Thematic insights from delivering technical assistance to agribusinesses through the African Agriculture Fund’s (AAF) Technical Assistance Facility (TAF)
EXECUTIVE SUMMARY

A major constraint to productivity for smallholder farmers\(^1\) across Sub Saharan Africa (SSA) is access to draft power resulting in reduced yields, lower production scale, lower cultivated area and high drudgery. Typical demand side barriers to smallholder mechanisation\(^2\) include high capital costs and interest rates, unreliable aftersales services and limited market access. On the supply side, farm equipment providers have had little success in reaching smallholders – they have been focused on larger equipment intended for commercial farmers that are unsuitable for smaller farms. They have also struggled to achieve economies of scale in serving smallholder farmers to make it an economically viable customer segment.

However, the market conditions are now conducive to initiate inclusive farm mechanisation models in SSA. This is due to a triad of factors – increasing urbanisation has pushed up rural labour rates bringing the manual cost of many farm activities to parity with the cost of mechanisation; increased adoption of basic agri-inputs like fertiliser and seed has primed farmers to reap the benefits of mechanisation; and saturation of the large commercial farmer market is compelling equipment providers to consider the much larger smallholder market that is yet to be mechanised.

Within TAF’s portfolio of inclusive business projects, we identified the need and opportunity to work with equipment providers to develop more appropriate business models to increase smallholder access to mechanisation. This paper presents key findings from TAF’s market analysis conducted in 2017 (primarily using evidence from three countries in SSA – Malawi, Zambia and Burkina Faso – where the AAF TAF had smallholder support schemes running); a business planning exercise and early stage experience from a pilot hiring model launched in 2018 with an AAF equipment provider in Malawi.

Our analysis showed that inclusive business models can be economically viable for all stakeholders only when both supply and demand side challenges are effectively addressed. The traditional purchasing and leasing models have proven unviable as the prohibitive costs of the equipment make it financially unsustainable for farm plots less than 30 hectares (ha). Based on our analysis, our hypothesis was that the most efficient model of access to equipment would be through a well-designed hiring model that can be sustainable for both the smallholders, farm equipment and service providers. In this paper, a hiring model is defined as an entity (e.g. Agri-SME) providing mechanisation services directly to smallholders for a fee. For hiring to smallholders to be viable, route optimisation is critical, appropriate service delivery channels need to be deployed and a strong focus on operational efficiency of the equipment maintained. A platform that brings together equipment suppliers and farmers demanding the service (e.g. Hello Tractor, Trringo, TROTRO) is an attractive model that has potential to address demand aggregation constraints but this relies on further market development and uptake of technology before benefits will be realised. Finally, farmer responsive services must be developed to encourage sustainable and appropriate smallholder investment in mechanisation.

1. CONTEXT

Market opportunity

Smallholder farmers constitute the majority of farmers in SSA, nearly 90% of the farmers have an average farm size of 1.8 Ha\(^3\) (see Figure 1). One common characteristic of smallholders across

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\(^1\) Smallholder farmers referenced are farmers with <10 ha of land
\(^2\) Mechanisation throughout the document refers primarily to land preparation and production activities
\(^3\) Excludes South Africa; Source: World Bank Agribusiness Indicators Report, 2014
This project was primarily funded by the EU, managed by IFAD and implemented by TechnoServe. The project received additional donations from the Alliance for a Green Revolution in Africa (AGRA), Italian Development Cooperation and United Nations Industrial Development Organisation (UNIDO).

Demand-side challenges can be defined around:

- **Small farm sizes**: The average size of the SSA farm (1.8ha) limits the type and models of farm equipment that are both technically and economically feasible on these plots. Additionally, these farms are often of irregular sizes and dimensions with many obstacles. This makes most equipment available in the market, primarily large, unsuitable for use on these farms.

- **Cost of Equipment**: Small farm sizes and poor yields make most farm equipment unaffordable for smallholders. With the average cost of a small tractor of 50HP at $20,000, it represents 16 years of investment for a smallholder farmer. The underutilisation of the farm equipment due to small farm sizes also contributes to suboptimal returns on that equipment.

- **Cost of Capital**: Interest rates for rural credit at 12 – 35% per annum across countries in SSA make it prohibitively expensive for smallholders to access loans for farm equipment.

- **Access to Credit**: Financial institutions (FIs) are reluctant to lend to smallholders for farm equipment due to high perceived and real risks in the sector.

