XX Conferencia Internacional sobre PALMA DE ACEITE
20th International Oil Palm Conference

Reforzar el Impacto de los Programas de Extensión Adaptando los Enfoques de Extensión a las Necesidades de los Clientes

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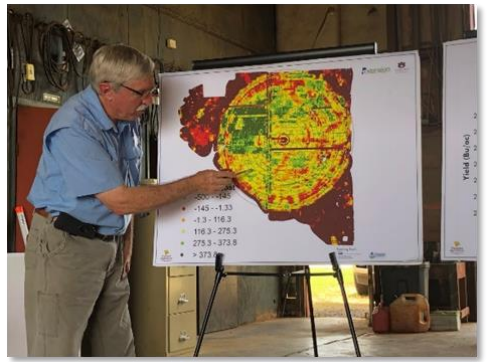
AUBURN UNIVERSITY

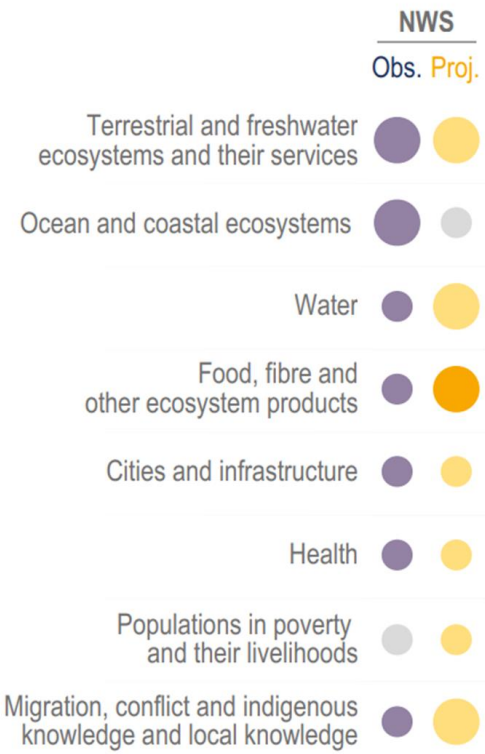
extension ALABAMA A&M & AUBURN UNIVERSITIES



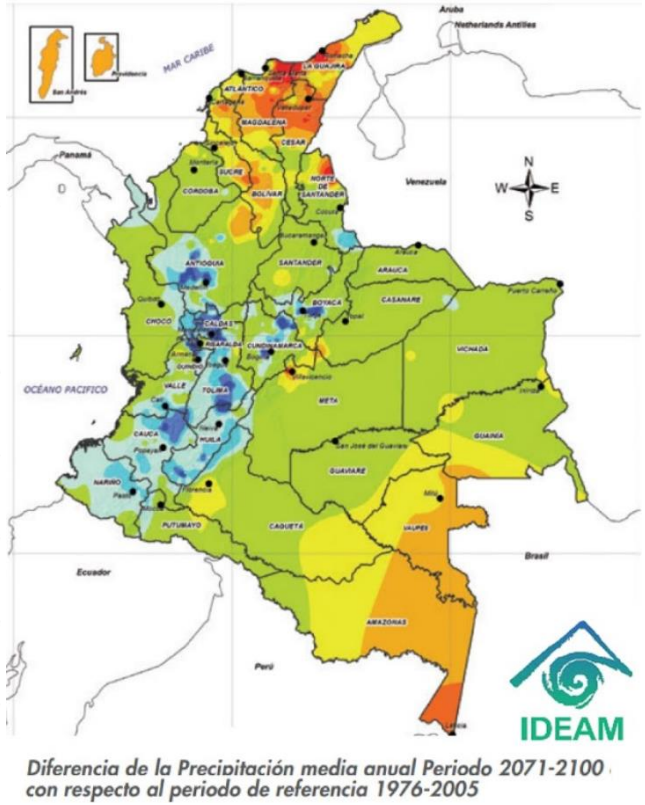

Food Security - Biggest Challenges of Humankind

Observed and projected Climate Change impacts to main sectors in North-West South America



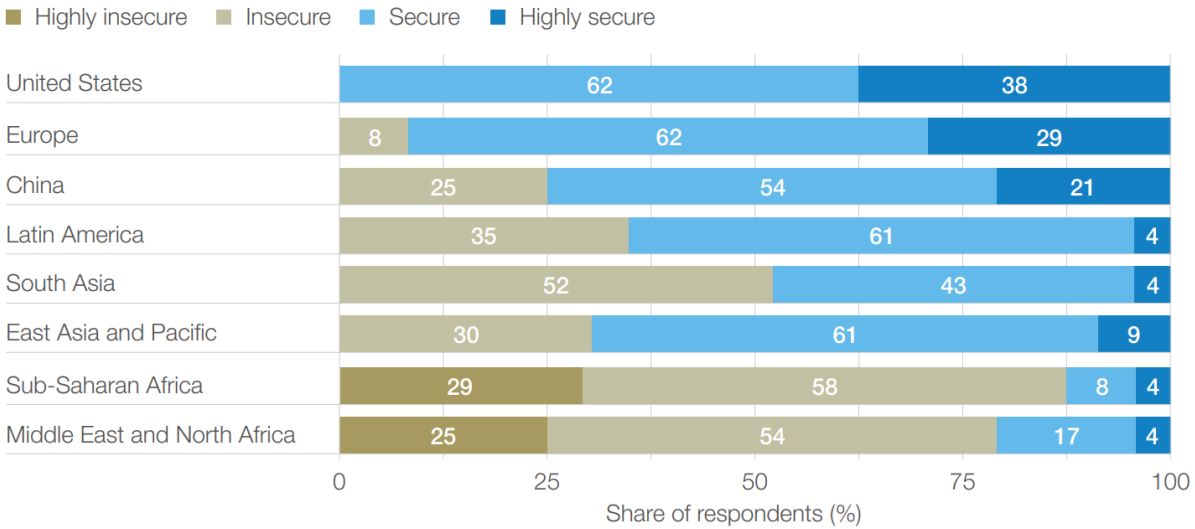
Source : 2022 IPCC Report
https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_Chapter12.pdf

Projected Annual Precipitation Anomalies 2071-2100



Diferencia de la Precipitación media anual Periodo 2071-2100 con respecto al periodo de referencia 1976-2005

Expected outlook for food security next 3-yrs (2022-2025)



Source: Chief Economists Survey, April 2022

Source: Chief Economists Survey April 2022

The Role of Extension Services - Factors facilitating change in agriculture

Agricultural advisory sector plays a critical role in facilitating on-farm change

Technical, economic, market or scientific knowledge, practical knowledge, learned from experience

Input Knowledge

A form of knowledge or a perception socially created. Representations are a way for every individual to organize his or her knowledge and are expressed in terms of judgements, opinions and mindsets. Representations are shaped within social groups

Social Representations
(Mindsets, perceptions)

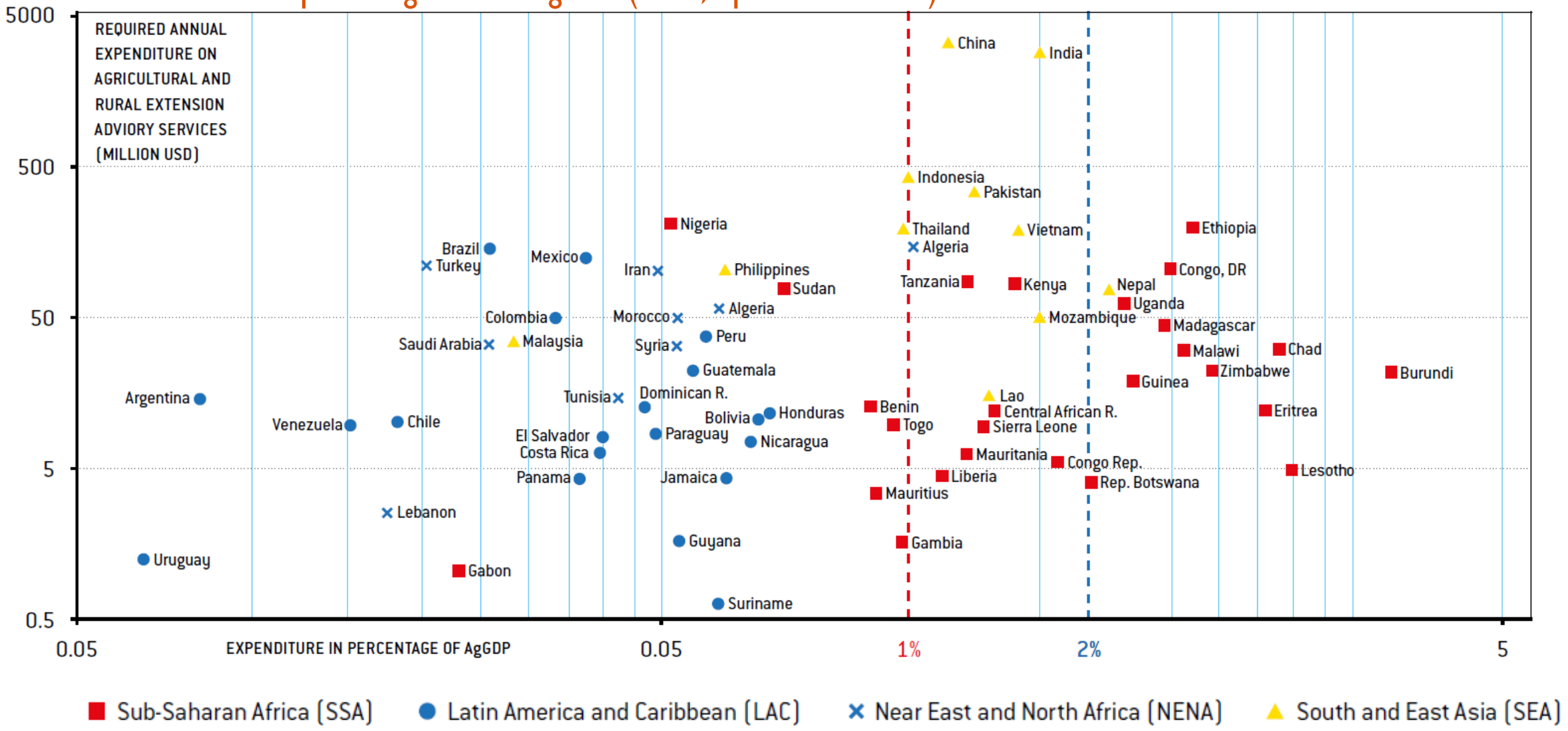
Social Groups

Peer-to-peer exchange is supported by social/discussion networks. Advisors provide information that is integrated into the discussions.

