Smallholder AgriTech Business Models:

High-potential models emerging in Southeast Asia

GrowAsia

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Executive Summary

Government, NGO and business leaders typically see great promise for digital tools to empower smallholder value chains to become efficient and profitable for farmers. However, hope is not enough; new technologies only reach scale when they are delivered within a functioning business model.

To scale, the business model must provide a (1) Lifetime Value for each new customer which exceeds (2) the cost of acquiring each new customer.

Finding a business model which meets this requirement on small, remote farms is a tough job. Delivery and acquisition costs are typically high, and lifetime values low, as each farmer's revenue is limited.

The Five Models

By observing the full range of solutions that have been developed across the ASEAN region, we see startups migrating to five business models which seem to show the greatest potential in reaching smallholder farmers at scale.

1. **Digital Advisory** services provide advice and information to farmers. A typical solution will provide some farming generic advice over a social media platform and migrate farmers over to a mobile application, where the farmer receives more customized advice.

2. **Peer-to-Peer Lending** platforms allow lenders to make individual loans to farmers over a digital platform.

3. **Traceability** solutions use a database or ledger to record the origin of commodities from farms. FMCG companies use these solutions as a basis to make origin commitments to the customers, and to better understand their supply chain.

4. **Digital Marketplaces** connect buyers and sellers online. This not only makes transactions more efficient, but opens up new markets to farmers.

5. **Mechanization Platforms** allow owners of tractors, drones and other equipment to schedule-lend equipment to farmers on a digital platform.

This report explores the key strengths and weaknesses of each model and highlights the key aspects of ensuring viability for each. The insights highlight not just Grow Asia's experience, include commentary from prominent founders and experienced investor for each business model overview.

Insights

The transformative potential of digital on the smallholder agricultural industry is undeniable. Over the next 10 years, a small portion of fragile startups in our industry today will go on to disrupt and define the industry in ways that are currently difficult to predict. These disruptors will stand out from other solutions in their ability to find a scalable business model. Our key findings are:

- **B2B is Important:**
  It is particularly challenging to build a business model around a smallholder customer base. The fastest growing models will likely service banks, input companies, lenders and FMCGs as customers.

- **Consider Lifetime Value:**
  Lifetime value is a critical consideration in launching a smallholder business model. Models which generate only a few dollars per farmer in profits are going to be much harder to scale than those that nett $10 or even $100 per farmer in each season.

- **Farmer Income Drives Lifetime Value:**
  Business model viability is highly correlated with farmer income. New technologies will gain traction more quickly in regions and crops with higher incomes.

- **Obsess over Value:**
  The motivation to build a new smallholder technology can come from a range of places: benevolence, a sense of adventure or simply a hunch that what worked in another industry will work for smallholders. While all these motivations are a good place to start, they are poor guides when it comes to unearthing a scalable business model. Businesses that grow will be obsessive about providing and capturing customer value.

Paul Voutier,
Director, Knowledge & Innovation
Grow Asia

Introduction

Smallholder farmers in Asia supply the bulk of the region's food. Many government, NGO and business leaders - including Grow Asia - see great promise in digital tools to help smallholder value chains become efficient and profitable for farmers. However, hope is not enough - new technologies can only scale when they are delivered within a functioning business model.

Grow Asia has run several hackathons, accelerator and pitch events in support of smallholder digital tools. Observing the full range of solutions that have been developed across the ASEAN region (many of which are listed in our Directory), we see startups migrating to five business models which seem to show the greatest potential in reaching smallholder farmers at scale.

To work, the model must provide (2) a Lifetime Value (LTV - the profit the business generates over a customer's lifetime with the business) for each new customer that exceeds (2) the Cost of Acquisition (CAC) of each new customer. These costs include marketing and other onboarding activities. When the LTV of each new customer exceeds their CAC the business increases profits with each new customer added. If CAC is higher than LTV the inverse happens, and adding each new customer carries a cost.

Finding a business model which works in the smallholder industry is a tough job. To create a business model that provides an LTV that exceeds CAC is particularly difficult on small, remote farms. Delivery and acquisition costs are typically high, and lifetime values low, as each farmer's revenue is limited. Despite these challenges these five business models are showing signs of viability. This report describes each model, which is summarized in Table 1 below:

Table 1: Overview of the five AgriTech Business Models

	Model	Customer	Value
	Farmer Advisory	Multiple Data Consumers	Access to pre-qualified farmer customers
	Peer to Peer Lending	Farmers and Lenders	Attractive loan terms
	Traceability	Food brands	Consumer trust
	Digital Marketplaces	Traders	Reduced transaction costs
	Mechanization Platforms	Farmers	Increased yields

Only one of the five models leverage farmers as the only customer (Mechanization Platforms) - this is a Business to Consumer (B2C) model. Four of the models rely on at least one business customer (a B2B customer). This reflects the shortcomings of smallholder farmer customers discussed above.

Farmer Profiles

A functioning business model is built on the differential between Lifetime Value (LTV) and Cost of Acquisition (CAC). To evaluate the lifetime value in each of the models, it's helpful to illustrate what this value could be. We have generated three prototypical farmer profiles to help us evaluate the lifetime value in each of the business models:

1. **Marginal Grain:** a marginal rice farmer on half a hectare who uses Open Pollinated Seed and little fertilizer, earning just USD700 a season.

2. **Commercial Grain:** a commercially oriented grain farmer growing a full hectare of maize for feed production, and actively using hybrid seeds and commercial fertilizers. These farmers earn USD2,000 a season.

3. **Horticultural:** a fully commercial potato farm working under a contract with a sophisticated buyer using a full suite of quality inputs and earning over USD9,000 a season. This profile represents the upper limit of what could be described as a smallholder in ASEAN.