- **Access to Spares**: Access to repairs and spares for farm equipment is minimal across most countries in SSA. By estimates of the Government of Burkina Faso, 20% of the tractors given out under the government

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5 50 HP tractor including implements

6 For a smallholder with 10-15 Ha of land, even assuming a 50% yield increase from 1.5 MT/Ha, investing only 20% of net income, with a rototiller life of 3-5 years and mini tractor life of 10 years

7 Ghana bank lending rate of 35.5% in March 2018, Zambia 12.5% in 2017, Malawi 16% in 2017: consumer lending rates will be higher than bank rates
scheme have broken down, where two-thirds of these could be repaired with access to spares; with only one service centre for the country in Bobo-Dioulasso.

**Supply side challenges have revolved around:**

- **Limited understanding of smallholder market**: Original Equipment Manufacturers (OEMs) have a limited range of products targeted at smallholder farmers.

- **Cost of sales channels**: Reaching smallholders is challenging and often costly. Individual equipment sales (to each farmer customer separately) further drives up the overall cost of sales.

- **After sales service**: Given the dispersed nature of the farms, OEMs and distributors find it difficult to service farm equipment unless there is a minimum threshold of equipment in an area. Not only is access cumbersome, the cost of servicing breakdowns is prohibitive.

- **Government intervention**: Many governments across SSA (Tanzania, Mozambique, Burkina Faso among others) have run schemes and tightly controlled tractor imports. This policy skews the equipment market as it disincentivises private equipment providers from entering the smallholder market, long perceived as the government’s domain.

**Current models for smallholder access to Farm Equipment in Sub Saharan Africa**

Leasing-to-hire has been the primary business model to reach smallholder farmers in SSA. This has been driven by both individual governments (Nigeria, Burkina Faso etc.) and by private sector players like Export Trading Group (ETG) and John Deere across a number of countries in SSA, NWK Agri-Services in Zambia and Equity for Tanzania (EFTA). This model starts with the farm equipment being leased by an entity (e.g. lead farmer/outgrower, farmer cooperative or commercial farmer) that then proceeds to provide mechanisation services to smallholder farmers within the area. There have also been a few models of equipment providers directly providing hiring services to farmers as in the pilot by Keegy Ltd (in collaboration with Musika) in Zambia in 2016/17.

These approaches have been primarily driven from the supply side. They often work with intermediaries like the lead farmer or the farmer cooperatives to address demand side challenges but these entities are challenged by key skills gaps, namely:

- **Limited technical skills**: Most entities that lease the farm equipment have limited technical expertise to operate and maintain equipment. This has often led to the equipment breaking down and left unrepaired because of the poor ecosystem of spares and repair centres.

- **Business Skills**: Many of these entities lacked business skills that are required to manage leasing and hiring activities including appropriate accounting practices, loan management, marketing, order processing and pricing. The equipment is often therefore under-utilised and entities are unable to recover their costs. Intervention models often lacked adequate focus on selection criteria to recruit the right entrepreneurs to play this role and appropriate programmes to develop core business skills and financial literacy.

- **Operational Skills**: hiring services also require strong operational capabilities focused on route optimisation, equipment operations, maintenance and service delivery.

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8 Source: Rapport Final, « Assistance technique aux acquéreurs de tracteurs dans le cadre de la mise en oeuvre du Projet de Développement de la Mécanisation Agricole et de Soutien au Secteur Hydraulique (PDMA-SSH) »
Recently, there have been efforts to leverage technology to solve some of the above mentioned challenges around smallholder farm mechanisation. Pioneering models in this space include Hello Tractor in Nigeria and TROTRO Tractors in Ghana among others. These models provide platforms that link tractor owners and operators to farmers to improve utilisation of tractors. These models are currently being tested in a number of markets. Figure 3 compares key models and their strengths and limitations; with commentary on these platform models captured in section C of Figure 3.