Material Conditions

The implementation of certain actions can be facilitated if material conditions (e.g., equipment, tools) for implementation is available, their cost and their expected benefit

Agricultural Extension Services - Annual investment requirement (millon USD) versus the value of the required investment as a percentage of the AgGDP (2009, updated in 2013)



Source: Evolution of country specific investment requirements of agricultural and rural extension and advisory services - FAO (2018)

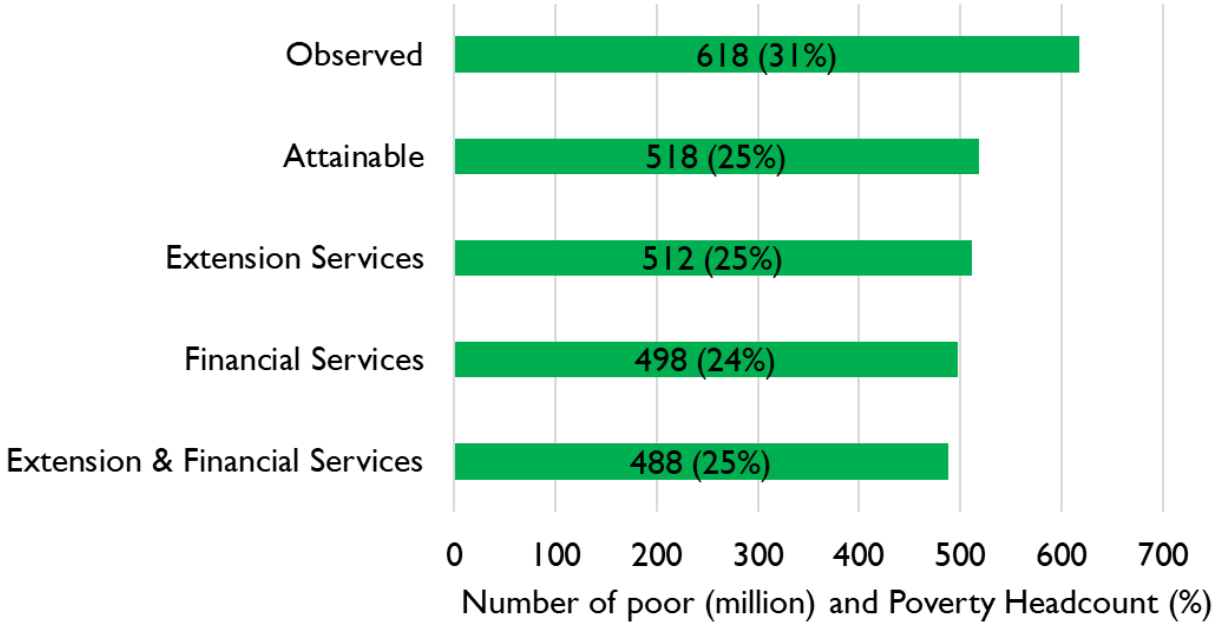
Regional comparison of investment requirement in Agricultural and Rural Extension and Advisory Services (EAS) – Public Services

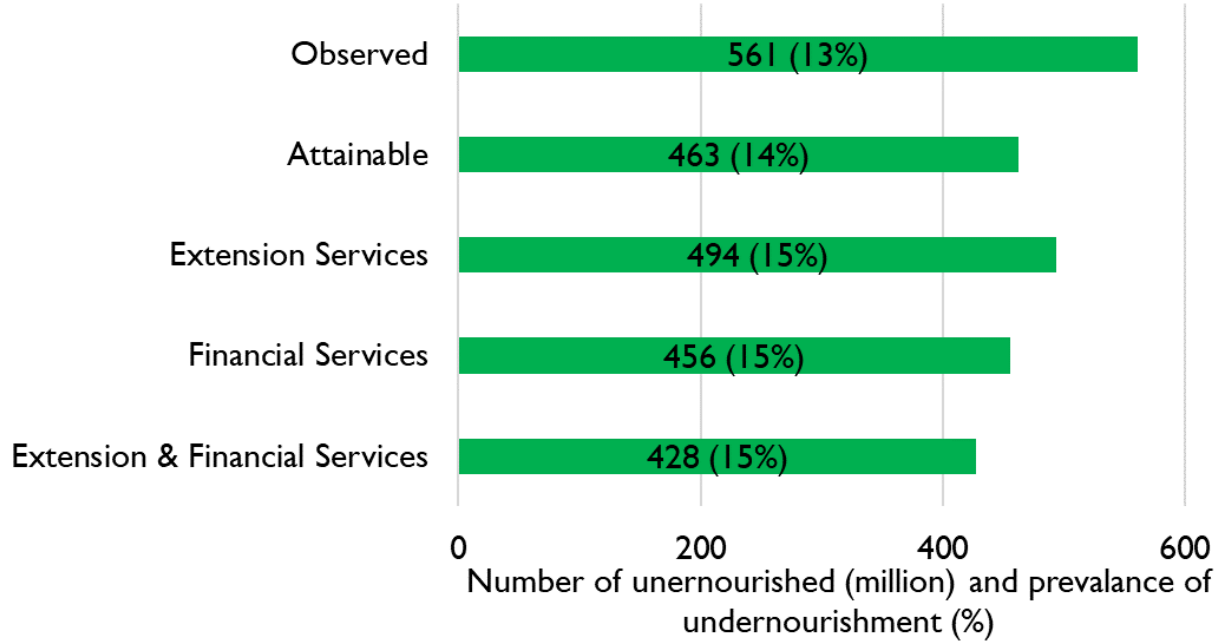
Region	EAS Investment Requirement (as % of AgGDP) Baseline and Climate Scenario 2009	Change in investment requirement Baseline 2013 (Compared with Baseline 2009)	Change in investment requirement Climate Scenario 2013 (Compared with Baseline 2009)
Sub-Saharan Africa (SSA)	1.91% – 2.39%	+15.61%	+38.58%
South East Asia (SEA)	1.45% – 2.16%	-6.25%	+20.57%
Near East and North Africa (NENA)	0.54% – 0.88%	-2.82%	+26.63%
Latin America and the Caribbean (LAC)	0.44% – 0.68%	+15.91%	+49.33%

The amount of financial commitment or annual expenditure on agricultural and rural EAS would decrease as a result of investment in poverty alleviation, ICTs, reducing population, etc. Research supports that ICT drives socio-economic development and leads to improved livelihood.

Source: Evolution of country specific investment requirements of agricultural and rural extension and advisory services _FAO (2018)

Investment versus Impact of Extension Services in Low-Medium Income Countries -2018





Total number of poor and undernourished people (in millions) and average values of the poverty headcount (%) and of the prevalence of undernourishment (%) in 2018, and gap between observed and attainable estimates of poverty and undernourishment with improved access to financial and extension services

Source: The role of extension and financial services in boosting the effect of innovation investments for reducing poverty and hunger: A DEA approach. Alejandro Nin-Pratt, International Food Policy Research Institute (2021)

Financial and extension indicators in 2018 compared to values under improved access to services - Low-Medium Income Countries

	2018	Access to enabling services	Change
- Average number of extension staff (full-time equivalents)	14,975	17,394	+16.2%
- Percentage of rural population that borrowed to start, operate or expand a farm or business	8.0	9.0	+12.8%
- Percentage of rural population that used a mobile phone or the internet to access an account	12.6	12.3	-2.7%

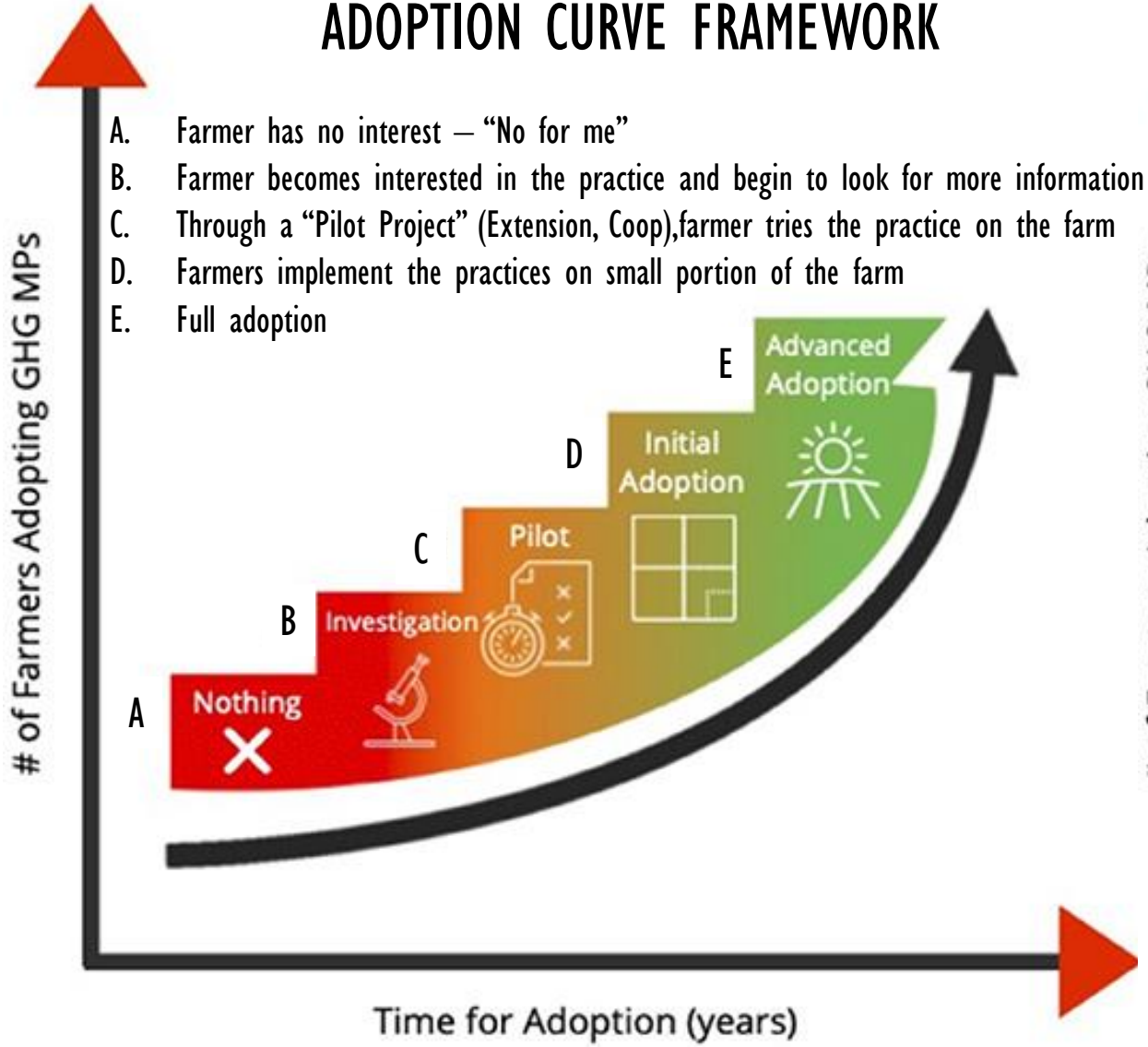
Increases in the number of extensionists (16.2%) and in the proportion of the population that borrowed to start or operate a farm or business (12.8%) are the main drivers of the reduction in attainable levels of extreme poverty and undernourishment in LMI countries.

