



# Technical Advisory Panel: Irrigation Financing to Benefit Smallholder Farmers

**Summary materials**

Co-hosted by **Global Good** and the  
**Innovation Lab for Small Scale Irrigation**

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## About the hosts

Funded by Bill Gates and focused on a shared vision with Nathan Myhrvold, [Global Good](#) invents innovative, affordable, and accessible technologies that improve the quality of life in low income settings. The Global Development Portfolio focuses on improving agricultural value chains, increasing food security and nutritional value, and supporting better access to water and sanitation. We do this by collaborating with governments, NGOs and academic and research organizations from all over the world at the earliest stages of an invention's lifecycle to make commercialization in the developing world feasible by understanding and reducing technology and market risks.

The [Feed the Future Innovation Lab for Small Scale Irrigation](#)<sup>1</sup> (ILSSI) is a USAID supported program that builds on previous research initiatives in farmer-led, small scale irrigation. The program is investigating approaches to accelerate scaling of irrigation, for example, through increased access to information, credit and hardware for farmers. ILSSI partners with private sector companies to identify scalable, sustainable business models in different contexts. The program takes a systems approach – considering both food and market systems – to identify entry points to catalyze scaling. One aspect of that is facilitating [multi-stakeholder dialogue platforms](#) in Ethiopia and Ghana that bring together research organizations, private sector companies and associations, and public institutions to jointly identify problems, and moreover to implement solutions and share experiences.

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## TAP Overview and Next Steps

The Technical Advisory Panel (TAP) on smallholder farmer irrigation financing convened experts representing the perspectives of lenders, borrowers, pump retailers, and research organizations in two 2-hour online sessions. The objectives of the TAP were to:

1. Explore the present state of the smallholder farmer irrigation financing field, including what has been successful and what challenges remain to scaling sustainable solutions
2. Identify opportunities where technology could help scale working irrigation financing solutions or allow introduction of new ones

The structure of the TAP included four breakout discussions, each representing a Scenario with defined constraints in market systems development and Information and Communication Technology (ICT) access (Figure 1). On Day 1, each group completed a modified [Business Model Canvas](#) to help define customer characteristics, product features, costs and payments, and the network of partnerships required for a sustainable financing operation. On Day 2, the groups brainstormed where technical or software development interventions could be applied along the financing process, and what solution features would be needed.

**MEDIUM to HIGH:** *medium to high access to input and output markets; low to medium price volatility; medium to high integration of finance; added value and processing; transportation and storage access*

**LOW to LOW-MED:** *low access to input and output markets; high price volatility; low integration of finance; low link between rural and urban markets, and value added/processing; transportation and storage access*

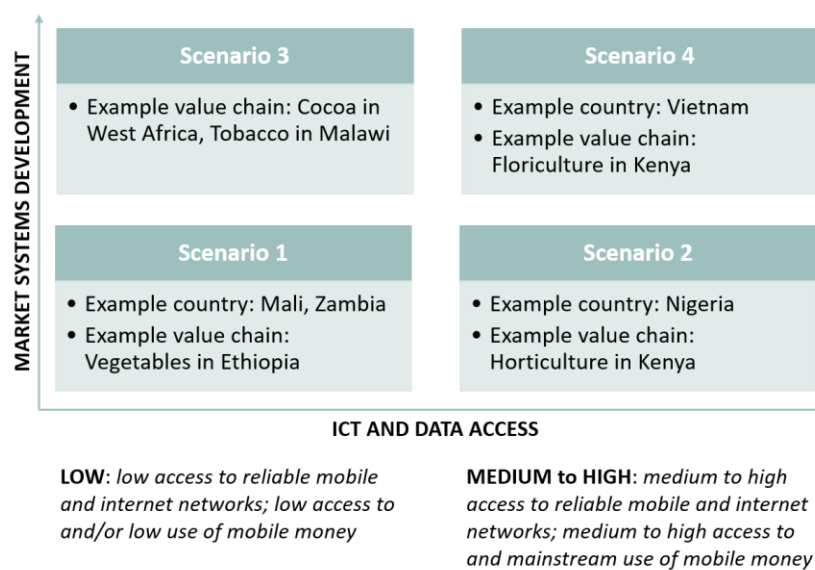


Figure 1. Scenarios for the breakout sessions defined by their level of ICT and Data Access and Market Systems Development

This document includes the output of the group sessions, as well as the pre-TAP questionnaire responses, and chat transcript of suggestions from the panelists to Global Good. The notes from the group discussions have been translated from the Canvas format to this document to improve readability, but the content has not been edited. We are making the raw text available in this report so that Panelists may benefit from the full range of contributions and insights provided in all four discussion groups. Global Good and ILSSI hope these materials support the broader set of objectives held by the Panelists, in addition to our own goals.

The [Global Good](#) team will use the outputs of the TAP to classify areas of technology need, and to develop conceptual solutions within the constraints of our low-resource target users. Areas of need identified during the TAP include a platform for retailers, lenders, and service providers to share information, a platform to connect farmers to other value chain actors, improved credit assessment tools, and digital farmer profiles. The former two address key challenges around customer acquisition cost, customer management, and farmer access to information. The latter two allow for data collection and analyses to reduce financier risk. For each conceptual solution, a risk and impact assessment will be used to guide further Global Good efforts in financing for irrigation.

An emerging interest of [ILSSI](#)'s [multi-stakeholder dialogue platforms](#) is finance as a constraint to scaling. In this regard, the outputs of the TAP will be shared with the platform participants, toward directly informing scaling activities across sectors in multiple countries.

# Scenario 1: Low market density/Low ICT development

## Business Model Canvas Analysis: Part/Day 1

### Customer Segment

#### **Assumptions:**

- Two perspectives to consider:
  1. Farmer (business case, multiple goals)
  2. Equipment supplier (integrated as financier)
- Scenario conditions define the customer segment: most are small, just becoming commercial. (Large, existing commercial farms likely served by own or other capital to invest.)
- No mobile money (i.e., reliable, able to rely on mobile money entirely); => Work through agents is necessary.

#### **Key identifying characteristics** for segmenting:

- Farm size; More importantly: Irrigated crop area (relates also to labor inputs)
- Type of water source: Risk of drought or water dries up during season
- Type of well or borehole (affects options, costs)
- Type of pump

Consider the overall market, as a general proposition. Is this irrigated crop in the overall market and scenario profitable? Should be valid for the *general* proposition rather than one specific customer.

IRR important - Customers must be able to generate a return from what they are growing (or have off-farm income supporting the payments);

May increase outputs, but then also need market linkages, access to buyers

#### **Different goals of the different markets/customer segments:**

- Reducing labor inputs
- Increasing yields
- Improved quality
- Producing different types of crops than existing (e.g. vegetables or other higher value)
- Converting from subsistence to market
- Food security throughout year
- Increase incomes
- Opportunities for women farmers

### Value Proposition

#### ***Given: A scalable finance mechanism for affordable irrigation for smallholder farmers***

- Value may depend on: Type of equipment, Pump volume
- Pump that is reliable, additional benefits compared to current pumps or method used.
  - Multiple uses from equipment: Multiple uses means potential multiple revenue streams (not limited to irrigated produce outputs but might include car washing or other income stream)

- Create opportunities for women farmers: Some companies have business model to target women. Their VP is to create opportunities (e.g. India, Bungaroo) for those who may not have other opportunities to access finance

## Products and Services

### Assumptions:

- Microfinance and banks not offering finance; equipment supplier and/or projects must provide financial service to expand equipment sales
- Not much bundling of products and services in this scenario at present

**Key issue/challenge:** Default and taking equipment affects profitability, undermines the objectives of the company or project, not good for reputation of distributor/company.

### How to address:

#### Financial products

- Lease to Own
- Warranties through term of loan (and possibly beyond loan term as an additional service/revenue stream for pump O & M, agronomic support)
- Ideal is Bundle of products and services, e.g. with financial product with insurance or some other type of risk management

Product potential: Develop service that is an “Exchange” for pump buy-backs to facilitate getting technology from those not using (not paying), to those who can use and pay (could be rental, sharing; could offer multiple benefits). Addresses product recovery, and protect reputation of equipment seller.

## Partnerships and Resources

*“Someone has to get the ground ready”*

*“Customers may look good on paper but [get the pump and they] don’t invest in other farm inputs [seeds and other inputs]”*

**Assumption:** Partners de-risk investment through capacity and other support

Critical partnership and resource: Capacity development

- Partners and/or company must support farmer and other actors **capacity** development!
- Must have a partner for **agronomic support** of farmers.
- Farmers need capacity **support on financial management** and mobile money, etc.
- **Agronomists** are condition for investment by farmer (for lease agreement)

Partners:

- Rural agents - **sales agents** from equipment supplier
- **NGOs** help as partners (e.g. capacity development, markets, credit)
- **Produce buyers** or partner to help reach markets (not only buyer but partner)
- **Payment services:** Mobile money (some limitations), saving (e.g. e-wallets for groups)
- **Equipment** suppliers (if project and equipment is not the main business)
- **Telecom** company (related to mobile money and other services)
- **Cooperatives** and group borrowing (e.g. VSLAs)

Regarding Ministry of Agric and Extension Agents as partner/resource: Extension agents must also be trained, paid, given funds to cover costs. Partnering with Extension is a cost to the company. Can be better for company to invest the same resources in training, i.e. in company's own agents/staff to provide same role

## Channels

**Assumption:** No existing distribution network in fragmented, frontier market (exception: companies that build on the marketing network from solar home system market)

### How to address issues:

- Marketing must have: Field level point of contact, Agents on ground. (No substitute for face to face!)
- Partners who have relationships that can be leveraged
- Links from other customers (farmers see other farmers using equipment; farmers encourage others to invest)

## Customer Relationship

### Assumptions:

- Main challenge is Risk Assessment
- Currently, companies/projects not assessing risk well

### Issues:

- Financing is specialized value chain and not all [equipment] companies have the competence or effectiveness.
- Many companies lack capacity in financial products/systems: Companies need risk culture, policy, and skills/expertise.
- Need to understand customers' diverse cash flows, not *only* revenue from irrigated production.
- Customer may not be able to repay only from irrigated production, so off-farm income may be helping the customer pay for equipment.
- Companies also lack understanding of agronomic context, so weak assessment on agricultural risks.