**Figure 3: Key mechanisation models**

<table>
<thead>
<tr>
<th>Model Type</th>
<th>Strengths</th>
<th>Limitations</th>
</tr>
</thead>
</table>
| **A Lease to Hire Model**               | • Greater proximity to farmers; ability to reach farmers more cost effectively  
• Community based-understand farmer needs; can establish payment plans | • Lack expertise in equipment and maintenance services                           
• Limited technical/business skill for equipment/service provision                  
• Diverse requirements for set of farmers                                               |
| Examples: (Tanzania) (Zambia)            |                                                                           |                                                                            |

| **B Equipment providers hire to Farmers** | • Expertise in equipment and maintenance services  
• Ability to procure spares                                                                 | • Difficulty to attain scale without time                                        
• Need to develop eco-system with other partners for success (e.g demand)             |
| Examples: Keegi (Zambia)                |                                                                           |                                                                            |

| **C Platform Aggregator Model**          | • Use of technology to solve demand aggregation constrains  
• Use of data to provide better service  
• Lower cost                                                                                  | • Poor smartphone coverage & networks  
• On boarding farmers to platforms  
• Ensuring appropriate, adequate equipment                                                      
• Need online & ground presence for success                                                    |
| Examples: Hello tractor (Nigeria)        |                                                                           |                                                                            |

**Lessons from other Regions in the world**

The agriculture sector in South Asia (particularly India and Bangladesh) and China historically shared many characteristics with the sector in Sub Saharan Africa (Figure 4) until a few decades ago.
The average land holding size in India is 1.2 Ha; in Bangladesh, the majority of the farms are less than 0.6 Ha; and in China, less than 0.6 Ha. These are all comparable to the 1.8 Ha average farm size in SSA. These are also markets that are characterised by strong government involvement in agriculture and where farming is primarily rain-fed.

The level of mechanisation in these countries has surpassed that in SSA in recent decades. The primary reasons for this include:

- **Type of equipment available:** Much of the equipment in South Asia and China is smaller equipment like power tillers, walking tractors and smaller tractors of 35 – 45 HP. These have also been developed and manufactured locally to best address local ecological and environmental realities. This has resulted in cost-effective equipment for smallholders. Our research found limited equipment customisation for smallholders and local manufacturing in SSA currently although efforts are moving in this direction in countries like Kenya and Zimbabwe.

- **Hiring Services models:** Many variants of the hiring models have contributed to the increased level of mechanisation of smallholder farmers in South Asia and China. It has made mechanisation affordable for smallholders even as it has made it economically viable for service providers. ~70% of smallholder farmers in India and China benefit from hiring models using inexpensive equipment.

- **Private Sector Led:** The private sector has led smallholder farm mechanisation either through the farmer cooperatives, lead farmer models (India) or through the farm service unit models (China).

Source: IFPRI Mechanisation in Ghana: Emerging demand, and the search for alternative supply models; CMA Agricultural Machinery Industry in India: A Study for Growth, Market Structure, and Business Strategies; UNAPCAEM Agricultural Mechanisation Development in China
Why SSA is at an inflexion point for smallholder farm mechanisation

SSA is now at an inflexion point for faster adoption of smallholder farm mechanisation. There are a series of macro-economic factors that can accelerate adoption of appropriate inclusive business models in the short term.

The first factor is the increasing farm wage rates and rural labour shortage across Sub Saharan Africa. Given the lack of mechanisation, smallholders rely completely on manual labour for most farm activities. Although, families work themselves on their farms, they also hire manual labour, particularly during the land-preparation and harvest season. The increase in labour rates is a result of growing labour shortage in the rural areas. This labour shortage is driven by increasing urbanisation and limited interest amongst the youth in farming. SSA has one of the youngest populations in the world and the fastest urbanisation rate in the world.

Our analysis in Malawi showed that the cost of rural labour for key farming activities is fast approaching parity with mechanisation rates. When wage rates were plotted for 1Ha of land preparation over the next 7 years (accounting for inflation) against mechanisation hiring rates (starting with current Government hiring rates and factoring in inflation), the rates converge in 2018/19 (see Figure 5). For the smallholder farmer, in addition to the mechanisation benefits of reducing drudgery, improved yields and higher farm productivity, now the cost parity is also making a strong economic case.

The second factor that supports smallholder farm mechanisation is the higher adoption rates of basic agri-inputs particularly fertilisers and improved seeds over the past decade (see Figure 6). While SSA still lags considerably in the level of input usage (13-20 kgs /Ha compared to South Asia (32kgs /Ha), East Asia (42 kgs / Ha) and South America (18kgs / Ha)9, more farmers are aware of the need and use some level of agri-inputs. This is key for mechanisation to

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be effective as the improved yield benefits of mechanisation are best realised with the existing use of appropriate agri-inputs and adoption of good agricultural practices.