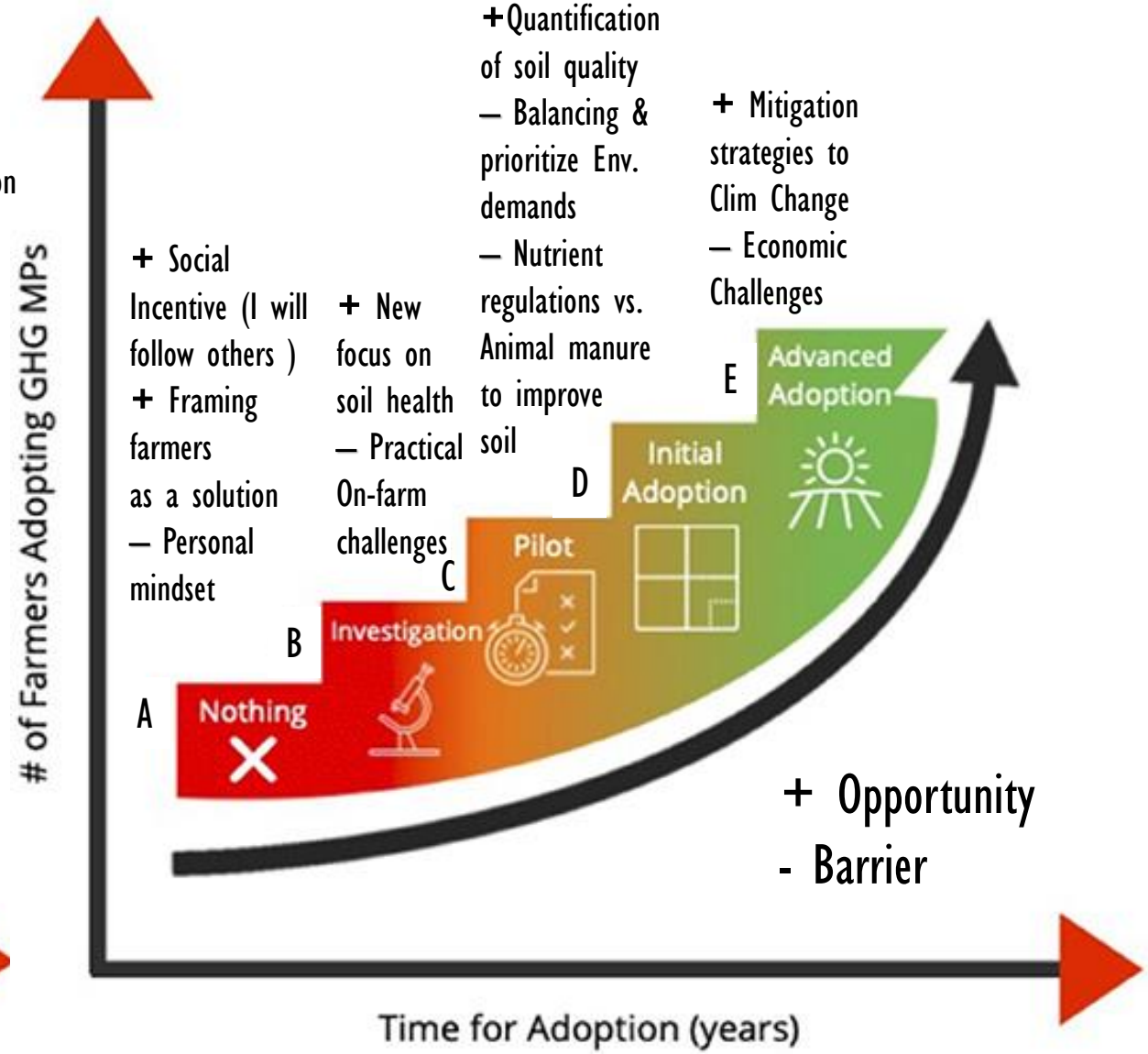
Source: The role of extension and financial services in boosting the effect of innovation investments for reducing poverty and hunger: A DEA approach. Alejandro Nin-Pratt, International Food Policy Research Institute (2021)

Barriers and opportunities for arable farmers to adopt practices which mitigate emissions from agricultural soils

ADOPTION CURVE FRAMEWORK

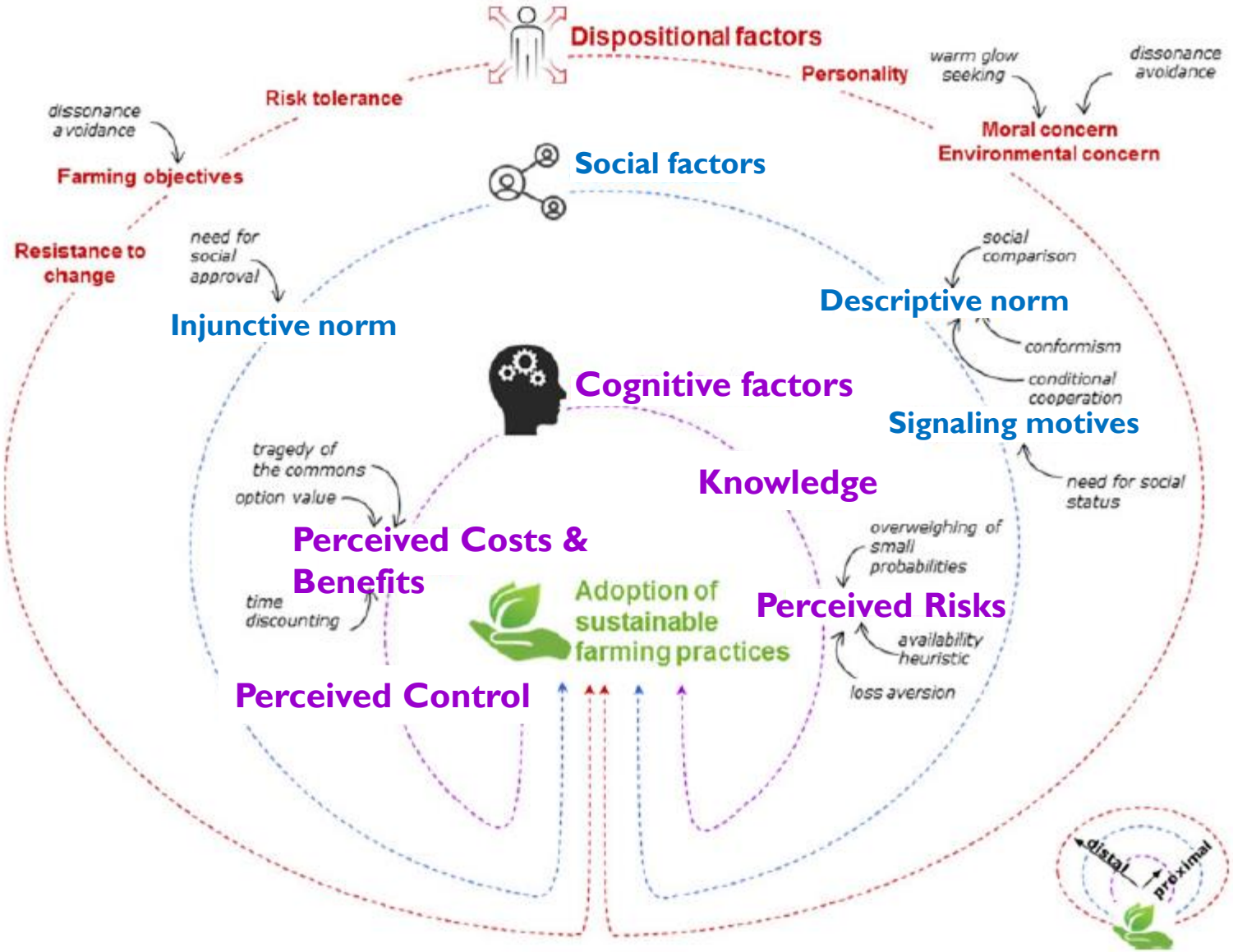
A. Farmer has no interest – "No for me"
B. Farmer becomes interested in the practice and begin to look for more information
C. Through a "Pilot Project" (Extension, Coop),farmer tries the practice on the farm
D. Farmers implement the practices on small portion of the farm
E. Full adoption





Gomes A and Reidsma P (2021). Frontiers in Sustainable Food Systems Data from UK farmers

Factors that Influence Behavioral Intention to Adopt



Dessart, et al. 2019. European Review of Agricultural Economics Journal. Vol 46 (3)

Factors that Influence Behavioral Intention to Adopt

Perceived behavioral control
Perception of feasibility and practicality
Perception of sufficient technical knowledge, understanding, and skills for practice implementation
Availability of required resources, compatibility, and ability to reduce potential barriers to implementation
Perception of complexity and difficulties on the use of new practice
Ability to make connections between evidence-based ideas and farmers' experience
Perception of governmental, organizational, and institutional support that facilitates implementation of recommended changes
Perceived trust, validity and accuracy of new practices or tools

THE FUTURE OF FARMING: INCREASING ADOPTION OF CONSERVATION PRACTICES AMONG ALABAMA ROW CROP FARMERS.

Conservation Innovation Grants On-Farm Conservation Innovation Trials, Environmental Quality Incentives Program. USDA NRCS and Commodity Credit Corporation.

GOAL: protect environmental quality and improve producers' resilience to climate induced shocks.

APPROACH: (1) demonstrate cover crops to improve soil health and reduce runoff and erosion, and demonstrate soil moisture monitors and smart irrigation to improve water- and nutrient-use efficiency;

(2) facilitate development of a stakeholder-scientist network that will collaborate to understand perceptions of, barriers to, and practice norms and habits that govern adoption, adaptation, and implementation of climate-smart technology; and

(3) develop an incentive program for tool adoption.

FUTURE OF FARMING

Games Theory– Promote knowledge exchange through specific "Participatory Games"

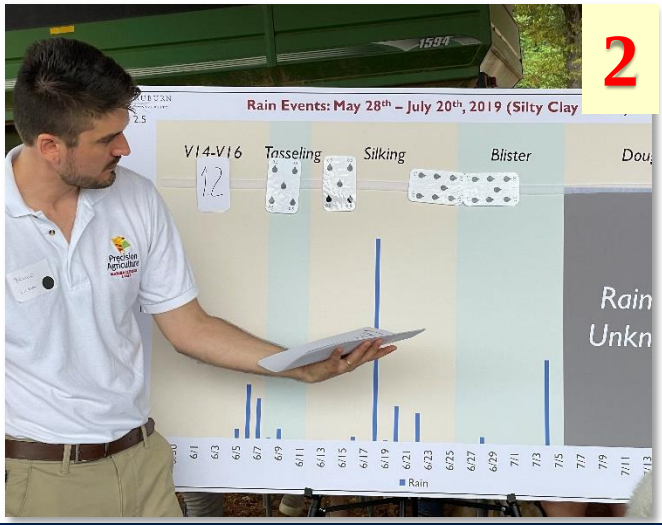
WHY? *"Knowledge-sharing processes have become dominated by a frustratingly unsatisfactory format: "Death by PowerPoint" (Winn 2003), the dreaded sequence of PowerPoint presentations followed by usually insufficient time for questions and answers"* (Mendler de Suarez et al, 2012)

