Driving AgriTech Adoption:
Insights from Southeast Asia's Farmers

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Executive Summary:

There are over 70 million small family farms in Southeast Asia. These farming businesses typically face a range of challenges in accessing credit, advice and markets.

In theory, new digital technologies could cut transaction costs and improve information flow within the sector. Technology could, as it has in so many other industries, drive greater efficiency in finance and trading; delivering higher incomes for farmers and stronger sectoral growth.

Over the last ten years, a host of technologies have emerged with the potential to fill this gap. Farmers have been slow to adopt these digital tools. For example, the largest smallholder e-commerce platform in Southeast Asia is used by just 25,000 farmers.

We talked to farmers directly, interviewing 100 farmers in Vietnam, Indonesia and Myanmar to find out why adoption has been so slow. What we found surprised us - we found farmers actively using their phones to grow their farming operation but in very different ways than we expected.

Farmers typically move through five stages of digital adoption:

1. **Face-to-Face:** farmers begin by using no digital technology at all -- each interaction with their suppliers, customers and lenders is undertaken face-to-face.
2. **Phone Call:** most farmers today substitute some face-to-face interaction with phone calls.
3. **Peer Group Dialogue:** once farmers own a smart phone, they tend to begin joining small group chats with their peers. WhatsApp, Line, and Facebook Messenger are common. These groups allow farmers to seek advice and discover information on price and products from their peers. As these groups build on existing social networks, farmers use the groups to communicate with people they know.
4. **Active Discovery:** The next step we observe is farmers using their phones to open up new connections they haven't or couldn't have made in person. These farmers are using technology to not only negotiate but also discover new transaction partners. Web search, video streaming and messaging allow these farmers to expand their network and knowledge.
5. **Digital Service Engagement:** a range of starts and agribusiness are building more formal tools, typically provided as an Android app to farmers. Apps have been created for trading, finance and disease recognition.

At each step along the way we observed farmers weighing up three key factors before they advance to the next step. They consider how the technology will perform, how easy it is to use and what other farmers say about the service.

Implications for Industry:

Digital adoption by smallholders is a strategic imperative for startup founders, agribusinesses, NGOs and governments in ASEAN. Our study highlighted the following learnings for industry:

1. The digital transformation of smallholder value chains is much deeper than farmers downloading and using apps. Building an app might not be the best place to start - consider engaging with farmers on a chat platform they already use to connect with their peers.
2. A standout feature of the adoption curve is farmers' strong preference for conversational technologies. Train, encourage and reward your staff to use chat-based technologies.
3. The bulk of digital communication that farmers engage in is with someone they know already. Digitalization is a decentralized activity. Drive digitization at the edges of your organizational structure - in villages.

4. Age is a key factor in willingness to adopt new technologies. Digitalization strategies should focus on younger farmers.

5. A few lead farmers typically provide most of the input into peer group dialogues. Engage these group leaders and provide them with messaging that is easily shared in online chat forums.

6. Chat-based technologies, while a clear preference for farmers have limitations. Take steps to capture data from your staff's digital chat conversations and use this data to build up client datasets and target messaging.

Introduction:

There are over 70 million small family farms in Southeast Asia. These farming businesses typically face a range of challenges in accessing credit, advice and markets.
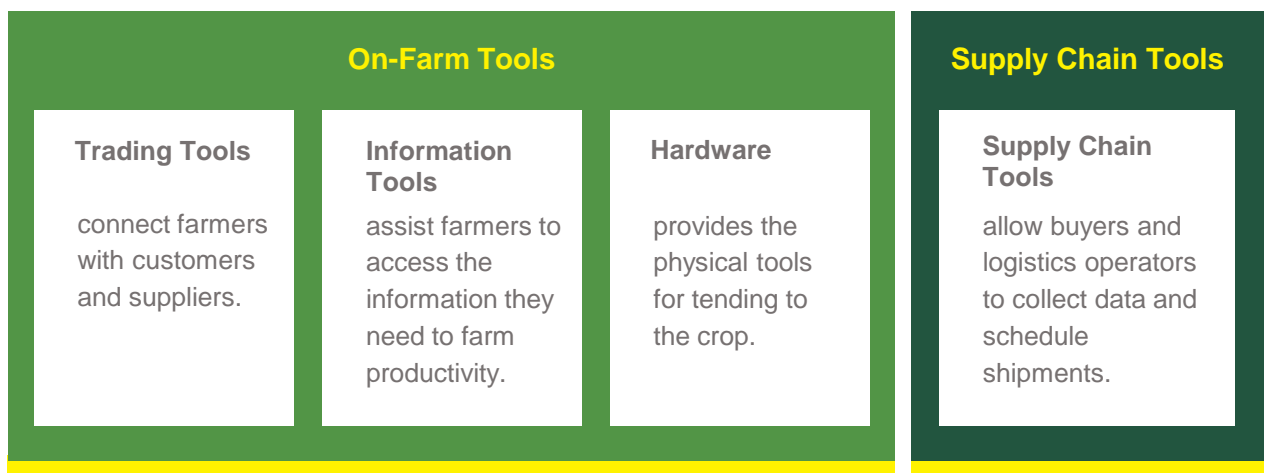
It has proven difficult for businesses to build profitable models to provide finance, advisory and market connections to these farmers at scale. Serving such small customers in remote locations using traditional in-person provision of loans, advice and trading is prohibitively expensive. As a result, most services are provided at a village level on an ad hoc basis and at a high cost to farmers.