The profiles are designed to capture the – though simplified - full sweep of the farming system in Southeast Asia and to give us a tool to explore the value of each business model. The market size of each profile varies significantly. There are tens of millions of marginal grain farmers and millions of commercial grain farms, while the horticultural profile represents just tens of thousands of farmers in ASEAN.

Table 2 below paints a picture a somewhat richer picture for each farmer profile. For simplicity, we are making the assumption that each farmer lends the full value of their inputs, and pays 30% in interest over the season.

Table 2: Farmer Profiles (all amounts in USD unless specified)

	Marginal Grain	Commercial Grain	Horticultural
Crop	Rice	Maize	Potato
Land (ha)	0.5	1	2
Yield (T/ha)	4	5.5	16
Wholesale price (USD/T)	500	600	700
Farmgate Price (USD/T)	310	225	500
Total Revenue	1,000	3,300	16,800
Agro-chemicals	20	300	1,500
Fertiliser	100	300	1,000
Labor	50	100	1,500
Tractor Hire	0	150	300
Seed	60	200	1,500
Costs	230	1,050	5,800
Loan Value	230	1,050	5,800
Loan Interest	69	315	1,740
Income	701	1,935	9,260

The Five Business Models
1. Farmer Advisory

Smallholder yields in Asia are well short of international benchmarks. At least part of this gap can be attributed to knowledge and information, including on seed selection, pest identification, climate, and planting timing. Digital farmer advisory seeks to solve this problem by providing advice and information to farmers.

A typical solution will provide some generic advice over a social media platform and seek to migrate farmers over to an Android application, where the farmer creates a profile, and receives more customized advice. Examples of advisory services include SIPINDO, Golden Paddy and Lisa.

Digital advisory services have a range of advantages:

1. Once the material and interface are created, adding each additional farmer costs the business very little, and is much cheaper than in-person advisory.

2. Advice can be targeted to the farmer's specific plot, crop type and point in the crop cycle.

3. Once trust is established, the business could undergo viral growth, with one farmer suggesting the advisory application to another.

Several types of digital advisory have been tested including Q & A with agronomists, advice driven by satellite imagery, and pest identification using image recognition.

An advisory solution is typically funded in two different ways: (1) through farmer subscriptions or (2) by selling farmer data. The farmer subscription model has proven difficult to scale, as the cost of building enough trust to secure each new paying farmer typically exceeds their LTV. Furthermore, paying farmers expect a high level of service, making this a more expensive offering to deliver.

What appears to be more scalable is to provide the service for free to farmers, and monetize the data collected on the farms and farmers. Thus, while a subscription can be added over time as a premium offering, data sales at present drive this business model. Much remains to be learned about how to build trust in digital advisory, what information farmers want, how to design the user interface, and leveraging existing trusting personal relationships (such as with retailers) to onboard farmers.

However, if data sales are going to drive revenue, considering who will pay for what data is a critical consideration. Potential data consumers include crop protection manufacturers, fertilizer companies, lenders and commodity buyers. In each case the advisory service is essentially selling a qualified lead. Examples include to a:

- **Lender:** this farmer is due to plan in three weeks and expressed an interest in hybrid seeds last season. Satellite images show consistent, high yields for three years.
- **Crop protection company:** this farmer is four weeks into a rice crop, and the crop is inundated with Brown Plant Hopper.
- **Buyer:** this farmer is one week away from harvest, with an estimated 6 tonnes of white maize.

Each lead's value is driven by three factors: the farmer's spend on the data consumer's product or service, the data consumer's profit margin and the likelihood of conversation. Referring to our three farmer profiles, the value of a farmer's data to fertilizer, seed and crop protection companies can be estimated in Table 3 below.

Table 3: Illustration of Farmer Data Value to Data Consumers

	Marginal Grain	Commercial Grain	Horticultural
Total Input Spend	USD 180	USD 800	USD 4,000
Seller's Profit Margin	10%	10%	10%
Likelihood of Conversion	10%	10%	5%
Revenue per Farmer	USD 1.80	USD 8.00	USD 20.00

The value of each lead will be low, but a particularly promising aspect of this business model is the ability to monetize the same farmer's data multiple times with different classes of data consumers. An advisory solution could sell the same lead to a lender, fertilizer company and seed company.

This model raises a number of ethical and legal issues around data protection and privacy, but with social media sites already operating at scale with a similar business model, there are solutions that could be adapted to address potential issues around data protection and privacy in the agriculture sector.

The comparison with social media is instructive as lenders, crop protection companies and buyers already use social media to reach pre-qualified customers. To remain competitive, advisory services need to offer more useful data at a lower cost.

Of the five models covered in this series, advisory stands out for its capacity to add value for farmers at scale. However, it's also a very challenging model, balancing on one hand the need to build trust with farmers by offering a quality service, and the need to harness the right data to deliver valuable leads to input companies and lenders.

Comment from Aukrit Unahalekhaka, Co-Founder & CEO of Ricult

"I generally agree that this business model can create a huge impact in improving yields for the farmers. From Ricult's experience in Thailand and Pakistan, monetizing from the small farmer is extremely difficult. Substantial value and trust need to be created and proved out over time before farmers are willing to pay for a digital app, especially when other day-to-day apps such as social media and messaging apps are free. Also, paying in itself is a huge challenge as most farmers in the developing world don't have a credit card or digital banking. Finding other stakeholders such as banks or crop buyers to pay for the data or lead generation is the most promising way to go with."

Comment from Ajay Taunk, Associate at Wavemaker Partners

"Wavemaker Partners works with founders in smallholder agritech business models: from digital solutions providers (Ricult), to applied AI for agriculture (Adatos), to IoT hardware (eFishery). These companies have developed advisory models, that while challenging to design, provide their customers with unquestionable value.