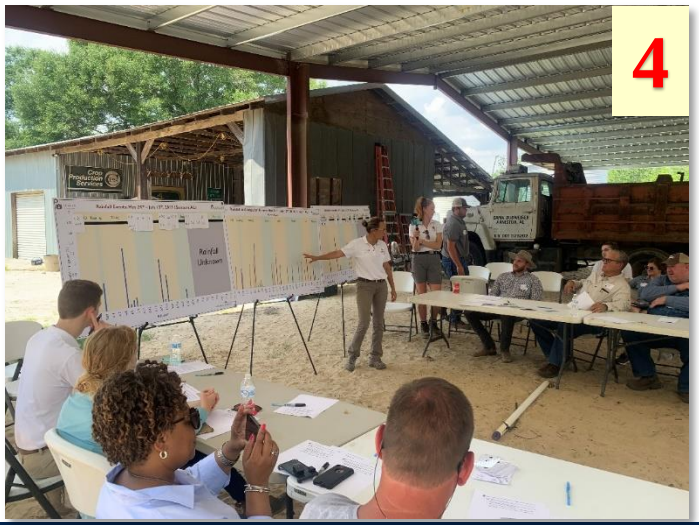
A MODEL OF THE GAMEPLAY EXPERIENCE

Player processes information about context and choices and makes internal decision based on possible outcomes

Players takes action → **Games creates output**

Salen and Zimmerman (2003)





Participatory Games

- Participatory Games have been designed with the objective of promote knowledge exchange among farmers members of focus groups
  - *How farmers irrigate (specific irrigation scheduling strategies)*
  - *Farmers/consultants knowledge on crop water use/growth stage*
  - *Farmers limitations to apply right rate and right time*
- The way participants react to the games
  - *Specific knowledge/experience participants share*
  - *Farmers exchanges while working on completing the game*

Identification of "what they know/don't know, perceptions, limitations, opportunities for new training

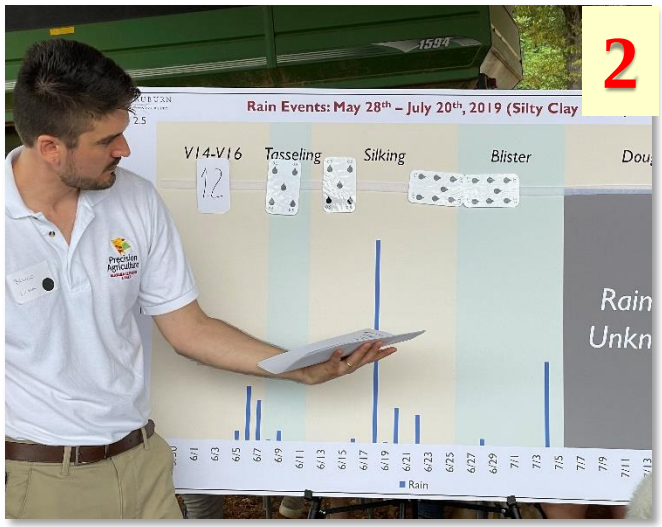
1

1. Real rainfall scenario (daily rainfall records and specific corn growth stages dates

2. y 3. Every group got "cards" with different irrigation rates and group member decided (together) how to irrigate (amount and frequency)

4. Farmers exchanged ideas, discussed the results of each group and reflect on what actually happened in the field.

2



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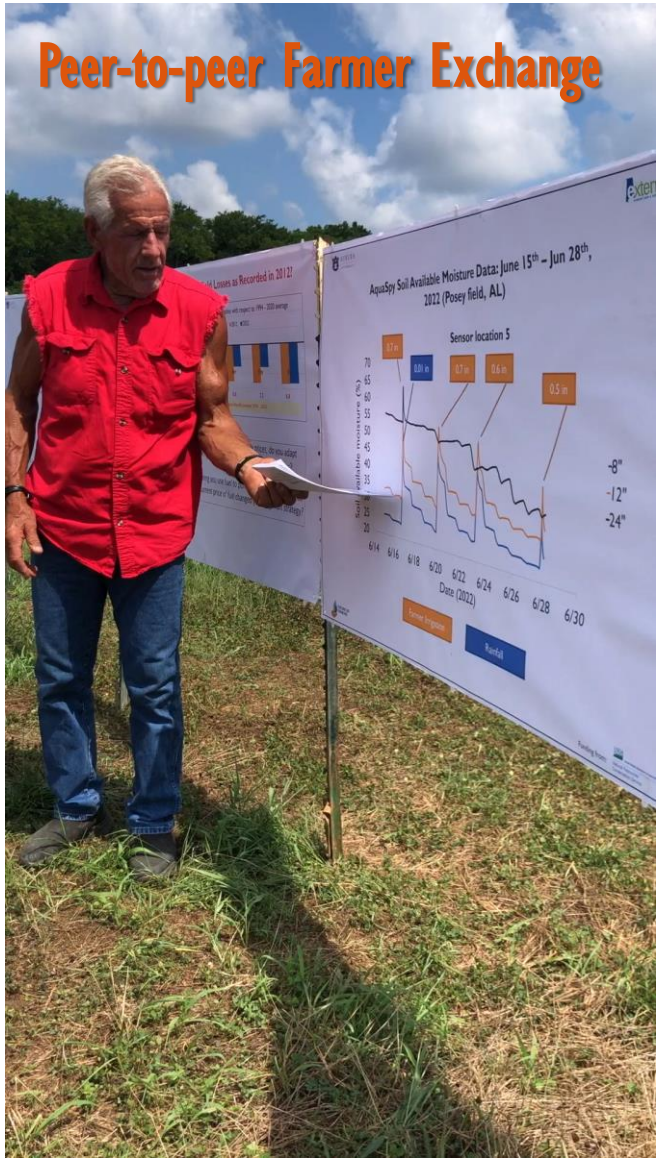
4

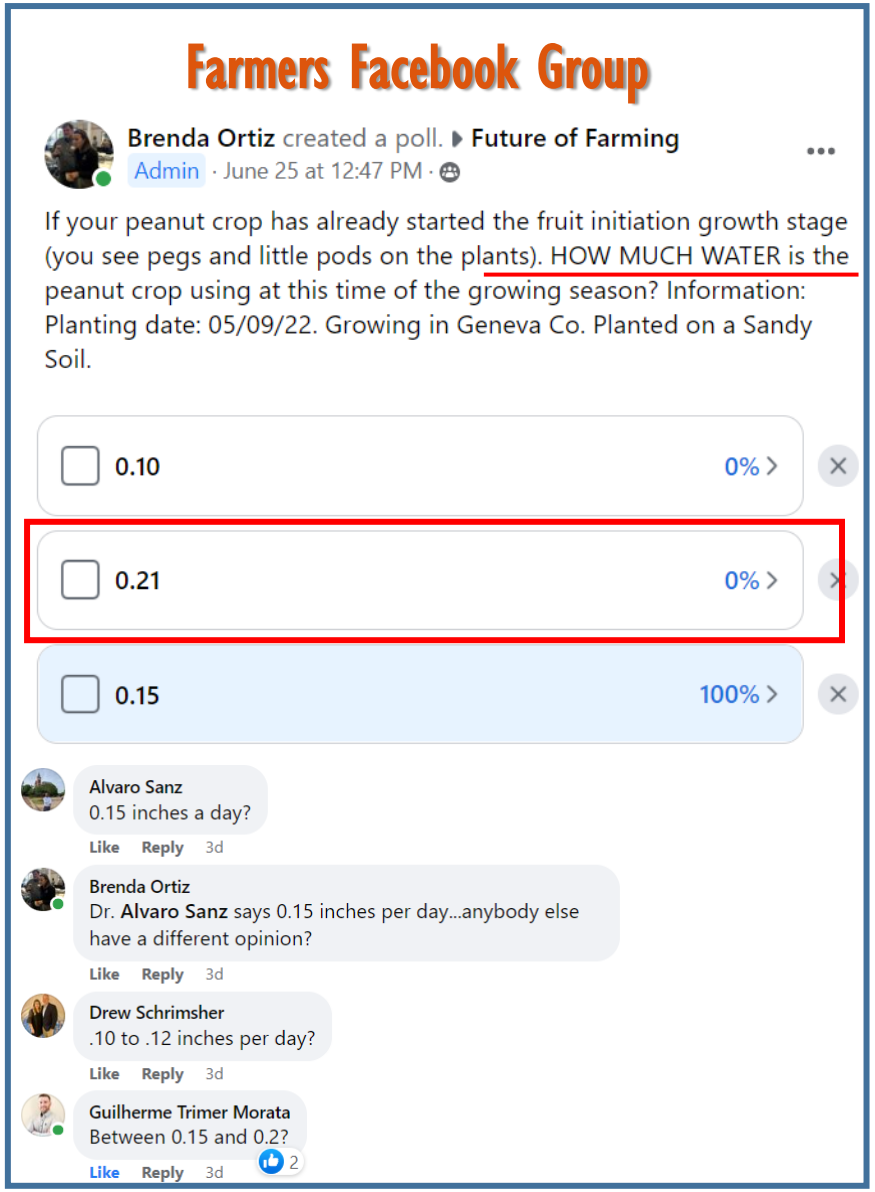
4

Multiple Extension Strategies – The Future of Farming Project (Auburn University)