In theory, new digital technologies could cut transaction costs and improve information flow within the sector. Technology could, as it has in so many other industries, drive greater efficiency in finance and trading; delivering higher incomes for farmers and stronger sectoral growth.

The Technology Toolkit:

Over the last ten years, a host of technologies have emerged with the potential to fill this gap. Grow Asia has compiled a directory of some 63 digital solutions which are being used in Southeast Asia today. These technologies focus on a number of different aspects of the farming operation and provide value in different ways.

These technologies can be divided into four groups. The first three types of tools have been developed for farmers, and help them with trading, information and crop management tasks. The fourth type of tool has been developed for traders, truck drivers and end-buyers of crops to manage their shipments and retain information along the value chain. These supply chain tools operate downstream of the farm gate.

| On-Farm Tools			Supply Chain Tools
Trading Tools connect farmers with customers and suppliers.	**Information Tools** assist farmers to access the information they need to farm productivity.	**Hardware** provides the physical tools for tending to the crop.	**Supply Chain Tools** allow buyers and logistics operators to collect data and schedule shipments.

Farmer consultation in Cirebon, West Java, Indonesia

The On-Farm Toolkit is Poorly Used:

Farmers have been slow to adopt these digital tools. The largest smallholder e-commerce platform in Southeast Asia is used by 25,000 farmers, while the most widely used advisory solution has been downloaded by just 50,000 farmers. These users represent a tiny portion of the potential user base of tens of millions of farmers. Supply chain tools have been faster to grow, with traceability platforms in the region holding data over one million farmers.

We talked to farmers directly, interviewing 100 farmers in Vietnam, Indonesia and Myanmar to find out why adoption has been so slow. Interviews covered a range from rice to potato and tomato. Our questions explored in detail how farmers use digital solutions today and expect to in the future. What we found surprised us - we found farmers actively using their phones to grow their farming operation but in very different ways than we expected.

Diagram: Distribution of Farmers Interviewed
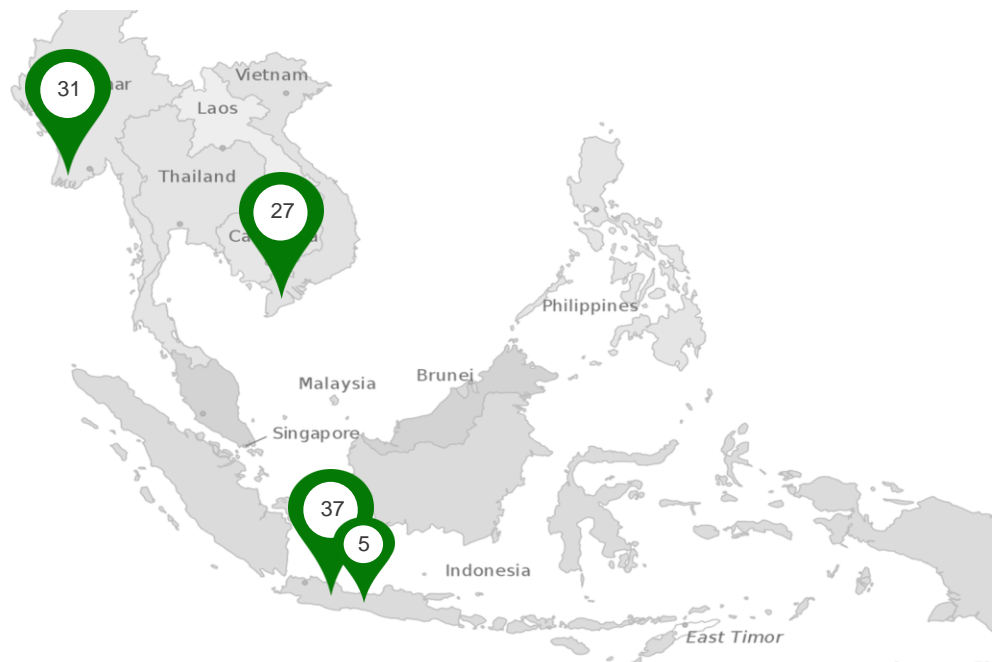
Background:

Business Model and Behavioral Pathway:

The Grow Asia digital program has been promoting digital solutions for three years. We have coached dozens of startup founders, convened hundreds of solution pitches and visited the field to see solutions in action. Over that time the number of smallholder digital solutions has grown significantly, as mapped in our solution directory for ASEAN.

We have observed that a new smallholder technology must exhibit two qualities in order to be adopted - ignoring one or the other leads to stalled growth. Firstly, the solution needs a business model, which is perhaps the most obvious of the two requirements. A sound business model requires that the solution:

- Provide greater value to the farmer than the solution costs to deliver;
- Convert this value to payment by the customer; and
- Cost less for adding (acquiring) each new customer than the customer's lifetime value to the business[1].

These criteria are particularly difficult to meet on small, remote farms. Delivery and acquisition costs are typically high, and lifetime values low. Take for example a digital marketplace for connecting farmers to lenders to borrow money for inputs. Such a solution has a sound business model if the cost of providing the app, marketing to the lenders and farmers and any non-payment losses is lower than the fees the solution levies on each loan.

While the business model is critical[2], this report deals with the second criteria in more detail, the need for a behavioral pathway. The pathway is all the steps or behaviors the farmer needs to adopt in order to use the solution. A solution works when the farmer is willing to undertake each step along the way.

