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AGRI-HIRE IN SUB-SAHARAN AFRICA

BUSINESS MODELS FOR INVESTING IN SUSTAINABLE MECHANIZATION



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AGRI-HIRE IN SUB-SAHARAN AFRICA

BUSINESS MODELS FOR INVESTING IN SUSTAINABLE MECHANIZATION

Karim Houmy
Mayling Flores Rojas
Claude Side

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Abstract

There has been a surge in the attention to sustainable agricultural mechanization for Africa. The importance of supporting agricultural mechanization in the value chain in order to achieve agricultural and rural development is well recognized. Therefore, it is vital to address the major challenge of ensuring that business models for mechanization hire services driven by the private sector (including farmers, cooperatives, and small and medium enterprises) are not only profitable, sustainable and inclusive for smallholder farmers and vulnerable community members including women and youth, but are also resilient to the effects of climate change. For a better understanding of how agricultural mechanization hire service provision can contribute to agricultural and rural development, this publication aims to (i) showcase a variety of business models of private-sector businesses providing agricultural mechanization hire services in Africa; (ii) identify success factors; and (iii) provide entry points for investment. The intended audience comprises policymakers, practitioners and financial partners working with sustainable agricultural mechanization in the value chain.

The publication is based on case studies of hire service providers from two regional workshops: the first held in Grand Lahou, Côte d'Ivoire, with the participation of Benin, Burkina Faso, Côte d'Ivoire and Senegal and the second in Kampala, Uganda, with the participation of Ethiopia, Ghana, Kenya, Uganda, Tanzania and Zambia. Moreover, the business model canvas tool was adopted to provide a framework for characterizing and analysing the different types of business models and highlighting success factors and investment strategies. Based on the analysis of the main characteristics of the enterprises encountered in the workshops combined with documentary analysis, five business models were identified, namely:

- I** **Model I** Individual farmer service providers;
- II** **Model II** Farmer group service providers;
- III** **Model III** Entrepreneur service providers involved in agricultural activities;
- IV** **Model IV** Entrepreneur service providers involved in the agricultural mechanization supply chain;
- V** **Model V** Entrepreneurs as intermediary hire service providers.

The main findings show that **Models II** and **III** remain closer to farmers and cover all services in the value chain, whereas **Models IV** and **V** are involved mainly in farm operations, offering services with specific value propositions.

Model II, based on the experience of Benin, shows that in a context where cooperatives are created on farmers' own initiative and there is external support, sharing of machinery and equipment is an appropriate way for small farmers to pool resources – especially in the case of vulnerable groups, including women.

Model III in particular provides services not related to agricultural mechanization. Services offered by enterprises include sale of agricultural inputs (e.g. seeds, fertilizers and pesticides), a marketplace for farmers' products and provision of technical advice. These services strengthen the relationship between providers and customers and facilitate transactions.

The services provided by Model IV are limited to on-farm operations, but there are other advantages in terms of control of the supply chain of agricultural machinery and equipment, in particular with regard to maintenance and repairs.

While Model V covers mainly tillage operations, it offers very interesting value propositions for farmers by reducing waiting time and for tractor owners by optimizing tractor use.

The study highlights eight success factors: skilful staff and leadership; diversification of mechanization services; involvement of farmer organizations; close linkages with processors and aggregators; presence of suppliers of agricultural machinery and equipment and relevant support services; profitability of the agrifood value chain; access to finance; and infrastructure. These success factors form the basis of the recommendations proposed in terms of why and when to encourage or promote the business models according to the local context.

Regarding investment in the promotion of hire service providers, five areas of investment are identified, related to capacity development, awareness raising of different stakeholders, incentive programmes for agricultural mechanization hire service provision development, research and infrastructure development. The investment options should be tailored to the local context analysis and a participatory approach adopted. Investments in the different models should promote and support the inclusion of women and youth both as customers and as mechanization service providers as highlighted in the Sustainable Agricultural Mechanization in Africa (SAMA) framework.

Finally, while the business model canvas tool has enabled an understanding of the situation of service providers, it is also a powerful tool – as per its original development – for designing new, more innovative and creative models, in the knowledge that there remains immense potential for improvement in sub-Saharan African countries. Value propositions, customer relationships and partnership development are all examples of business model building blocks that the new generations of hire service providers should explore in the coming years.

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Foreword

Agricultural mechanization is a key driver of efficient farming systems. It can enhance productivity and enable the transition towards market-oriented agriculture, providing off-farm employment that is attractive to women and youth and catalyzing rural development. It can also spark an increase in on-farm investments as well as investments along the agri-food value chain including smallholders and small and medium enterprises. In sub-Saharan African countries, in particular, this transition is barely underway. More work is needed to ensure that agricultural mechanization plays its part as it has done on other continents. Investments in digitalization are also important and can help to improve many of the services that agricultural mechanization provides to farmers and actors in the agricultural mechanization supply chain.

For agricultural mechanization to be accessible to all and resilient to the effects of climate change, it is crucial to address challenges related to affordability, capacity development, rural infrastructure including information communication technologies, and conducive environments for mechanization interventions. Given that most farmers, smallholders in particular, are unable to invest in buying machinery and equipment, one business model particularly well suited to sub-Saharan Africa is the provision of hiring services.

For over a year, the FAO Investment Centre and the FAO Plant Production and Protection Division joined forces to draw on the wealth of experiences in Africa with different business models for mechanization hire services operating along agri-food value chains. We are grateful to the private providers who shared their experience during two workshops – one in Grand Lahou, Côte d'Ivoire, and another in Kampala, Uganda, – organized by FAO in close cooperation with the African Conservation Tillage Network (ACT).

Analysis of the workshops' outcomes resulted in the identification of a typology of mechanization business models. This publication presents an overview of these business models, highlighting their characteristics and advantages according to the local context. We envision this publication guiding and supporting small mechanization businesses in the field and throughout the agri-food value chain. We also see it enabling the implementation of mechanization strategies, policies and investments helping to strengthen the private sector's role and contribution.

The business model concept will help to operationalize the Framework for Sustainable Agricultural Mechanization in Africa (SAMA) and develop programmes and projects that support sustainable mechanization and job and wealth creation for sustainable livelihoods, especially in rural Africa.

This publication provides a timely overview of existing business models in mechanization. It also shows the potential to innovate and develop new business models that are applicable to different sub-Saharan contexts and, with the right investments, are scalable. It should inspire governments, programme managers and decision-makers in international and national financing institutions as well as other donors to take a fresh look at supporting viable mechanization enterprises to accelerate sustainable agriculture and rural development.

Jingyuan Xia

Director

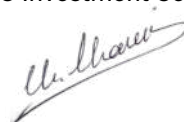
FAO Plant Production and Protection Division



Mohamed Manssouri

Director

FAO Investment Centre



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Abbreviations and acronyms

ACT	African Conservation Tillage Network
AfDB	African Development Bank
AUC	African Union Commission
CIMMYT	International Maize and Wheat Improvement Center
CNAAS	Compagnie nationale d'assurance agricole du Sénégal (Agricultural Insurance Company of Senega)
CUMA	Coopérative d'Utilisation du Matériel Agricole (farm machinery cooperative)
ECOWAS	Economic Community of West African States
EIG	Economic interest group
FACASI	Farm Mechanization and Conservation Agriculture for Sustainable Intensification
FAO	Food and Agriculture Organization of the United Nations
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Corporation for International Cooperation)
GPS	Global Positioning System
ICT	Information and communications technology
LLC	Limited liability company
NGO	non-governmental organization
OHADA	Organisation pour l'Harmonisation en Afrique du Droit des Affaires (Organisation for the Harmonisation of Corporate Law in Africa)
SAMA	Sustainable Agricultural Mechanization: A framework for Africa
SME	Small and medium enterprise
SSA	sub-Saharan Africa
UN-CUMA	Union Nationale des Coopératives d'Utilisation de Matériel Agricole – Bénin







Chapter 1

Introduction

There has been a surge in the attention paid to sustainable agricultural mechanization for Africa. The need to support agricultural mechanization in the value chain towards agricultural and rural development is well recognized. Sustainable agricultural mechanization plays an essential role in production, processing and transportation of inputs and goods, increasing the efficiency of operations in the value chain and helping to overcome mobility restrictions and labour shortages in rural communities (Food and Agriculture Organization of the United Nations [FAO], 2020). Agricultural mechanization can reduce poverty and contribute towards food security by increasing land productivity and income. In Zambia, smallholder farmers using mechanization services increased their yields by 25 percent and doubled their incomes (Adu-Baffour, Daum and Birner, 2019). In the United Republic of Tanzania, access to irrigation allowed smallholder farmers to double their profits and reduce work time by two hours (Falcoz and Seurot, 2009). Appropriate and adapted agricultural mechanization has the potential to reduce post-harvest losses, leading to increased food availability and higher incomes. A study in Kenya showed that 19 percent of the potato crop is lost every season, and most of the loss or damage (95 percent) is due to inappropriate agricultural mechanization at harvesting and limited skills (German Corporation for International Cooperation [GIZ], 2014). In wheat-growing zones in Ethiopia, farmers renting combine harvesters from service providers experienced higher yields due to lower post-harvest losses compared to farmers practising traditional harvesting and threshing methods (Berhane *et al.*, 2017). Moreover, mechanization reduces drudgery by increasing the efficiency of on- and off-farm operations, and this can spark interest among young farmers to engage in agriculture and related businesses, including provision of mechanization services. Considering these benefits, agricultural mechanization plays an important role in the transformation towards sustainable food systems. Furthermore, in the light of the COVID-19 pandemic, sustainable agricultural mechanization is indispensable for increasing resilience and enabling social distancing in the field.

Current and future agricultural mechanization interventions, including projects, programmes and policies, cannot repeat the mistakes of the past, where the provision of machinery, equipment and mechanization hire services across Africa was led by the public sector (Malabo Montpellier Panel, 2018). Most experiences were doomed to failure and programmes were unsustainable. One reason for the failure of public sector tractor hire schemes was the public sector's poor management of commercial ventures (Ashburner and Kienzie, eds, 2009). In contrast, in Asia, medium-scale farmers and agribusinesses providing mechanization services to small-scale farmers and processors have been the driving force behind the spread of agricultural mechanization over the last 40 years (FAO, 2008). Smallholder farmers, who represent the vast majority of farmers in Africa – and in developing countries in general – lack the capital or finance to invest in and access agricultural mechanization. Mechanization hire services and cooperatives through asset sharing have played a key role in countries with mechanized agriculture (Olmstead and Rhode, 1995). In some African countries, private sector-driven markets are gradually emerging (Berhane et al., 2017). Nevertheless, challenges remain – for example, in Ghana, service providers avoid providing mechanization hire services to smallholder farmers because of the high transaction costs associated with small farm size and spatial dispersion (Daum and Birner, 2017). Other factors hampering the uptake of agricultural mechanization include low incomes of farmers, absence of infrastructure in rural communities, poor skills of operators and technicians, and lack of incentives for private sector investments.

A critical issue to address is how to ensure that business models for mechanization hire services driven by the private sector (including farmers, cooperatives and small and medium enterprises [SMEs]) are not only profitable, sustainable and inclusive for smallholder farmers and vulnerable community members including women and youth, but also resilient to the effects of climate change. Business models for mechanization hire services that use digitalization can pool the demand of smallholder farmers, increasing attractiveness for service providers. Moreover, the digitalization of mechanization hire services creates attractive employment opportunities, also for youth and women.

Mechanizing African agriculture in a sustainable way is urgent to reach Zero Hunger by 2025, as stated in the Malabo Declaration of 2014 and in Sustainable Development Goal 2 (FAO and AUC, 2018). *Sustainable Agricultural Mechanization: A framework for Africa* (SAMA) provides guidance and highlights priority areas based on the economic, social and environmental dimensions, and underscores the need for a long-term vision and the establishment of sustainable institutions for regional cooperation and networking (FAO and AUC, 2018).

Against this backdrop, this publication aims to (i) showcase different business models of private sector-led businesses providing agricultural mechanization hire services in Africa; (ii) identify success factors and propose improvements; and (iii) provide entry points for investment. The intended audience comprises policymakers, practitioners and financial partners working with sustainable agricultural mechanization in the value chain.