**How to address:** Agronomists (field support) often a condition for investment by the farmer (on a lease-to-own agreement), which is assumed to de-risk investment through capacity and other support.

**Example:** Azuri - "Agronomists": Function is to advise on irrigated production and check on payments and profitability. Building "log" on pump use, how farmers are doing. Enables understanding of why farmers may not be using pumps (or not using optimally).

## Cost Structure

**Assumption:** Cost structure of the financial product

Elements of the cost structure that must be covered by the price of the product (with or without subsidies):

- Transportation/distribution;
- Cover the cost of agronomic support;
- Cost of collection of payment (staff time, operational costs);
- Call center;

- Fee for payment collection (e.g. banks, mobile money platforms);
- Risk premium (rate default as factor of finance cost). [companies cannot charge interest rate on finance] Exchange rate changes.
- Water resource assessments.

**How to address** these are other cost issues:

- Face to face costs cannot be reduced. Need to consider reducing cost of pump production.
- Can we build a system where these costs are covered by customers without subsidies? If not, what would need to be subsidized? Need some type of subsidy to make it affordable to farmers, especially women.

## Payment Structure

### **Assumptions/observations:**

- Downpayment difficult for farmers.
- Payment may be taken in commodity (non-cash pmt); particularly certain VCs allow for non-cash pmt.

### **Issues:**

- Farmer business case - ability to pay off balloon payment, but at same time, not prevent their investment in running costs for the next season.
- Size of downpayment affects number of clients that can be reached by company (i.e. products sold). High downpmt limits number of clients that can purchase, but low downpayment increases risk and may reduce overall reach.
- Challenge: Scale issue, number of clients affects feasibility for systematic monitoring, action on payments or non-payment.
- Currently, company/project funding reduces pressure to repossess.

### **Ways to address:**

- Scalable approach would be to lump groups or markets by characteristics, according to who can pay through which payment structure.
- If only a few clients, company can look at individual business cases (but that is not scalable). Staged risk assessment: Downpmt one way to assess risk. Other approaches to monitor payments (small monthly payments that cover certain costs but also indicate risk of default; pump use monitoring; field visits).
- Some customers save up for pump after make commitment to buy, i.e. lay-by program. This also helps company understand customer cash flow.
- Physical assessment of farm.
- Cashflow assessment. Set up tracking for each/indv farmer and identifying risks (layers, identify when and how to intervene). Need clear dates for specific actions. Positive repayment incentives: Group liability (negative incentive). Cutoff/take back tech (negative incentive). Agronomic support is positive incentive. Give farmers referral finder fee is positive incentive.



## Technology Overlay: Part/Day 2

### Customer Segment

**Question(s): What could technology enable in terms of identifying individual customers and clusters of customers that might be profitably served?**

#### Opportunities:

- Exchange or platform/source of information sharing  
Aim would be to link pump service providers or equipment distributors with other organizations. Address the problems of finding customers (farmers), getting information about farmers and the market context, and also network/link with partners that provide complementary inputs and services across projects (NGOs, capacity development, off-takers, high potential value chains).
- Water resource mapping needed, but must address the missing link to customer data and to business case. (i.e. Currently, maps indicate areas suitable around water resources, but are not linked to farmer business case in the field for those 'suitable' sites)
- Farmer profiling linked with GPS location (application and feasibility questionable). [Limitation: relies on staff to collect data in field; capacity limitations]

Value Prop: N/A

### Products and Services

**Question: What could technology enable in terms of improving the delivery of identified products and services?** Did not complete

### Partners and Resources

**Question(s): In what way could technologies support the work of key partners? How might technology enable integration of partners across the irrigation ecosystem?**

#### Opportunities:

- Tech may be able to overcome some limitations of field agents
- Areas for technologies to address the capacity gaps or reduce number/roles of agents.
  - Improving mobile money constraints (resource; partners that provide mobile money platforms)
  - Do not know how much a farmer earns, so makes it difficult to manage payment systems and assessing risk. Platform or tech solution to link to buyer might provide more data.

### Channels

**Question(s): What could technology enable in terms of: - Marketing, - Sales, - Installation, - After-sales service**

#### Issues that cannot be addressed easily/quickly by tech:

- Farmers lacks smart phones; irrigation service providers may have smart phone but does not overcome wide range of constraints related to access.
- Tech cannot replace the "high touch" parts of the business model - middle-man or local traders (e.g. quality assessment, access to cold chain, etc.). Face to face interactions add to cost of doing business.

### Opportunities:

- Marketing [See Customer Segments - overlap with customer acquisition]
- After-sales service
  - Linking farmers to market; different apps available for linking to markets a/o inputs, but some are too complex and limited
  - Some of the marketing and information apps are complex; use of feature phones is limiting.
  - Data/app to alert and link buyers to producers.
  - Groups of farmers (ideal) coordinate and then can link to cold chain and buyers.
  - App that links farmer to loan or credit until get produce/grain sold. These work for high density markets, but have not been adapted to lower density, less developed contexts.

### Customer Relationship

**Question(s): What might technology enable in terms of the development and maintenance of customer relationships? Reduction of default risk? Addressing the unique needs of women farmers?**

### Opportunities:

- Improved system for downpayment may address the saving/payment needs and style of financial management of women (from field-based experiences and observation in pilots).
- Credit assessment using multiple sources of data (mobile money transactions, payment history for inputs, Satellite or remote sensing data).  
Already have scorecards for credit assessments and going through those steps (not very tech focused - standard; NOTE: Many distributors either do not use scorecards or are not well developed or applied; scorecard relies on field agent capacity)
- INSURANCE!!! (disease, pest, flood, seasonal weather, etc.)

Cost Structure: N/A

### Payment Structure

**Question(s): What might technology enable in terms of: Irrigation finance, Payment systems, and Reduction of default risk?**

### Opportunities:

- Platform/system to save up for the downpayment (i.e. lay-by program). Maybe 'e wallet' (especially for groups to enhance transparency) or other type of account monitoring (with financial institution). This enables customers to put money toward the downpayment once committed to purchase pump.
- Tools to assess downpayment structure and follow up payments to (reduce risk).
- Improved systems of PAYGO and/or lease/customer finance. E.g. Shut off access via blue tooth, restart entering codes. (payment structure for this approach is still in formation)

### Reflection

**Most feasible/scalable technology:** Remote sensing and remote monitoring use of pump - high potential & can link to risk of default (alert to potential problems)

**Largest remaining obstacle to a scalable, impactful financing solution:**

- On the ground data collection and face to face interaction (no footprint of customers);

- Limitations of feature phone; customer acquisition costs (establishing marketing and distribution channels)
- Cost of capital cannot be solved by tech (low cost product relative investment of suppliers; local currency based financing)
- Financial institutions don't provide finance for irrigation & burden falls on the equipment suppliers and distributors

**Best “moonshot” technology:** Prioritize insurance for irrigated producers/products; Linking with other organizations and farmer identification (finding farmers, enabling partnerships)

## Scenario 2: Low market density/High ICT development

### Business Model Canvas Analysis: Part/Day 1

#### Customer Segment

##### **Assumptions:**

- Farmer is already active in market
  - Sells some vegetable or other high value crops at the market, but wants to sell more
  - Knows which market or buyer to sell to
- Irrigation will increase production and increase \*income\*
  - That this is a business for the farmer

##### **Uses:**

- Irrigation, household, livestock use cases (water to animals, though irrigated fodder is becoming more common)
- Household access increasingly important

**Big picture: Our offering:** "PAYG"-like water access, though not necessarily the same as PAYG solar home systems, where service availability is directly related to payment amount

#### Value Proposition

##### **Given: A scalable finance mechanism for affordable irrigation for smallholder farmers**

- Income: Allowing farmers to upgrade current irrigation activities to increase production for sale, thereby increasing income.
  - Could be upgrading from bucket or hand irrigation to a mechanized solution
  - Could be upgrading from mechanized but high labor (e.g. treadle) to solar or fuel-powered solution
- Nutrition: Nutritional benefit thru production of veggies, year-round
- WaSH: Health benefits due to water access
- Extra time available for education, leisure, extra income generation. More time for women, especially

#### Products and Services

##### **Irrigation tech: Advanced irrigation technology**

- This exercise does not focus on the technology type – we assume that one has been selected

##### **Support/services made available in addition to irrigation equipment:**

- Farmers can be linked to aggregators (could be a choice or required)
- Technical after-sales support for equipment
- Remote monitoring (IoT) to improve performance and detect/predict malfunction
- ICT leverage points: Information and education

### **Financing mechanism:** Flexible PayGo (soft PayGo)

- Not like solar home systems where payments correspond immediately to equipment use
- More flexible model for operation and payments
- Small payments more often are more feasible for our customer
- The financier must consider pattern of rains and seasonality of farming in designing the financing product and payment schedule

### Partnerships and Resources

#### **Partnerships:**

- Local shops with technical capabilities - or service includes a shop network
- Leverage current value chain actors to provide agronomy information at lower cost, coordinated off-taking
  - These organizations could facilitate the financing
  - Bundle financing with existing services that farmers are using
  - Farmers already have a relationship with them, they have trust
- To help reach farmers, organizations with access to farmers to support with education and training
  - Reduce financiers' burden of traveling to farmers to build awareness and conduct trainings
- To help target locations for irrigation development, organizations with expertise in water availability, quality and access
- To help farmers with related costs, organizations providing support for additional required services (E.g. water.org finances boreholes based on capacity to repay rather than collateral)

#### **Resources:**

- Extension services could provide some of these services (e.g. education and outreach) at lower cost to the business
- Regulations are sparse, but there may be some government resources to locate water resources.