What we specifically like to see amongst agritech businesses are solutions which are aimed at increasing yield and reducing waste - the two primary levers to improve farmer profit. The challenge is developing a technology that has a large enough ROI and payback period for the farmer to see immediate and long-term value. The founders we invest in build trust with farmers by taking the time to understand the problems they face, develop solutions to tackle those problems specifically, and always look to improve farmer profit."

2. Peer-to-Peer Lending

Smallholder farms require capital to operate and grow. The most common capital requirement for Southeast Asian farms is to cover the cost of inputs such as fertilizers and crop protection products. Although traditional, localized lending models currently dominate the market, digital platforms have the potential to offer farmers better terms by introducing farmers to a broader range of lenders.

Today, farmers are presented with two main sources of finance to cover these costs: the retailer who sells them the product, or the trader who will buy their crop at the end of the season. These "village level" funding options are usually expensive, often charging 10% interest per month.

These high interest rates reflect both a high level of inherent risk, but also the reality that village-level lenders have a number of advantages over formal lenders:

- They have insights the banks do not on each farmer's credit worthiness.
- It is cheaper for them to acquire lenders. Banks struggle to sell smallholder loan products because the customers are expensive to reach.
- They don't need to comply with the same Know Your Customer (KYC) requirements as a bank. KYC is the process of a business verifying the identity of its clients and assessing their suitability, along with the potential risks of illegal intentions towards the business relationship.
- They ask the farmer for less paperwork and make faster cash payouts.

As a result of these advantages to village-level lending, the smallholder farmer segment has remained hard to reach for formal lenders. This leaves farmers with few options and drives up interest rates. Formalizing loans to farmers could offer compelling, desirable returns to lenders and lower interest rates for farmers.

A range of digital solutions are emerging which solve one or more of these challenges. Digital lending solutions can help address all four limitations, which are: lowering the cost of acquisition, gathering data on the farms, reducing the cost of KYC processes, and reducing paperwork required.

At the forefront of this digital transformation are the Peer-to-Peer (P2P) lending platforms. P2P platforms emerged as a means of allowing urban professionals (often in capital cities) to tap into the high interest rate market for loans to farmers in rural areas. The motivations of urban lenders vary, from seeking a higher return than other assets to a philanthropic motivation to help farmers succeed. Investments are typically small - a few hundred dollars per farmer - but lenders often provide loans to dozens of farmers, spreading the repayment risk.

The P2P lending model is quite simple. The platform matches a farmer with a lender and charges the farmer a higher rate than it pays to the lender. Loans are typically made at the start of the cropping season and repaid a few months later. Short cycle crops that generate strong returns are ideal; including chili, vegetables and maize. P2P lending is growing quickly, with leading solutions in both the Philippines and Indonesia seeing double digit growth annually.

Examples of peer-to-peer lending services in ASEAN include Cropital, Crowde, and Slide.

However, the pool of potential lenders in a P2P model is limited compared to the size of the market for loans. As a result, P2P lending platforms are changing over time, packaging]larger portfolios of loans from their platform to be securitized at scale by financial institutions. It is only at this point that digital lending to smallholders is likely to expand much more rapidly. However, for now, the P2P model allows the platforms to continue to improve their acquisition processes and credit scoring algorithms. Once developed, these two capabilities (low cost acquisition and sound scoring model) will unlock portfolio investments, and much faster growth.

Table 4: Illustrating Farmer Engagement with P2P Lending Platforms (all amounts in USD)

	Marginal Grain	Commercial Grain	Horticultural
Loan Value	230	1,050	5,800
Interest Earned (25%)	58	263	1,450
Interest Paid to Peer Lender (10%)	23	105	580
Platform Revenue per Farmer (25% non-performing)	9	39	218

The platform normally carries the cost of non-performing loans, so accurate scoring is critical to ensuring this margin is not lost to bad loan decisions. Most platforms provide the loans as vouchers for inputs, rather than cash, which improves repayment rates.

While P2P lending is growing quickly, in order to reach scale and move from a peer lender to a portfolio securitization model, two key challenges need to be addressed:

1. The regulatory environment for P2P is uncertain, and the unscrupulous practices of a small number of lenders could put the whole industry in jeopardy.
2. Pricing the loans and setting rates remains a challenge for platforms; it can take years to gather enough repayment data to price accurately.

Of the five models covered in this report, P2P stands out for its strong underlying profitability. Smallholder farmers can be valuable lending customers, due to the high interest rates in this market. While the other models rely on data sales or subscriptions - which typically net only a few dollars per season per farmer - this model generates the highest lifetime value from each farmer client.

Digital lending is likely to grow quickly, opening a new market for financial institutions and reducing loan costs for farmers.

Comment from Yohanes Sugihtononurgoho, CEO at Crowde.co

"Smallholder farmers are exposed to a million problems and we see that access to alternative financing is a big problem - especially in the beginning. When they gain access to the right financing, they are going to face more advanced challenges such as how to market their product/produce, how to get access to the market, and how to use technological innovation for growing their business.

The output of the P2P is not only can we channel an alternative investment portfolio for urban people in the agriculture sector, but also to fuel a traditional agri-ecosystem to change so data can be gathered for a better agri-decision, save lives, and feed the world better."

Comment from John Friedman, Director, Asia of AgFunder

"The evolution of digital lending platforms is particularly exciting for the agriculture industry due to the constant need for working capital among smallholder farmers, and the ability for technology to expand across a broader geographical reach.

As the article suggests, developing a robust credit scoring metric is arguably the most important feature if a lending platform is to ensure the success of its business model, digital or otherwise. In the case of agri-lending, this could be assisted through engagement with local farming communities, partnerships with coops, corporate suppliers etc. At the same time these community partnerships are beneficial for the expansion of the platform's user-base, which is ultimately critical for growth…

Another important aspect to consider is how to manage the collection-end of the loan, which has to do with monetizing the crop production. Several existing companies offer a digital take on the traditional "village" model of lending to farmers who then guarantee their crop sale through the same platform. While this digitally integrated lending and off take solution has its benefits, in my mind it still prevents the farmer from gaining full access to the broader market and potentially better prices for their produce.