Even if a solution has a great business model and offers the farmer strong value (such as a significantly lower cost loan) it won't succeed if a typical user is unwilling to undertake just one vital step along the way.

Learning from Other Industries:

Smallholder technologies are not the first to struggle with adoption. In fact, smallholder technologies are at a similar point Personal Computers (PCs) and word processors were in the 1980s.
Slow adoption of these technologies in the 1980s surprised many tech firms then who felt customers had a clear economic incentive to use their product. Many smallholder tech founders are equally surprised today. Why don't farmers adopt when they would make more money if they did?

A sound economic model is not enough to drive adoption of new technologies in the real world. Technologies which deliver value are not universally adopted. Human and behavioral factors are at play.

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1. See "How Valuable Are Your Customers?" by Amy Gallo, Harvard Business Review.
2. See "Business Model Guides" by Grow Asia.

Unified Theory of Acceptance and Use of Technology (UTAUT):

Reflecting on the experience with PCs and other technologies, Fred Davis at the University of Arkansas published his Technology Acceptance Model (TAM) in 1989, which provided a framework for considering why users adopt new technologies. TAM was further developed by Davis' student Venkatesh into the Unified Theory of Acceptance and Use of Technology (UTAUT).

UTAUT has been widely adopted. It is particularly useful when assessing small holder technologies as it has a workplace focus; it focuses tasks such as farming a crop rather than social or entertainment tasks which are the focus of other adoption theories.

When the results of the interviews started to become clearer, we turned to UTAUT to help us understand and describe what we were hearing from farmers. The UTAUT theory identifies the key preconditions for a user to adopt the solution, the "Use Behavior" in the diagram below. In our sector, an example of use is buying fertilizer on an e-commerce site or checking what fertilizer to use in an agronomy advice application.

The theory suggests that use by the farmer is driven by two factors: an Intention to use the technology and the right Facilitating Conditions. Taking the example of the fertilizer recommendation:

1. Behavioral Intention is driven by:
    - Performance Expectancy - she expects the app to perform, that is provide a sound product recommendation
    - Effort Expectancy - her perceived effort to use the app is low; and
    - Social Influence - other farmers apply pressure for her to use it.
2. Facilitating Conditions include the farmer owning a phone, knowing how to download an app, and being aware that the app exists.

Diagram: Unified Theory of Acceptance and Use of Technology (UTAUT)
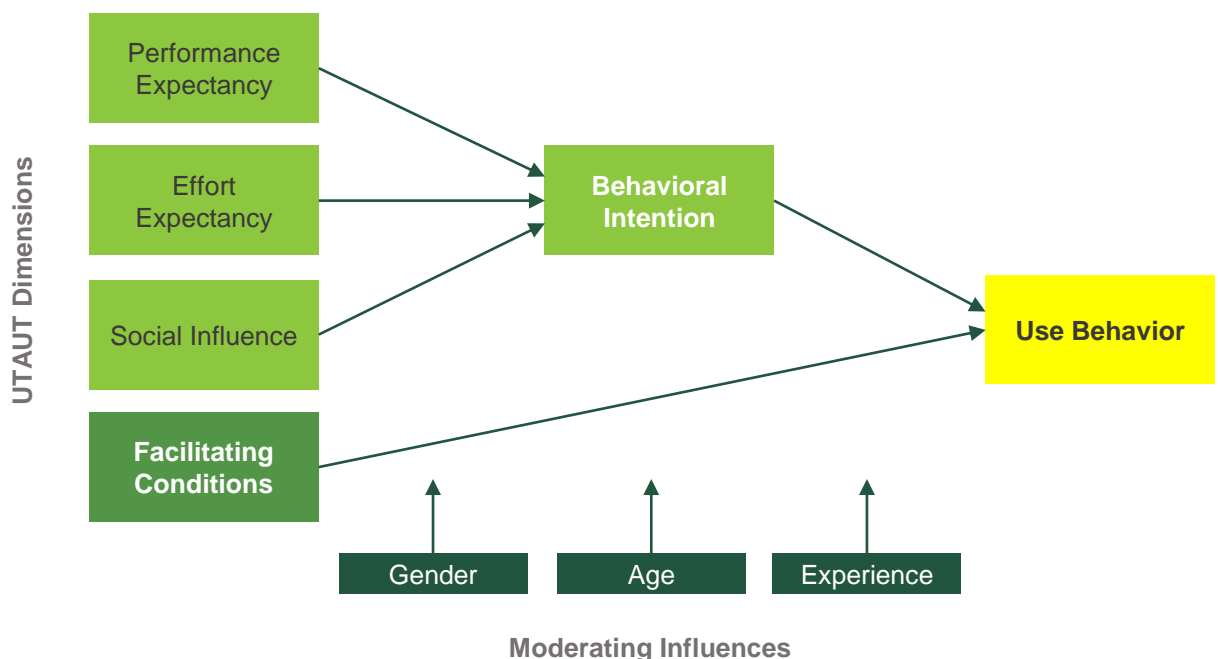
Why Adoption is Critical for Industry:

Digital adoption by smallholders in a strategic imperative for solution developers, agribusinesses, NGOs and governments in ASEAN:

Solution developers (i.e., startup founders) need adoption to drive business growth. Adoption is the only pathway to success for their business, and to recovering the time and resources they have invested. Startup founders are acutely aware of adoption challenges and techniques and many founders track usage statistics of their solution on a daily basis.