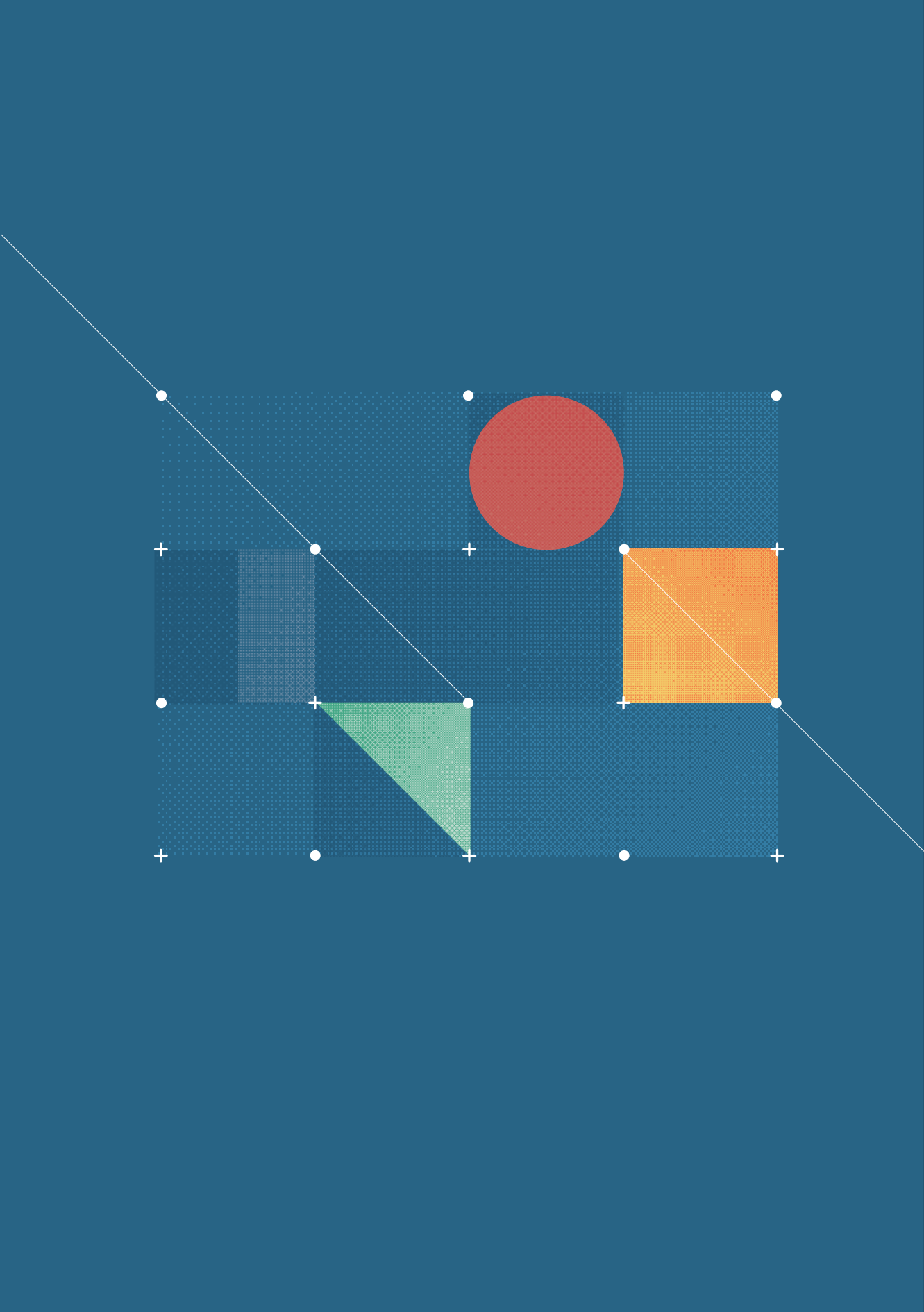
The publication is based on cases studies of hire service providers from two regional workshops: the first held in Grand Lahou, Côte d'Ivoire, with the participation of Benin, Burkina Faso, Côte d'Ivoire and Senegal and the

second in Kampala, Uganda, with the participation of Ethiopia, Ghana, Kenya, Uganda, Tanzania and Zambia. Moreover, the business model canvas tool was adopted to provide a framework for characterizing and analysing the different types of business models and highlighting success factors and investment strategies.

Following this introduction, the publication is organized around the following chapters:

- chapter 2 presents the methodology;
- chapter 3 identifies and describes different business models of agricultural mechanization hire service providers in selected countries;
- chapter 4 analyses and compares the business models identified;
- chapter 5 highlights the key success factors;
- chapter 6 recommends investment options for the support and promotion of agricultural mechanization service provision.





Chapter 2

Methodology

2.1. DATA COLLECTION

For the purpose of this study, the purposive sampling technique was adopted and mechanization hire service providers were selected as case studies. The selection system was based on responses to a questionnaire sent to a sample of service providers and criteria were chosen in such a way as to ensure the following:

- involvement of different types of business models of service providers;
- balanced participation of women and youth; and
- inclusion of the entire agrifood chain.

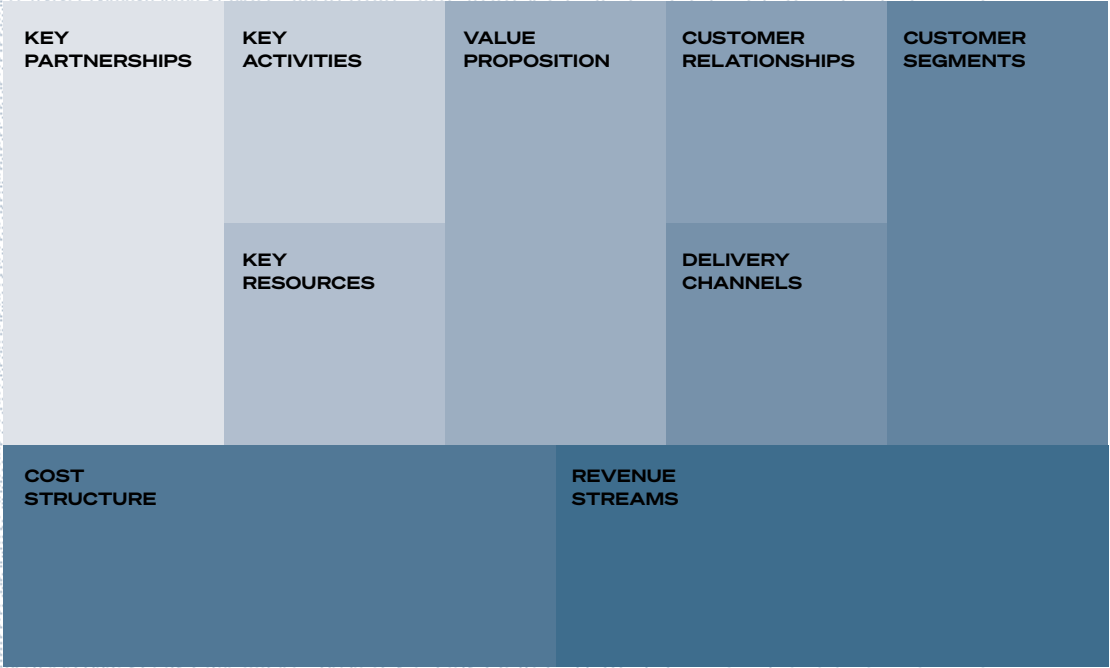
Data collection was mainly carried out through two regional workshops organized to share experiences of sustainable agricultural mechanization hire service provision practices in sub-Saharan African (SSA) countries: the first held in Grand Lahou, Côte d'Ivoire, with the participation of Benin, Burkina Faso, Côte d'Ivoire and Senegal (Houmy, Djagoudi and Side, 2019) and the second in Kampala, Uganda, with the participation of Ethiopia, Ghana, Kenya, Uganda, Tanzania and Zambia (Mkomwa, Mutai, Kamwendo, Mpagalile and Jiang, 2020).

Through presentations, discussions in the various workshops sessions and group work, participants shared experiences in a process of collective learning and analysis. The situation of agricultural mechanization was presented with an emphasis on the different business models of agricultural mechanization hire service provision, and the respective business environments, success factors and constraints. In addition, a literature review was conducted to complement the analysis of the business models identified.

2.2. DATA ANALYSIS: BUSINESS MODEL CANVAS TOOL

The business model canvas tool was adopted to understand how mechanization service providers operate, interact with customers, cover costs and make a profit. The approach enables the comparison between the different business models and highlights the key factors for success. The canvas tool has become popular in recent years as markets are required to constantly evolve their economic processes, practices and operations in order to ensure competitiveness and sustainability (Osterwalder, Pigneur and Tucci, 2005). It is based on mapping of the following nine building blocks: customer segments, value proposition, delivery channels, customer relationships, revenue streams, key resources, key activities, key partnerships and cost structure (Box 1). The nine blocks cover the four main areas of business: customers, offer, infrastructure and financial viability.

Box 1
Canvas Building Blocks



SOURCE: Strategyzer. 2013

1

Customer segments are the people, organizations and institutions for which the business is creating value. The same business may have different customer segments depending on the age as well as the geographic, social and cultural characteristics of the customers.

2

Customer relationships regard how the business acquires, keeps and expands customers over time.

3

Key activities are the essential activities that must be carried out to run the business and make profits.

4

Value proposition is defined as the products and services that are provided to customers to solve an existing problem or need.

5

Revenue streams concern how the business makes money, how and through what pricing mechanisms the business captures value, and the amount that customers pay for the service (or product).

6

Key partnerships comprise organizations, institutions and individuals supplying inputs or services needed by the business. Key partners perform key activities that allow the business to run properly. Partnerships include joint ventures and strategic partnerships with non-competitors.

7

Delivery channels are the ways the business provides the service (or product) to customers. In general terms, distribution can be physical or digital (internet, mobile phone).

8

Key resources are all the human (e.g. skilled staff), financial (e.g. credits) and physical assets needed to generate profits.

9

Cost structure refers to the most important costs, including fixed and variable costs. Fixed costs remain invariable regardless of the level of production and services provided; they include depreciation of equipment, rent of shelters or facilities, insurance, interest payments and certain salaries. Variable costs are linked to the level of production or services provided and can therefore increase or decrease together with the services or production; they include fuel, electricity and water bills.







Chapter 3

Typology of business models: Provision of mechanization hire services in Africa

3.1. OVERVIEW

Based on the analysis of the main characteristics of the enterprises encountered in the workshops combined with documentary analysis, two variables were chosen for the typology of business models:

- ownership of the business – including farmer groups and individual entrepreneurs;
- types of services provided – including agricultural mechanization hire services, other services related to agricultural activities or the agricultural mechanization supply chain, and acting as an intermediary between farmers and service providers.

Based on these two variables, business models of agricultural mechanization hire service providers were identified as follows (Table 1):

- | | | |
|-----|------------------|---|
| I | Model I | Individual farmer service providers; |
| II | Model II | Farmer group service providers; |
| III | Model III | Entrepreneur service providers involved in agricultural activities; |
| IV | Model IV | Entrepreneur service providers involved in the agricultural mechanization supply chain; |
| V | Model V | Entrepreneurs as intermediary hire service providers. |

This chapter describes the five business models based on the nine canvas building blocks.

Table 1

Types of business models according to ownership and services

	Model I	Model II	Model III	Model IV	Model V
Ownership	Individual farmers	Farmer groups	Private entrepreneurs	Private entrepreneurs	Private entrepreneurs
Services	Agricultural mechanization hire service	Agricultural mechanization hire service	Agricultural mechanization hire service and agricultural services	Agricultural mechanization hire service and mechanization supply chain services	Intermediary for agricultural mechanization hire service and digital services

I

3.2. MODEL I – INDIVIDUAL FARMER SERVICE PROVIDERS

Hire service provision has been and remains a vital service for improving accessibility to agricultural mechanization for farmers – particularly small-scale farmers. Indeed, it is mainly large-scale farmers who have the financial capacity to invest in the purchase of farm machinery and equipment to first meet the needs of their own farms and then provide services to neighbouring farmers. This is the most widespread model and customers are generally small-scale farmers cultivating less than an average of 1 ha of land (Sims, Röttger and Mkomwa, 2011). Mechanization services not only concern production, but cover the entire agrifood chain from planting or transplanting to post-harvest, processing and transport operations.

Services were traditionally paid for in kind or in exchange for a favour; it is only more recently that more business-oriented farm households have begun to charge fees for the services provided. These kinds of hire service providers do not generally operate as businesses in their own right, but provide occasional services as opportunities arise (Hilmi, 2018). This model is less conducive to innovation in hire service provision; farmers typically operate within a small radius of their location and the service is characterized by customer loyalty. Model I has provided and continues to provide a means for small-scale farmers to access mechanization services in rural communities; for this reason, support for enhancing this model in the field can be envisaged in the framework of sustainable agricultural mechanization development.

Investments usually come from the farmer's own funds and tend to be small. The machinery and equipment used are relatively simple, are generally acquired second-hand and include small tractors, tillers and small processing units. Operators are often family members, but external operators are sometimes recruited.

Nevertheless, the service provider's primary objective is to meet their own needs before offering services to other farmers; generating a profit is not their main motivation. In periods of high agricultural activity (e.g. tillage), this can result in situations where the entire customer base remains unsatisfied. This model sparked little interest in relation to the objective of the study, given that the constraints to its development are the same as those related to the individual acquisition of agricultural mechanization by farmers. It is part of the general issue of agricultural mechanization at the country level and is documented extensively in the literature. For these reasons, there were no examples of this model in the workshops.

3.3. MODEL II – FARMER GROUP SERVICE PROVIDERS

This model comprises a group of individual farmers who come together principally to serve their own interests. There are several possible forms (e.g. associations and cooperatives) and it represents an interesting means for farmers to pool their resources and increase access to agricultural mechanization services. Services cover all operations in the agricultural value chain, from tillage to post-harvest activities, processing and transport. Services first meet the needs of members and are then extended to neighbouring non-member farmers (Figure 1).