As with any P2P lending there is the question of who bears the burden of non-payment, the platform or lender? Crop loss due to disease or natural disaster make NPL risk in agri-lending that much more unpredictable. These considerations should be clearly articulated and need not be borne entirely by the lending platform, especially when institutional financing is involved.

Ultimately, I see the advent of digital lending platforms as an important evolution to traditional agri-financing solutions. The combination of industry sector and business model makes P2P lending in agriculture an exciting prospect for both traditional finance-focused investors as well as those with a more impact-driven mandate, assuming the factors discussed above are well thought out."

3. Traceability

Consumers are seeking greater transparency and easier access to data about the origin and supply chain of their food. There are many drivers of this trend, including a desire to avoid food that are:

- Unsafe due to bacteria or pesticides;
- Grown using slave labor; or
- Grown on recently deforested land.

Some consumers are also looking for a guarantee of positive traits such as food that are organic or nutritious. Ensuring that food meets these expectations requires the capacity to trace its origin. Traceability solutions use a database or ledger to record the origin of commodities, particularly data which reflects consumer concerns.

These consumer pressures are particularly acute for Fast Moving Consumer Goods (FMCG) produced by organizations such as Nestlé, Unilever and Mars. For these firms, meeting consumer expectations can build brand equity while also reducing reputational risk and create a competitive edge. FMCGs have been leading implementers of traceability solutions. Traceability offers other advantages to FMCG companies, as it allows non-compliant (unsafe or off-specification) shipments to be traced back to source. This can provide incentives throughout the chain to supply improved quality. Moreover, because FMCG companies buy their commodities from trading firms, it is usually the traders that ultimately implement traceability databases at the behest of their clients.

Traceability is closely associated with certification. Certifications include independent organic and fair-trade standards (such as Rainforest Alliance), as well as internal standards (such as the ISO Standards). While certification sets the standard, traceability is used to determine if it is being met.

In Southeast Asia, traceability has its origins in cocoa and palm oil. Cocoa traceability was driven by concerns about slavery in West Africa, and palm oil by deforestation. Many of the leading traceability solutions started in one of these two crops but are now used on a range of commodities including rubber and coffee. This places traceability in a niche market, outside our three more mainstream farmer profiles.

We observe two approaches to traceability being practiced in the region. The first is simpler, called "farmer mapping" while the second, "batch traceability", requires greater investment of time and funding.

Farmer mapping is the most common starting point. The trader typically engages a contractor to map their farmer suppliers in a region and store the data in a database. The data typically includes personal information, plot location, plot size and certification details. The database becomes a "white list" of suppliers from which the trader (and ultimately the FMCG) buys their raw materials.

Batch traceability goes a step further and includes in the database specific details of each shipment of goods purchased from each farmer. Each batch is given a unique code (such as a QR code), which is maintained throughout the supply chain. Batch traceability is significantly more complex than farmer mapping, as data needs to be added to the database in real time at each step along the value chain by a range of different parties.

Even the (simpler) mapping option requires a range of activities by multiple stakeholders, including field surveys, coordination with certification bodies, and farmer training. The buyer also needs to consider the cost of dealing with any supplier farmers who do not comply with the agreed upon standard. Compared to the other business models in this series, the digital element of traceability services is a relatively small part of a much larger business model that the contractor provides. Batch traceability carries other additional costs including batch tags and payments to intermediary traders to record data at each step.

With consideration to the full range of costs, only some products have proved to be viable targets, and traceability is working best under the following conditions:

- Where consumer pressure is greatest;
- In contract farming schemes, where implementation costs are lower;
- Where food safety risks are particularly high; and
- When the value of the goods is particularly high.

In these scenarios, the premium provided by the end buyer is adequate to meet the costs of traceability; and if required, certification.

Both traders and traceability contractors are exploring other ways to monetize the data in traceability systems, including selling it to financial institutions to help assess loan applications from farmers. In fact, traceability is evolving from a service targeting FMCGs. We are likely to see both traders and traceability contractors increasingly monetizing traceability data with not just banks, but input manufacturers and logistics providers as well. The movement towards making data available to a wider range of parties will see the sector evolve from traceability systems that target an end buyer, to "data exchanges" that sell data on a value chain to multiple data consumers. These systems raise a number of data protection risks but could ultimately make smallholder value chains more efficient.

Examples of traceability services in ASEAN include Koltiva, FarmForce and GeoTraceability.

Of the five business models covered int his report, the traceability model stands out because contractors typically deliver large complex traceability projects rather than selling a unitized service within the value chain. The future of this model is dependent on changing consumer sentiments and the potential for contractors to shift into a broader data exchange offering.

Comment from Leesa Soulodre,
General Partner at R31 Ventures

"In any risk driven business model there are two levers for disruption: (1) reduce the level of information risk in an industry - empowering the change of who, what, where, and how the decision is made in the value chain, and (2) align the incentives in the industry.

By its origin, traceability platforms are designed to achieve both. Reducing the level of information risk is done by empowering transparency along the value chain. Regarding realigning the incentives, for example if there is an irrefutable source of origin for a product, this reduces the risk for any buyer/third party, encourages a consumer to potentially continue to buy or buy more, gives a financier the accurate information in order to insure/fund at lesser risk premium, and for a farmer, it can provide a stamp of "legitimacy" and "provenance" that can command higher margins, brand loyalty and increased market share.

The issue is that this model demands a desire for transparency of the value chain, willingness of the ecosystem to subscribe to it, and evidence of the same side, cross side network effects.