### Channels

(Not focused on during the workshop)

Could use existing sales channels to reach customers, as discussed in Partnerships above

### Customer Relationship

- Customer evaluation: Assess capacity to repay based on *how* they plan to use the equipment, not collateral they have already
  - Consider aspirations of customer, what are their business plans and goals?
  - Assessment should be based on how they plan to use it, e.g. irrigation, livestock, other businesses (washing motorcycles, etc.). Don't assume it's just for irrigation.
- Leverage partnerships with existing relationships and experience with individual customers
  - They may have records of payments (e.g. for inputs) or agricultural production brought to a buyer
- Leverage partnerships with expertise in agronomy to help assess customer
- Use ICT to maintain connection with customers

## Cost Structure

**Issue:** It's very difficult to be profitable in our scenario

### **Challenges:**

- Complex decision matrix for farmer. Farmer wants evidence for good ROI.
- High costs for financier: Overhead, acquisition costs, cost of capital, transport, after-sales costs

### **Solutions:**

- ICT to aid decision making for farmer, share farmer experiences?
- Move burden of costs from marketing and education to partners (NGOs, extension, other value chain players, etc.)
- Integrate into existing value chains to increase economy of scale

## Payment structure

### **Defining payment plan:**

- Payment flexibility will be based on information about household income streams
- Consider different loan periods for different customer needs

### **Executing payments:**

- ICT leveraged for payment transactions and tracking

## Technology Overlay: Part/Day 2

## Customer Segment

**Question(s):** What could technology enable in terms of identifying individual customers and clusters of customers that might be profitably served?

### **Issues:**

- How can ICT identify who gets access to the technology?
  - Do farmers have a smartphone? More likely to have a feature phone, but in this scenario maybe we can assume they have a smart phone?
  - Women are less likely to have a phone, often share a phone, difficult to receive information
- Privacy concerns about sharing data
- Consider unintended impacts of tech introduction
- Historic payment information that is farther out is less useful to the banks. Few banks are using alternative data in credit models.

### **Opportunities:**

- Digital identity for building credit history
- Building credit histories
  - financing reported to credit bureau
  - blockchain documentation
  - income sources document
  - identity establishment

- Incorporate observations on gender, e.g. women tend to be better at making payments

Value Proposition: N/A

## Products & Services

**Question: What could technology enable in terms of improving the delivery of identified products and services?**

### Issues:

- Connectivity and data costs are restrictions
- Men tend to be the defacto owner of higher tech products.
  - Literacy and education is needed for gender equity. May not be a hurdle if ROI is clear - decision may be made by men and women together.

### Opportunities:

- Technology for monitoring irrigation equipment operation
  - Measuring GW depth changes
  - Monitoring pump operation
  - Ability to remotely turn pump on/off based on payment performance
- There are apps that link farmers to aggregators - could be bundled with irrigation financing
- Platforms for shared equipment or irrigation service providers (e.g. Hello Tractor).
  - Requires higher flow rate irrigation equipment which is less efficient (e.g. flood irrigation vs. sprinkler or drip)
  - Requires geographic density of customers
  - Allows women to share equipment
- Remotely sensed agricultural and climate/weather data to help reduce risk
- Share data with insurance? Irrigation should derisk lending and lead to lower insurance premiums
- Index based insurance

## Partners and Resources

**Question(s): In what way could technologies support the work of key partners? How might technology enable integration of partners across the irrigation ecosystem?**

### Opportunities:

- Set up networks across irrigating farmers (peer-to-peer) to supplement or in place of public extension.
  - Knowledge sharing about irrigation practices
  - Ag advisory for high value crops that the extension officers don't currently focus on
- Connections between input suppliers, irrigation suppliers, off-takers (and repeat)
  - Help inform business decisions across the value chain
  - Provide the right links at the right time
    - E.g. Inputs for the right crops
    - Good prices to customers from off-takers with known suppliers
  - Could use the digital identities created for each farmer (e.g. using blockchain)
- Bundling household water access with irrigation supply
  - Reduce water collection time
  - Potentially reduce water quality concerns

- Access to groundwater

## Channels

**Question(s): What could technology enable in terms of: - Marketing, - Sales, - Installation, - After-sales service**

### **Opportunities:**

- Information chain through the stakeholders-- input provider thru off-taker
- Tool to generate leads: Reduce need for individual agents for each company traveling to identify potential customers
- After-sales: Still a huge cost. Ideally the ecosystem would take care of this.
- Need a network for maintenance - contacts that can be provided to farmers in their village/town
- Interactive remote monitoring. E.g. send pictures and have a conversation.

## Customer Relationship

**Question(s): What might technology enable in terms of the development and maintenance of customer relationships? Reduction of default risk? Addressing the unique needs of women farmers?**

### **Opportunities:**

- Customer management and continuing to sell products. Helps decrease overall cost of customer acquisition
- Referral program with existing customers.
- Utilize networks in-person and online (Facebook)
- Customer assessment
  - There is no difference between genders in the assessments for some orgs
  - Most large financiers do make decisions considering gender
  - Want to assess capacity to repay
  - Consider using digital identity and financial, agricultural, business, etc. data that may be associated with that individual
- Leveraging data from digital transactions
  - Tracking quantity and quality of production (e.g. milk) to inform credit scoring algorithm
- Banks want information on how much you can earn from what you sell
  - Verified, validated data
  - Something like picture-based insurance

Cost Structure: N/A

## Payment Structure

**Question(s): What might technology enable in terms of: Irrigation finance, Payment systems, and Reduction of default risk?**

**Issues:** Mobile money is very country specific

### **Opportunities:**

- Digital payments
- Digital identity will support this



## Reflection

### **Most feasible/scalable technology:**

- \*Creating connections between stakeholders in the value chain
- Determine credit history with existing data
- \*\*\*PAYG, more opportunities with ICT
- Financing thru existing points in the value chain

### **Largest remaining obstacle to a scalable, impactful financing solution:**

- For the case of connecting stakeholders in the value chain, we still don't have a reward/incentive process for them to share information or participate in a new platform
- Access to maintenance for equipment
- Development of spatial clusters for technology/financing deployment (may require subsidies)

### **Best 'moonshot' technology:**

- Creating connections between stakeholders in the value chain to share data
- \*\*\*\*Digital identity development

## Scenario 3: Medium-High market density/Low ICT development

### Business Model Canvas Analysis: Part/Day 1

#### Customer Segment

- **Forward contract farmers**  
(Commodity farmers selling into established value chain)
  - Sophisticated supply chains with intermediaries established
  - Focused on building volume
  - High access to inputs and services
  - Farmers tend hold the risk
  - Geographically concentrated, commercially focused, specialized in certain crop markets
  
- **Specializing/Diversifying farmers**  
(Either intensifying with current value chain which utilizes irrigation as best practice, AND/OR farmer is trying to access another value chain which utilizes irrigation or might benefit from irrigation)
  - Intercropping (tends to be how farmer introduces a secondary investment / cropping type)
  - Trying to access higher value other crop (cocoa example- aging trees require transition to other crop or new income source for inputs)

#### Value Proposition

**Given: A scalable finance mechanism for affordable irrigation for smallholder farmers**

- Issue for farmers, it's about Risk Management and Resilience through greater income (often doing both of the below at the same time, or deciding which is more favorable)
  - Understanding local resource suitability to diversify into new/secondary crops
    - Access to new /different inputs (farmer needs financing, crop and market info)
    - Build farm(er) capacity
  - Diversifying and add income streams to optimize / re-invest in primary crop
    - Seeking calculations and best tactical choices for reinvesting, specifically into customer's own farm

#### Products and Services

- **Tech advisory ag extension**  
(especially for forward contracting, a bundled service often sent out by the buyer, often detrimentally hides economics from farmer)
  - Specific farm assessment to build farm(er) profile
  - Providing farming data and prices
  
- **Bundles**
  - For diversifying farmers, to acquire and learn how to do a new farming practice  
Often pump vendors have stepped in to put bundles together to entice or support farmer
  - Tend to be expensive to put together, hard to scale

- **Financing needs to be local and ag-specific** (with considerations/understanding that represents farmers schedules, risk profiles/models)
  - How to assess farmer along the way, to nudge to success?
  - What does this look like? Not able to come up with a good example of this being done ag-specifically.
  - Need to innovate: e.g., Service provider models, lease-to-own, other novel structures

#### Partnerships and Resources

- **Structural resources**
  - Buyers / owners of forward contracts, in particular if they have an interest in what the farmers are going to be growing
  - Traders, aggregators
  - Farmer-representing producer orgs / Coops
  - Input suppliers, fertilizer companies, agrovets
  - Gov't extension officers
- **Other (potentially) leverageable resources**
  - Radio (especially for low ICT settings)
  - Financial institutions, MFIs
  - VSLAs (most local and common “financial” institutions)
  - Mobile money [if available under low tech scenario]
  - Pump retailers (offering a range of pumps and potentially services to offer/bundle)
  - Local and multinational NGOs (funding and subsidy, on the ground personnel)
  - CSR or other big biz interests to diversify