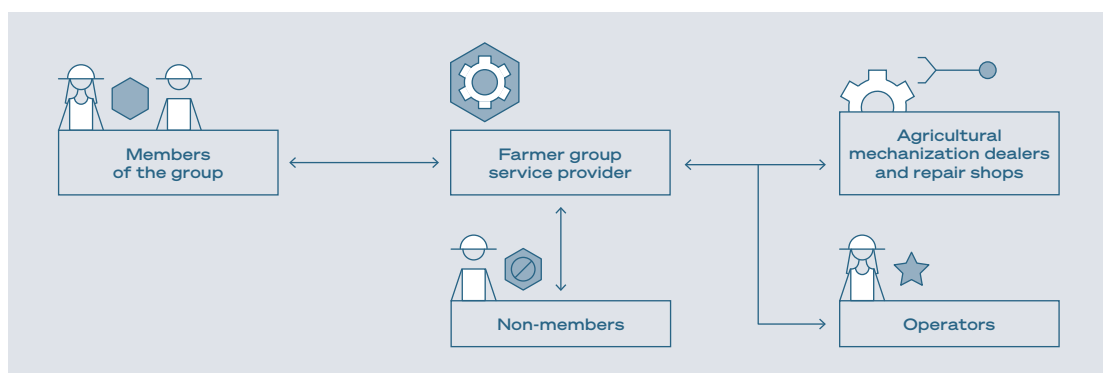


Figure 1

Model II – Farmer group service providers

The motivation for creating these groups is not to make a profit but to meet members' needs in an equitable manner. Success depends on several factors, including consent to cooperate within the group, fair management of group assets and individual rights, and the skills of the farmers. Figure 2 summarizes the canvas building blocks of **Model II**.

During the Grand Lahou workshop, the experience of cooperatives in Benin was presented by the Farm Machinery Cooperative of Benin (Union Nationale des Coopératives d'Utilisation de Matériel Agricole [UN-CUMA]). This organization, created in 2009, comprises 82 agricultural production cooperatives and 64 processing cooperatives, and covers 1 465 farmers, of which 1 001 are women (Table 2). The UN-CUMA presentation revealed that the CUMA movement has made significant progress in comparison with other countries in sub-Saharan Africa. This success can be explained by the fact that the cooperatives were formed on the initiative of the farmers themselves; external support came at a later stage.

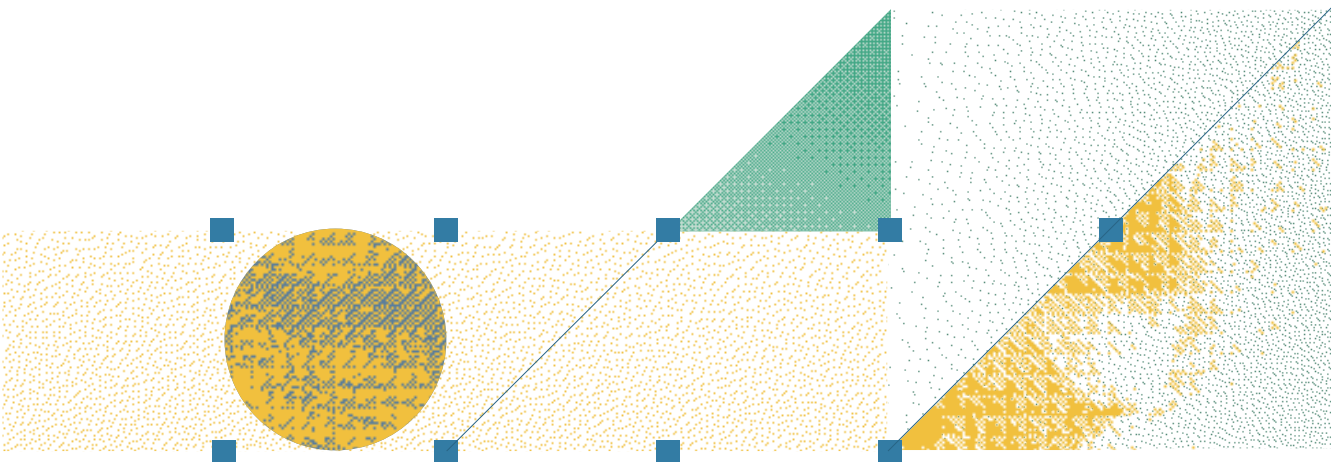
The cooperative system in Benin involves the creation of a framework where all the beneficiaries are members and services are performed in rotation according to the areas involved. Members pay a fee to the cooperative on a regular basis. With regard to the cost of service provision, CUMAs charge members a reduced price, while services provided to non-members are invoiced at the market price.

The UN-CUMA framework fosters cooperation between cooperatives and also allows cooperatives to partner national and foreign institutions (e.g. Benin Ministry of Agriculture, Swiss Agency for Development and Cooperation, United States African Development Foundation and French Federation of CUMAs).

Table 2
UN-CUMA cooperatives in Benin

Department	Number of CUMAs	Members: Men	Members: Women	Total
Soil preparation cooperatives				
Mono/Couffo	8	79	20	99
Borgou	25	179	24	203
Alibori	49	174	22	196
Subtotal	82	432	66	498
Processing cooperatives				
Mono/Couffo	19	10	272	282
Borgou	10		228	228
Alibori	15	1	174	175
Collines	20	12	261	273
Subtotal	64	23	935	958
Total	146	455	1001	1456

In general, the machinery and equipment of the cooperatives can range from very simple tools (e.g. women's processing cooperatives in Benin) to more sophisticated equipment (e.g. Lafiaso cooperative in Burkina Faso – Box 2).



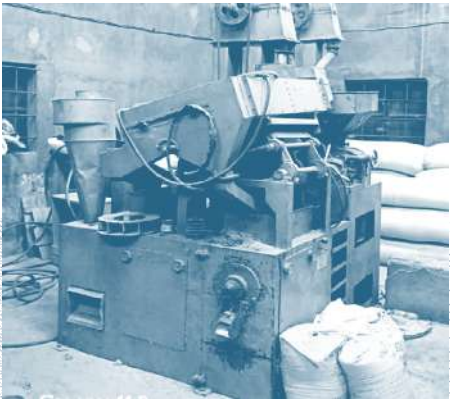
Box 2

Lafiaso cooperative, Burkina Faso

The Lafiaso cooperative was created in 2003 and migrated under the “Organisation pour l’Harmonisation en Afrique du Droit des Affaires” (OHADA) law in 2019. It specializes in the processing of rice, maize and sorghum. Thanks to the leadership of its president and its eight members, the cooperative has been able to diversify its activities and provide additional services such as tillage. Its agricultural equipment comprises processing apparatus including three husking machines (2 tonnes/hour) and two mills to grind flour (1 tonne/hour). Lafiaso also has a wide range of machinery including three tractors and various machines for tillage.

SOURCE : Tanou, L. 2019

In addition to its members, the cooperative has a salaried staff (permanent and temporary). Moreover, the cooperative offers the surplus electrical energy produced by its generators to the population with a view to electrifying the surrounding villages. Difficulties encountered are linked to the cooperative’s limited financial means.



KEY PARTNERSHIPS	KEY ACTIVITIES	VALUE PROPOSITION	CUSTOMER RELATIONSHIPS	CUSTOMER SEGMENTS
- Farmer organizations - Maintenance and repair shops - NGOs - Agriculture Ministry *NGO: non-governmental organization	- Agricultural mechanization operations: tillage, post-harvest activities, processing etc. - Management KEY RESOURCES - Machinery and equipment - Operators	- Low price for members. - Timely access to mechanization services. - Access to vulnerable population including women. - Flexibility for payment: in cash or in kind.	- Dedicated personal assistance for members. - Personal assistance. DELIVERY CHANNELS - Services at customer locations. - Services at equipment locations.	Small-scale farmers: - Group members - Non-members
COST STRUCTURE - Fixed cost of machinery and equipment. - Variable cost of machinery and equipment.		REVENUE STREAMS - Cooperative membership fees. - Non-members hiring mechanization services fees.		

Figure 2
Canvas building blocks of Model II

Linked to group members
Linked to non-members

3.4. MODEL III – ENTREPRENEUR SERVICE PROVIDERS INVOLVED IN AGRICULTURAL SERVICES

This model represents various kinds of enterprises with differing status, such as sole proprietorship enterprise¹, limited liability company (LLC)² and economic interest group (EIG).³ They vary from very small to medium sized; several cases were encountered during the workshops, some of which are run by women and youth (see Boxes 4 and 5).

The services cover all activities in the agricultural value chain, from tillage to post-harvest operations, processing and transport. According to the data collected, the agricultural machinery and equipment used – most of which is second-hand – includes the following:

- tractors with (≤ 120 hp) and power tillers (≤ 15 hp);
- soil tillage implements dominated by disc tools, in particular the disc harrow. In some cases, the rotary tiller is also used for rice cultivation;
- combine harvesters (width ≤ 5 m);
- trailers for transport (capacity ≤ 10 tonnes);
- a wide range of post-harvest equipment, including rice, maize and groundnut processing equipment, mills and rappers, with varying yield depending on the size of the enterprise (e.g. the capacity of rice huskers can reach 2 tonnes/hour). In addition, some enterprises have invested in sophisticated equipment such as the hulling machine with an optical sorter.

These enterprises are run by managers with entrepreneurial skills who are more inclined to adopt new ideas and innovation. They are motivated to generate a profit and cover all hire activities in the agrifood value chain. **Model III** enterprises are characterized by the diversification of their activities, which are not limited to agricultural mechanization hire services but include sale of agricultural inputs (Figure 3). Figure 4 summarizes the canvas building blocks of **Model III**.

- 1 In a sole proprietorship enterprise, there is no legal distinction between the business entity and the owner.
- 2 Limited liability implies that all the shareholders are accountable for all debts, which the company incurs. In most cases, an LLC is formed when two or more business individuals come together and form a partnership.
- 3 An EIG is a type of legal entity designed for companies to join forces and carry out projects that exceed their individual capacities.

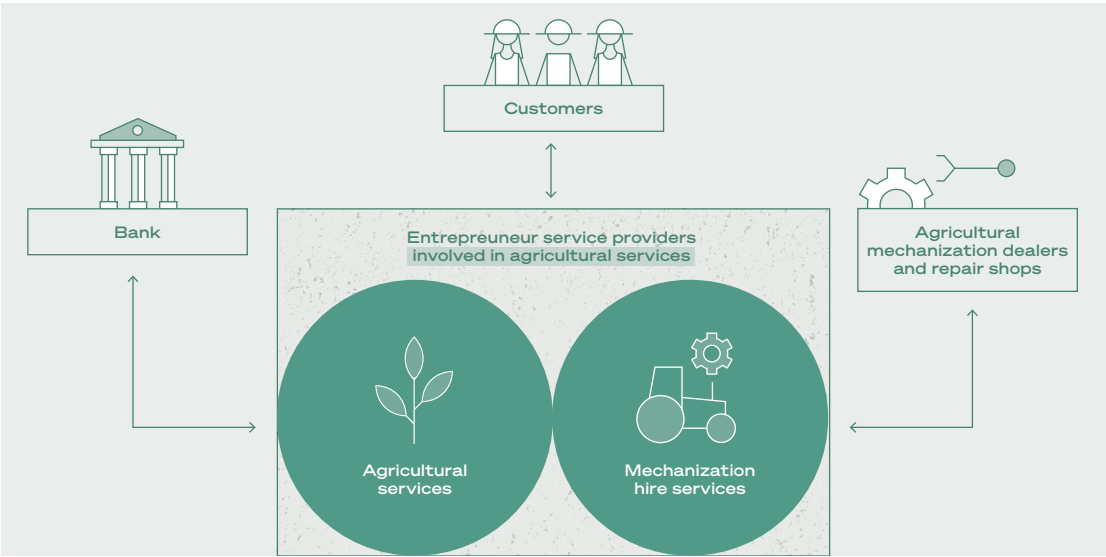


Figure 3
Model III - Entrepreneur service providers involved in agricultural services

KEY PARTNERSHIPS	KEY ACTIVITIES	VALUE PROPOSITION	CUSTOMER RELATIONSHIPS	CUSTOMER SEGMENTS
- Maintenance services - Banks	- Agricultural mechanization operations. - Management	- Agricultural mechanization hire services. - Other agricultural services. - Market for farmers' products. - Flexibility for payment: in cash or in kind (i.e. parts of harvest or in return for other services).	- Personal assistance - Group assistance	- Small-scale farmers - Large-scale farmers - Others
	KEY RESOURCES - Managers - Operators - Machinery - Equipment		DELIVERY CHANNELS - Services at customer locations. - Services at equipment locations.	
COST STRUCTURE - Fixed cost of machinery and equipment. - Variable cost of machinery and equipment.		REVENUE STREAMS - Hire service fees for various operations in the value chain. - Sales of agricultural inputs.		