To invest in a business with this model, investors would typically need to see: (1) a level of ecosystem critical mass re user adoption, (2) evidence of same side and cross side network effect, (3) demonstrated traction of user adoption across each of the main user groups, (4) demonstrated willingness to pay from the "Customer" and (5) barriers to entry and exit from fast followers."

Comment from Pierre Courtemanche, Sustainability and Supply Chain Specialist, Optel Group

"The farmer data collection and farm mapping, that the piece qualifies as 'farmer mapping' could certainly help in building a trustworthy supplier list. However, this will not give the assurance that the supplies comply with the market requirements and expectations as it is a static database.

Tracing raw materials from those 'compliant farms' throughout the supply chain is the only way to guarantee product integrity and ensure the lack of contamination and substitution with non-compliant products. On the other hand, a basic traceability solution will only track and trace the movement of the product along the supply chain without providing much additional insight.

This was the reason why we merged both databases when building GeoTraceability. A solution that guarantees the integrity of the products origin and its evolution while carrying production, contextual and impact data. In the future, farmers could receive a payment for sharing his or her data to downstream supply chain actors and other stakeholders. The farmer keeps the ownership of its data and accepts to share the information with organizations paying a fee on a data exchange. Everyone wins, a trader or brand owner does not have to support alone the investment of gathering data and complying with data privacy regulation, and farmers are incentivized to participate in the digital booming economy.

The great thing is that multiple organizations could access the same farmer data set and pay to use it: a trader, a brand owner, a bank, an agri-dealer, a NGO, the government, etc. This will increase the revenue streams, distribute costs and benefits among stakeholders and maintain the system."
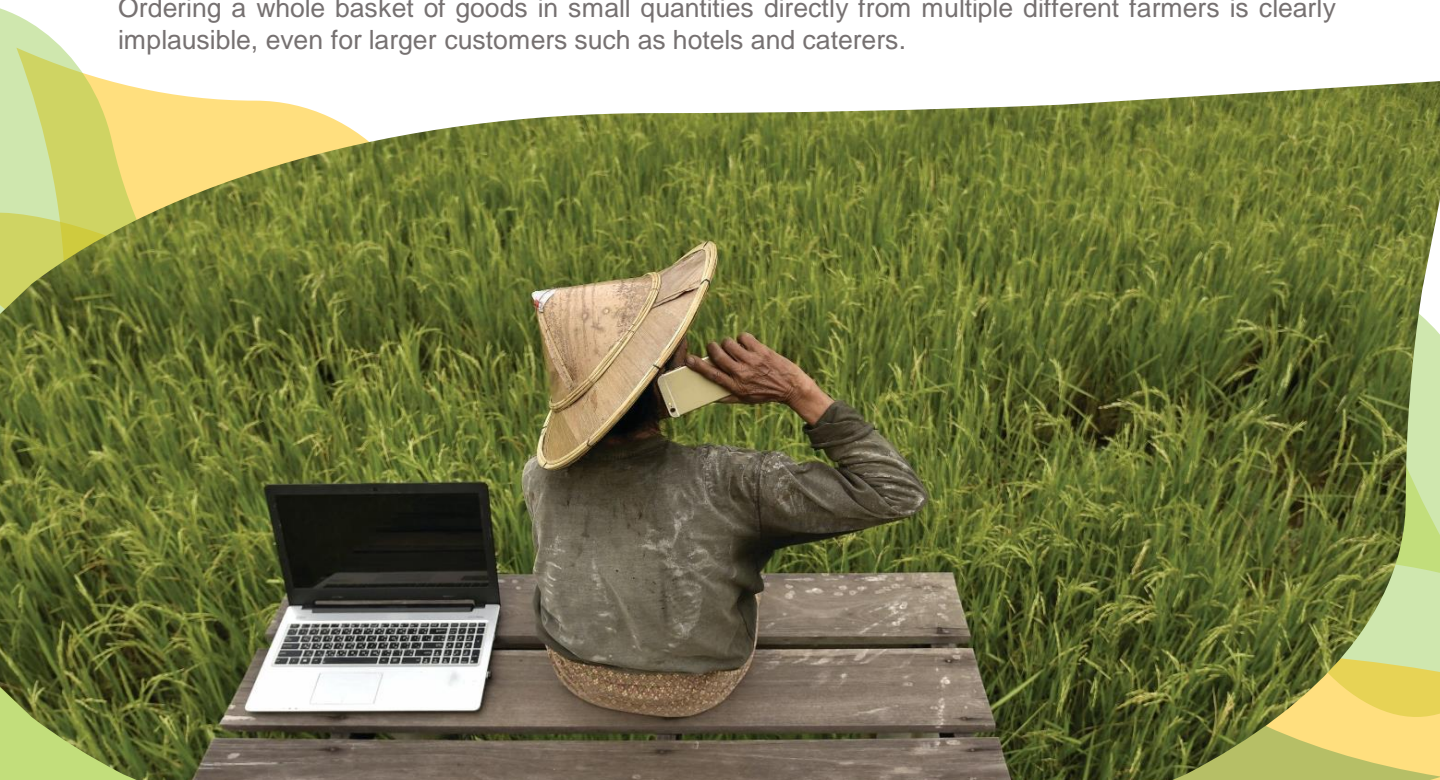
4. Digital Marketplace

The most profitable digital business model is the Digital Marketplace. Amazon, eBay, Pinoduoduo, and Alibaba have become global giants connecting buyers and sellers online. The model generates value by operating at a scale that "brick-and-mortar" traders cannot, while delivering far lower transaction costs. Furthermore, while these businesses collect commissions on a significant volume of sales, they typically do not have to allocate capital to carrying inventory. Digital Marketplaces have not only made transactions more efficient but have allowed smaller businesses to enter a range of previously inaccessible markets, and thus improved competition.