#### Channels

- Gov't extension (farmer information, marketing, connector)
- Agents to provide farmer advisory services and take info for MFIs, e.g. farmer's history of production for credit worthiness, etc (farmer information, finance, connector to introduce new resources and institutions)
- NGO facilitators on the ground (connector to link to other services)
- Input suppliers as distributors of irrigation supplies (Sales, Marketing, connector to other resources and institutions)
- Radio (farmer advice extension dissemination, marketing)
- Loan officer (finance focused mostly)
- Aggregation points serve as payment points via the crop buyer, payments both to/from farmer including loan repayments
- Presale introduction of potential tech (sales)
- Maintenance and training engagement programs, potentially from many key resources
- Cash payments still important despite mobile money (some farmer resistance of mobile transactions, but buyers prefer its ease and tracking)
- Scratch off layaway example of a finance/repayment mechanism

## Customer Relationship

### Issues:

- Largely relies on face to face interaction, but intensive face to face is not really scalable
- Community resource structures must be enabled and accessed first
- Vegetables can often offer intro to women, although using pumps still tends to be men
- Farmer doesn't really have data security, even if long-term data acquisition about farmer is collected
- Risk profile for use of various irrigation products needs different support interactions
- Relationships needed for payment collection and issue mgmt (e.g., commissioned collectors)
- Farmer needs access to field schooling, replacement parts, after sales service
- Farmer may need/benefit from add'l loan products

### Opportunities:

- Lead farmers, leads of informal sharing networks (especially for inclusion of women), often linking or providing foot in door for MFI
- Women's ownership likely increases as investment goes down
- Phone over transport (phone trees can be used when individuals dont have phone access)
- Leverage commissioned agents and (more resource-rich) forward contract owners

## Cost Structure (built into unit cost)

- Costs of new financial product development and customer/market development (early/startup risks)
- Customer acquisition and cost to entice new irrigation practice (costs for marketing, maybe radio cheapest, overall cheaper acquisition if irrigation practice or product is not novel, need live demos/training, which often means transport costs)
- After sales maintenance/service
- Collection of loans or repossession (with low ICT collection generally relies on people, could be outsourced commissioned collectors, but generally high costs for in person contact and transport if not geographically concentrated)
- Farmer costs to resolve loan (travel to finance points, paying for photocopies, lost productivity / costs to cover for lost labor, etc)
- Manufacturing, distribution, inventory, overhead markups to push product to customers
- Transport costs are especially important in low tech environment

## Payment structure

[Did not complete]

## Technology Overlay Part/Day 2

### Customer Segment

**Issues:** Need to focus on building and accessing local community networks, especially for word of mouth marketing and info/education sharing by local resources who do/might/could have access to ICT.

### Opportunities:

- Aggregating farmers makes it easier to share access to info and drive costs down for irrigation engagement
- Bundling or sharing access costs among Scen 3 developed market actors could help

Value Proposition: N/A

### Products and Services

#### Opportunities:

- Bundle phone with new irrigation equipment
- Push programs (on phone, to lead farmer) that enhance local access to irrigation education
- Personal consultation to farmers (equip, financing, economics)
- Trusted accessible product reviews of technologies and specific products
- Remote pay as you go (esp for solar) for time owned or time used or hybrid of both (although some risk and hard to finance)
- Very low cost pump (~\$50) as bridge tech or opportunity specifically for women

### Partnerships and Resources

**Issue:** Low ICT inhibits access to SHFs and profitably managing relationships

#### Opportunities:

- Solutions can consider community engagements and investments that can be made to bring greater access for the SHFs.
- Many Community development offices have funds that could be leveraged to help cover some costs of community level acquisition.

Channels [Did not complete]

Customer Relationship [Did not complete]

Cost Structure NA

Payment Structure [Did not complete]

### Reflection

**Most feasible/scalable technology:** Education relevant to local farmer, dissemination of good farming practices

**Largest remaining obstacle to a scalable, impactful financing solution:** Costs for farmer (upfront purchase / ROI / is farmer even capable or likely to be able to repay?) AND for irrigation actors to be able to extend services to customers in low ICT setting.

**Best “moonshot” technology:** Bundled phone and personal assigned agent (perhaps commissioned) that comes with new pump purchase (although who in the value chain assumes/shares this kind of cost?)

## Scenario 4: Medium-High market density/Medium-High ICT development

### Business Model Canvas Analysis: Part/Day 1

#### Customer Segment

In Vietnam, a lot of government investment in infrastructure paved the way for private sector involvement.

#### Characteristics of farmers:

- Business-savvy
- Resource constrained
- Well positioned to take advantage of access to capital for any farm improvements.

Groupings are important, especially **cooperatives**, in offering solutions as scale. Otherwise, the numbers are just too daunting.

#### Value Proposition

**GIVEN: A scalable finance mechanism for affordable irrigation for smallholder farmers.**

#### Issues:

- Risk management = key to all players.
- Different value propositions for each player in the system.
- Scale is the concern of financial institutions, but not farmers themselves.  
Financial institutions are not well suited to financing these systems because they don't understand farmers and they are not used to thinking this way [agriculture].
- Financial institutions problem: How do you finance someone who doesn't have a credit history?

**Vendor value proposition** is to help them [the vendors] sell product. They don't understand finance and see financing as a cost of doing business rather than an opportunity to make money.

**Farmer's value proposition** is to generate a good ROI without taking on undue risk. Risk reduction is a primary concern.

**Governments and NGOs:** the value proposition is development/social benefit.

#### Products and Services

#### Assumptions:

- Likelihood of having a credit history is greatest in this scenario
- Irrigation and finance are related -- both must work. You need a good finance system, but you can't take the irrigation system for granted.
- Only people who come from a social background would be willing to think about the lending opportunity specifically as it needs to be thought about it even at this stage of development.

**Vendors:**

- Vendors offer financing options because they think they have to in order to sell product.
- Vendors don't see finance as one of their core competencies.

**Financial Institutions:**

- Financial institutions prefer disaggregation. They don't want to manage product -- they are looking for a pure play on financing. The bank product is a loan with specific payment terms.
- Banks need an insurance/reinsurance system to guarantee their loans (or perhaps a risk-sharing arrangement with vendors so that they don't take the first financial hit).
- There is a need for different products for farmers at different levels. At the lowest level, farmers need help developing business plans.

## Partnerships and Resources

**Issues:**

- Partnerships are context-dependent.
- Reaching individuals rather than groups is much more difficult to scale. Working through big aggregators is easier. There are definitely extra requirements for working with groups: governance, financial management, means of underwriting. It can work, but it's not replicable. And it works well for small loans, but if you were to use it to finance a larger purchase (e.g. an irrigation system), only one might be financed at a time, stretching out the benefits to group members over too long a time period.
- There are multiple educational needs in the ecosystem:
  - Bankers need to understand ag
  - Suppliers need to understand finance
  - Farmers a need to understand financing mechanisms.

**Opportunities:**

- Insurance or reinsurance or loan guarantees to reduce risk to lender.
- You can use credit scoring and remote monitoring of productivity measures to develop a composite assessment
- Transaction costs of farm visits are too high relative to returns at scale. There are models that work well, but they don't scale.
- Group lending can work well with small items. Finance org lends to groups, two years/loan if group buys one pump at a time.
- Credit history can be based on mobile phone history.
- Local ag input suppliers could supply credit history, but banks would be unlikely to trust their assessments unless they assumed part of the risk (say the first 10%).

## Channels

**Issues:**

- In our scenario, smart phones are in widespread use (90%).
- Channels can be used for both money and information going in both directions  
In Vietnam, farmer unions deliver credit and crop buyers provide credit.
- For traditional lending, bank branches don't extend to rural areas, so it is hard for them to reach these customers.



### **Opportunities, examples:**

- It is possible to monitor [irrigation] system usage as part of irrigation technology and tie that to agronomy support.
- Distributors can identify potential clients, but they still need to be reached personally.
- There is a good network of small scale financial institutions in rural Senegal (700!); they are not used for irrigation yet (and interest rates are high).

### Customer Relationship

Who already has the long-term relationship with farmers in the field? Those long-term relationships become a channel for delivering irrigation technology and/or finance.

### Cost Structure

Did not complete

### Payment structure

Did not complete

## Technology Overlay Part/Day 2

### Customer Segments

#### **Issues:**

- Information should move both ways in terms of market conditions and access
- Information about the farmer (biometric info) -- is s/he a good farmer based on history?
- Data on phone use may not work as well in rural settings as in urban settings
- Granularity is a key issue: Public data is available and cheap, but unavailable at the individual farm level and hard to validate against ground data. More granular data is available, but expensive.

#### **Opportunities:**

- Information hubs for farmers and access to that information through cooperatives
- Google Earth - good data at the areal level, but not the farm-specific area
- Big Data could look at individual farmer behavior

### Value Proposition N/A

### Products & Services

#### **Issues:**

- The whole process of loan processing is more efficient if done digitally. Will it reduce need for facetime? Unclear.
- Loans are available in Senegal through informal financial institutions, but interest rates are way too high: 15%. (Dailor case/example)

#### **Opportunities:**

- Loan and ag extension information can be provided by tablet or phone

- Irritrack Technology includes decision support features, which either reduces the need for fieldwork or allows it to be done by less well-trained people (Jonathan Denison case/example).
- In Ghana, some supplier companies do credit surveys that combine farming conditions plus credit history plus farming activity (understood through relationships in the market value chains). (Minh case/example)

## Partnerships and Resources

### Issues and challenges:

- Is geospatial data included? Geo data is pre-loaded. Hydrology data remains a big challenge.
- Overall challenge - get lots of data from multiple sources, some digital and some not, and pull them together into a single app.