Figure 4
Canvas building blocks of Model III

Box 3

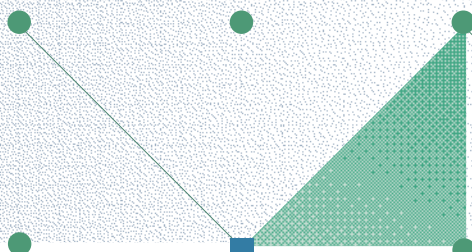
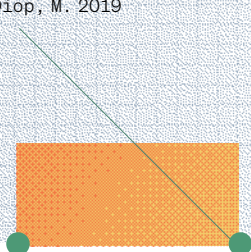
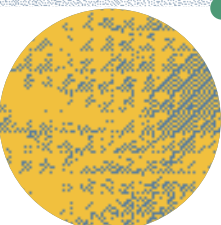
The role of the Agricultural Bank in Senegal in supporting agricultural mechanization

The Agricultural Bank in Senegal comprises 38 agencies and offices located across the country and divided into six networks. The bank is involved in all operations in the value chains of the country's main crops. The financing of agricultural mechanization targets farmer organizations (economic interest groups [EIGs], EIG unions etc.), agricultural service providers, sole proprietorships and limited liability companies. Thus, not only are beneficiaries involved, but also the suppliers of agricultural equipment and the technical support services of the Ministry

of Agriculture. The State provides support to the bank through three funds:

- Guarantee Fund – covers 75 percent of credit granted to producers and providers;
- Subsidy Fund – finances production and mechanization with an interest rate of 7.5 percent instead of 12.5 percent (the 5 percent differential is borne by the State);
- Natural Disaster Fund – is provided by the National Agricultural Insurance Company of Senegal (CNAAS).

SOURCE: Diop, M. 2019



The case studies indicate that financing comes mainly from the enterprise's own funds. Nevertheless, there are cases of credit being granted, particularly in Senegal, within the framework of a financing model involving the Agricultural Bank (Box 3), the technical departments of the Ministry of Agriculture, and agricultural machinery and equipment suppliers and processors in the rice value chain. The success of this model in Senegal relies on the integration of all the players in the rice value chain, including processors, to facilitate transactions between actors.

Payment is based on the surface covered (ha) for tillage and on the quantity of product processed (kg or tonnes). Generally, prices are fixed at the local level to avoid competition. For example, the association of service providers in the Saint Louis region of Senegal sets standard prices per hectare: offset XOF 25 000 (USD 46), ploughing XOF 90 000 (USD 165.6) and ridging XOF 35 000 (USD 64.4), and per transport bag: XOF 300 (USD 0.6) and XOF 800 (USD 1.5). Payment is made in cash or in kind and sometimes informal contracts are established whereby the enterprise receives payment after farmers have harvested and sold their products.

Box 4

Gypsée, Benin

Gypsée is an individual processing enterprise created in 2016 by a woman. It is located in Comé (Mono), Benin, and the intervention zone is in the Departments of Mono, Atlantique and Couffo. Specialized in the processing of cassava, soybean and tomato, it has a mill (100–200 kg/hour) and a grinder (500–700 kg/hour).

The enterprise generally achieves annual processing quantities of 1 200 tonnes of manioc, 750 tonnes of soybean, 500 tonnes of tomatoes and 650 tonnes of chili peppers. The resources at its disposal are financed by its own funds.

The processing unit is mobile, allowing the enterprise to move from village to village to provide services and reach more customers.

The service costs are determined by (i) the distance covered; and (ii) the price of fuel at the time of service. In Benin, the price of fuel is very volatile. For example, in 2019, the price of 1 litre of fuel increased from XOF 325 (USD 0.6) to XOF 1 000 (USD 1.84).



SOURCE: Gypsée, D. 2019

Box 5

Ferm'bio Sarl, Côte d'Ivoire

The company Ferm'bio Sarl was formally established in 2016 after receiving the 2015 Award of Excellence for Emerging Entrepreneur. Directed by a young engineer, the mechanized hire services provided include:

- soil preparation: ploughing, spraying and ridging;
- sowing of cereals (e.g. maize, soya, groundnut);
- crop transportation; and
- mowing and baling of hay.

The agricultural equipment was acquired by leasing from an agricultural equipment dealer. Customers are mainly professional agricultural organizations and private individuals.



SOURCE: Kouamé, S. 2019

3.5. MODEL IV – ENTREPRENEUR SERVICE PROVIDERS INVOLVED IN THE AGRICULTURAL MECHANIZATION SUPPLY CHAIN

Model IV comprises businesses supplying machinery and equipment while also providing agricultural mechanization hire services (Figure 5). These businesses repair and sell agricultural machinery and equipment; the provision of mechanization services does not represent the core of the business, but complements the other activities.

CI-Motors Corporation in Côte d'Ivoire is a typical example of Model IV (Box 6). A medium-sized business, it specializes in the marketing and sales of agricultural machinery and equipment, but also offers mechanization hire services in the rice value chain as well as maintenance services. Figure 6 summarizes the canvas building blocks of Model IV.

In the case study (Box 6), the fleet moves from one place to another to provide mechanization services. The main obstacle is the physical distance between the farmers and the company; for this reason, the company targets large-scale farmers and farmer groups to ensure profitability. Customer relationships are based on trust, with both sides respecting commitments established in annual contracts.

The company is well structured and run by managers who have entrepreneurial skills and the support of a staff including professional accountants and technical managers. The inventory of machinery, equipment and spare parts represents an important physical asset. Another resource is the access to finance through the banking system.

The model includes other types of businesses operating in the farm mechanization supply chain, such as manufacturers. For example, in the typology defined by Farm Mechanization and Conservation Agriculture for Sustainable Intensification (FACASI), one model comprises manufacturers providing hire services (FACASI, 2016).

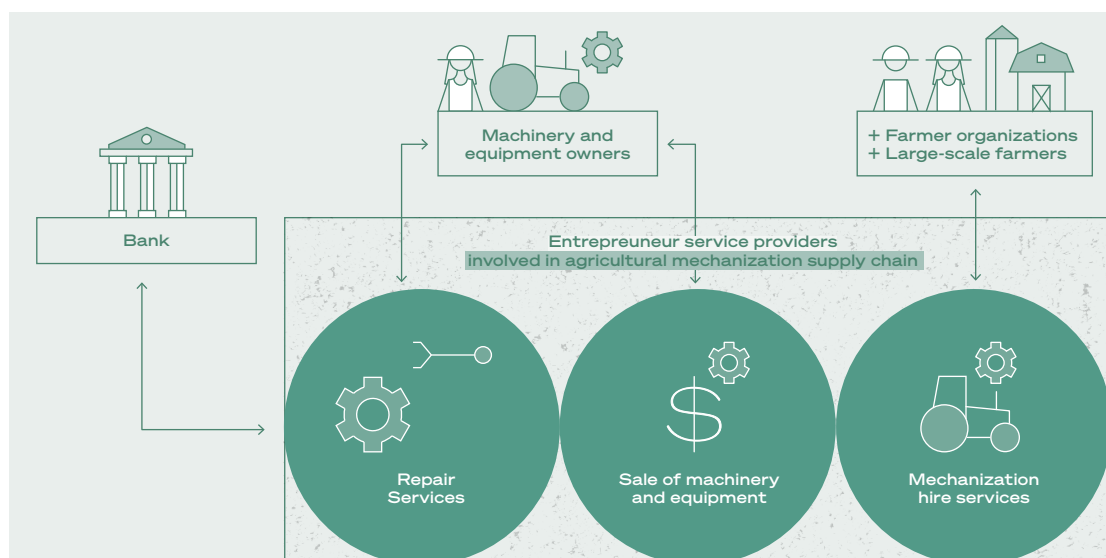


Figure 5
Model IV – Entrepreneur service providers involved in the agricultural mechanization supply chain

Box 6

CI Motors Corporation, Côte d'Ivoire

CI Motors Corporation is a medium-sized company, created in January 2015. It specializes in the marketing of agricultural machinery and equipment, including tractors, power tillers, combine harvesters, mobile drying systems and silos for grain storage. In addition, it offers mechanization hire services for agricultural production operations, from tillage and planting to harvesting – in particular for rice cultivation.

The business is located in Abidjan, but it uses mobile units to work in agricultural areas. All transactions are carried out with producer associations within the framework of agreements; the prices charged for services are in line with local prices.



SOURCE: Ehuà, F. 2019

KEY PARTNERSHIPS	KEY ACTIVITIES	VALUE PROPOSITION	CUSTOMER RELATIONSHIPS	CUSTOMER SEGMENTS
- Manufacturers - Banks	- Machinery operation - Business management - Machinery repairation	- Agricultural mechanization hire service in on-farm production. - Control of breakdown problems. - Agricultural mechanization acquirement service. - Agricultural mechanization maintenance service.	- Personal assistance - Group assistance	- Small-scale farmers grouped - Large-scale farmers - Tractor owners
	KEY RESOURCES - Managers - Machinery - Operators - Repairers		DELIVERY CHANNELS Services at customer locations	
COST STRUCTURE. - Fixed cost of machinery and equipment. - Variable cost of machinery and equipment.		REVENUE STREAMS - Farm hire service fees. - Sales of machinery, equipment, spare parts. - Repair and maintenance.		

Figure 6

Canvas building blocks of Model IV

Linked to small-scale farmers grouped
Linked to tractor owners

3.6. MODEL V – ENTREPRENEURS AS INTERMEDIARY HIRE SERVICE PROVIDERS

In this model, the business does not have agricultural machinery at its disposal, but rather plays the role of intermediary between the owners of the machinery and the farmers (Figure 7). The case study (Box 7) describes how an intermediary can use an on-demand platform to optimize local resources and provide timely agricultural mechanization services to farmers in the vicinity. Such a platform allows tractor owners to use Global Positioning System (GPS) to monitor the movement and work progress of their equipment. The use of mobile phones allows immediacy when connecting farmers with service providers.

TROTRO Tractor (Box 7) is characterized by entrepreneurial skills in terms of digital technology and computer development as well as business management. Its assets comprise the platform and the brand. The company also has access to bank financing.

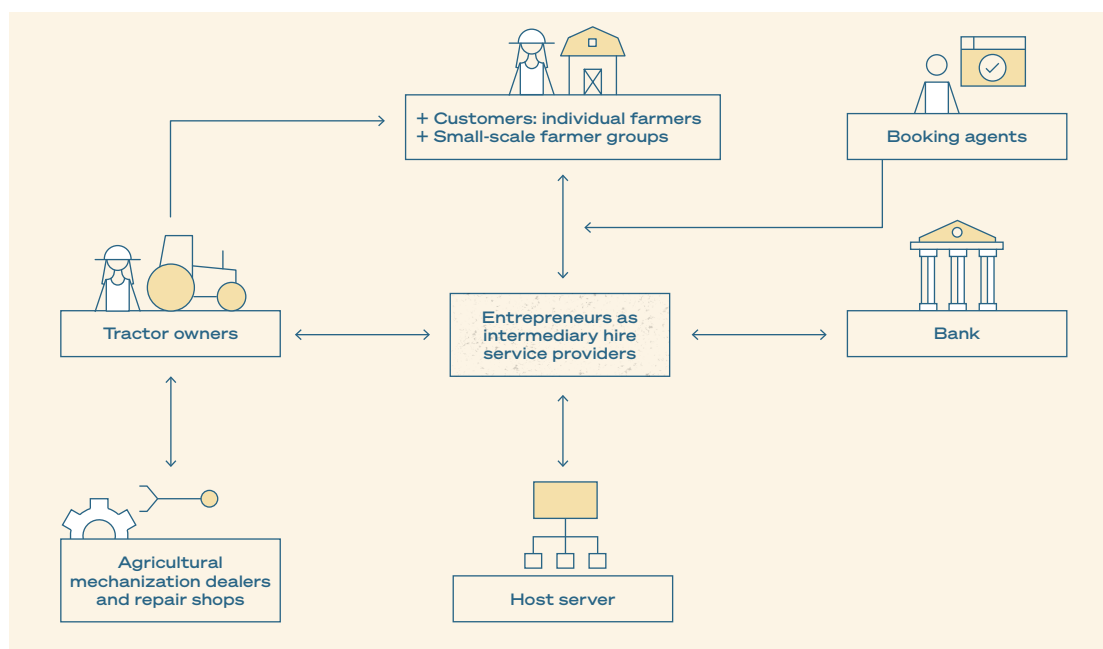


Figure 7

Model V – Entrepreneurs as intermediary hire service providers

A similar business model, Hello Tractor, exists in Nigeria and involves a booking platform to request tractor services and GPS tracking devices to monitor equipment. The booking platform comprises a mobile app and a booking agent who aggregates demand from farmers in a given location and makes bookings (Anidi, Mayienga and Mpagalile, 2020).

Model V includes other types of intermediary enterprises or associations, which do not necessarily use digitalization. For example, an enterprise may hire agricultural machinery and equipment from tractor owners to then offer services to farmers, or it might recruit booking agents and play the role of commission agent (Issa, 2017). Booking agents identify customers and connect them to owners in return for a commission for services rendered.

Box 7

TROTRO Tractor, Ghana

Founded in 2016, TROTRO Tractor is an on-demand platform that connects farmers with tractor owners in the vicinity. Using mobile phones and Global Positioning System (GPS), farmers can request, plan and pre-pay for tractor services (e.g. land preparation) which are provided within 72 hours of the request. The service provider is able to optimize the movements of their tractor(s) as TROTRO Tractor matches farmers' requests to the location of the service provider's equipment and provides information on the specific location of a group of customers.