Smallholder value chains have a number of characteristics that suggest that Digital Marketplaces could add value. Both the inputs that farmers buy, and the crops they sell typically pass through a significant number of traders, each collecting a commission. These commissions are high when compared to modern, competitive and digitized value chains. Moreover, as a result of weak logistics linkages, inventory costs are also high, with each link usually carrying significant stock.

Market power is significant, with both input and crops traders often able to dominate a region by developing deep long-term relationships. This combination of fragmentation, high market power and multiple levels of traders would appear on the surface to provide the ideal entry point for the Digital Marketplace model.

The most immediate challenge to Digital Marketplace integration is digital literacy, as many farmers lack either the right device or skills to generate a digital listing, accept digital payments and to correspond with buyers. However, this issue is likely to prove to be transient as access to devices and payment services improves, and in many cases, there is already someone in a village with the skills and access to generate listings.

There are more fundamental issues likely to plague the Digital Marketplace model in the ASEAN smallholder marketplace. While a farmer might have a ton of potatoes, most buyers only want a few kilograms, and not just potatoes but a range of different products such as rice, spices and tomatoes. Ordering a whole basket of goods in small quantities directly from multiple different farmers is clearly implausible, even for larger customers such as hotels and caterers.

What is much more likely to emerge is the digitally enabled trader; traders who use digital tools to capture the benefits of Digital Marketplaces, but still carry an inventory of goods on their balance sheet. Carrying an inventory will allow these traders to aggregate enough products from each farmer, and then divide these into a basket of goods for customers.

Digitally enabled traders (and cooperatives) use technology to cut out the ad-hoc phone and message-based communication that traders currently use to communicate with farmers and consumers. They could also use a digital platform to schedule logistics, offer live auction-based negotiation and digital shipment tracking. Digitizing listings also allows traders to better balance supply and demand, by providing a real time (and historical) map of supply and demand.

When mapped against the three farmer archetypes, the Digital Marketplace adds the most value for the Horticultural profile. Early indications are that the model works particularly well for fresh fruit and vegetables where the time to get a product to market is short – and supply, demand, and prices shift daily. Given the limited shelf life of these products, the ad-hoc process of phone and message-based communication also causes wastage.

However, even traders for Marginal Grain and Commercial Grain (the other two archetypes) can benefit from digital tools to map and communicate with their farmer suppliers, and manage inventory. The value of digital tools extends beyond the traditional online marketplace.

Digitally-enabled traders compete directly with more traditional traders, providing an incremental but important advantage to both farmers and consumers. It will be interesting to observe the response from the global e-commerce players. Backed by significant resources and brand power, it remains to be seen if the need to carry inventory with a short shelf life will keep e-commerce companies at bay.

Examples of smallholder digital marketplaces in ASEAN include RegoPantes, iFarms and TaniHub.

This model stands out from the others in the series in how incremental it is. We are likely to see traditional traders gradually being challenged by traders who introduce more and more of the tools of e-commerce marketplaces to make communication, shipping, and negotiation easier and more efficient for farmers, suppliers, and consumers.

Comment from Jairus Ferrer,
Founder at iFarms, Inc.

"We are at the infancy stages of testing the viability of our e-commerce product within the Philippine Agriculture industry. Discovering the right strokes, formulating innovative win-win business models for stakeholders and user adaptability has been our core focus as a start-up company for the last 2 years.

Given our country's geography, perennial natural disasters, economic market shifts and the polarized political climate within the Philippine Archipelago, empowering the smallholder farms is needed now more than ever. How? By establishing the digital ecosystem alongside enhancing supplemental post-harvest facilities with tight logistics chains."

Comment from Larry Taylor,
Co-Founder at The Yield Lab Asia Pacific

"Digital business models do seem ubiquitous, certainly to the consumer who buys B2C goods in this way. But agricultural products are often not standardized in quality as a branded product and are often perishable. The Yield Lab is invested in and a believer in the advent of digitization of agriculture markets. Early movers are those working with grains, where product grades are standardized and verifiable, and the quality can be sustained over some time and during transportation. We also see digital marketplaces being designed in ways that agriculture markets can benefit.

One way is entering the credit cycle; producers buying inputs on credit and selling the harvest to that provider of credit; and a digitized credit system offers 'merit' based access to farm credit, providing quality smallholders with the credit they need. Another way is to enter the transportation service; producers would know the markets to sell to if they have sight of the pricing prevailing today and get their produce to that market without having to take the day off to go to market. The technologies adopted in the market today are those that enhance the efficiency of the established supply-chain. Anecdotal evidence gives us the confidence that rural producers are able to quickly learn and adopt such technologies."

5. Mechanization Platforms

Migration away from rural areas is reshaping smallholder value chains in Southeast Asia. Over the next 15 years, 1 in every 5 people in rural Asia are expected to move to a city[2]. One of the most significant implications for farmers is the declining availability of labor. Farmers face a lack of access to laborers to weed, spray and harvest crops - as a result, day rates are gradually increasing.

A range of equipment is available to replace labor on farms, from tractors which have been available for over 100 years, to spray drones that have been developed in the last 10 years. These tools have replaced labor at scale in developed markets. For example, in the United States, farmworker numbers have dropped by 80% in the last 100 years while grain production has increased six-fold. Many of these machines not only reduce labor costs but also increase yields.

Despite its advantages, the shift toward mechanization in Asia has been very slow. Small farm sizes are the main barrier. It is simply not viable for a farmer to buy a tractor to plow one hectare of land once or twice a year. Instead, it is more common for an investor to buy a tractor and lease it out. This allows the cost of the equipment to be amortized over hundreds if not thousands of individual farms.

However, there are presently inefficiencies in equipment allocation. Hiring is normally arranged ad hoc over the phone, and the time to travel between farms limits both availability and returns to the investor. These inefficiencies thus result in limited use of equipment in smallholder farms in Southeast Asia, which prevents farmers from benefiting from mechanization.