Agribusinesses from international traders to crop protection companies also stand to benefit from adoption. For many of these companies, smallholders remain an inaccessible or at least very expensive customer to serve. Poor lines of communication and the high cost of in-person transactions, marketing and customer research limit market reach.

The farmer is also pushed on to adopt by a range of good will actors who want to see the power of these tools achieve poverty alleviation and environmental outcomes. A host of national and regional governments as well as NGOs have set up programs to drive digital adoption. Digital tools are commonly sighted as a means of impact on farm productivity at a scale not possible with traditional, in-person techniques.

Understanding barriers and pathways to adoption is not just a consideration for technology developers. Applying what we learn from listening to farmers and applying methods such as UTAUT to better understand adoption is critical for governments, NGOs and agribusinesses who all stand to benefit from deeper adoption.

A key aspiration for this report is to highlight what can be done to drive adoption, and help stakeholders work more efficiently both individually, and together in partnership to help unlock the power of these tools.

Farmer consultation in Pathein Township, Ayeyarwady Region, Myanmar

Findings:

Typical Adoption Pathway:

Farmers typically hold relationships with five key external actors:

1. **Other farmers** who provide information
2. **Retailers**, who sell inputs such as seeds and fertilizers as well as providing information
3. **Lenders**, who provide credit
4. **Traders** who provide access to markets, and
5. **Machine owners** who rent equipment including tractors

Smallholder farmers have held these relationships for decades (if not centuries). Whether it's a credit transaction, input purchase or crop sale, the relationship involves three steps:

Diagram: Discovery, Negotiation and Execution

Discovery of transaction partners	**Negotiation** of terms, such as price or repayments	**Execution** of the transaction including payment and exchange

Technology has been transforming the way farmers discover, negotiate and execute transactions for decades. Farmers are using digital technologies to communicate and transact with these five external actors more quickly and easily. They are also using technology to find new suppliers and customers, and to secure better deals.

Across our interviews we saw farmers engage with digital transaction tools in five stages.

1. Face-to-Face:

Initially, farmers begin by using no digital technology at all, each interaction is undertaken face-to-face. Taking credit as an example, the whole process of assessing several lenders (discovery), reaching an agreement of terms (negotiation) and receiving the funds (execution) are all undertaken in person, at the retail store or the lenders premises. Prior to the advent of the mobile phone this was the only way farmers could secure credit, input and trade.

In person communication is ideal for building trust and relationships. Where possible, it appears to remain most farmers' preferred form of discovery, negotiation and transaction.

2. Phone Call:

The overwhelming majority of farmers today substitute some face-to-face interaction with phone calls.

During our survey, most farmers reported undertaking part of the negotiation step remotely by calling. For example, she might ring the lender before visiting in person to find out if they are currently offering credit, and how much they will charge. At this stage, the farmer is simply using their phone to replace certain steps, but still communicating with the same parties they would have in person.

The key technologies at this step are feature phones. Using a phone to supplement meeting in person allows the trust and relationships built in person to be maintained.

3. Peer Group Dialogue:

Phone calls have their limitations, and once farmers own a smart phone they tend to begin joining small group chats with their peers. The platform they use varies between countries, but WhatsApp, Line and Facebook messenger are common.

These groups allow farmers to seek advice and discover information on price and products from their peers. Retailers play an important role in their groups. Farmers also compliment these groups with direct personal messages about specific issues.

The farmer will typically join an online chat (e.g., Facebook, Line or WhatsApp) of farmers in his region who all grow the same crop. The group might include not just farmers but local retailers, a chemical company sales rep and a government extension worker. While she still buys similar goods from the same retailer, she has replaced the in-person step of gathering advice.

These groups build on existing social networks, and at this stage farmers only communicate with people they know in person. These groups add significant value, speed up communication, allow for photos and images to be shared, and allow farmers to learn from questions they observe, but didn't ask.

Peer group dialogue represents a small behavioral step as there is no need to interact with anyone the farmer doesn't normally meet in person.

4. Active Discovery:

The next step we observe is farmers using their phones to open new connections they haven't or couldn't have made in person. These farmers are using technology to not only negotiate but also discover new transaction partners. This represents a more significant step away from in-person interaction. Farmers begin using messaging services to reach out to new suppliers and buyers. Moving beyond his own network of friends and past business partners offers a range of advantages including finding a better deal outside her network to place competitive pressure on her current suppliers.

On the advisory side, these farmers start using web searching and video streaming services to discover information outside of their network. Video plays a particularly important role in information discovery. These farmers also often use Facebook to find new products and gather advice from a broader network.

Key technologies at this step are messaging apps and social media. Some farmers reported following a link on a social media ad. While the previous two steps build on the traditional face-to-face model, this step represents a range of new behaviors including searching and establishing trust online.

5. Digital Service Engagement:

While Facebook, cell phones and messaging services are rapidly being adopted, they do have their limits. What many founders are building today is perhaps best described as structured digital services. These services move beyond ad hoc communication and offer a richer range of services. Formal tools already exist for the full range of services from advisory to credit. Many of these tools are presented as an Android application.

In this final step, farmers began to download apps which contain a menu structure. Once inside the app, she can view a local weather forecast, access a photo library of common diseases and will receive a notification every few days suggesting activities from a crop calendar targeting her crop. This step significantly expands the farmers network - she can access a lot more information from a much larger pool. In addition, she expands the network of counterparties she could buy from and sell to.