The technology directly helps farmers and tractor operators in Ghana to increase their productivity and income. Currently there are more than 15 000 registered farmers on the platform and 400 registered tractors.

Income is generated from a 10 percent commission on all ploughed hectares and from the sale of GPS devices for tractor monitoring and safety. To attract both tractor owners and farmers, TROTRO Tractor relies on word-of-mouth, brochures and business cards. In addition, such services can be publicized on community radio, through educational activities or by working closely with district officers from the Ministry of Agriculture to inform farmers.



SOURCE: TROTRO Tractor Limited (TTL). 2020

KEY PARTNERSHIPS	KEY ACTIVITIES	VALUE PROPOSITION	CUSTOMER RELATIONSHIPS	CUSTOMER SEGMENTS
- Banks - Host server	- Management - Computer development	- Optimization of tractor use. - Timely agricultural mechanization service.	Personal assistance	- Tractor owners - Farmers
	KEY RESOURCES		DELIVERY CHANNELS	
	- Numerical skills - Platform - Brand		Mobile phones	
COST STRUCTURE		REVENUE STREAMS		
- Acquisition of GPS units. - Salaries of booking agents.		Commissions received on transactions related to the payment of services (percent of the transaction).		
	- Host server fees. - Application development.			

Figure 8
Canvas building blocks of Model V

Linked to tractor owners
Linked to farmers







Chapter 4

Comparing the business models

Each enterprise is created according to the business model that makes it profitable and viable. By using the business model canvas tool to compare the models, it is possible to understand how mechanization service providers operate and in what context, and to identify where there is room for improvement and innovation. This section compares the nine building blocks of the canvas tool across all the business models.

4.1. CUSTOMER SEGMENTS

The customer segments for mechanization service providers include small-scale farmers, small-scale farmer groups, large-scale farmers, actors in the construction sector and tractor owners (Table 3).

In SSA countries, small-scale farmers represent 70 percent of the population and produce 80 percent of the food consumed (African Development Bank [AfDB], FAO and Economic Community of West African States [ECOWAS], 2015). Small-scale farmers tend to be characterized by:

- cash flow problems – specifically the lack of capacity to pay in certain periods (e.g. beginning of the cropping season);
- fragmentation and dispersion of plots of land – which reduces the capacity and efficiency of machinery;
- poor quality plots – if poorly grubbed up, they can damage tractor tyres; and
- lack of uniform quality of agricultural products – this can pose problems for post-harvest and processing operations (e.g. the quantity of broken rice conditions the quality of processing).

Model III remains versatile and provides services to all segments, while Models IV and V only provide mechanization services for on-farm crop production. Models I and II respond to the needs of small-scale farmers. Model IV, given the size of its fleet, can only offer services to farmer groups, including women's groups, or large-scale farmers. It should be noted that large individual farmers may also be customers of Model III only for processing; for on-farm operations, they have their own equipment. Other less common customer segments include actors in the construction sector, mainly for transport services.

Table 3
Customer segments

Customer segment	Business model				
	I	II	III	IV	V
Small-scale farmers					
Small-scale farmer groups					
Large-scale farmers					
Others (e.g. actors in the construction sector, tractor owners)					

The majority of farmers still use rudimentary tools and are therefore potential customers for service providers as they make the transition to more advanced mechanization. In this context, it is vital to ensure that the vast majority of farmers in SSA (small-scale farmers, including women farmers) gain access to affordable agricultural mechanization to allow them to increase their incomes, break the poverty cycle and thus achieve food and nutrition security. It is clear from the lessons learned in Asia that the development of agricultural mechanization must be driven by the private sector; however, the rapid spread of mechanization in rural communities in Asian countries was led by mechanization service providers in an enabled environment created by the public sector. Smallholder farmers require special attention to facilitate their access to mechanization services; for example, in Ghana, high transaction costs mean that tractor owners are reluctant to provide services to these customer segments (Daum and Birner, 2017). Furthermore, it is important to promote inclusive business models in which women's needs are taken into account so that they too receive mechanization services. In this regard, social networking among smallholder farmers can play an important role in accessing mechanization services (Cossar, 2016).

4.2. VALUE PROPOSITION

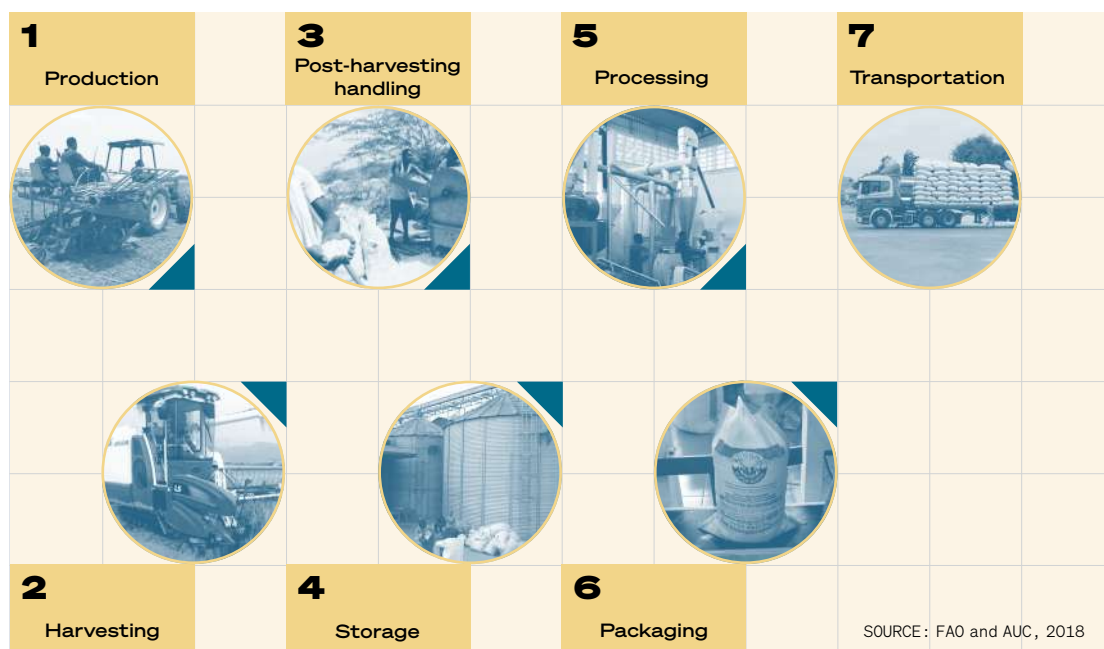
Value proposition defines what the service providers bring to the farmers (Table 4) and what the added value is. It may be considered in terms of what kind of problem the service provider is solving for the producers. Indeed, provision of hire services improves small farmers' accessibility to agricultural mechanization, since small-scale farmers, with their small farms and low incomes, are unfortunately not in a position to invest in the acquisition of agricultural machinery and equipment. The five business models presented herein make it possible, to varying degrees, to solve this problem and thus improve agricultural productivity and production, and raise producers' incomes. Compared to traditional practices based on animal traction and manual operations, service providers increase added value in many ways:

- improved agricultural productivity – resulting in extension of cultivated agricultural land or time savings. In a study, the farmers surveyed multiplied an average of 3.5 times the area cultivated when ploughing with a tractor (the minimum was 1.2 times, the maximum 6.4 times) (Balse et al., 2015);

- improved quality of service – especially for post-harvest and processing operations. For example, the quality of rice husking is an important criterion for farmers;
- facilitation of certain agricultural operations – specifically those requiring high levels of energy and which must be done at specific times (e.g. tillage, harvesting and transport);
- increased efficiency and timely performance – important for time-bound operations (e.g. planting, transplanting, harvesting), thus increasing the resilience of farmers faced with erratic weather and freeing up time for diversification of income activities;
- reduced drudgery – in particular for women, whose work burden is thus also reduced;
- value addition – through processing, packaging and labelling of products for customers;
- maintenance of social distancing – in the context of COVID-19, mechanization allows operations to be performed while respecting social distancing requirements because fewer workers are required.

Mechanization services cover all the segments of the value chain of the different agricultural production systems: from production to transportation (Figure 9). Nevertheless, depending on the specific business model, the services offered vary. Models II and III cover almost all agricultural services, whereas Models IV and V are limited to on-farm operations. However, Model IV offers advantages in terms of control of the supply chain of agricultural machinery and equipment and, in particular, resolution of maintenance problems. Model V, on the other hand, offers very interesting value propositions both for farmers by reducing waiting time and for tractor owners by optimizing tractor use (Table 4).

Figure 9
Agricultural mechanization value chain



Other services not related to agricultural mechanization may also be provided. This is the case in particular for **Model III**, where the enterprises met offer the following services:

- access to inputs (e.g. seeds, fertilizers and pesticides); and
- advisory services for improved agricultural practices.

Finally, in the case of **Model V**, where digital platforms are used for tractor reservation, the installation of GPS trackers provides an additional service to tractor owners as the machinery is monitored and security is improved.

Table 4
Value proposition

Value proposition	Business model				
	I	II	III	IV	V
Tillage operations					
Other mechanization services (e.g. planting, fertilizing, spraying)					
Post-harvest and processing activities					
Low prices for hire service provision					
Checking of maintenance problems					
Reduced waiting time for farmers					
Optimization of tractor use					
Other agricultural services (e.g. marketing of inputs)					
Transport					
Other services related to ICT					

In terms of innovation, **Model III** enterprises tend to be characterized by more open and flexible management and can thus be an important channel for technology dissemination. Therefore, businesses following this model can also provide farm advisory services. According to entrepreneurs, this translates to improved yields, thus ensuring that farmers are able to pay for hire services. Advice could cover the latest topics such as conservation agriculture practices. However, given that farmers are not yet aware of the value of these practices, incentive programmes are first required.

4.3. DELIVERY CHANNELS

Delivery channels are developed according to the services offered. If the enterprise provides services for crop production, it must move to the location of the plots (Table 5). In the case of post-harvest and processing services, it is generally the farmers that move to the location of the processing units. Nevertheless, some small processing units are mobile – as in the case of the Gypsée enterprise (see Box 4).

For **Models I, II and III**, customers are generally located close to the service providers. This is not the case for other models such as **Model IV**, which tends to be located in large cities and it is the business that moves to agricultural areas to provide the service requested by a group of farmers.

There needs to be a margin of profit to justify the business mobilizing its machinery and equipment to the plots. For this reason, a “new” business model (Model V) based on booking agents, mobile applications and text messaging is emerging to pool together customers located in the same vicinity. Model V adopts a wide range of delivery channels to put tractor owners in touch with producers, including text messaging, mobile applications and booking agents working on the spot.

Table 5
Delivery channels

Delivery channel	Business model				
	I	II	III	IV	V
Services at customer locations					
Static post-harvest/processing units					
Mobile post-harvest/processing units					
Booking agents					
Mobile application/text messaging/ web-based platform					

4.4. CUSTOMER RELATIONSHIPS

Most customer relationships are based on human interaction. The exception is Model V where all connections are made by mobile phone. The different types of relationships are shown in Table 6. Word-of-mouth marketing is common to all business models as a spontaneous means to reach new customers in the community. The relationship can also be long term, where customers become loyal over time and an atmosphere of trust is created. For Model V in particular, customer relationships can be strengthened by:

- using community radio to play jingles and promote educational activities;
- involving community information centres to play jingles and publicize products; and
- working closely with district officers from the Ministry of Agriculture who can keep producers informed.

For Model III, personal assistance has an important role, providing payment facilities, offering quality services and responding quickly to farmers’ needs. However, for activities with high seasonality (e.g. soil preparation), the demand is so high that the market for service providers is guaranteed. For Models III and IV, group assistance (see Section 4.1) is important both for developing relationships with farmers and for optimizing the hire service provider’s resources.

Customer relationships are a core element of the business model and should be developed. In order for the business to grow, it is essential to acquire new customers and reach a large number of farmers. Customers are linked to most of the canvas blocks and represent an important pillar for innovation.

Table 6
Customer relationships

Relationship	Business model				
	I	II	III	IV	V
Word-of-mouth marketing					
Long-term					
Personal assistance					
Group assistance					

4.5. REVENUE STREAMS

Revenue generally comes from the income generated by the payment of mechanization hire services. The exception is **Model V**, where revenue comes from the commissions paid by farmers for booking tractors and from the sale and installation of GPS devices. Table 7 shows the various kinds of revenue streams.

Several innovations were made due to a favourable ecosystem comprising close linkages with processors and/or aggregators. Payment in kind (i.e. part of the harvest) is easier when the provider also sells crop products. Where trust exists between farmers and providers, delaying payment until after the harvest can resolve the problem of farmers' lack of cash flow. References for payment include a daily rate for tractor rental and – in the case of transport services – a rate based on distance travelled.

Table 7
Revenue streams

Revenue	Business model				
	I	II	III	IV	V
Cash revenue from mechanization services					
Payments in kind for hire of agricultural machinery and equipment					
Membership fees					
Commission from booking services					
Revenue from other benefits					

4.6. KEY RESOURCES

Key resources refer to all the human, financial and material resources needed to generate profits (Table 8). In terms of physical assets, the models have a range of equipment to cover the various activities in the value chain.