### Opportunities and examples:

- Irritrack: Identified all the suppliers and microfinance organizations working in Uganda + simple business plans from farmers + farmer history of ag; then gave access to that information to lenders. Used that information to put service providers directly in contact with farmers. All of this data was integrated into a simple app that took only two months to develop. (Jonathan Denison case/example)

## Channels

## Customer Relationships

## Cost Structure N/A

## Payment Structure

### Issue/challenge:

- Technology enabling irrigation finance, payment systems, and reduction of default risk

### Opportunities and examples:

- Provide irrigation kits to customers and customers pay by phone app. Supplier does “prevention” calls to check in on how the system is working, payment delinquencies, etc. (Dailor case/example)
- Lease equipment and do not remove it if a client is delinquent -- they try to make the system work by extending payment terms. (Dailor case/example)
- Offer significant cash discounts for up-front payments. (Dailor case/example)  
Payment experiment found that simple pay-by-period worked better than pay-by-use for both farmers and lenders. (Latter didn’t work because farmers reduced their use to save money.) (Alan case/example)
- Payments tied to harvest cycles was complex to administer, did not produce significant behavior change. (Alan case/example)

## Reflection

**Most feasible/scalable technology:** Irritrack-type technology that captures data from multiple sources and provides it to lenders; combining data capture, networking, remote sensing, historical data on

production and credit, business plan forward-looking.

**Largest remaining obstacle to a scalable, impactful financial solution:**

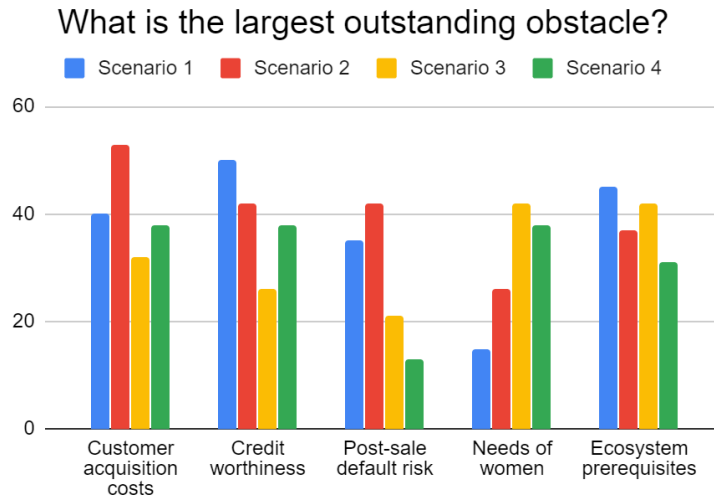
- Irritrack still requires farm visits by field facilitators, which is a problem at scale.
- Decision support system at least alleviates the training requirement for field workers.

**Best “moonshot” technology:**

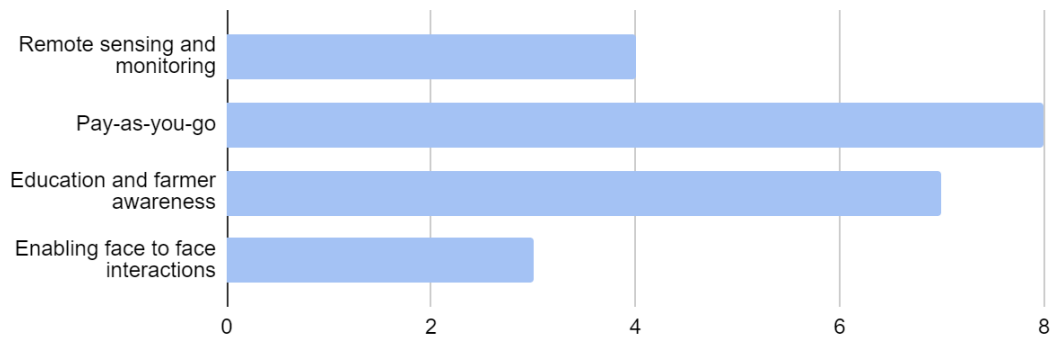
- Geotech data at a level of granularity so that you can identify individual farmers remotely. Amazing digital technology available, all of the remote sensing -- a one-stop shop to find a mix of technologies and pull them together.
- Getting the lender repaid before the farmer does, possibly by having the buyer pay lender directly in advance, then the farmer.
- Bitcoin link on financing.
- Farmer provides info by pictures.

## Online Poll Summary

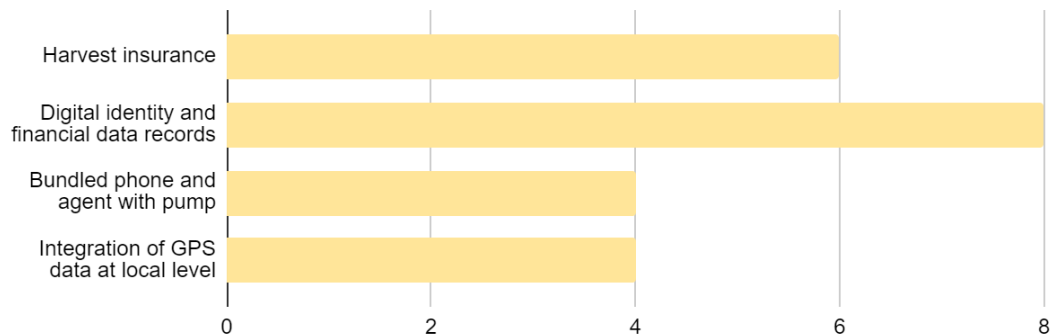
After the breakout group discussions, the Panel reconvened as a single group to present the highlights from their discussions. The following three figures show Zoom polling results from the Panel.



### Highest priority 'feasible' tech idea:



### Highest priority 'moon shot' tech idea:



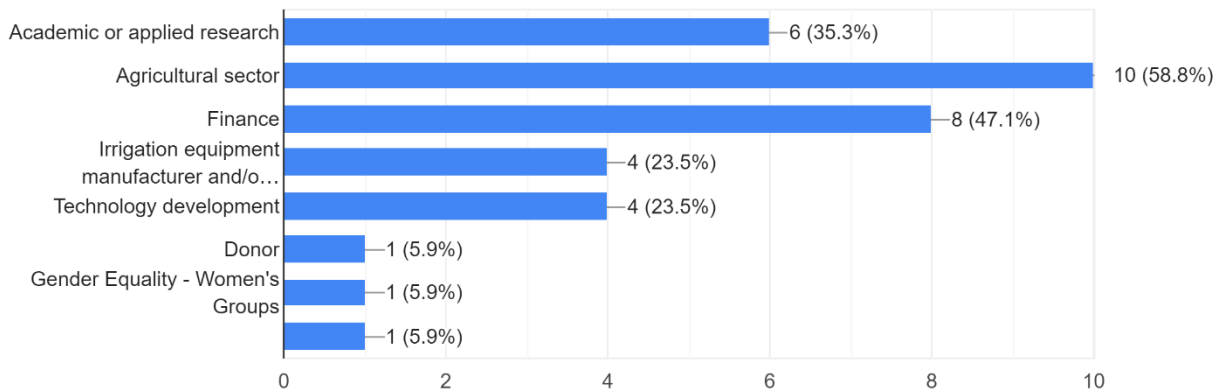
[More detailed descriptions of the 'feasible' and 'moon shot' ideas from each Scenario are included in the Scenario notes sections.]

## Pre-TAP Questionnaire Results

Prior to the TAP, a questionnaire was distributed to the panelists. The following figures summarize the responses to the questionnaire.

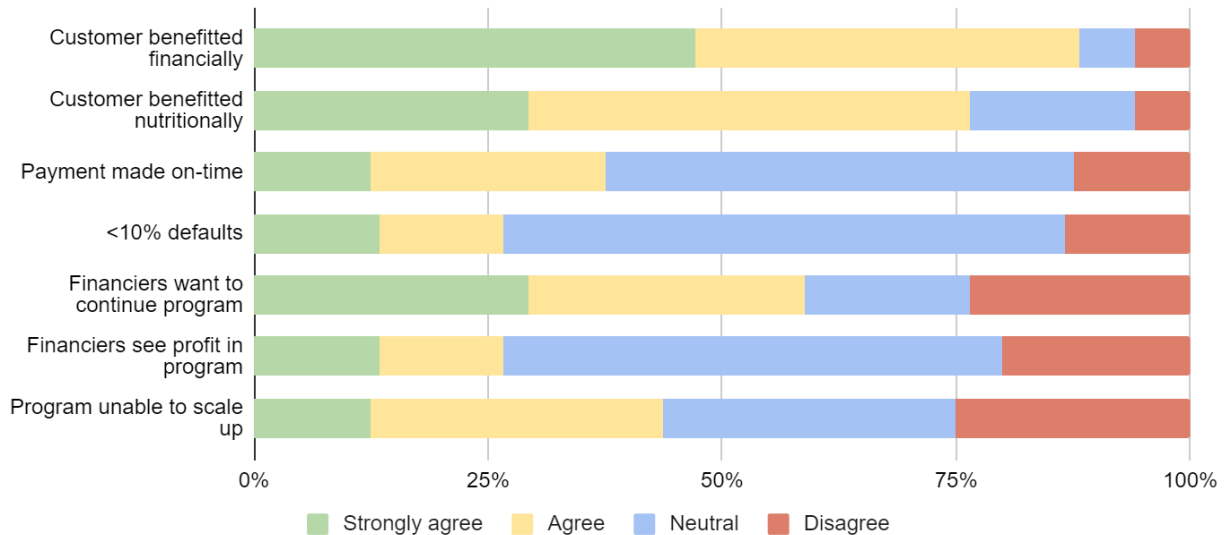
Please indicate which field(s) best describe your work. Check all that apply.