And finally, the smallholder market size is large. 70% of the population in SSA works in agriculture and nearly 90% of all farmers in SSA are classified as smallholders. These farmers represent a large untapped market for agricultural equipment and service providers. Commercial farmers have been almost fully mechanised in SSA. This customer segment, therefore, is now increasingly a replacement market as equipment wears down or nears the end of its commercial life. Smallholders represent a limited new equipment sales market for equipment providers. On the other hand, smallholders represent a growth market if appropriate ways of serving them can be designed. Smallholders are also well aware of the benefits of mechanisation making them eager customers.

Financial Viability for smallholders

Fundamentally, smallholder farmers can access farm mechanisation in three different modes: outright equipment purchase, lease equipment and / or opt for hiring services. Each of these options comes with its own benefits and challenges. However, for smallholders, defined as those with less than 10 Ha of land, the financial viability of the three models poses the most important decision-criterion and bottleneck. Detailed analysis of tractors shows that neither outright purchase nor equipment leasing is economically viable for smallholders (see Figure 7). This is either because the pay back on the equipment investment is longer than its planned life or that the equipment at the price point is unsuitable for use on small farms.

![Figure 7: Payback in years on Equipment Investment](image)

Particularly for smallholder farmers, farm equipment (i.e. tractors in the analysis above) as capital investment proves unviable and it is more effective to treat it as an operational expense (i.e. pay for hiring services). For the farm equipment provider, while leasing might be the most profitable option, hiring services can be as or more profitable than other options (Figure 8).

This would be the win-win market condition for all stakeholders. For equipment purchase to be viable, farms need to be over 30Ha to ensure optimal annual equipment utilisation. This continues to be the constraint for leasing models too. However, hiring services can be economically feasible for smallholders starting from as low as 3 Ha or even smaller if farms can be aggregated.

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Key assumptions in the model: 50% yield increase from current 1.5 MT/HA, farmers invest only 20% of net income, rototillers life is 3-5 years and mini tractors have a life of 10 years.

This project was primarily funded by the EU, managed by IFAD and implemented by TechnoServe. The project received additional donations from the Alliance for a Green Revolution in Africa (AGRA), Italian Development Cooperation and United Nations Industrial Development Organisation (UNIDO).
2. POTENTIAL HIRING BUSINESS MODELS

Different farm equipment hiring models can be developed based on local market conditions, demand patterns, and capabilities and strengths of different stakeholders. Before defining different types of hiring models, the key design elements need to be determined:

- What are the fundamental principles behind successful hiring models?
- What are the pre-conditions to be met before hiring services can be offered in a region?
- What kind of private sector players are best suited to offer these services? What would be the characteristics to look for in these players?

**Fundamental principles for successful hiring models**

As the private sector develops inclusive business models to offer farm mechanisation services to smallholders, it must focus on addressing both demand and supply side constraints. The key outcomes would be reduced costs through better efficiency, lower prices for farmers, maintaining margins for equipment providers and ensuring optimal equipment utilisation.

"...first fundamental demand side principle for successful smallholder hiring models – demand aggregation”

One of the key challenges of serving smallholders is the size of their farm plots. This establishes the first fundamental demand side principle for successful hiring models – demand aggregation across multiple farms to ensure optimal utilisation of the equipment at each run of the equipment from its base. It also enables smoother operations of the equipment with reduced set up times and increased operating hours. Successful demand aggregation also increases efficiency of operations since there are fewer changeovers as farmers in a region tend to grow the same crops during a season.
Dispersed farms imply additional costs associated with the service delivery. This therefore brings the second fundamental demand side principle for successful hiring models – route optimisation of the farm equipment as it moves through farms delivering its services. Route optimisation ensures that farm equipment spends less time in transit and more time on farms performing the requisite operations. It also has a direct impact on the fuel consumed by the equipment, tyre wear that impacts repair and maintenance costs and therefore on total costs of operations. Route optimisation also poses some supply side concerns for equipment providers. They need to bear in mind repair centres, availability of spare, equipment security and other consumables like fuel in a region where the hiring routes are designed. Other key demand side constraints that need to be addressed are marketing of the hiring services, efficient order processing, scheduling and administration and farmer needs assessments for developing appropriately priced and relevant services.

The supply side constraints primarily deal with the farm equipment required and the related operations. The first fundamental supply side principle for successful hiring models – assessment of the local conditions to identify suitable equipment that best address the local soil conditions, topography, irrigation and crop patterns. Stakeholders need to set up appropriate processes for finding and training equipment operators, ensuring prescribed operational standards are met and maintaining and servicing the equipment as per defined schedules. They also need to ensure appropriate spares are available and processes for timely repair of broken down equipment is undertaken. (See Figure 9 for critical principles to be followed).