The founders who are building these solutions point to their ability to open a larger network than the "Active Discovery" step and offer more sophisticated services such as pooling shipments, ranking sellers and digital payments. It is these more formal platforms that have transformed other industries at scale. As noted in the background, adoption of these tools is very low.

Diagram: Farmers Engaging with Digital Transaction Tools

|	Face to Face	Phone Call	Peer Group Dialogue	Active Discovery	Digital Service Engagement
Important Tech	None	Feature Phone	Messaging Smart Phone	Messaging and Internet Search	Android Apps
Added Value	None	• Reduction in travelling time.	• Use of images to illustrate issues and solutions. • Opportunity to learn from others' questions. • Direction to relevant links by peers.	• Opportunity to identify new suppliers and customers. • Able to gather information from external expert sources.	• Opportunity to identify a broader range of new suppliers and customers. • Richer, customized services through targeted digital solutions.

Examples: Farmer interactions at each stage:

	In Person	Phone Call	Peer Group Dialogue	Active Discovery
Advisory	Meet a fellow farmer at the mosque and ask them if they found urea to be effective.	Call the retailer to ask which chemical to use to fight plant hoppers.	A farmer notices a photo in local chat group that plastic ties can be used for tomatoes.	Google search for fertilizer formulations.
Credit	Visit a trader's house and ask them for a Rp.100,000 loan.	Call the trader before a farmer leaves to see if the trader is home.		Reach out to a lender in another village .
Inputs	Buy hybrid seeds at a store.	Call the retailer to see if urea is in stock.	The retailer posts a photo of new product.	Find a new product only available in the capital city.
Machinery	Ride to a neighbors' house to ask to hire a tractor.	Call to find out if the tractor is coming, even in the rain.	A group of farmers team up in a group to hire a tractor for the day.	Connect with a nearby village to generate enough users to hire a harvester.
Crop Sales	The trader visits in person two weeks before harvest to settle on a price.	Call to find out today's rice price.	A supermarket representative uses a chat to invite farmers to lunch	Introduce yourself to a supermarket buyer.

Smallholder Digital Adoption in Southeast Asia: What will it take?

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Current Adoption:

It is difficult to estimate adoption at each level given our limited sample size. Over 90% of the farmers we met have used a phone to call a transaction party while less than 1% have ever downloaded a farmer service app. Interestingly, it consistently took about three years from beginning to engage in peer dialogue to take the important step of engaging in active discovery.

Adoption was quicker for younger farmers and for wealthy farmers.

Diagram: Current Adoption

Stages of Engagement with Digital Transaction Tools
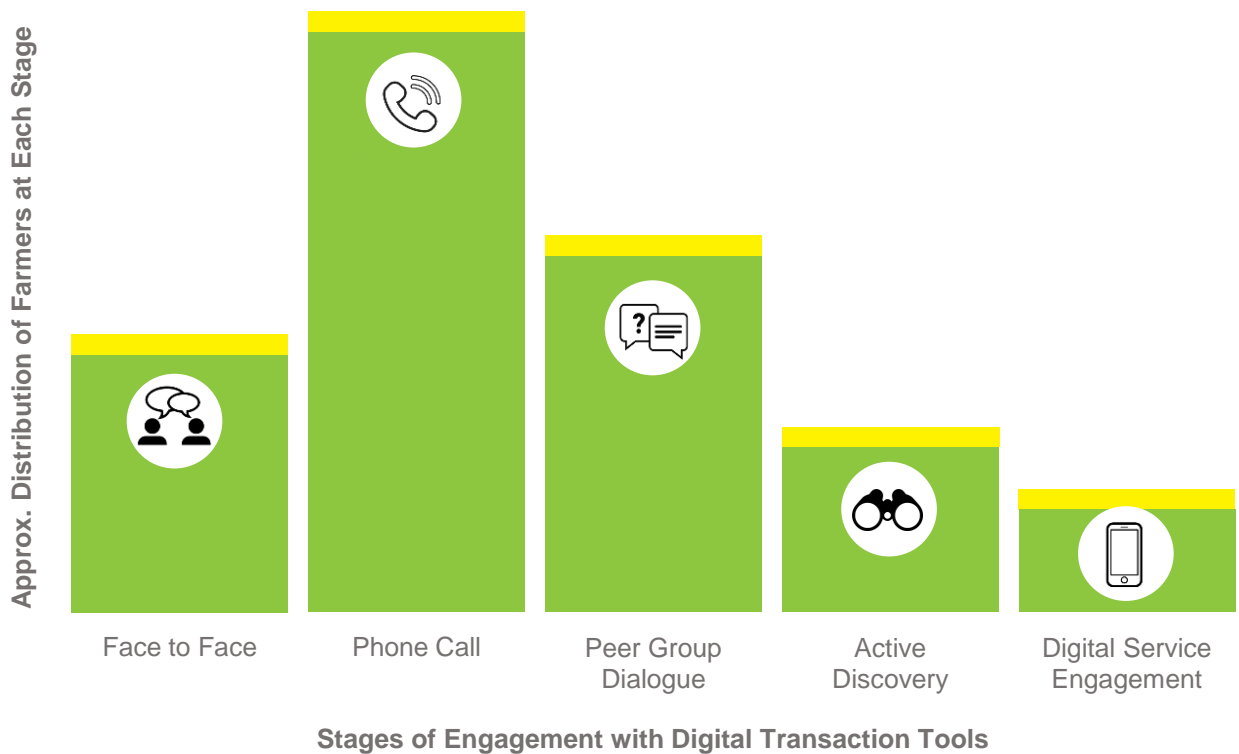
Application of UTAUT:

At each step along the way, the UTAUT frameworks tells us a farmer will expect the new technology to do four things[3]:

1. Performance Expectancy is defined as the degree to which an individual believes that using the system will help him or her attain gains in the job
2. Effort Expectancy is the perceived degree of ease associated with the use of the system.
3. Social Influence is the degree to which an individual perceives that important others believe she or she should use the new system.
4. Facilitating Conditions includes the technical infrastructure to support use of the system, including devices and network coverage.

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3. See "User Acceptance of Information Technology: Towards a Unified View" by Venkatesh, et al.

At each step on the journey from Face-to-Face and toward Digital Service Engagement farmers will weigh up all four factors. In fact, during our interviews, farmers at each different step openly discussed all four considerations unprompted.

We saw the influence of their peers as well as Facilitating Conditions playing a key role. Farmers who owned the right hardware, had enough money to buy data, and who had friends already using a service were much more likely to take the next step. However, a key finding of the original UTAUT research is that Effort Expectancy is of paramount consideration. This was also clear in our interviews, with farmers consistently ranking perceived effort as the most important consideration.

We also observed age playing a very important role. Consideration of Effort Expectancy weighs heavily on older farmers.

Insights:

As farmers navigate the continuum of the five stages of digital adoption, the UTAUT framework provides four dimensions to understand farmers' likelihood to adopt a technology. Whether we represent a government, an NGO, an agribusiness or a solution provider, understanding and building these considerations into our plans is of vital importance.

Peer Group Dialogue:

The step from using a phone to peer group dialogue is the first significant step in digitization. Farmers weighed up all four UTAUT dimensions:

1. Performance Expectancy:

These groups offer farmers a number of advantages, including access to a wider pool of advice. Farmer's appreciate the capacity to monitor other people's conversations and discover solutions to problems they may not have been aware of before. Photos play an important role, as they make issues, products and solutions easier to describe and understand.

Much of the group's performance will depend on how relevant the discussion is and how closely matched their other members are to the farmer's scenario. Good group management keeps the conversation focused on user needs. Most farmers at this step subscribe to several groups to meet a variety of needs.

2. Effort Expectancy:

Joining the group and drawing value from it requires a range of tasks and new behaviors, each of which carries effort for the farmer, including:

- Downloading the app and joining the group.
- Reading and typing, which represents a significant change in behavior from talking to the retailer and other farmers in person or on the phone.
- Determining if advice directed to someone else is applicable to her.
- Finding relevant chats to take part in and dropping out of those that aren't relevant.

All these tasks take effort and, importantly, time to master. While it's easy to equate effort with tasks (e.g., downloading the application) farmers calculate effort in other ways too. For example, the risk of being embarrassed in the group weighs heavily and represents its own effort.

3. Social Influence:

The farmer is most likely to hear about and decide to join the group during an in-person conversation. Because she already knows the other members of the group, Social Influence is a strong pull here.

4. Facilitating Conditions:

There are several basic items that need to be in place for the farmer to join the group. They need a smartphone, access to mobile coverage and the skills to access the chat.

These chat groups represent the most widely used small holder digital technology in Southeast Asia. They carry no cost to the farmer and are relatively easy to use. Perhaps most importantly they complement existing relationships rather than replacing them.

Active Discovery:

1. Performance Expectancy:

The potential of Active Discovery can seem from an outsider's perspective to be invaluable, as this step opens up a much wider pool of information and transaction partners, beyond the farmer's peers. However, most farmers place little value on these benefits. Farmers reported placing more value on advice from and access to people they already knew.

A small fraction of farmers do see the value of Active Discovery. Interestingly, these progressive farmers (as well as retailers) bring new perspectives (including new products and new ideas) into local groups. Thus, in effect large numbers of farmers benefit from one or two who engage in Active Discovery, but without the effort of making this step themselves.

2. Effort Expectancy:

Active Discovery introduces a range of new skills and behaviors which take effort. Importantly, information discovery shifts from an exercise in asking questions (which works well for the first three steps) to keyword searching. Keyword searches involve a range of skills from formulating key words, filtering results and comprehending conceptual information which are new behaviors.

- She can no longer phrase issues as questions like she did with the retailer and online chat. She must use a combination of keyword search, menu structure and screening irrelevant information to find what she needs.
- She is also now dealing with independent expert advice, rather than the opinions of people she is in a relationship with and trusts.
- She must also translate information from another context to her own. For example, she might receive a fertilizer recommendation as a coded formulation, which she needs to then translate to product selection at her local retailer.

Up to this point, people the farmer trusts have filtered the information they see. For example, a new technique might have been tried and dismissed by peers. However, in the Active Discovery step, this filter is removed, and the farmer must begin judging value for themselves.

3. Social Influence:

This step is also the first one in which Social Influence is not playing an important role. Farmers typically buy a phone to make calls and a smartphone to enter Peer Group Dialogues. Adoption is essentially viral and reinforces existing social links. However, Active Discovery is all about seeking information and transactions beyond the immediate local group.