Peer-to-peer Farmer Exchange

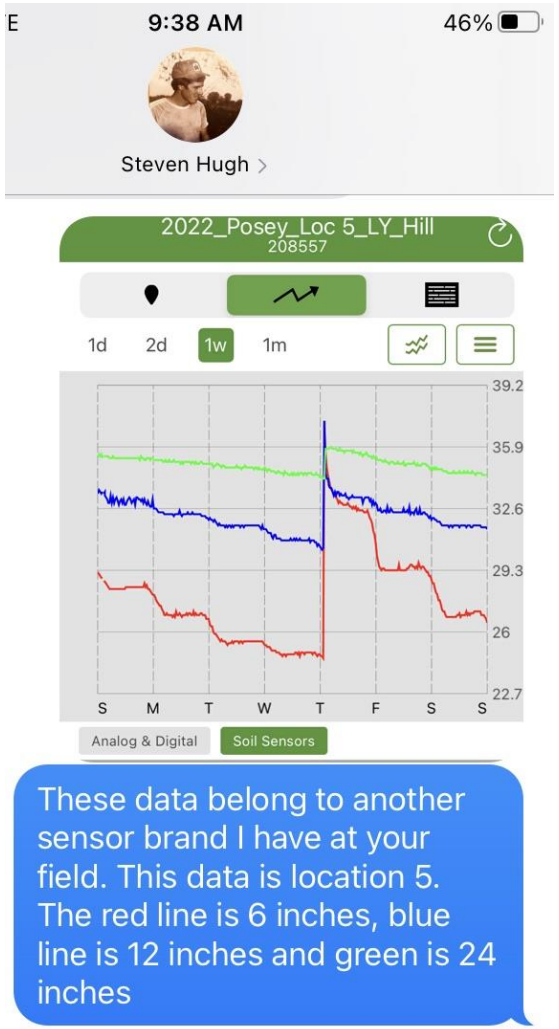


Farmers Facebook Group

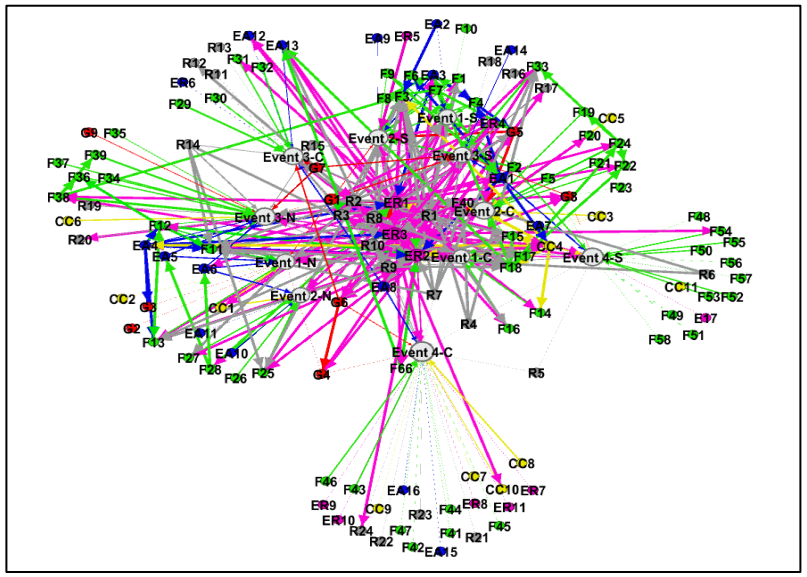


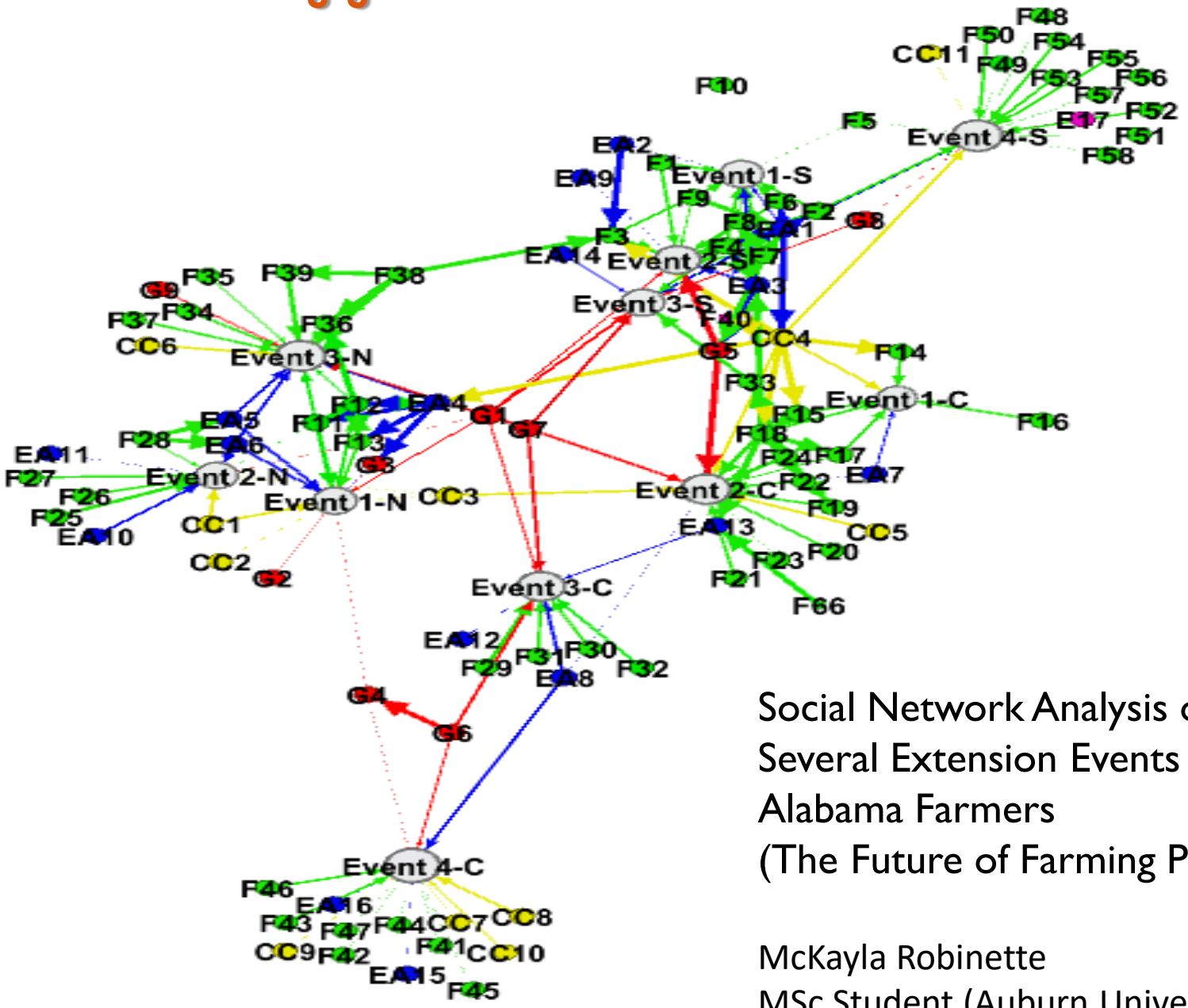
Text Messages to Increase Knowledge

How to interpret the data



The Extension Strategy and Process of Engagement Matters





Social Network Analysis of Several Extension Events with Alabama Farmers
(The Future of Farming Project)

McKayla Robinette
MSc Student (Auburn University)

FUTURE OF FARMING

Preliminary Findings – Adoption of Conservation Practices 5-yr project (Auburn Univ)
Rural Sociology Analysis

- How were project goals interpreted?
- What were the underlying assumptions?

Farmers input

. . . what I would love to see is over this five-year project to be able to **build a… system . . .** [that will] **teach you how to think** and what's your capabilities are more so than 'how do I survive?' . . . and **if you get stopped** on [anything] call us. The **mentors in the group will help you get through it** . . . (Interview, F40)

. . . **quite frankly** . . . **I just feel like extension** . . . **has lost a lot of following** in the last years because they've by and large [done] what I would say as **unpractical research** . . . it was hard to find an application . . . **I just feel like there's a certain disconnect**. . . (Interview, F28)

- Researcher as decision-maker, producer as consultant
  - *. . . a complete [sic] different universe than the one [in which] farmers are practicing.* (Planning Meet)
- Traditional information dissemination is valued most
  - *. . . having the farmers speak about their operation encourages* [peer-to-peer] *engagement.* (Reflexive Eval)
- More data is <u>the</u> remedy
  - *. . . it's not clear what they learned or if they learned enough to implement on their farm.* (Reflexive Eval)

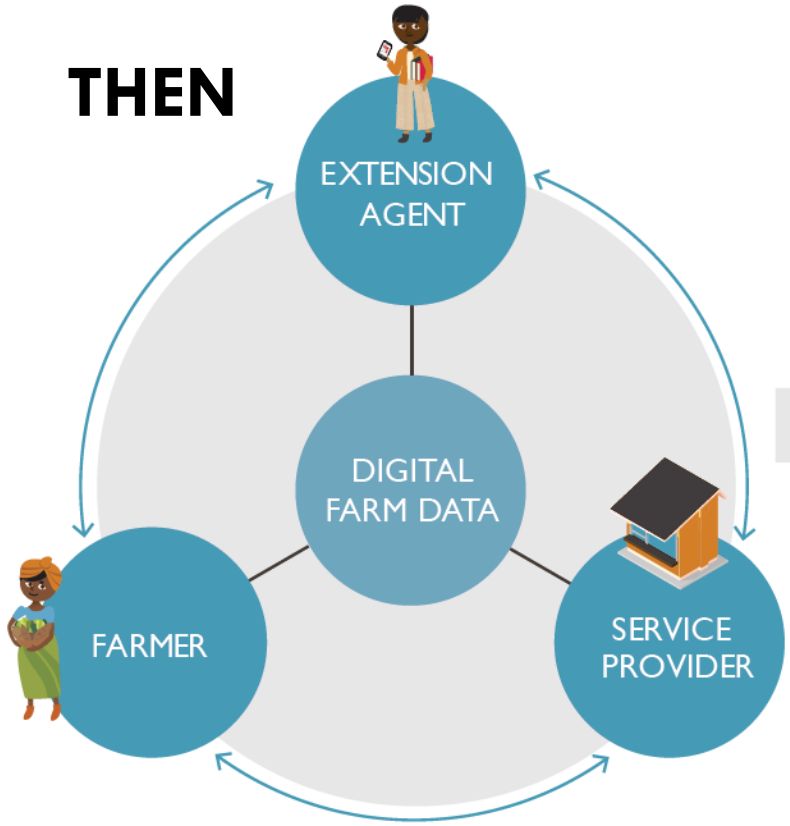
Source: Dr. Michelle Worosz (Auburn Univ)

FUTURE OF FARMING

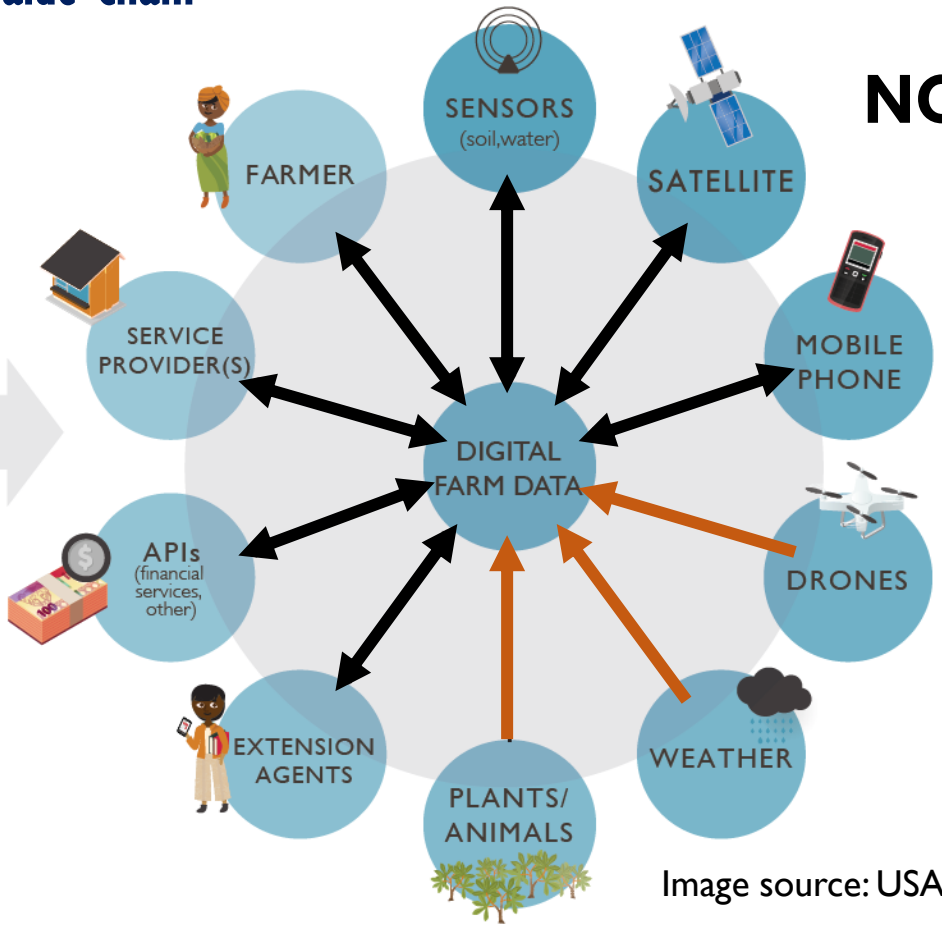
Digital Agriculture

Changes in the way farmers access and generate data to support farm management decisions and strength the supply value chain

