Collaboration and  
interoperability are new  
levers of value creation



Food-as-Health is a  
production-side  
transformation logic

**The future of agriculture will not be defined by who grows the most, but by who grows the healthiest systems.**