Much of the equipment available to enterprises is second-hand, except in Senegal, where it is mostly new. Maintenance is a major issue: limited technical know-how in the use and maintenance of agricultural machinery and equipment is compounded by a lack of support and aftersales services.

With regard to human resources in **Model I** and **II** enterprises, staff generally lack professional qualifications and have simply gained experience on the job. This is the case for both managers and operators. On the other hand, for **Models III, IV and V**, the staff does have the necessary skills to carry out the various operations. These businesses are run by men, women and young people. Managers have an entrepreneurial spirit and start the business partly because they own agricultural land and partly because of the high market demand for service provision. It should be noted that:

- women business leaders operate not only in post-harvest activities but also in crop production;
- young people with external support have been able to start their own businesses; and
- businesses are also created by members of the diaspora.

Table 8
Key resources

Resource	Business model				
	I	II	III	IV	V
Physical assets or material resources (agricultural machinery and equipment)					
Repair facilities					
Human skills in business management					
Human skills in new technologies					
Financial resources					

There are a wide range of financial resources. In particular, it should be noted that:

- the enterprise's own funds finance **Models I and II**;
- enterprises also have recourse to loans for **Models III, IV and V**; and
- one case of leasing granted by an agricultural machinery and equipment dealer was identified (Ferm'bio Sarl, Côte d'Ivoire – Box 5).

4.7. KEY ACTIVITIES

In order to provide the different services, key activities are performed in different areas depending on the model (Table 9). All the models – except **Model V** – carry out mechanized operations for crop production and/or post-harvest and processing activities. The period of activity varies greatly from one operation to another. In general, however, processing equipment operates almost all year round, while on-farm operations take place during specific periods (e.g. for rice production in the Saint Louis area, Senegal, the planting periods are July–August and December–March). Technical operations also include maintenance, as is the case for **Model IV**, where the enterprises are dealers and repair services are incorporated in their infrastructure.

Management is fundamental. For **Models I and II**, the system remains very rudimentary and there is a noticeable lack of management skills. In contrast, for the other three models, enterprises are generally managed by teams that may be structured into departments and have the skills for planning, market prospecting and other management activities.

For **Model III** in particular, some enterprises comprise a technical framework to guide farmers in agronomy-related issues (e.g. Ferm'bio Sarl, Côte d'Ivoire – Box 5). In addition to hire service provision, these businesses are involved in other agricultural activities such as commercialization of agricultural inputs and products.

Finally, a key activity relevant in particular to **Model V** is digital development with information and communications technology (ICT) skills.

Table 9
Key activities

Activity	Business model				
	I	II	III	IV	V
Provision of mechanization for on-farm production and post-harvest operations					
Other agricultural activities					
Support to producers through farm advisory activities					
Maintenance operations on agricultural machinery and equipment					
Management operations according to formal corporate standards					
ICT development					

4.8. KEY PARTNERSHIPS

A hire service provider is in contact with several partners who may be national or international (Table 10). Farmer organizations (associations, unions etc.) are strategic partners; the UN-CUMA union in Benin, for example, plays an important role in the supervision and support of CUMA cooperatives.

Financial institutions are also key partners and their support is crucial for enterprises in **Models III, IV and V**, in particular. The Agricultural Bank in Senegal, for example, plays an important role in boosting the service sector in the country. Other partners identified are listed below:

- support services – including repairers and spare parts suppliers;
- technical departments of the ministries of agriculture of the countries participating in the regional workshops – important for the supervision and training of providers, although to date their involvement has not been sufficient to meet demand;
- development partners and non-governmental organizations (NGOs) – a major role in some cases. They provide various kinds of support ranging from capacity building to financial support. They sometimes contribute to the financing of projects for the creation of service provider enterprises and provide the necessary support in terms of supervision and training.

Table 10

Key partnerships

Partnership	Business model				
	I	II	III	IV	V
Farmer organizations					
Suppliers and repairers of agricultural machinery and equipment at the national level					
Manufacturers of agricultural machinery and equipment					
Banks					
State institutions					
Development partners and NGOs					

4.9. COST STRUCTURE

The cost structure includes fixed and variable costs that fluctuate depending on the activity (Table 11). Fixed costs include depreciation of equipment, rent of shelter and equipment, and salaries. For Models I and II, the fixed costs are relatively low because most investments are in second-hand equipment. In contrast, for Models III and IV, the fixed costs are high due to the high prices of machines, which also fluctuate over time depending on the currency market.

Variable costs are high for Models I and II, mainly due to the repair costs of the second-hand assets. Fuel costs are highly variable and depend largely on how operations are managed; for example, good work planning to minimize travel can greatly reduce fuel costs.

Finally, Model V enterprises must face other costs such as the acquisition of GPS units, booking agent salaries and host server fees.

Table 11

Cost structure

Cost	Business model				
	I	II	III	IV	V
Fixed charges for use of agricultural machinery and equipment					
Variable charges for use of agricultural machinery and equipment					
Other costs related to agricultural activities					
Costs related to new technologies					

It should be noted that the costs of the various business models are also conditioned by a range of other factors influencing the implementation of the different activities. For example, road infrastructure is a determining factor for travel costs.







Chapter 5

Success factors

Both internal and external factors can determine the long-term sustainability of the business models for the provision of agricultural mechanization hire services. Eight success factors have been identified: skilful staff and leadership; diversification of mechanization services; involvement of farmer organizations; close linkages with processors and/or aggregators; presence of suppliers of agricultural machinery and equipment and relevant support services; profitability of the agrifood value chain; access to finance; and infrastructure.

5.1. SKILFUL STAFF AND LEADERSHIP

This internal factor is key to the success of the businesses encountered during the regional workshops. For all models, the businesses are run by highly motivated people with entrepreneurial and managerial skills, whether heads of enterprises or presidents of cooperatives. In the case of **Model III**, all the chief executive officers are young and some are women – a clear indication of the potential role of these categories of the population in the development of mechanization hire service provision.

Another important element to take into consideration is risk-taking. The company managers need to constantly take risks given the uncertainty of an environment subject to the hazards of agricultural production systems. Young people are more willing to take risks, they learn new skills and technologies quicker, and are more open to innovation (FAO, 2014). These are important considerations when targeting and providing support to the development of mechanization hire services.

5.2. DIVERSIFICATION OF MECHANIZATION SERVICES

Model III is characterized by diversification of the mechanization services provided in the value chain. Diversification allows the business to generate income throughout the year by providing, for example, land preparation, harvesting and milling services. In some sectors such as rice, diversification can result in the business mastering the value chain. Transport services can be carried out year round, not only for agricultural products but also for construction materials and other inputs. Another option to consider is the diversification of mechanization services targeting different operations in more than one value chain, as this creates the potential to covert more than one cropping season in the year. Complementary services or sales also present opportunities; for example, Model III is involved in areas such as marketing of agricultural inputs and seed production.

5.3. INVOLVEMENT OF FARMER ORGANIZATIONS

Farmer organizations (FOs) can also play an important role in the success of hire service providers. The cooperative movement in Benin – thanks to UN-CUMA, NGOs and development partners – has gained significant momentum and has become a sub-Saharan African success story. The following emerged from the regional workshops. Farmers organizations:

- play an important role in financing mechanization, acting as an intermediary between producers and financial institutions;
- can be key for improving coordination between small-scale farmers to enable access to mechanization hire services (Diao *et al.*, 2018);
- can enable group purchases of machinery, equipment and spare parts;
- play an advocacy role in promoting access to mechanization services at the level of national institutions and development partners;
- constitute a significant and organized market for hire services.

5.4. CLOSE LINKAGES WITH PROCESSORS AND/OR AGGREGATORS

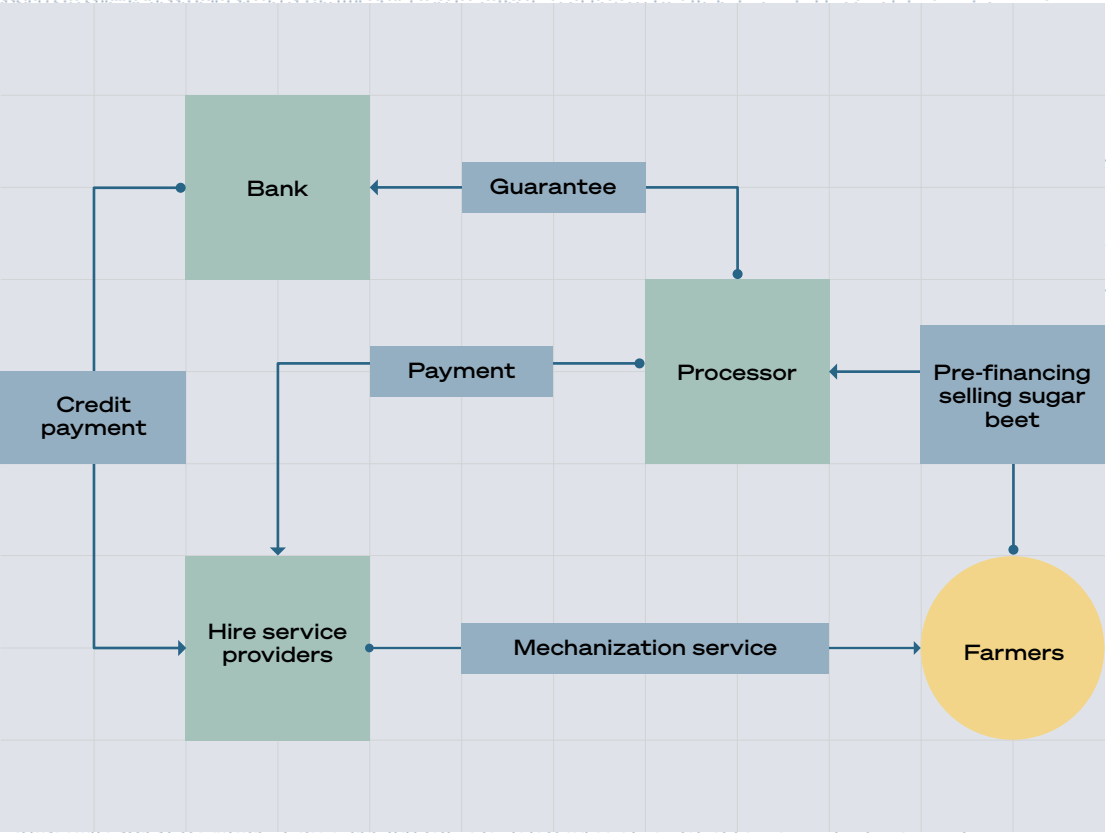
Processors and aggregators can play an important role in the development of mechanization service provision by linking up farmers in need of specific services with the appropriate hire services. Contracts between mechanization service providers and processors or aggregators allow service providers to have a stable source of income and to plan their operations during the year. Other benefits include access to credit for mechanization service providers from processors and aggregators. COSUMAR in Morocco is a good example of the processor promoting the creation of a network of hire service providers (Box 8). This experience may be adapted to SSA countries, especially for monopsony markets such as cotton.

Box 8
COSUMAR Group, Morocco

The Moroccan company, the COSUMAR Group, specializes in the extraction, refining and packaging of sugar. COSUMAR developed a network of 246 private mechanization hire service providers to meet the needs of 80 000 farmers (80 000 ha) who produce and supply sugar beet and sugar cane. The farmers pay for the services through a system of pre-financing. COSUMAR pre-finances not only mechanization hire services, but other agricultural inputs such as seeds, fertilizers and pesticides.

The mechanization service providers have a non-exclusive contract with COSUMAR; this permits them to have both a stable source of income and the flexibility to reach out to more customers and mechanize additional crops. COSUMAR also grants credit for the purchase of agricultural machinery and equipment and acts as a guarantee for service providers who seek a loan from the Agricultural Bank. The introduction of digitalization through a geolocalization system allows the company to optimize and monitor agricultural operations and equipment.

Role of the processor in promoting hire service providers



SOURCE: Mounir, H. 2019

5.5. PRESENCE OF SUPPLIERS OF AGRICULTURAL MACHINERY AND EQUIPMENT AND RELEVANT SUPPORT SERVICES

Retailers and distributors of agricultural machinery and equipment supply the necessary technology. Support services carry out repairs and maintenance, sell spare parts, and provide aftersales support and capacity building for appropriate operation by users. In this regard, the private sector in the agricultural mechanization supply chain is indispensable. The presence of suppliers and support services, as is the case in Senegal, ensure the supply of quality equipment and the timely provision of adequate aftersales service. This network can only develop if there is a demand for agricultural machinery and equipment. For the other experiences presented in the workshops, it appears that this supply chain issue is a real constraint for mechanization service providers.

5.6. PROFITABILITY OF THE AGRIFOOD VALUE CHAIN

Among the enterprises consulted, those involved in the production of market-oriented agricultural products such as irrigated rice manage to generate sufficient income for farmers to pay for services and thus create demand for agricultural mechanization (Houmy *et al.*, 2013). In this context, performing a cost-benefit analysis for different crops is one way to assess the payment capacity of producers, particularly with regard to the cost of mechanized operations.