THEN



NOW



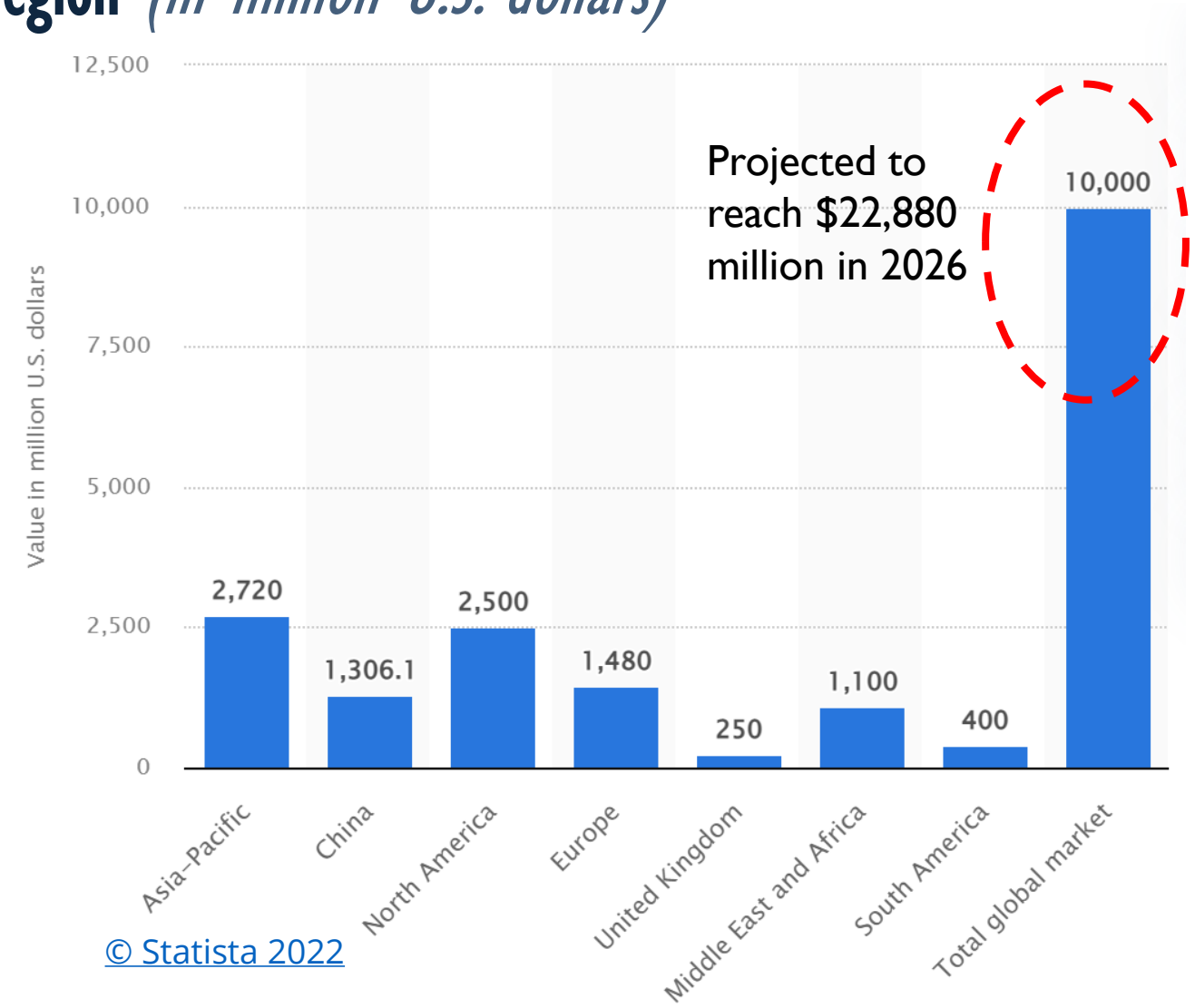
Digital applications and platforms have the potential to dramatically change the way knowledge is processed, communicated, accessed & utilized.

Image source: USAID, 2018

Farmers were more passive actors, receiving recommendations, no much data generation of data.

Farmer(s) one of many contributors to his/her farm' data generation, use of real-time data, two directional flow between farmer and data, extension agent and data

Global digital agriculture marketplace market in 2020, by region *(in million U.S. dollars)*



Major drivers of the digital agriculture market growth

- Advancements and innovations in technology
- Affordability
- Connectivity / access (internet)
- Availability
- Government policies

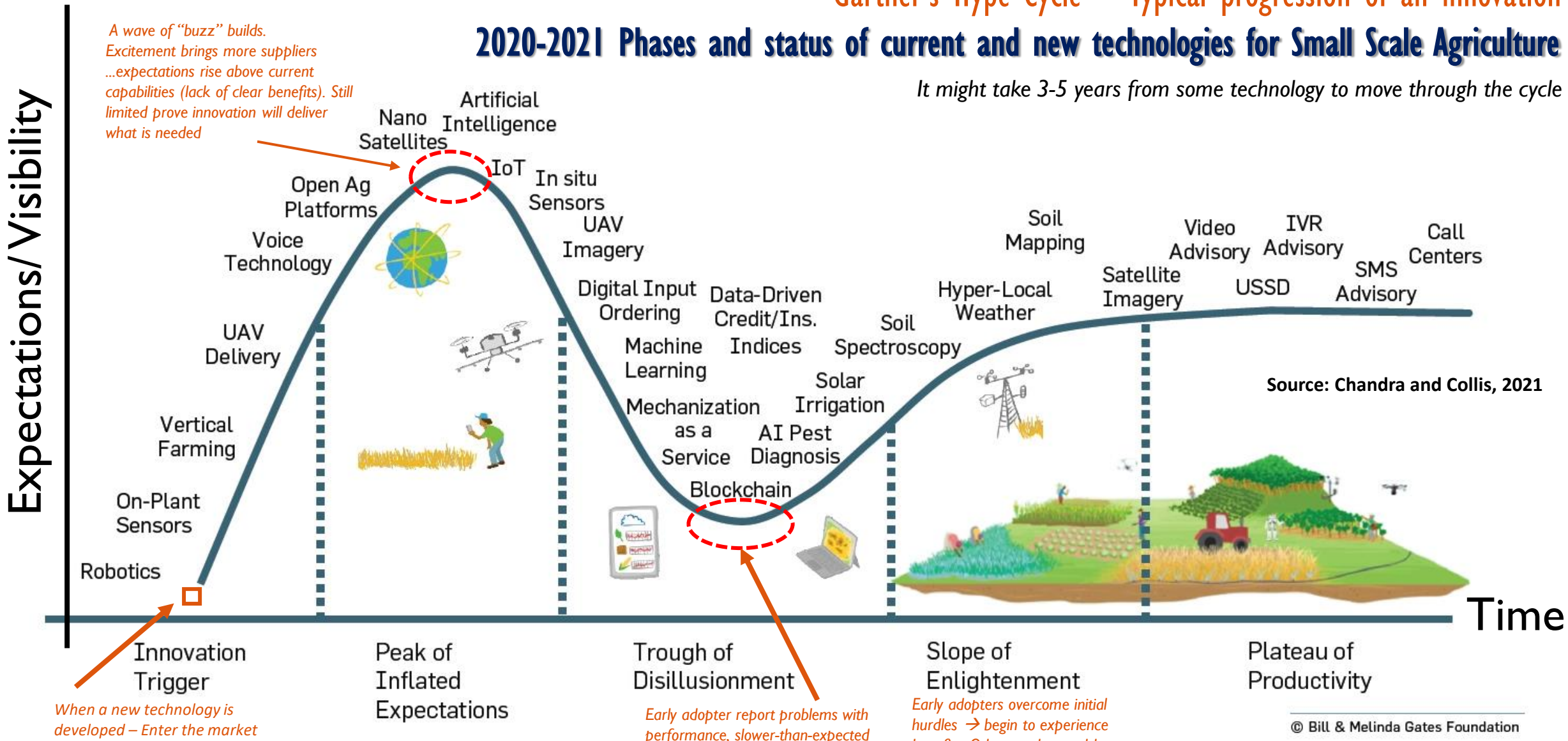
- *North America → Has been the largest and most mature market in relation to digital agriculture, followed by Europe.*

- *Asia-Pacific is projected to be the fastest-growing market, followed by Europe.*

Gartner's Hype Cycle – Typical progression of an innovation

2020-2021 Phases and status of current and new technologies for Small Scale Agriculture

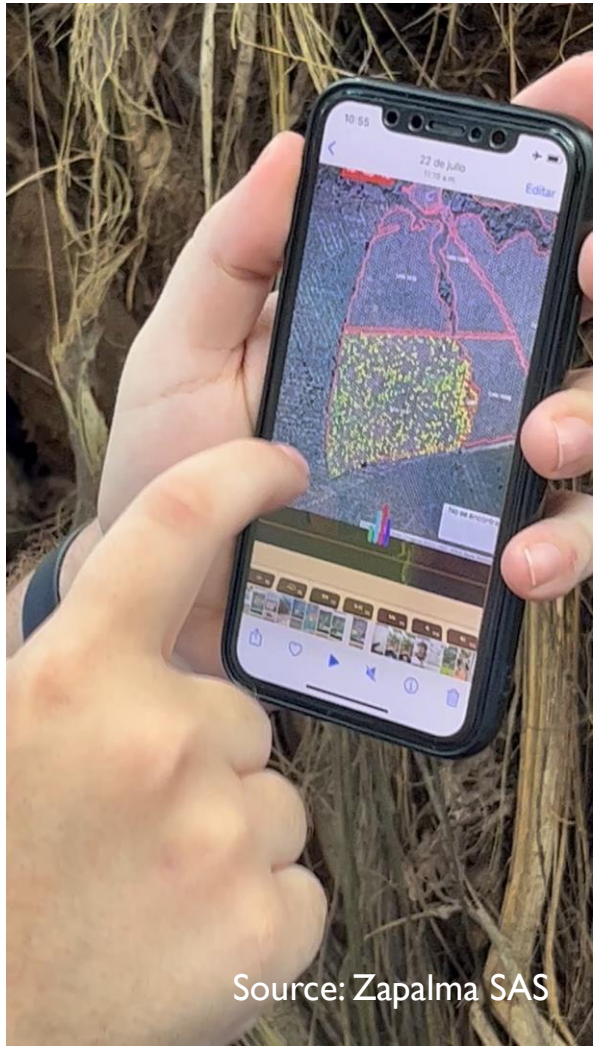
It might take 3-5 years from some technology to move through the cycle



Source: Chandra and Collis, 2021

Note: Same assumptions might not apply for low to middle-income countries

Decision-making Capabilities Strengthened with Digital Agriculture



Past sources of knowledge → research experiments, on-farm trials, farmer's experiential knowledge

Smart technologies offer on-farm, local-specific information to farmers

Better knowledge of farmers' production sites and thus gain greater certainty when making decisions