Social Influence can however play a positive role at this stage. For example, when farmers share the results of a Google Search or video link in the peer group dialogue, this can pique the interest of others in the group to try Active Discovery themselves.

4. Facilitating Conditions:

The shift to Active Discovery does not require additional hardware or equipment, however, Active Discovery is linked to higher levels of formal education.

Digital Service Engagement:

We did not meet any farmers in our random sample who used digital services, so it is difficult to judge farmers' considerations at this step.

1. Performance Expectancy:

The step from searching and chatting into an application offers a range of benefits. The information can be much more targeted to her situation. Applications also open up a whole new range of counterparties, who are often ranked in the app based on feedback from other farmers.

2. Effort Expectancy:

The jump from following a chat or searching to operating an app introduces a whole new level of effort. The farmer is asked to take part in a number of new behaviors. Most apps ask farmers to fill out a form, and describe their farm using units of area and yields.

3. Social Influence:

When farmers are introduced to an online chat they are then likely to "meet" the person who invited them in the chat. In contrast, the app works more independently of traditional lines of social interactions.

Ultimately, Social Influence will play a strong role in application adoption, as early adopters highlight the value of an app to their friends, and network effect occurs when usage reaches a certain threshold. For now, Social Influences push farmers to use tools which are essentially local and reinforce existing relationships.

4. Facilitating Conditions:

The farmer will need access to similar hardware to the chat including a phone and data. However, the skills required have jumped significantly with the need to navigate menu structures and filter information adding significant complexity.
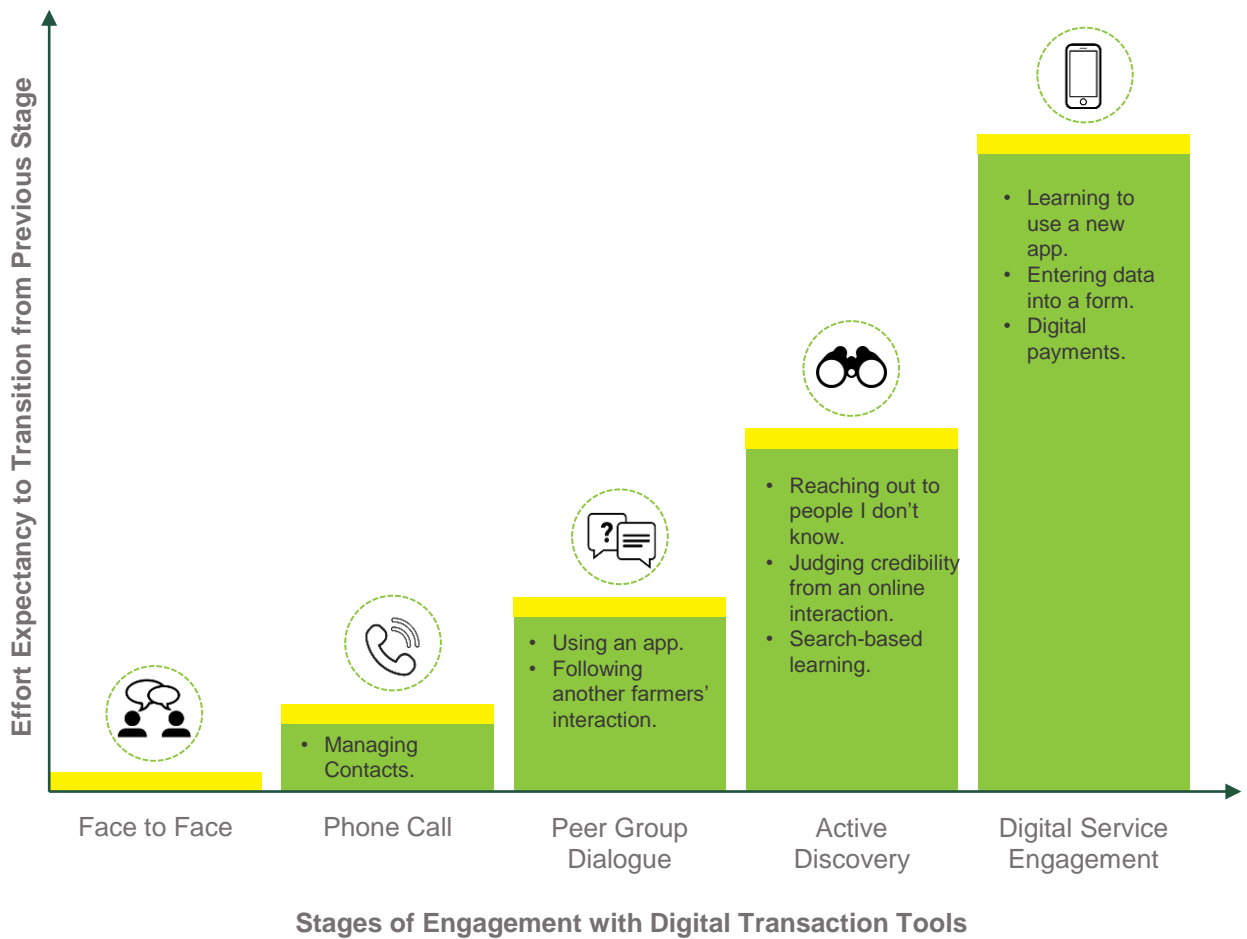
Having engaged with the app, the final step is engaging in online transactions. This sees the farmer move beyond simply using the app to discover what to buy, and where to buy it to conducting transactions online. The leaps in effort and facilitating conditions from seeking information in apps to trading is significant. The step to trading online requires a level of skill, effort and trust.