5.7. ACCESS TO FINANCE

Financing has been important for the viability of some businesses, particularly those located in Senegal receiving support from the Agricultural Bank (see Box 3). Banks have granted credit for the development of Model III, IV and V enterprises based on the viability of the projects submitted. Indeed, as already mentioned, the managers of these models are equipped with the necessary skills to develop bankable projects worthy of credit.

While the commercial loan remains dominant – this is the case in Benin, Côte d'Ivoire and Senegal – other forms of credit are also encountered. Leasing, for example, is used by the AgLeaseco (Mkomwa *et al.*, 2020) enterprise in Zambia (Box 9) to finance agricultural mechanization. The key characteristic of leasing is the separation of ownership of the asset from its economic use. This way, the leased asset acts as security for the financing contract, helping to reduce the need for collateral (Ströh de Martínez, Feddersen and Speicher, 2016). This is of particular interest when targeting women and youth, who tend to lack the collateral to access finance.

Box 9

AgLeaseco, Zambia

Established in 2017, AgLeaseco is an agricultural leasing company focused on improving farmers' access to agricultural mechanization by providing access to finance to acquire machinery. The business model is premised on the provision of equipment together with a set of services that include tailored financing, delivery, and training in equipment maintenance and repair. This gives clients a comprehensive set of skills and knowledge so that they can use the asset to catalyze their business creation.

AgLeaseco partnered with three reputable companies supplying agricultural machinery in the country – SARO Agro Industrial Ltd, BHBW Zambia Ltd and AFGRI – to establish a financing scheme. The scheme is based on fixed interest (interest does not change) and the leased asset represents the collateral. The current interest rate is 28 percent without any associated charges. The lease is intended to finance the acquisition by farmers and

entrepreneurs of agricultural machinery including irrigation sets, two-wheel tractors, four-wheel tractors, dairy equipment and hammer mills. Prices range from USD 2 000 to USD 45 000. The scheme comprises an arrangement whereby AgLeaseco and partners share the risk up to a value of 50 percent.



SOURCE: Mkomwa, S., Mutai, W., Kamwendo, M., Mpagalile, J. & Jiang, S. 2020

5.8. INFRASTRUCTURE

Some enterprises emphasized the role of infrastructure for business viability. Infrastructure includes irrigation scheme developments, rural electrification, roads and ICT networks.

In irrigated areas, two or more cropping seasons per year are possible, allowing a better return on agricultural machinery and equipment as there is year-round demand for mechanization services.

Rural electrification plays an important role, particularly for enterprises specializing in post-harvest operations. Unfortunately, in the absence of an electrical grid – as with the Lafiaso cooperative in Burkina Faso – the use of generators leads to excessive energy costs, hindering the provision of processing services. In contrast, in Benin, the ESOP Vallée enterprise is located in an electrified region, and this has been crucial for its development. Moreover, all the enterprises that were met with expressed their wish to adopt solar energy as an alternative energy source.

The road network conditions agricultural dynamics in general and the development of agricultural mechanization and hire service provision in particular. Movement of agricultural machinery, access to repair services and supply of spare parts all require good-quality roads.

Finally, the quality of the ICT network is crucial for **Model V**, given that the intermediary system between farmers and tractor owners is based on the internet connection, with GPS trackers placed in the tractors and mobile phones essential for making contact and carrying out payments.

5.9. DIFFERENT BUSINESS MODELS: WHY AND WHEN TO RECOMMEND

Based on the information in the previous chapters and the success factors, Table 12 summarizes why and when to adopt and adapt a specific business model for the local context. This information can be taken into consideration in development projects. It is important to adapt the business model to respond to market demand, satisfy a local need or solve a problem.

Model II allows for the pooling of resources and is therefore adapted to poor farmers; their willingness to share resources is a determining factor.

Model III offers numerous advantages and remains close to farmers' problems; in the context of a favourable ecosystem and the collaboration of key partners, it adapts well to the value chain.

Model IV, although it has good control of the agricultural mechanization supply chain (high-performance equipment, repairs, infrastructure etc.), mechanization services are limited to on-farm agricultural production (i.e. processing services are not offered) and can only be profitable if the target customers are large-scale farmers or farmer associations.

Model V offers a very high quality of service, on the one hand optimizing the use of agricultural machinery and equipment, on the other reducing waiting time for farmers. Nevertheless, the focus is limited to tillage (although there is scope for exploring diversification of the services) and the business model is dependent on an ICT network that can register farmers and tractor owners on the platform.

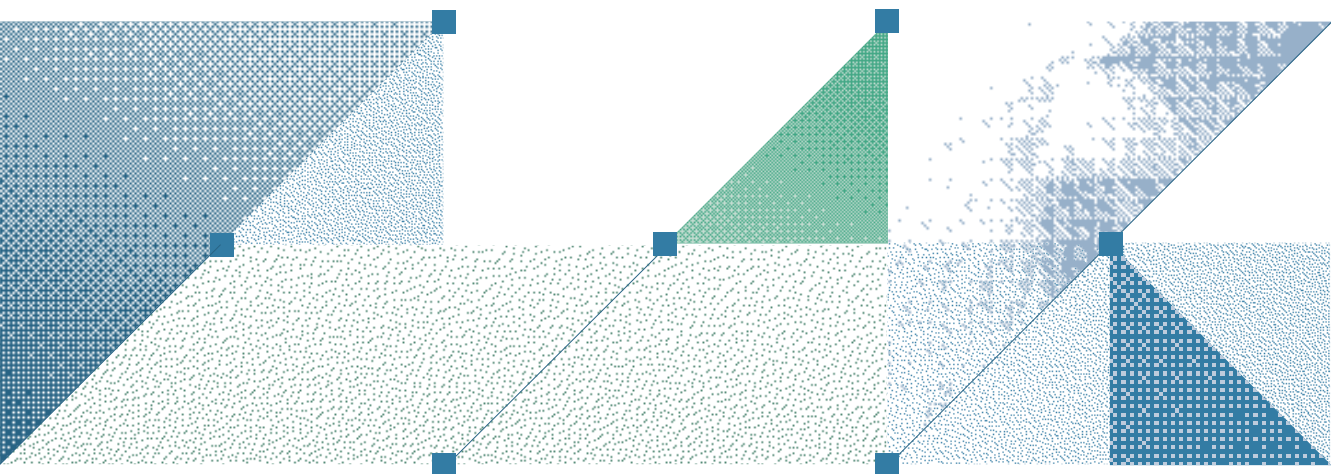


Table 12

Recommending business models according to strength and local context⁴

Model	Strengths	Local context
I	• Meets the needs of small-scale farmers by providing mechanization services in their local and neighbouring communities, once their own needs are met.	• Presence of medium- and large-scale farmers with capacity to invest in the acquisition of machinery and equipment. • Cases and areas of little interest to entrepreneurs providing mechanization services.
II	• Pools resources of small-scale farmers. • Encompasses all operations in the value chain. • Is well adapted to women's groups and vulnerable parts of the population.	• Group formation desired by farmers. • Presence of small-scale or poor farmers. • Presence of farmer organizations and other supporting institutions. • Possibility of access to microfinance.
III	• Covers a wide range of customer segments. • Offers diversified services comprising both mechanization and agricultural services (e.g. technical advice of good agricultural practices). • Is suitable for innovation. • Adapts to the environment when linkages between different actors in the value chain are possible. • Promotes new practices, equipment and machinery.	• Favourable ecosystem around value chains with the existence of key partnerships. • Need for mechanization of the entire value chain. • Involvement of youth with a leadership mindset. • Possibility of access to finance.
IV	• Masters machinery use and maintenance. • Offers a diverse range of services within agricultural mechanization. • Invests in new machinery and equipment.	• Need for mechanization of on-farm operations. • Existence of well-developed farmer organizations. • Possibility of access to credit.
V	• Improves linkages between customers and mechanization service providers. • Optimizes tractor use. • Develops digitalization. • Is suitable for innovation. • Appeals to youth.	• Existence of ICT infrastructure. • Willingness/interest of tractor owners to be involved. • Possibility of access to credit. • Existence of competencies in ICT.

⁴ Provided with the right support and skills, women and youth can be part of all models.







Chapter 6

Investments for agricultural mechanization hire service provision development

This chapter defines investment options for programmes, projects and interventions dealing with agricultural mechanization hire services for rural and agricultural development. As stated in section 4.2, agricultural mechanization hire services have a leverage effect on agricultural development as they increase land and labour productivity and alleviate drudgery. They also reduce production costs and create off-farm jobs, benefiting both those receiving the service and those providing it. The investment options are based on the success factors identified in Chapter 4 and are valid for all the business models described in Chapter 2. These options should be tailored based on the local context analysis, and a participatory approach should be adopted. It is vital that investments address the main challenges and bottlenecks that prevent vulnerable people, including women and youth, from accessing agricultural mechanization. Furthermore, investments must consider the impact on landless people and labourers, and aim to create employment and income-generation opportunities with positive spillover effects for the rural community as a whole.

6.1. CAPACITY DEVELOPMENT

The experience in Asia proves that the availability of machinery and equipment in the rural community is just one of the elements to consider for agricultural development. In order to facilitate the adoption and appropriate use of machinery, there is also a need for technical capacity and know-how.

Target groups include entrepreneurs – and potential entrepreneurs (including farmers) – willing to provide mechanization services. They can benefit from training in business skills to set up, improve, adapt and run a business in a profitable manner and from assistance in drawing up business plans. Investments must also target youth to increase their involvement in mechanization hire services. There should be a particular focus on university

and vocational training school graduates in agricultural mechanization who have the capacity to engage in business. Special attention is required to enable women to participate in training, including training of trainers: tailor the content of the training, and select the location, timing and duration in response to women's needs and the local context (FAO, 2018).

Capacity building is needed in machinery and equipment use, business management, organization and creation of networks, digitalization and agronomic aspects including conservation agriculture, value addition options and reduction of post-harvest losses. Operators can learn through hands-on activities and demonstrations, they need training in how to safely operate agricultural machinery and equipment, and require basic knowledge of maintenance and repair.

In this context, the Food and Agriculture Organization of the United Nations (FAO) and the International Maize and Wheat Improvement Center (CIMMYT) published a training manual for small-scale mechanization service providers, *Hire services as a business enterprise* (Sims *et al.*, 2018). The manual, aimed at trainers, is designed to train potential farm and value chain mechanization service providers including individuals, cooperatives, farmer organizations and SMEs. In addition, FAO has already organized training sessions. Nevertheless, given the massive effort still required, the coming years must see investments made in training centres, training of trainers, development of virtual courses and numerical applications.

6.2. AWARENESS RAISING OF STAKEHOLDERS

Women-friendly agricultural mechanization

To date, there is a common misconception that mechanization and business are for men and not for women. It is essential to raise awareness among public and private actors regarding business opportunities for women in the provision of mechanization hire services through, for example, television and radio campaigns, or posters in rural shops. It is fundamental to systematically incorporate inclusive programmes in all interventions related to agricultural mechanization, including support for mechanization hire services.

Various approaches are possible to address the issues hampering women's access to agricultural mechanization and business; gender-sensitive market analysis, for example, identifies not only key stakeholders, but also specific market interventions that can benefit small-scale farmers, in particular women (FAO, 2018). Understanding the market demand for mechanization services in the community is critical when selecting machinery and equipment for the business; it is important to take into account both women's demand for mechanization as customers and their capacities as service providers in order to increase their access to agricultural mechanization.

Youth-friendly agricultural mechanization

Model III and Model V demonstrate that youth can play a vital role in agricultural mechanization development with the emergence of a new generation of entrepreneurs. Experience shows that motorization and digitalization are very attractive to youth. Outreach programmes to identify and stimulate young entrepreneurs in service provision represent a key strategy for improving small farmers' access to agricultural machinery and equipment.

Mechanization hire service provision through creation of cooperatives

The experience of Benin demonstrates that farmer groups want to improve access to agricultural machinery and equipment. For both women and men, cooperatives are a means of pooling resources to improve agricultural production and productivity in the entire value chain. Small-scale farmers need support so that they can form groups and act collectively. The collective demand for mechanization services can generate enough economic incentive and profit for the service provider to mobilize machinery and equipment to a specific location, because provision of services to a group of farmers means more hectares on which to operate and more kilograms of products to process. However, **Model II** can only be developed in a context in which farmers are willing to share equipment. Sensitization programmes serve to identify favourable situations and understand how to bring farmers together.

6.3. INCENTIVE PROGRAMMES

Gaining access to finance is a fundamental issue. The overall aim is to improve the business climate and, more specifically, develop investment incentive programmes. Women and youth should be encouraged to set up businesses through business financing start-up incentive programmes. Such programmes should include credit, enabling enterprises to invest in agricultural mechanization through subsidized interest rates and the creation of guarantee funds. It is important to diversify the forms of credit and adapt them to the country context. In this regard, the experience of leasing in Zambia (see Box 9) deserves to be evaluated for replication in other countries in sub-Saharan Africa.

Other possible incentives include exemption from customs duties for agricultural machinery and equipment imported by hire service enterprises. It should be noted that in some countries (e.g. Côte d'Ivoire), this exemption already exists for farmers but not for hire service providers.