Volume and complexity of the data make it hard to manage, interpret, or make use of it

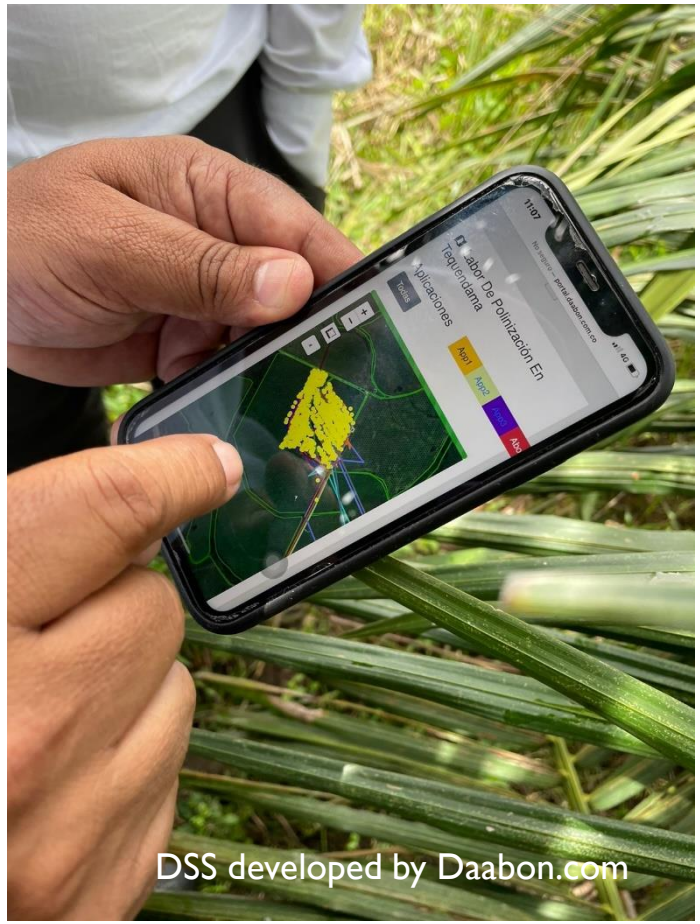
Famers will be transitioning from experiential decision-making to data-driven processes

Digital Ag requires new capabilities, interpretive skills for decision making, skills on modes of knowledge processing

Investment not only on smart technologies but also human capital is needed

Ingram J and Maye D (2020). Front. Sustain. Food Syst. 4:66.

Digital Agriculture → Enabling or Disrupting Farmers' Knowledge Networks



1. Supports collaborative knowledge creation
2. Enables farmers to exchange information
3. Benchmark their production against others
4. Development of informal information systems that can complement more formal information systems.
5. Provide farmers with analytical power and access to information previously unavailable
6. DSS / Artifitial Intellegence (both digitizing expert knowledge) → change the adviser's role and change the type and quality of advisory services
7. Advisers need to reassess their capabilities, practices, services and skills as they respond to new demands, need to create new networks with technology providers and R &D

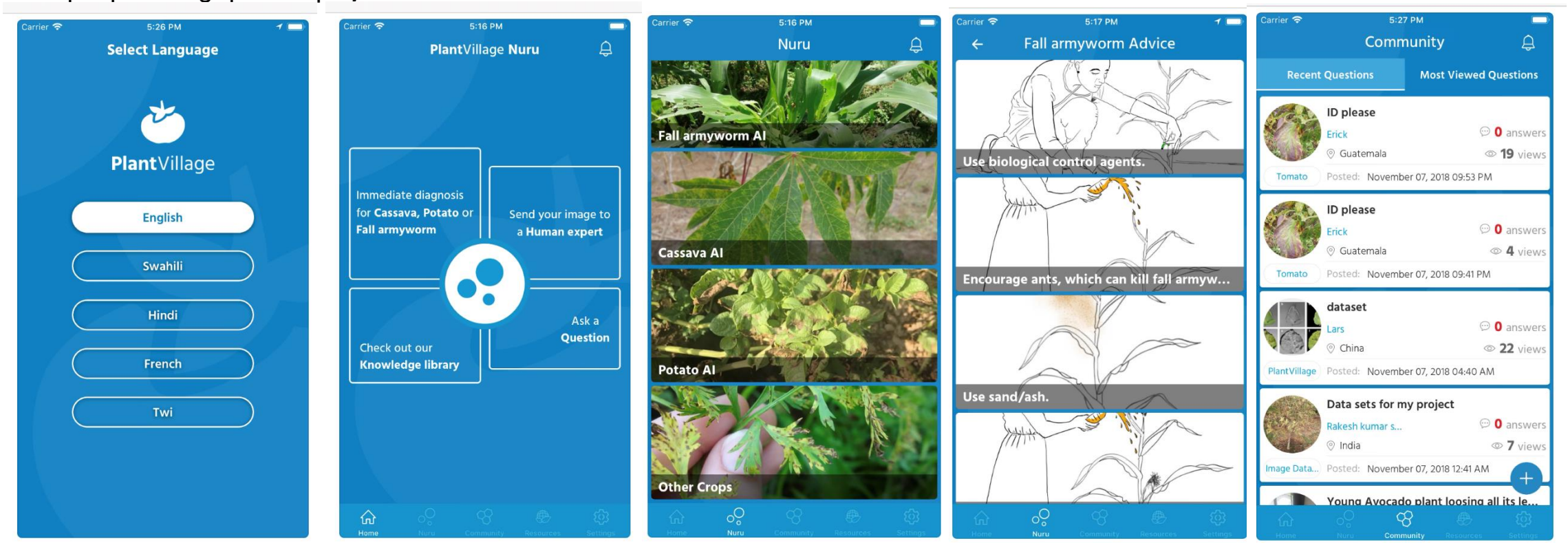
AI applications in Agriculture – Example: Crop Pest and Diseases

PlantVillage Nuru

Source: https://plantvillage.psu.edu/projects

Nuru → is an Artificially Intelligent tool developed by Penn State Univ. in collaboration with the UN FAO, CGIAR, and other publicly funded institutions.
As an intelligent assistant, Nuru has learned to diagnose multiple diseases in Cassava, fall armyworm infections in African Maize, diseases in potato and wheat. Also diagnosing spotted lanternfly pests in Pennsylvania.

This App uses Google's Tensorflow machine learning tool and a database of images collected by crop disease experts across the world.



Accelerating Adoption of Digital Agriculture – Targeting Factors the Influence Adoption

Model of Determinants of Diffusion, Dissemination, and Implementation of Innovations

(Greenhalgh et al., 2014)

1. Innovation

Relative adv.
Compatibility
Low complexity
Triability
Observability
Fuzzy boundaries
Risks
Task issues
Nature knowledge required
Technical support

2. Communication and Influence

Soc. networks
Peer opinion
Expert/Leaders opinion
Boundary spanners
Change agents (champions)
Formal dissemination programs

Diffusion ↕ Dissemination

3. Outer context

Organization's decisions to adopt innovation and efforts to implement it

Inter-organizational networks and collaboration
Intentional spread strategies
Wider environment
Political directives

4. Adopter

Needs
Motivation
Values and goals
Skills
Learning style
Social networks

5. System antecedents for innov.

- Structural determinants of innovativeness
- Absorptive capacity of new knowledge
- Receptive context for change

6. System readiness for innov.

- Tension for change (supporters vs opponents)
- Innovation-system fit
- Assessment of implications
  - *Support & advocacy*
  - *Dedicated time and resources*
  - *Capacity to eval. innovation*

7. Linkage among comp of model

Linkage at development stage
Role of Change agency
External change agency
Implementation stage

8. Assimilation

Complex non linear process

9. Implementation process

Complex sequence of trialing, adapting, and refining

Organizational Structure
Intraorganizational communication
Human Resource Issues
Interoganizational networks
Funding
Feedback
Leadership and Management
Adaptation/reinvention.

Factors Affecting Precision Agriculture Adoption – Review

Adopter
- Needs
- Motivation
- Values and goals
- Skills
- Learning style
- Social networks

94.1% pub.

Innovation
- Relative adv.
- Compatibility
- Low complexity
- Triability
- Observability
- Fuzzy boundaries
- Risks
- Task issues
- Nature knowledge required
- Technical support

88.2% pub.

Communication & Influence
- Soc. networks
- Peer opinion
- Expert/Leaders opinion
- Boundary spanners
- Change agents (champions)
- Formal dissemination programs

Diffusion ↑ ↓ Dissemination

82.4% pub.

Outer content

Organization's decisions to adopt innovation and efforts to implement it
- Inter-organizational networks and collaboration
- Intentional spread strategies
- Wider environment
- Political directives

38.2% pub.

Linkage
- Linkage at development stage
- Role Change agency
- Ext. change agency
- Implementation stage

FIVE components only TWO publications

Relative advantage in MOST of the publications and **was the dominant determinant in the innovation component.**

Adopter
- Needs
- Motivation
- Values and goals
- Skills
- Learning style
- Social networks

Have NOT analysed, inferred, or discussed in ANY of the publications – MAJOR omission from PA technology adoption studies

34 PA studies
2003-2018

USA, Germany, Australia, Greece, Turkey, Denmark, Czech Rep, Brazil, Iran, Hungary

Sharan, Brown, Best, 2019. Prec. Ag Journal

Factors Affecting Precision Agriculture Adoption – Review

5. System antecedents for innov.

* Structural determinants of Innovativeness
  - *Size/maturity*
  - *Formalization*
  - *Business maturity*
  - *Slack resources*
* Absorptive capacity of new knowl.
* Receptive context for change

6. System readiness for innov.

- Tension for change (supporters vs opponents)
- Innovation-system fit
- Assessment of implications
  - *Support & advocacy*
  - *Dedicated time and resources*
  - *Capacity to eval. innovation*

8. Assimilation

Complex non linear process

9. Implementation process

Organizational Structure
Human Resource Issues
Funding Feedback
Leadership and Management
Intraorganizational communication
Interoganizational networks
Adaptation/reinvention

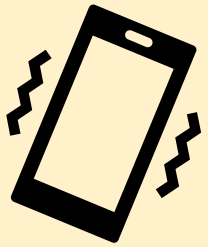
Many of these determinants were not included of the PA studies reviewed

What about analysis of complex interactions between components?