**Potential Farm equipment hiring models**

Farm equipment hiring models can be differentiated by the service channel to the farmer and by how the distinct roles of demand aggregator and equipment supply are managed by different market players. We have identified three different models for different market conditions, based on the channel to the farmer:

![Figure 9: Critical Principles for Successful Equipment Hiring](image)

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• **Model 1: Supply-led**

In this model, farm equipment providers directly provide hiring services and handle the demand side of the market. This model is best suited in areas of medium farm sizes (sizes > 10 ha) with medium to high farm density. Higher farm density minimises need for strong route optimisation capabilities. In such models, the equipment provider should have deep roots in local communities with a long term market presence.

• **Model 2: Demand Side Led**

In this model, an Agri-SME that has a strong geographical footprint and already offers farmers a wide range of products/services and agri-inputs is best suited to diversify into offering mechanisation services. This is then an organic expansion of its product portfolio and leverages an existing understanding of the local farmer and last mile logistics. This model can be used even in areas of medium to low farm density leveraging an SME’s local knowledge to do detailed route optimisation. However, this model requires substantial investments to build requisite capabilities on the supply side (e.g. equipment maintenance, operations) or will need a partnership with an equipment provider.

• **Model 3: Collaborative**

Certain markets have well established and differentiated players that provide different services to the farmers in the region. A (loose/ formal) partnership between different players brings together different capabilities where an Agri SME potentially focuses on demand aggregation while the equipment provider manages supply and operations of the equipment. This leverages the strengths and unique capabilities of individual players to build a hiring ecosystem. Refer to Figure 10 for a summary of the potential models.

### Demand side led models

As outlined earlier, the most common models in the market place today are supply led. The most critical constraint for their limited success has been the lack of proper investment (time, money

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**Figure 10: Summary of potential equipment hiring models to smallholders**

<table>
<thead>
<tr>
<th>Channel to Farmer</th>
<th>Description</th>
<th>Conditions</th>
<th>Supply Side = Model 1</th>
<th>Demand Side = Model 2</th>
<th>Collaborative = Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Agricultural equipment provider</strong></td>
<td><strong>Provide hiring services directly to smallholder farmers</strong></td>
<td><strong>Medium farm sizes</strong></td>
<td><strong>Small farm sizes</strong></td>
<td><strong>Small farm sizes</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Medium to high farm density</strong></td>
<td><strong>Medium to low farm density</strong></td>
<td><strong>Equipment provider with strong network directly with farmers</strong></td>
<td><strong>Agri SME that already serves farmers</strong></td>
<td><strong>Medium to high farm density</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Owns equipment &amp; provides hiring services</strong></td>
<td><strong>Agri SME with strong local footprint providing range of products to farmers</strong></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Potentially lease to lead farmers / other Agri SMEs as franchisees for reach</strong></td>
<td><strong>SME handles demand aggregation, marketing &amp; order processing</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Have partners for equipment service &amp; maintenance</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Each stakeholder plays different roles:</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Equipment provider provides tractor, tractor operations and repair &amp; maintenance</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>SME handles demand aggregation, marketing &amp; order processing</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Strong differentiated players in the marketplace</strong></td>
</tr>
</tbody>
</table>
and effort) into demand aggregation and route optimisation. Demand side led models build on two critical propositions required—namely in-field operations and credibility with local communities to get buy-in:

- **In-field operations**: Knowledge of local farmers and on-the-ground infrastructure to drum up demand and ease flow of information, orders and payments are important capabilities. Existing processes and databases can also support efficient clustering/back-end management and farmer communication across multiple channels. Recently, the adoption of technology to reach farmers makes the process more analytical, data driven and efficient.

- **Getting farmer buy-in to clustering** – Local community credibility of the demand aggregation partner is critical to ensure buy-in and trust to get the model off the ground and scale it. Community engagement is essential and may often need local authority support to encourage ‘aggregation’ approaches.

For many players, this will be an obvious market or service expansion to their portfolio – e.g. farmer groups / cooperatives, Agri SMEs or lead farmers / outgrowers. Each of these have their own strengths and weaknesses and are suited for different conditions (see Figure 11).

The most efficient of these players, from our analysis, is the Agri SME given its stronger business skills, stronger brand equity with farmers, and the required cash support to build and scale a new business line.