A solution to this challenge is the digital Mechanization Platform. These platforms allow equipment owners to offer a service on a digital portal, matching them with farmer customers. Using digital portals improves efficiency as it avoids the ad hoc placement of multiple phone calls and opens up new farmer customers. However, it also allows more effective scheduling around clusters of demand. For example, a tractor owner can be notified when 200 acres of plowing is required in one village, enough to make vehicle allocation economical.

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2. Source: United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP)

Digital Mechanization Platforms have also driven the allocation of spray drones in China, with drones also allocated around clusters of farmer demand. In this model, drones have a number of advantages over tractors:

- They can be moved more easily between farms.
- They spend less time on each farm (about 15 minutes to spray a hectare).
- They are cheaper, allowing a contractor to get set-up (and generate a return) more quickly.

Amortizing the equipment over many farms is the critical element of the Mechanization Platform model. For example, while a spray drone might cost the buyer $10,000 to purchase, an individual manual spray application by a laborer in Indonesia is typically only $10 per hectare. Moving the equipment quickly and efficiently to over 1,000 farms in the drone's life cycle is critical, and contractors need multiple farmers signed up to use it each day. As the service is only needed at certain points in the cropping season, there is pressure on contractors to move quickly.

Table 5: Contextualizing Mechanization Platforms to our Farmer Profiles (all amounts in USD)

	Marginal Grain	Commercial Grain	Horticultural
Tractor Hire	0	150	300
Revenue per Farmer (10% fee)	0	15	30

Mechanization Platforms are being used by tractor owners for ploughing and harvesting as well as for spray drones. The model could be extended to seeders and farm imaging and mechanical weeders. Platforms provide the greatest value where the service not only displaces labor but adds value in other ways. For example, drone operators may bring value by not only spraying the crop, but also by providing insights from imagery or advice on pest control.

These mechanized contract services are generating new and preferred employment opportunities in rural communities. Providing services to other farmers can be an important pathway for young people to exit their family farm and enjoy a higher income and more meaningful work.

Better access to contract mechanization services will enable farmers to reap the benefits of mechanization. Timeliness in planting leads to higher yields, while saving in labor reduces costs. This is achieved without having to buy the equipment themselves. These services will drive the emergence of a cadre of younger, better, and more professional farmers, supported by a network of farm service companies – for example, providing tractors, drones, and labor gangs.

Examples of mechanization platforms in Asia include Tun Yat in Myanmar and EM3 in India.

The Mechanization Platform model stands out from the others in the series in that the complexity of the digital platform is relatively low while the required effort and value is in marketing and equipment selection, and ensuring contractors are trained to provide the service to farmers.

Comment from Hujjat Nadarajah,
CEO at Tun Yat Limited

"We can confirm that we are seeing how Digital Mechanization platforms that address mechanization needs of smallholder farmers in South East Asia are leap-frogging a process that is often limited in reach. Farmers use smart phones combined with social media platforms like Facebook, to find machines and book them to use on a seasonal basis. The question is, how does the Digital Mechanization platform evolve from Facebook to beyond?

What we learned was that in implementing the digitization process, a lot of trust-building and handholding is needed with smallholders to become platform users and even more effort is needed for on-going users.

In our first three years, we found that delivering a reliable mechanization service that is affordable and on-demand itself is a foundation to first build and gain trust from farmers, followed by delivering the service and then adding on the technology layer after. Once farmers see the actual machine on their land harvesting / tilling their crops, they become more interested in value-added and efficient services as the next upgrade of this core service and are more open to learning and using the tech.

Scaling in an agricultural or rural market is not the same as scaling in an urban setting of savvy applications and tech users and requires patience. Based on our experience, we found that many apps and platforms claim thousands or millions of users, but in fact this is more Facebook boosting or content-type users rather than active paying users – in fact this last step of gaining paying users via mobile wallets was a process that took us several months to learn about and grow; machine owners were more tech-savvy on this side including using of payment wallets compared to famer users.

Yes, it's true, farmers use Facebook and Google Maps, but beyond those apps, using a dedicated app for tractor bookings is challenging. Google Maps are often not updated in these areas. Internet connectivity drops in / out, usually depending on if there is a nearby telecom tower for mobile signal. Many of the remote areas are not near these towers, thus causing connectivity issues and data usage is a cost constraint. Sometimes it was the farmer's daughter/son who was the actual user vs. the farmer themselves and so there is a gap between the decision maker and the young person using the tech that needs addressing.

Overall, the process is complex. We are still continuing to learn, but it is great to be at this frontier of learning to help bridge this gap and move this system from traditional service delivery to tech-enabled transfer, bookings, customer profiles and transactions. The opportunities from this continue to unfold."

Comment from Larry Taylor,
Co-Founder at The Yield Lab Asia Pacific

"Firstly, let me say that I am a believer in the general concept that is described in the Mechanization Platform section. More convincingly perhaps is that the Yield Lab is an investor in rolling out such technologies.

Firstly, on the human side there is indeed migration from rural to urban living, and importantly it is the younger generation that is moving, leaving the rural area with limited talent to operate agriculture. Loss of labor is one factor, but loss of owner/operators with the skills to engage with new technologies compounds the problem. We run the risk of loss of land under viable cultivation. The authors suggest that professional farm services is an opportunity and we agree. Professional services that bring effective and efficient technologies to the aging rural owner/operator presents the dual benefits of keeping hectares in viable production and proving interesting and remunerative careers for the younger generation.