Sharan, Brown, Best, 2019. Prec. Ag Journal

Challenges for Adoption of Digital Tools

Pitfalls that limit the potential of Digital Extension Tools (DET) in Low- and Middle-Income Countries



Access Interface

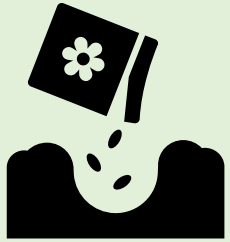
Pitfalls

- Lack of awareness on DET
- Inaccessible device?
- Electricity no available
- No mobile network
- Insensitive to digital literacy (Lack of skills/knowledge on use of digital tools)

Access Content

Pitfalls

- Insensitive to illiteracy
- Unfamiliar language
- Slow to access
- Hard to interpret
- Unengaging



Change Behaviour

Pitfalls

- Insensitive to knowledge (farmers, adv)
- Insensitive to priorities
- Insensitive to socio-economic constrains
- Irrelevant to farm
- Distrust

S. Coggins et al. - Global Food Security 32 (2022) 100577

Videos, Podcast, WhatsApp Networks: New versus Traditional Extension Information Delivery and Exchange Methods

	Credibility	Relevance	Legitimacy	Accessibility
Videos	If information is accurate and Credible if filmed to high quality (+) Limited trust from lack of face-to-face contact (-)	Various topics when produced Visual, practical learning can be No personalized for individual farms (-)	Trusted advisors and farmers in the No interactive (-)	Remote access (+) Broad dissemination, re-watched, low cost (+) If clear language, effective (+) Poor Internet connection and need of digital skills (- Lack of knowledge of where to find the videos (-)
Podcasts	If information is accurate and Credible if filmed to high quality (+) Limited trust from lack of face-to-face contact (-)	Various topics when produced No personalized for individual	Trusted advisors and farmers in the No interactive (-)	Remote access (+) People can listen while performing other tasks (+) International knowledge gained (+) Effective if language is clear (+) Poor Internet connection and need of digital skills (- Lack of knowledge of where to find the videos (-)
In-person (1:1)	Delivered by trusted advisor (extension agent, private consultant), and face-to-face contact (+)	Highly personalized delivery (+)	Can be highly interactive (+)	Advisor visits the farm (+) Cost and time associated with delivery means that engagement is unlikely to be frequent (-)
In-person (e.g., group meetings, field days)	Delivered by trusted advisor (extension agent, private consultant), and face-to-face contact (+) **Side conversations with peers at events very useful (+)**	On-farm (cooperating farmer) or other farmer's farm, which makes it highly relevant to farmers (+)	Can be highly interactive (+) Fosters peer-to-peer learning (+) Can revert to top-down delivery (-)	Requires travel to attend, time and resources (-) More focused on place-based not international learning (-)

Successful approach

Low impact approach

Mixed efficacy

Skills of the Advisors

Advisors being able to facilitate and support farmer learning and innovation

Participatory model (Bottom-Up)

Facilitator role:

- Assist individuals/groups through the process of implementing a change in practice.
- Uses intervention strategies helping participants to engage in a communicative dialogue that results in consensual decision making.
- Support peer to peer learning
- Coaching
- Broad knowledge and skills (production, management, administration, etc)
- Credibility and relational trust

Knowledge broker role:

- Facilitate and improve knowledge sharing between stakeholders,
- Facilitate learning and build local capacity

Are we including these topics on our in-service trainings?

Farmers and Advisors Interactions – Digital Agriculture

1. Advisors' hybrid knowledge

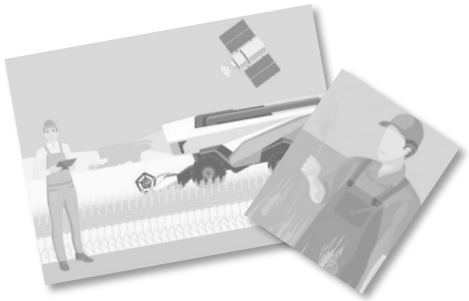
- Knowledge of farm systems combined with outputs from digital tools
- Intermediary btw farmer and tools (operate tool and analyse data for farmer)
- Sense-making role: advisor's experiential knowledge PLUS tools data help farmers realizing value-proposition

2. Remote or one-to-one interactions

- Possibility to less physical farm visits and more remote monitoring
- One-to-one interactions still preferred by farmers over long distance interaction
- Advisors' farm knowledge preferred by farmers compared to DSS Tools
- Farmers concerns over erosion of human-human interactions resulted from smart tools
- Video-call with farmers might be a possibility (Internet service needed)

Advisor' Role changing with Smart Farming

1. Advisor's professional identity



Who is responsible for data analysis?

- New practices don't match an advisor's perceived identity
  - *Farm advisors asked to support data-driven decisions (also Env. sustainability, adaptation to climate change) along with regular activities*
- Private companies conducting extension activities

2. Advisor's organizational context

- Does the organization provide smart farming services?
- Who are the actors required to support the use of technology?
- How can actors be organized to develop and share knowledge?

3. Changing professional identity

- Skills required might change actor's professional identity.
- Require evidence of how other advisors adapted (role models)
- Need for enhanced inter-professional practice

4. Changes to established practice

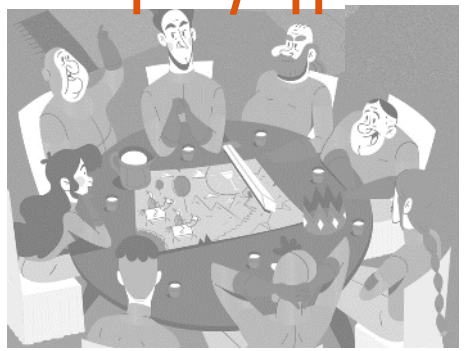
- In-season data collection & analysis for farmers (new knowledge & skills)
- Less frequent farm visits (front-office) and more data analysis (back-office)
- Tech. investment recommendations
- Recommend. of data integration to support management
- Using tools to strength services and create new ones
- New networks (Tech. providers), R&D

What is needed to strength smart farming adoption

Public-private partnerships

- Strengthening knowledge sharing, training, research, impact evaluation.
- Demonstration of the value preposition
- Connecting back-office with front-office
- Sharing risks and benefits
- Adapting technology to contexts and needs
- Facilitate learning & reduce uncertainty
- Funding brokering activities

Participatory approaches (Co-design)



- Adapting technology to contexts
- Co-design smart tools (tech. expert, farmer, advisor) – mutual learning.
- Co-development help farm advisors and tech. suppliers identify value proposition linked to data analysis and interpretation
- Training for farmers and advisors

Facilitate learning and skills

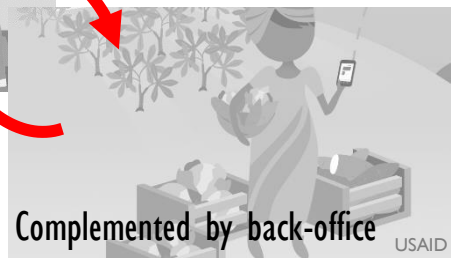
- Tech. providers engage in training but small social network → public ext. extend coverage
- Users groups
- Peer-based training
- Professional training to trainers (participatory approaches

Back-office

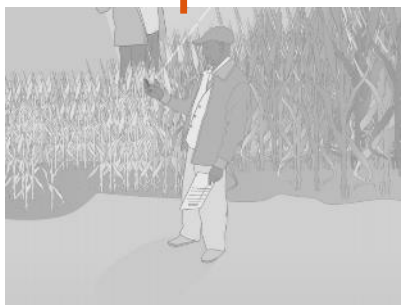
Analysing and interpreting data collected in the field

Training farmers
Know-How
Know-Why

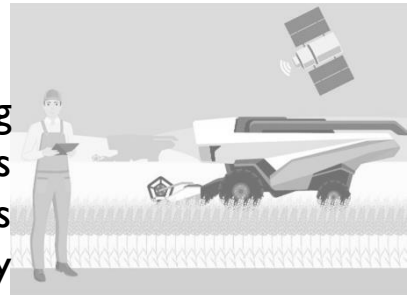
Front-office



Public & private advisors' skills development

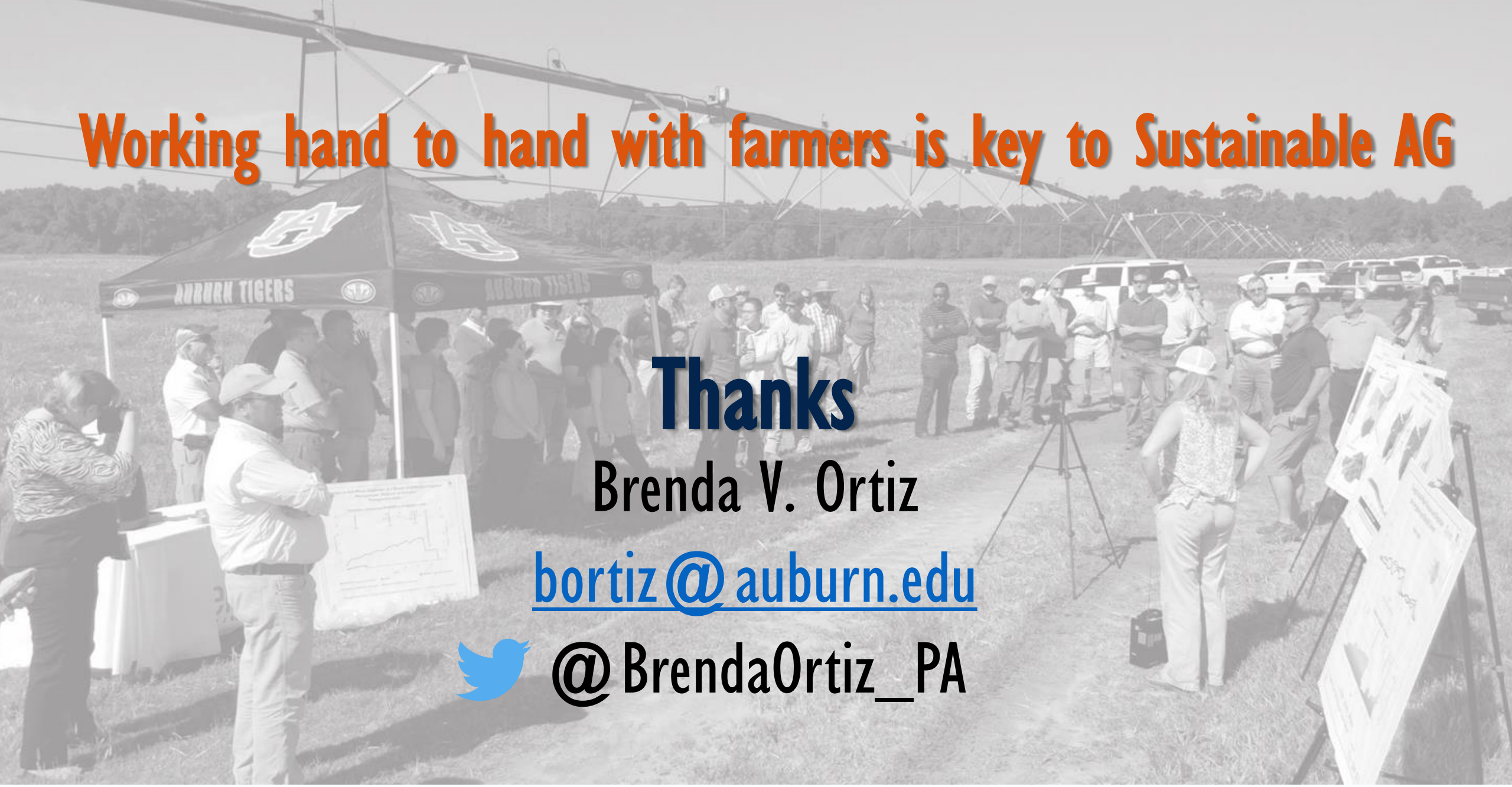


Farm advisors building skills on data analysis, data usage to support farm decisions,



- Technical advisors learning about farm systems
  - Training the trainers
- Farmers clubs/Community of practice

Working hand to hand with farmers is key to Sustainable AG



Thanks

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