### 3. MALAWI PILOT AND LESSONS LEARNED

Malawi is one of the poorest and least mechanised countries in SSA. Malawi’s dualistic farm sector means there is a thriving mechanisation market targeted at the very small, niche estate sector of 14,700 farms, with less than 2% of farmers having access to any form of mechanisation for any farm activity. Government intervention has helped to increase adoption of agro-chemicals (61% farmers use inorganic fertilisers) making the case for mechanisation as the next push to...
increase yields. The Government hiring scheme is almost the only source of mechanisation for smallholder farmers but very few smallholder farmers use the hiring services due to high prices and frequent breakdown of tractors.

Leading agricultural equipment brands (i.e. Massey Ferguson, John Deere) and dealers (i.e. ETC Agro, CAMCO, FES) are present in Malawi although none have actively served the non-estate smallholder market segment to date. Malawi exhibits characteristics that support a hiring model for smallholders with very high farm density (139 / km²) and high use of hired manual labour (44% use non-family labour). The southern region presents an even better picture with (185 / km²) compared to the central region (154 / km²). On the basis of the analysis conducted by the AAF TAF, FES, an AAF portfolio company and agricultural equipment provider in Malawi, was identified as a key partner to work with to further develop and test a smallholder inclusive hiring scheme.

FES is a one stop shop for equipment and services in Malawi; and has historically primarily serviced large scale commercial farmers and estate farms. The pilot project aimed to support FES to diversify its customer base to include smallholder farmers and take advantage of the massive market opportunity (with over 98% of the market comprising smallholder farmers, 97% cultivating less than 5 ha and 90% farmers cultivating less than 2 ha\(^1^1\)).

However, it was clear that FES did not have existing knowledge or networks with smallholder farmers. TAF identified the need for FES to collaborate with a demand aggregation partner to handle and address demand-side issues. Agora (the southern branch of Meridian’s retail stores and another AAF TAF portfolio company partner) was identified as well-positioned to leverage its retail network of 36 stores in the south; longstanding relationships with smallholder farmers; Farm Services Unit (FSU) and agronaut\(^1^2\) network to aggregate smallholder demand for hiring services. In addition to profits from tractor hiring services, Agora could benefit from improved brand value and competitiveness; increased farmer loyalty and increased farmer spend on inputs (see Figure 12).

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11. World Bank’s 2013 Integrated Household Panel Survey in Malawi, The Quiet Rise of Medium-Scale Farms in Malawi; Expert Interviews
12. Agora established the Farm Service Unit (FSU) which has recruited agronomists, known as ‘Agronauts’, at retail stores to conduct soil testing and produce crop-specific blends for smallholders. Agronauts provide advice on good agricultural practices and market inputs for sale. See input and extension platform project documents for further information on how TAF has worked with the Meridian group to support smallholder access to appropriate inputs and technical advisory services in central and southern Malawi.
TAF has since supported a partnership between FES and Agora to test a collaborative hiring model (see Figure 12 and 13). A key focus has been to support business modelling; build capacity of key staff and set up systems and processes to support the operationalisation of the business model. The timeline of the project being too short (~10 months), there is further need to support the company to set up the scheme effectively. However, some early stage learnings are evident:

- **Route optimisation** should be planned well ahead, supported by robust market surveys and farm assessments, a clear financial model (continuously updated based on practical trials), appropriate field aggregation combined with a management information system (MIS) to support efficiency.

- **Right sizing**: There is need to identify equipment that can get the work done at the lowest possible cost and has the shortest task time. In the upfront financial modelling conducted with FES, it became clear that too small equipment resulted in inefficiencies, high repair and maintenance costs; and too large equipment would result in sub-optimal equipment utilisation and higher overhead costs. Ultimately, a used 82hp was identified as able to provide services at the lowest rate even though FES had originally envisaged using a 35hp tractor model.

- **Target locations** should be identified carefully taking into account farmer profiles, density and infrastructure. The viability of the business model is highly sensitive to fuel costs and tractor allowances; a GPS tracker and MIS can support more efficient back-end tracking and management. In the pilot, Malosa was chosen based on assessment criteria highlighted in Figure 14 and existing (much higher) farmer spend on manual labour compared to other regions.