17 responses



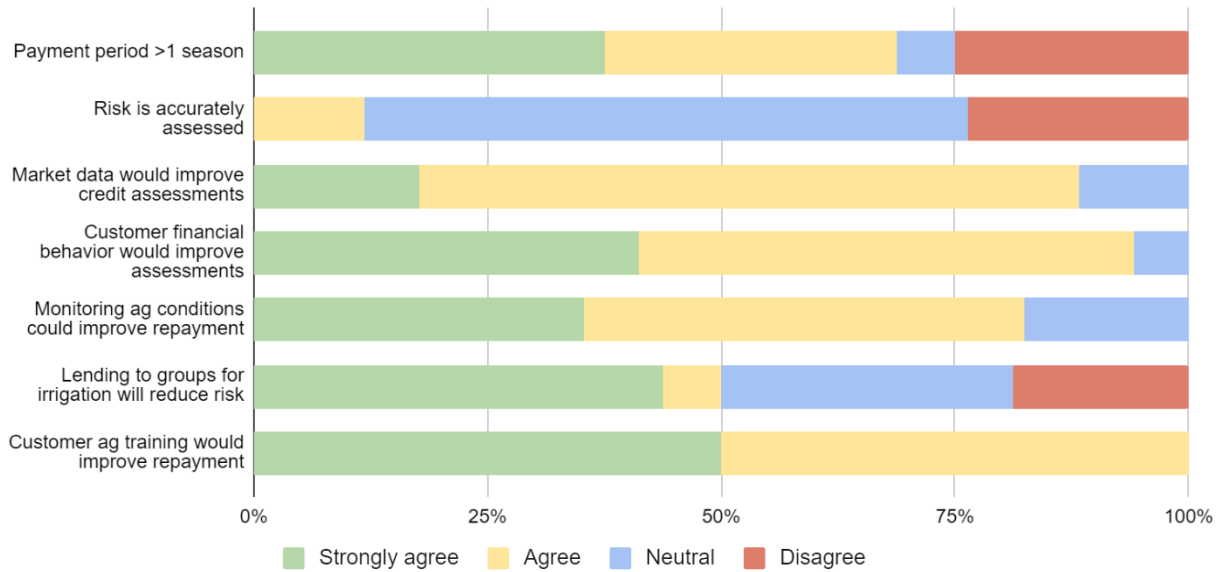
## Question 1

I familiar with a smallholder farmer (SHF) irrigation financing program where...



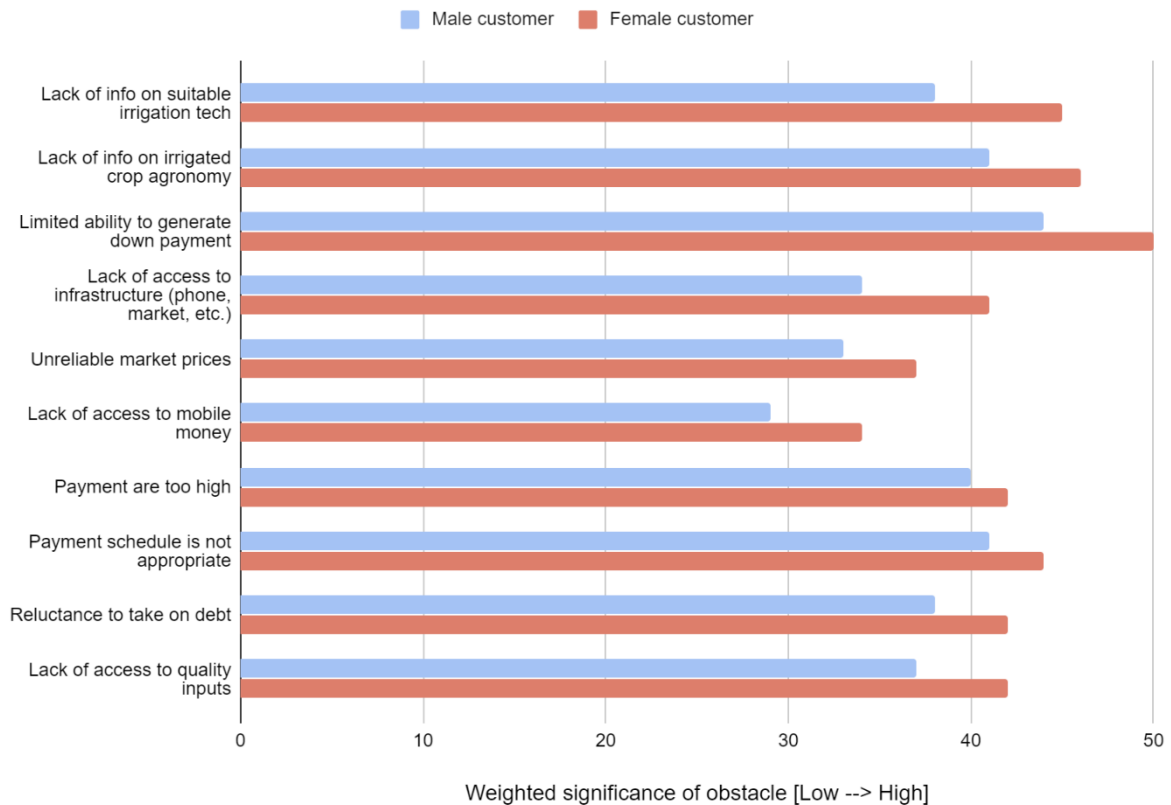
## Question 2

Please indicate your level of agreement with each statement.



## Question 3

Indicate the significance of the obstacles for customer access to irrigation financing



Other obstacles for **MALE** customers:

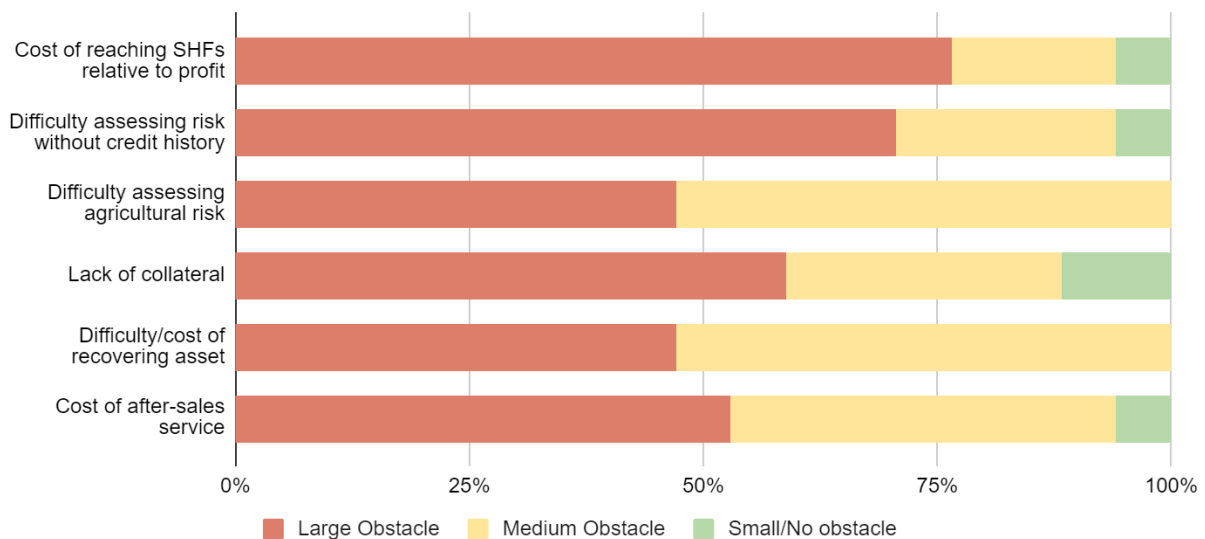
- Number of inputs available, no clarity on which one is best to use for which crop/ soil. Also lack of initial support to buy right quantities and application in fields
- Challenge to identify sustainable water resources; challenge to identify "cheap" labor
- Lack of understanding about: The fact that it is best to harvest and sell crops during the off-seasons and that irrigation gives the farmer the ability to plant, harvest and sell continually (with overlapping cropping cycles) throughout the year
- Allowing grace period for loan repayment

Other obstacles for **FEMALE** customers:

- Once the asset gets to a certain size the man may take over the decision on the loan, but the women is still doing the farming this creates a disconnect.
- Lack of access to land is one major issue for female prospects.
- Poor tailoring of products/marketing to women customers
- Women's mobility to shop for the right products or new markets, norms on who owns cash crops and the sale of product. Number of inputs available, no clarity on which one is best to use for which crop/ soil. Also lack of initial support to buy right quantities and application in fields. Women may be more ready to take on debt, but their share of the HH finances end up growing as their incomes grow. share of HH expenditures are not equalized.
- Land tenure
- Lack of understanding about: The fact that it is best to harvest and sell crops during the off-seasons and that irrigation gives the farmer the ability to plant, harvest and sell continually (with overlapping cropping cycles) throughout the year