Secondly, on the equipment side. The 'developed' economies that have experienced the mechanization described, mostly have large scale farms or have crop values that afford mechanization. Smallholder farming presents unique challenges. Equipment needs to be sized to perform in small plots. Drone applications introduce efficiency for some functions, but only some; and then small adjacent farmers need to manage drift, and relations with neighboring crops; both drones and tractors (and robots) are needed. Digitalization of the 'hiring' of the professional services, offering the drones and tractors and combines etc, will introduce both economic efficiencies as well as democratization to the owner/operators. Due to the seasonal crunch on demand of each type of equipment, the author may be overestimating the number of farms assisted by a given set of equipment. But this just means that there is widespread opportunity in rural agriculture for professional services that provide mechanization - they offer selection, deliver, maintain, operate, service, train, and advise… all for a value added to the agriculture production community."

Comparing Models

As articulated in the Introduction, a strong business model delivers high customer Lifetime Value (LTV), at a low Cost of Acquisition (CAC).

Lifetime Value

The viability of each model will vary significantly with context and the tactics used by the management team. However, we can draw several conclusions about the order of magnitude of the LTVs in each model.
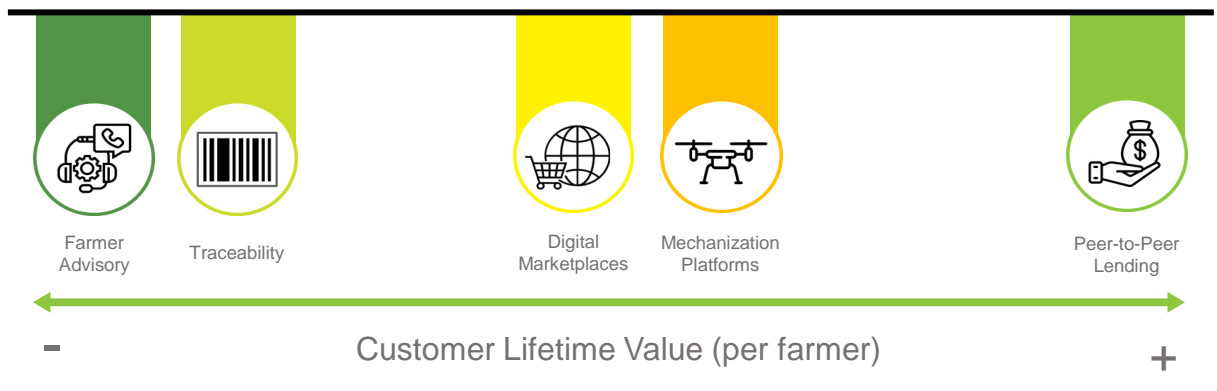
Models which present high LTVs are linked to services which farmers spend heavily on each year. Credit is a key cost for farmers, who typically pay high interest rates, this positions Peer-to-Peer Lending a clear leader with farmers often spending 5% or more of their annual revenue paying interest on loans (over $50 on a $1,000 revenue farm) each year.

Mechanization Platforms also capture appreciable value, with farmers spending up to 5% of their annual earnings on equipment hire. Digital Marketplace also captures solid value (per farm) with traders capturing up to 30% of crop value between the farm gate and market.

Traceability and Farmer Advisory provide very low LTV per farmer, selling the data they produce to traders, lenders and food companies at less than $5 per farm. These models require very low acquisition costs to prove viable.

- Guiding questions when considering the Lifetime Value of a proposed model:
- What is the average LTV of each farmer I engage?
- Can I serve a B2B rather than a farmer customer to increase LTV?
- Is there a wealthier market segment that sustains a higher LTV, at least as we build the model?

Diagram 1: Business Models relative to their general Customer Lifetime Value (per farmer)

| Farmer Advisory | Traceability | Digital Marketplaces | Mechanization Platforms | Peer-to-Peer Lending |

Customer Lifetime Value (per farmer)

Cost of Acquisition

The CAC depends in large part on how actively farmers are pursuing the relevant service. Services which farmers actively pursue have a lower cost of acquisition. In our view two models stand out here – Peer-to-Peer Lending and Digital Marketplaces. Farmers are likely to increasingly pursue lower cost credit options, while traders will seek technologies which reduce costs and increase the customer base.

The CAC also depends to a large extent on how many customers the model requires to operate efficiently - the fewer the customers the better. Here, Traceability stands out, as a whole business can be built off one or two FMCG customers, while Mechanization Platforms required thousands of farmers customers to ensure viability.

We expect to see more successful entrepreneurs acquire customers through partnerships. Rather than acquiring customers directly, they will provide their digital service as an extension to a product or service farmers are already buying. This approach has the potential to significantly reduce CAC and is widely used in agriculture.

Guiding questions when considering the CAC of a proposed model:

- What is the average CAC for each farmer I engage?
- Can I work with a business that already sells products to service, and add my offering as an addition?
- Which customer segment is likely to seek out my service, cutting acquisition costs?

Conclusion

The transformative potential of digital on the smallholder agricultural industry is undeniable. Over the next 10 years, a small portion of fragile startups in our industry today will go on to disrupt and define the industry in ways that are currently difficult to predict. These disruptors will stand out from other solutions in their ability to find a scalable business model. Our key findings are:

- **B2B is Important:**
  It is particularly challenging to build a business model around a smallholder customer base. The fastest growing models will likely service banks, input companies, lenders and FMCGs as customers.

- **Consider Lifetime Value:**
  Lifetime value is a critical consideration in launching a smallholder business model. Models which generate only a few dollars per farmer in profits are going to be much harder to scale than those that nett $10 or even $100 per farmer in each season.

- **Farmer Income Drives Lifetime Value:**
  Business model viability is highly correlated with farmer income. New technologies will gain traction more quickly in regions and crops with higher incomes.

- **Obsess over Value:**
  The motivation to build a new smallholder technology can come from a range of places: benevolence, a sense of adventure or simply a hunch that what worked in another industry will work for smallholders. While all these motivations are a good place to start, they are poor guides when it comes to unearthing a scalable business model. Businesses that grow will be obsessive about providing and capturing customer value.