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• Beyond planning, **continuous trial and error** to refine the model is a reality; a patient and nimble team is required to course-correct based on realities on the ground. A demo plot in Malosa was set up as a marketing ‘shop window’ to attract smallholder customers but also for FES to test operating costs. In the first trials on <1ha plots, the land preparation services took 2-3x longer than anticipated (due to land clearing, hidden obstacles, etc.). However, this has become more efficient over time and closer to the intended time/costs required for the model to break even. We expect this to become even more efficient over time with scale; as critical mass develops and farmers are informed and can prepare for the services in advance.

<table>
<thead>
<tr>
<th>Figure 13: Assessment Criteria for Pilot location</th>
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<tbody>
<tr>
<td><strong>Fertiliser sold per year (MT)</strong></td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Ntcheu 1945.9</td>
</tr>
<tr>
<td>Mangochi 699.3</td>
</tr>
<tr>
<td>Malosa 683.5</td>
</tr>
<tr>
<td>Balaka 558.4</td>
</tr>
<tr>
<td>Mayaka 410.1</td>
</tr>
<tr>
<td>Nselena 307.89</td>
</tr>
<tr>
<td>Nchalo 84.95</td>
</tr>
</tbody>
</table>

• **Upfront investment** to resource this ‘start up’ phase is often more expensive than planned. In the Malawi pilot, there has been a need to systematise the entire distribution channel to eliminate inefficiency and drive greater coordination: this takes time and effort. Investment was needed in terms of staff recruitment and training, setting up standard operating procedures; facilitating smooth communication between two new business partners and stimulating partner buy-in.

• **Edu-marketing and development of farmer responsive services** is necessary to support sustainable investment and adoption of mechanisation services. The AAF TAF pilot supported the development of decision making tools (taking into account farmer soil conditions, household economics and adoption of best practices) to inform farmer decision making on whether and when it makes sense to invest in mechanisation; which package of services made sense; and whether the farmer could afford this based on projected sales and guaranteed offtake. Pricing was tailored to be on par or below what farmers were already spending on manual or government hiring services. Time will tell whether the above investments will translate into cost-effective demand aggregation, increased farmer uptake and associated returns for smallholders, and commercial benefits for the partners involved. However, the pilot

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strategy (building on regional learnings) and experiences to date hopes to capture the success ingredients we have identified to contribute to an evidence base for viable methods to enhance smallholder access to mechanisation.

4. REFLECTIONS FOR FUTURE MODELS

Based on the pilot underway in Malawi and the various smallholder mechanisation models being tested across SSA, several themes emerge that continue to pose challenges and others that could help accelerate the success of these models. In addition to sound business planning, entities need to be conscious of other elements that can hinder or support the business just as with any other start-up service.

- **Pre-conditions for mechanisation:** Not all regions and locations are equally well suited to be a launch point for smallholder mechanisation. To build momentum and stabilise business models, it is imperative to ensure that certain pre-conditions are in place:

  - **Adoption of Inputs:** Farmers should already have adopted basic agri-inputs before mechanisation can be deployed. This will give a multiplier effect on yields.

  - **Farmer organisation:** Some level of farmer organisation already in place helps initial demand aggregation before the service gains traction through both word-of-mouth and results from the first cohort of farmers.

  - **High Farm density:** Launching in areas with high farm density makes demand aggregation easier at the outset.

- **Pre-launch preparation:** has to be thought through and executed. It also will require patience to put the elements in place before the model can take off. Key elements of this preparation include:

  - **Farmer sensitisation:** Soil conditions (nature of top soil, drainage levels etc.) and environment conditions are critical drivers of the nature of equipment deployed. These must be communicated clearly to farmers.

  - **Relevant Data:** For the business model to be deployed, relevant data should be collected and analysed. This includes GPS coordinates of farms, current spend of farmers on farm activities, adoption rates of agri-inputs and ability to service equipment (e.g. spares, gasoline stations, availability of local tractor operators etc.) among others.

- **Start-Up mentality:** Deployment of mechanisation services for smallholders should be treated as a separate business while leveraging the close linkages it has with the other business lines of the entity deploying. This requires constant focus, patience (and patient capital) to build the model and the mindset to constantly evolve and strengthen the model. We believe that Sub-Saharan Africa is at the cusp of an accelerated adoption of smallholder farm mechanisation. As the private sector takes the lead on this through innovative business models that can tackle the constraints in an efficient and profitable way, over 100 Million farmers can be brought on board to modern farming practices. This has high potential to change lives both economically through higher incomes and socially taking the drudgery out of farming.

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