Question 4

Indicate the significance of the obstacles for SUPPLIERS OF CREDIT

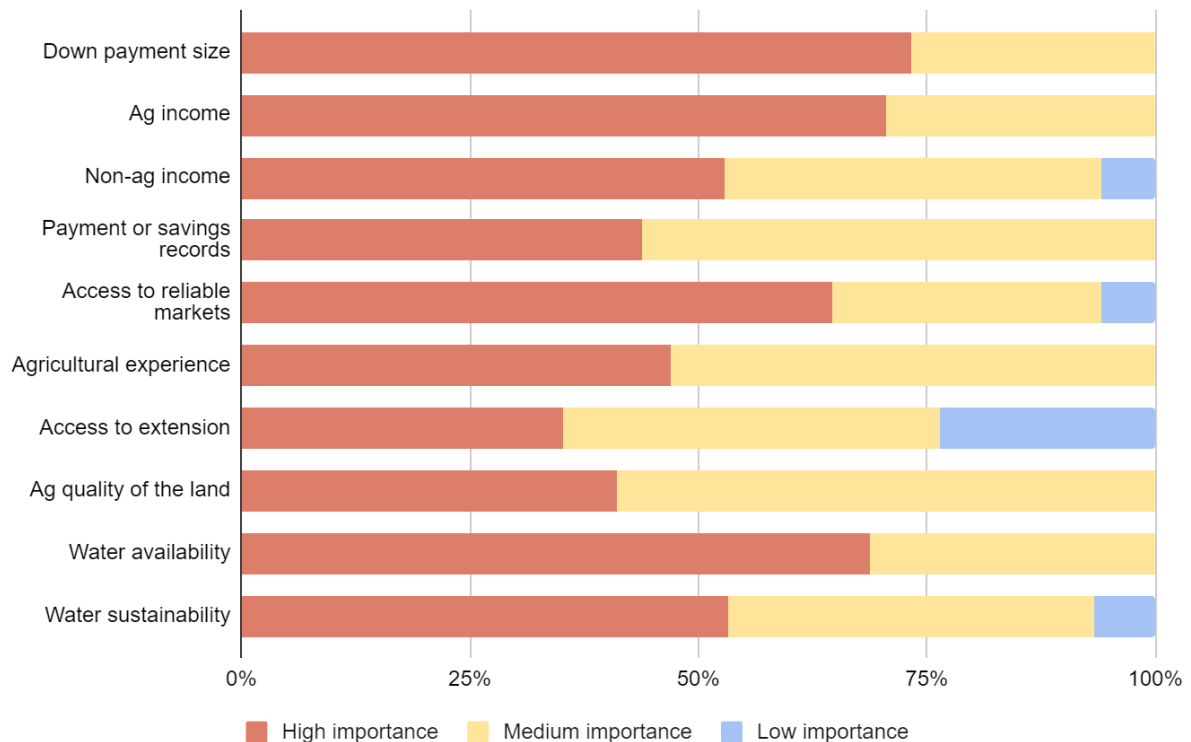


Other obstacles for **suppliers of credit**:

- Lack of professionalized credit risk management
- Distribution required to reach and serve SHF is too expensive and labor intensive
- A new and different model needs to be explored rather than trying to employ the same model for richer, denser cash crop farmers with greater access to knowledge and resources.
- It is expensive to reach and educate farmers about value of irrigation and to convince them to invest. This is especially the case in SS Africa where there is very limited history of irrigation and less than 4% of farmland is irrigated in most countries.

Question 5

How important is knowing each item in developing a predictive PRE-financing assessment of the customer?



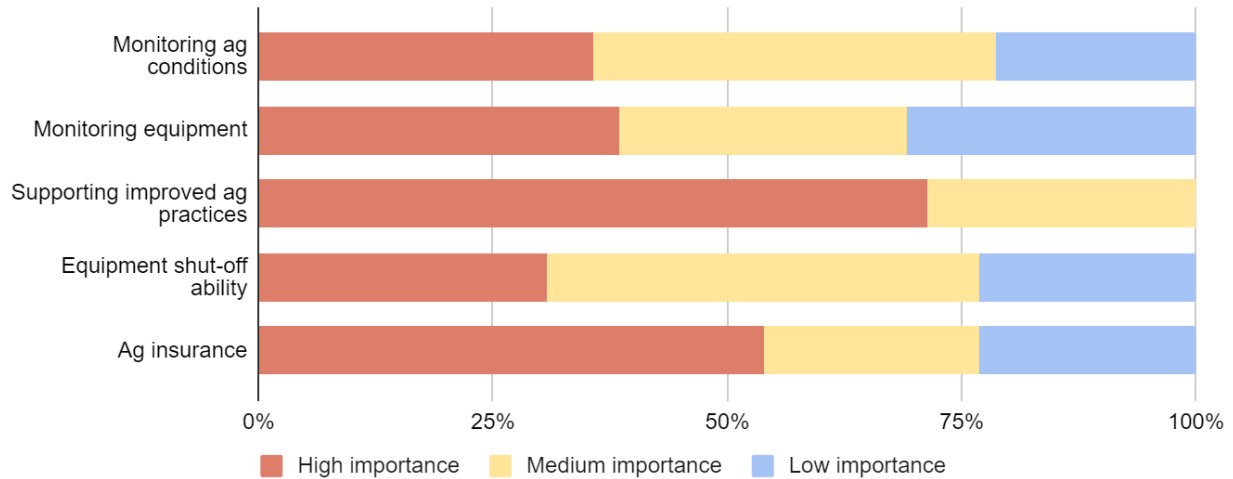
Other items to include in a predictive PRE-financing assessment:

- Customer reputation in the community
- Capacity to provide a business plan
- How seriously are they going to take irrigation as generating a key part of their family income is a critical question. Farmers who depend on irrigation for a key part of their livelihood make better use of the assets and perform better on repayments etc. - while other wealthier farmers with multiple other sources of income (who may look like better credit risks) may not really take the irrigation seriously, so they see lower benefits and less reason to repay their loans as a result.



## Question 6

How important are the following data or activities in reducing risk during the financing period (e.g. POST-installation or purchase)?

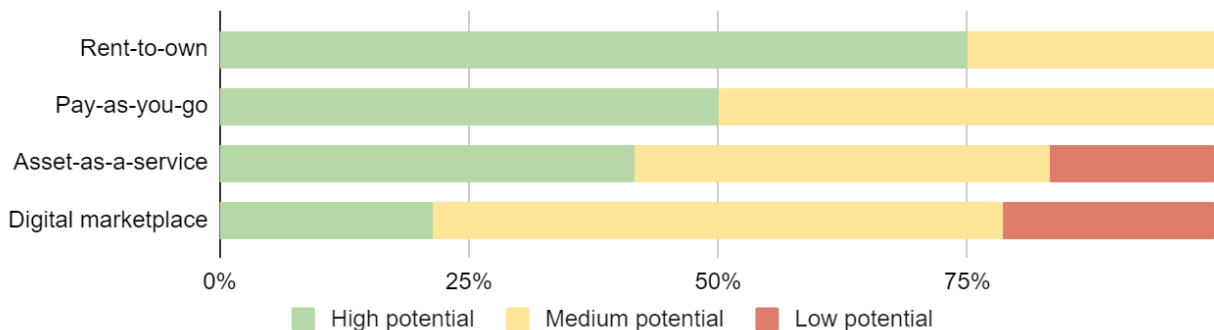


Other items to include to reduce risk during the financing period:

- Feedback mechanism to check lending is working and adjusting for new clients
- Supplier warranties matched to the length of the loan term
- Repayments timeliness, information on sales data
- Monitoring pump use etc. is only useful if either it (1) lets you know that a pump is broken (but a phone call from the farmer can do that too) or (2) if you can act on the information and help a farmer improve the effectiveness of their irrigation. So the information alone will not lower the credit risk, but if you can act on it, then it may.

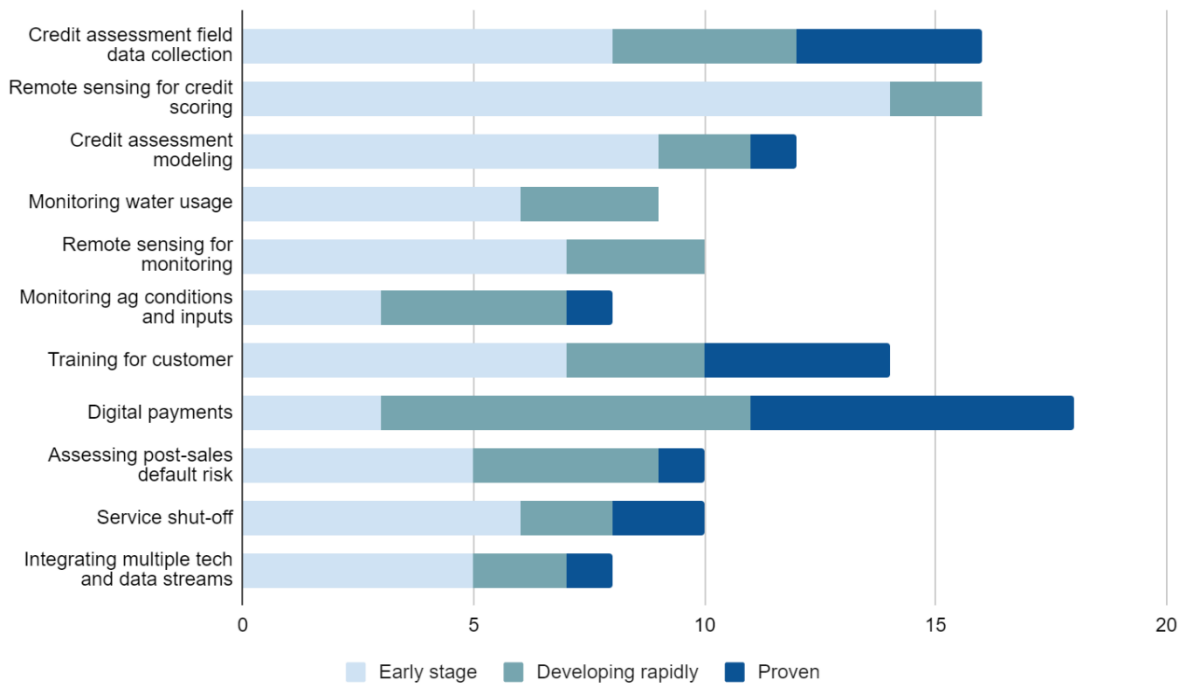
## Question 7

For each financing system, what is the potential for enabling customer access to irrigation?