Effort Expectancy:

As discussed in the background, Effort Expectancy usually plays a more significant role in technology adoption than the other three factors. Therefore, it is important to carefully consider how farmers will measure effort at each step along the way. The diagram below shows some important, and sometimes difficult behavioral changes at each step.

Diagram: Effort Expectancy

Effort Expectancy to Transition from Previous Stage (y-axis)

- Managing Contacts. (Phone Call)
- Using an app.
- Following another farmers' interaction. (Peer Group Dialogue)
- Reaching out to people I don't know.
- Judging credibility from an online interaction.
- Search-based learning. (Active Discovery)
- Learning to use a new app.
- Entering data into a form.
- Digital payments. (Digital Service Engagement)

Face to Face | Phone Call | Peer Group Dialogue | Active Discovery | Digital Service Engagement

Stages of Engagement with Digital Transaction Tools

Implications for Industry:

Farming Apps Represent a Fraction of Adoption:

The digital transformation of smallholder value chains is much deeper than farmers downloading and using apps. While app downloads are easily measured, they are a poor indicator of digital transformation.

Implications:

- Building an app might not be the best place to start. Consider engaging with farmers on a chat platform they already use to connect with their peers.
- When designing a new digital service, map the behavioral changes a farmer is being asked to make in order to engage. Take specific note of farmers' effort expectancy at each step.
- Good UX (User Experience) in app development is important, but it is not a silver bullet for addressing effort expectancy. A form or key word search, even one that is well designed, still represents a significant (and perhaps difficult) change of behavior.

Farmers Want a Conversation:

A stand-out feature of the adoption curve is farmers' strong preference for conversational technologies. Conversational tools mirror the behaviors of building trust and sourcing information which have worked well for farmers all their lives.

Thus, while it might be more desirable to have the farmer fill out a form, navigate a menu structure or search online, these activities are often foreign, and likely to be poorly adopted.

Implication:

- Train, encourage and reward your staff to use chat-based technologies. The measures you currently use such a in-person training attendance, or farmer field days delivered could be complemented with chat-based metrics.

Build on In-person Relationships:

The vast bulk of digital communication that farmers engage in is with someone they know already. Most digital peer group dialogues are mirrored in the "real world" by at least weekly in person meetings. The existing personal relationships that NGOs, government officials and agribusiness teams have are a vital tool in digitization.

Implication:

- Digitalization is a decentralized activity. Drive digitization at the edges of your organizational structure - in villages.

Age Drives Adoption:

Both the original UTAUT studies, as well as our own interviews highlight how important age is in willingness to adopt new technologies. As we age, our perception of the effort to try new technologies increases.

Implication:

- Your digitalization strategy should focus on younger farmers.

Lead Farmers Influence Others:

Only a small portion of farmers practice Active Discovery. Yet, these "lead" farmers act as a critical conduit to the much larger group of farmers who are engaged in Peer Group Dialogues. These leaders bring messages from beyond the group about new products, sales channels and techniques.

The role of social media influencers in scaling messaging is well established in the advertising industry. These lead farmer's existing network of local trust could be leveraged in a similar fashion.

Implication:

- Engage peer group leaders and provide them with messaging that is easily shared in online chat forums.

Address Chat's Limitations:

Chat-based technologies, while a clear preference for farmers have a number of limitations. Firstly, they are time consuming to take part in. They also don't lend themselves to the same level of data capture as can be expected of an app. Chat also makes it more difficult to segment users and target messages than in an app.

Implication:

- Take steps to capture data from your staff's digital chat conversations and use this data to build up client datasets and target messaging.

Training is a Poor Investment:

Many of the issues which slow adoption of more formal digital services can appear to be addressed by training. It could be concluded that a desire to chat rather than use an app results from a lack of skill in the app marketplace or in searching. However, this was not validated by our interviews. If farmers see value in a service, they typically build the skills they need around it. A lack of interest in communicating outside one's peer group or in filtering conceptual information are more likely to hinder engagement than skills do.

Implications:

- Encourage your staff to invite farmers on gradual steps of engagement as they discover value, rather than providing training.
- Introduce the value of active discovery into the peer dialogue groups. For example, actively demonstrate the value of online search within the group.

What's Next?

The UTAUT framework tells us farmers will adopt new technologies which perform, require minimal effort, are promoted by peers and which the farmer has the skills and equipment to access. Our field research shows that farmers often take four critical steps on the pathway to engaging with formal digital solutions.

If governments, NGOs, founders and agribusiness wish to see farmers adopt particular tools, then we need to promote tools that address all four dimensions in the UTAUT model. Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions should all be considered in any strategy to drive adoption.

Each sector plays a role in encouraging greater engagement and adoption of digital solutions, yet we must all integrate all four considerations into our work. By working together using a multi-stakeholder approach perhaps we begin to move the needle on smallholder adoption of digital technologies.

Further Reading:

- Agro-based Industry, Mobile Phone and Youth: A Recipe for Success, by Shaffril Et Al

- ICT in Agriculture: Connecting Smallholders to Knowledge, Networks, and Institutions, by the World Bank

- User Acceptance of Information Technology: Toward a Unified View, by Venkatesh, et al.