6.4. RESEARCH

More evidence is needed to guide investment, policy and interventions for successful business models on mechanization hire services. Research is required on community-based solutions for mechanization in order to identify the best solutions for each specific context.

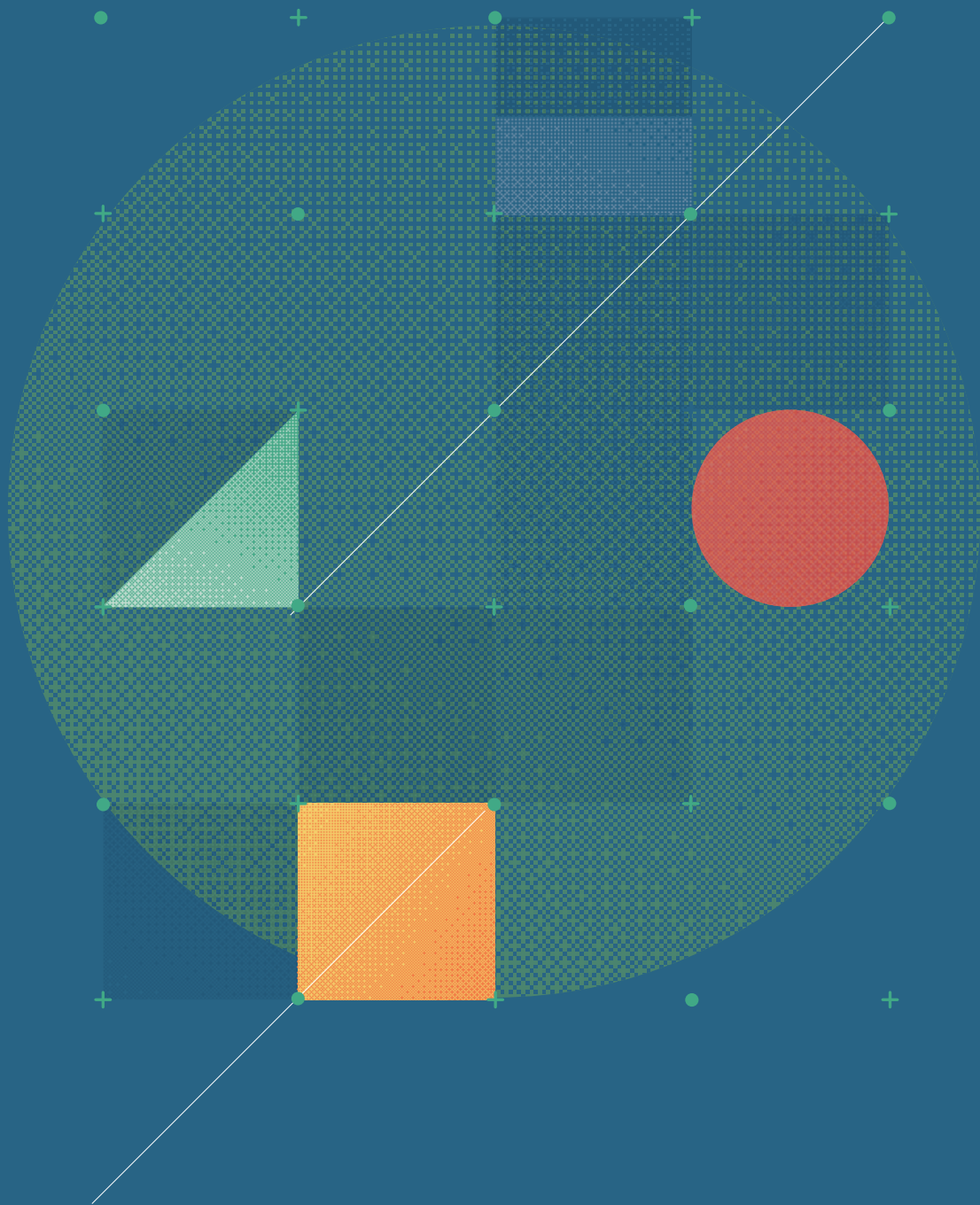
To this end, there is a need for data collection, followed by analysis and dissemination of the success factors (and failure factors) for designing and running a business for mechanization hire services. The analysis should include any risks and external factors relevant to the development of mechanization business models. It is important to invest in research and evidence-based solutions and to stimulate regional – and international – exchange of findings. In addition, research in the field should guide the adaptation of agricultural mechanization to make it women-friendly. It is vital to strengthen the linkages between manufacturers and prototype developers in the research sector. Results show that international research centres can facilitate access to technologies developed elsewhere (Fuglie and Rada, 2013).

6.5. INFRASTRUCTURE DEVELOPMENT

Investment is needed to improve infrastructure in order to boost agricultural mechanization in general and agricultural mechanization hire service provision in particular. The cost of the different models depends on the existing infrastructure, which in turn affects the profitability and sustainability of the business. Indeed, infrastructure development is essential for agricultural and rural development in African countries. For agricultural mechanization, development is required in four main sectors:

- road networks in areas of high agricultural activity – to improve the mobility of agricultural machinery and the supply of spare parts;
- irrigation infrastructure and facilities – to improve the performance of agricultural production systems by increasing the number of crop cycles per year and thus profitability. In areas with irrigation, mechanization hire service providers can provide services year round and customers have the economic capacity to pay for the service;
- rural electrification, especially through promotion of renewable energy (e.g. solar energy) – to promote processing in rural areas and the creation of small enterprises for the maintenance and repair of agricultural machinery and equipment. Electrification can also enhance the development of local manufacture of small agricultural machinery;
- digital connectivity (in particular for Model V) – to promote start-ups involved in digitalization, facilitate online modes of payment and improve communication and equipment hire service provision. Investing in digital connectivity will open up new opportunities for digitalization in agricultural mechanization, such as improving monitoring and tracking equipment for better machinery use, sharing hire service market information, accessing credit services, and improving access to services by developing mobile interfaces adapted to all users, including illiterate users.





Chapter 7

Conclusion

This study focused on the provision of agricultural mechanization hire services by conducting case studies in ten sub-Saharan African countries: Benin, Burkina Faso, Côte d'Ivoire, Ethiopia, Ghana, Kenya, Senegal, Uganda, Tanzania and Zambia. Five business models were identified, namely:

- I** **Model I** Individual farmer service providers;
- II** **Model II** Farmer group service providers;
- III** **Model III** Entrepreneur service providers involved in agricultural activities;
- IV** **Model IV** Entrepreneur service providers involved in the agricultural mechanization supply chain;
- V** **Model V** Entrepreneurs as intermediary hire service providers.

The models were presented and a comparative analysis conducted based on the nine canvas building blocks. The findings indicate that women are involved mainly in processing; nevertheless, there is evidence that they are engaged in the whole value chain from production through to post-harvest and processing operations.

Models II and III are managed by the farmers themselves and cover all services in the value chain, whereas Models IV and V are involved mainly in on-farm operations with specific value propositions. The findings regarding Model II indicate that when a cooperative is created on farmers' own initiative and there is external support, sharing of machinery and equipment is an effective way for small farmers, especially vulnerable groups including women, to pool resources. Businesses can also provide services unrelated to agricultural mechanization; in the case of Model III, in particular, additional services may include sale of agricultural inputs (e.g. seeds, fertilizers and pesticides), creation of a market for farmers' products and provision of technical advice. These services strengthen the relationship between providers and customers and facilitate transactions.

Model IV limits its services to farm operations, but it offers advantages in terms of control of the agricultural machinery and equipment supply chain and resolution of maintenance problems. Model V concentrates mainly on tillage operations, but it offers very interesting value propositions both for farmers by reducing waiting time and for tractor owners by optimizing tractor use.

Eight success factors are highlighted: skilful staff and leadership; diversification of mechanization services; involvement of farmer organizations; close linkages with processors and/or aggregators; presence of suppliers of agricultural machinery and equipment and relevant support services; profitability of the agrifood value chain; access to finance; and infrastructure. Based on these success factors, recommendations are proposed in terms of why and when to encourage and promote these models in the local context.

Five areas of investment are identified for the promotion of hire service providers: capacity development; awareness raising among stakeholders; incentive programmes for agricultural mechanization hire service provision development; research; and infrastructure development. Investment options should be tailored based on the local context analysis and a participatory approach adopted. It is important that investments in the different models promote and support the inclusion of women and youth, both as customers and as mechanization services providers, as highlighted in the SAMA framework.

Finally, not only has the business model canvas tool enabled an understanding of the situation of service providers, it is also a powerful tool – as per its original development – for designing new, more innovative and creative models, in the knowledge that there remains immense potential for improvement in SSA countries. Value propositions, customer relationships and partnership development are all examples of business model building blocks that the new generations of hire service providers should explore in the coming years.



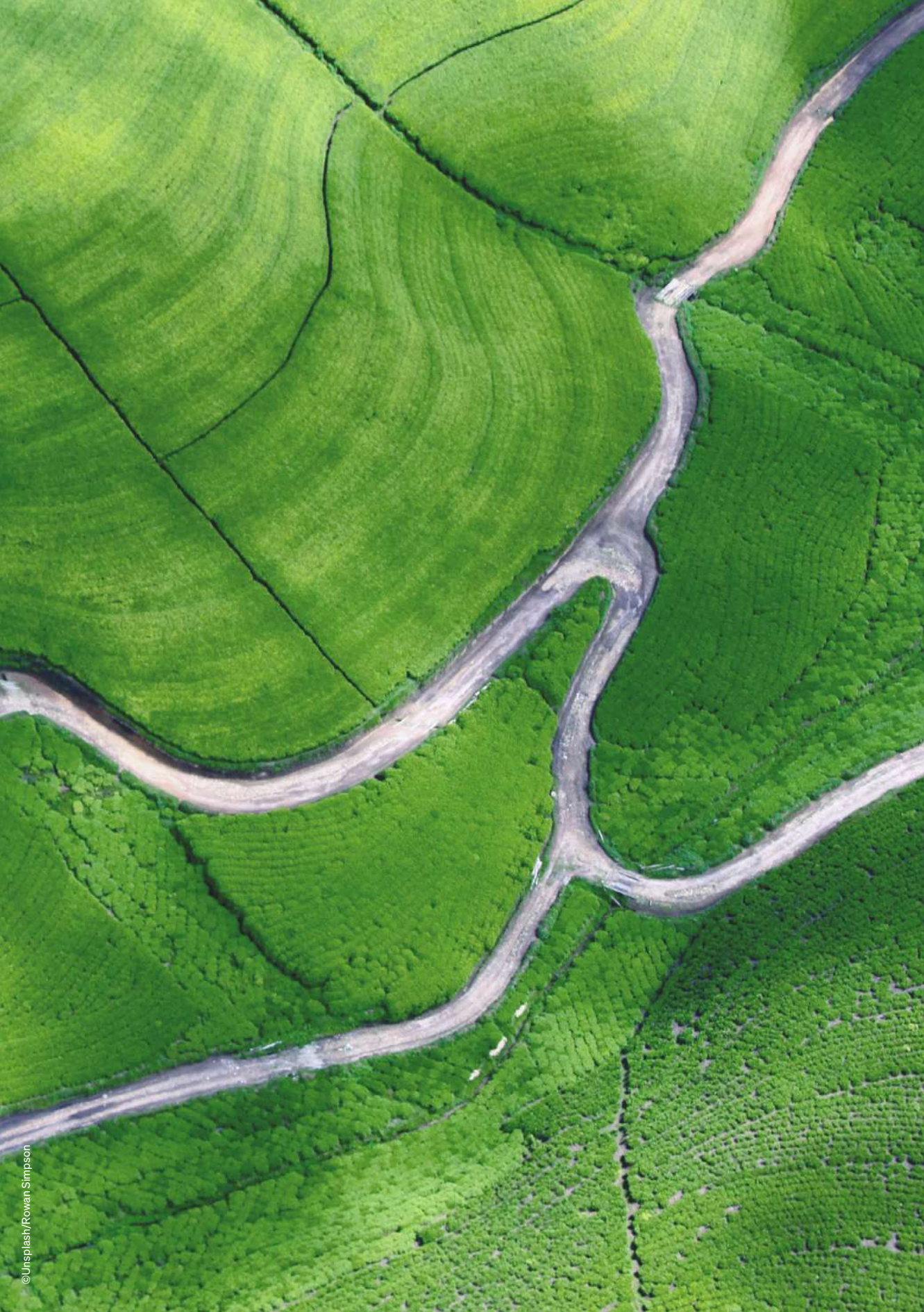


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Sustainable agricultural mechanization can boost agricultural productivity, reduce post-harvest losses and ease the burden of hard physical work. It can also drive the transition from subsistence to market-oriented agriculture, creating jobs and accelerating sustainable agriculture and rural development. A business model particularly well suited to sub-Saharan Africa is the provision of hiring services. This publication showcases different private sector driven business models for agricultural mechanization hire services in Africa, drawing on experiences shared by providers during regional workshops in Côte d'Ivoire and Uganda. Geared to policy-makers, practitioners and financial partners, the publication looks at factors behind the success of these business models and identifies entry points for investment.

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