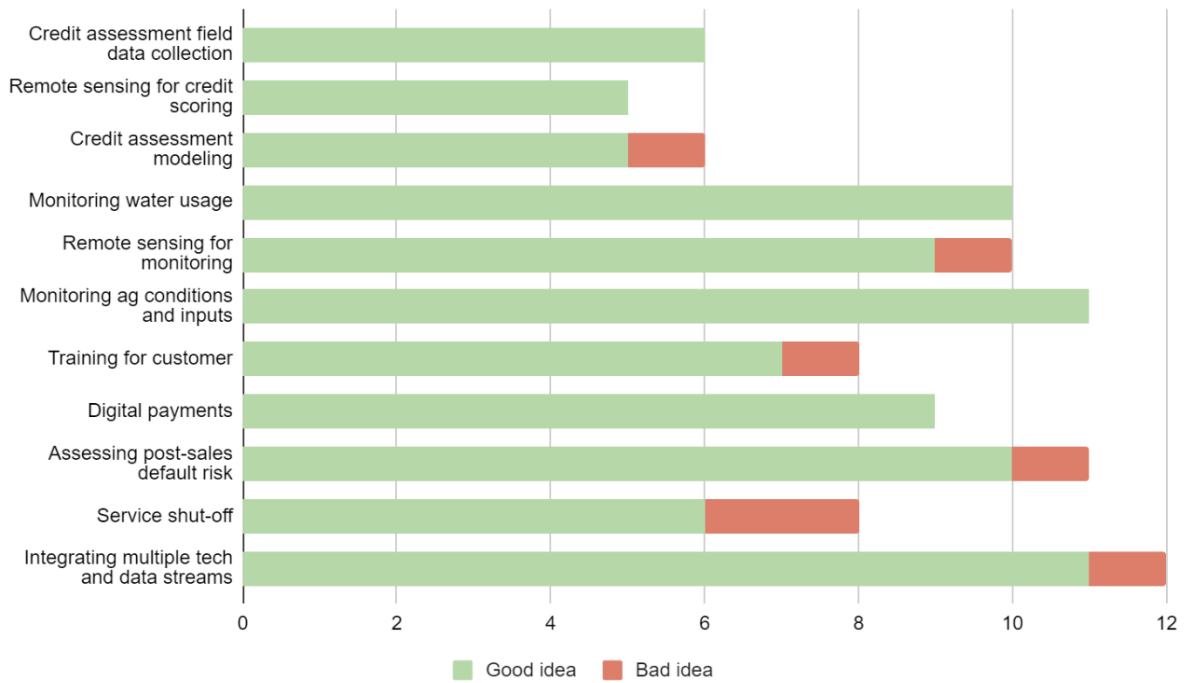


## Question 8

What is the current state of each technology/concept?



What do you think about each technology/concept?



## Question 9

What do you most want to get out of the irrigation financing workshop?

### To Learn:

- What has been tried and how can it be improved
- Which technologies and data are needed to support offering equipment on credit
- Which business models can be profitable in different African markets

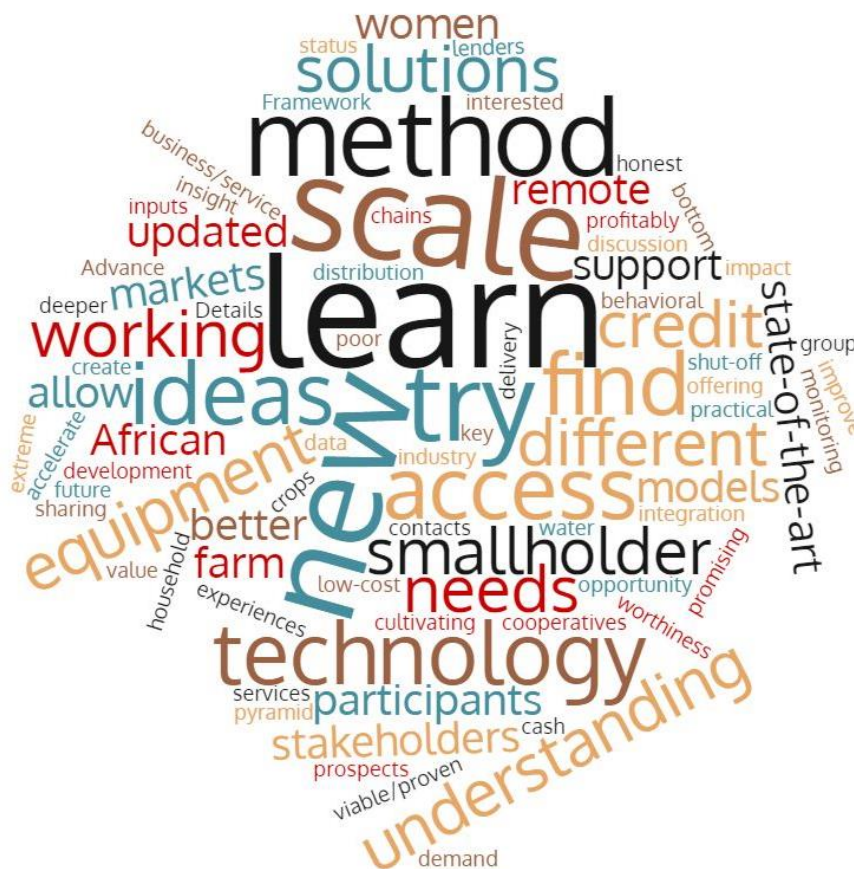
### How to ensure access:

- To women
- For irrigation water and household water
- For high value crops and non-cash crops

### New:

- Ideas to try
- Contacts for people working on similar problems

### Details on solutions that can scale up



Word cloud from the panelist responses to this question

## Zoom Chat Closing Advice to Global Good

- 08:56:00 From Jessica Jacobson (Water.org) : Pleasure to meet you all, learn from you and contribute to the discussion.
- 08:56:13 From Julie Cheng : Thx Jill. Enjoyed having you as moderator and discussions w our group. Hope to keep in contact with others!
- 08:56:33 From Nicole Lefore : Advice to Global Good?
- 08:56:34 From Nicholas Brozovic : Thank you - a very stimulating discussion!
- 08:56:40 From Claudia Ringler, IFPRI : Thanks for organizing! Learning from different perspectives was very useful!
- 08:56:40 From Dialor THIAM : Hey would be great to share the contact list\$
- 08:56:46 From Jill Bamburg : Work with the most developed solutions to make them even better!
- 08:56:54 From Alan Spybey : Hope we get the same group next time :)
- 08:56:58 From Sybil Chidiac : There are gender perspectives that we discussed in our group #3, High market dev/ low ict, that should also be considered in increasing access to the benefits of irrigation...
- 08:57:18 From Marie Connett : Thanks so much to Nicole, Jill, Tess and Ben for hosting, and we at Global Good look forward to further inputs.
- 08:57:22 From Jonathan Denison : @globalgood - this kind of interaction with small group discussions seems to have more engagement/power than a webinar style engagement. I would enjoy the opportunity for more-specific type engagements eg. elaboration of some of what we heard from colleagues on what they are doing!
- 08:57:25 From Nicole Lefore : Thanks Sybil - Very important!
- 08:57:26 From Claudia Ringler, IFPRI : I agree with Sybil. we also mostly focused on gender.
- 08:57:36 From Georgia Van de Zande : Thank you! Please keep making these wonderful connections
- 08:57:38 From Hack Stiernblad : Interesting event and great to meet so many people who are working in the space from different angles!
- 08:57:45 From Richard Reynolds : This is such a critical area - but also v difficult (no silver bullet). continue to engage with FSPs.
- 08:57:48 From Tom Griffith : Great, job, exciting to connect with everyone, thanks again
- 08:57:55 From Sybil Chidiac : Thank you for this 2 day workshop. Great connections made, insights gleaned. We did need more time for the breakout conversations!
- 08:58:00 From Minh Thai : Emphasize contextual conditions in designing technology

08:58:06 From Nicholas Brozovic : The breakout room discussion was very good - I'd like to see more of this kind of facilitated discussion.

08:58:06 From Max Mattern : Thanks everyone, really appreciate the opportunity to engage with this group of experts. One piece of advice would be to continue to push to reduce the cost of irrigation equipment and localize manufacturing/refurbishment. It's hard to find ways to reduce the costs of customer acquisition and support, so bringing down the cost of the asset may be one of the ways to make these financing models more sustainable

08:58:17 From Nicole Lefore : Thanks Minh - good advice!

08:58:41 From Jill Bamburg : Great advice here!

08:58:49 From Michelle Kurian : We looked at post-irrigation market innovations. there's potential to connect soil sensing with harvest times and solar cold storage aggregation. would build off of existing technologies such as vittava cold storage or the loop app

08:58:49 From Hack : I 2nd Jonathan, small groups, longer time and maybe more specific subjects would be very interesting!

08:58:56 From Richard Reynolds : My advise is to provide insights on what are the options for irrigation with pumps around potential, price, reliability

08:58:59 From Martin Fisher : great if one could catalog all the ideas - from each group - in more detail - I expect there are some more hidden gems that could be built-on - thanks to all!

08:59:04 From Dialor THIAM : Thank you for these sessions! Very interesting and a lot of lessons learned

08:59:07 From Rana El Hattab : Thanks everyone and my advice to global good would be to keep the conversation going and think of how to keep connecting and leveraging the community. There is so much happening and so much to learn. Thanks again for organizing this workshop and thanks to everyone for their time and their contributions.

08:59:16 From Dialor THIAM : Hope we will keep in touch

08:59:35 From Sybil Chidiac : Solutions can also consider community engagements and investments that can be made to bring greater access for the SHFs. Many Community development offices have funds that could be leveraged to help cover some costs of community level acquisition.

08:59:39 From Timothy Prewitt : Thanks all. Technologies certainly improve agriculture, but remember the fundamentals: seeds, soil, nurtriants, crop protection, and labor. There are some physical aspects here ICT won't change for our farmer friends. .

08:59:55 From Nicole Lefore : Very true, Tim!