Mechanization Hire-Service Models for Conservation Agriculture in Kenya

Report



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Summary

A study was carried out to profile potential mechanization hire service models in four counties in Kenya. This study was carried out under the Ukama Ustawi: Diversification for Resilient Agri-food in East and Southern Africa. The survey revealed that hand hoe (33% for land preparation and 50% for planting) was the most used tool in the surveyed area due to small land holding with about 25% of the respondents practicing tractor sub-soiling and tractor ripping respectively especially in areas with better land holdings for various reasons and 17% using hand ripper to prepare ripe lines (furrows). 30% used jab planter in planting and 20% used tractor planters. The majority (81%) of the respondents, access CA mechanization services from hire service providers in regions. Only 25% of the responded owned machinery for use in their CA field operations. The study profiled 6 models for mechanized hire services in agriculture that can be tapped depending on context of the farmers. These include 1) Individual farmer / entrepreneur service providers, 2) Farmer group/ cooperative service providers, 3) Entrepreneur service providers involved in agricultural activities, 4) Entrepreneur service providers involved in the agricultural mechanization supply chain, 5) Entrepreneurs as intermediary hire service providers, and 6) Government provided service. The most ideal model is individual farmers owning the machinery for their own use and providing services to farmers. The best practical service provision would be small and medium service providers owning several tractors and exclusively providing services to other farmers. Access to mechanization services by smallholder farmers is dependent on the business model linking them to accessing mechanization services. A hire service enterprise should be developed in close coordination with other stakeholders to define needs and select the most appropriate solutions. With the high cost of purchase of the equipment, private sector-led approaches to accessing mechanization promises to offer sustainable agricultural mechanization solutions to the millions of smallholder farmers in the target sites. There is a need to create awareness among farmers on the use of mechanization and introducing affordable business models for providing services to farmers

Introduction

Africa is the continent with the least mechanised agricultural system in the world. African farmers have ten times fewer mechanised tools per farm area than farmers in other developed regions, and access has not grown as quickly as in other regions. 50-85% of farm work continues to be done manually, without the support of animals or machinery. Only 10% of total power for land preparation in sub-Saharan Africa comes from engine-powered machines, usually using fossil fuels.

In Kenya, Agricultural production systems are powered by 48% human labour (up to 2.5 acres farm size), 20% Animal Draught power and 32% Motorized power mainly for medium and large-scale farming systems (from 5 Acres and above). Average mechanization levels are about 30 % based on land development with limited investment is in post -harvest processes (value addition and storage). For many years farming in the country remains predominantly small scale, rain-fed and poorly mechanized, in addition to inadequate institutional support and infrastructure.

Agricultural mechanization remains to be a critical input towards achieving enhanced agricultural productivity. It is widely acknowledged that sustainable agricultural mechanization has great potential to contribute to the growth and modernization of the agricultural sector along the entire agrifood value chain. However, the use of mechanization technologies and entrepreneurial skills is still very low in Kenya. With a hoe and panga (machete) in hand, the population is able to contribute very little towards the national economy. Moreover, many smallholder farmers often do not have the necessary capital nor access to long-term credit to invest in required farm machinery which helps them increase their land and labour productivity, increase their incomes and improve their livelihoods. land and power intensification, for improved productivity in a country that has only 20% land capable of producing crops under rain-fed systems. Thus, entrepreneurial hire service provision becomes the only option suitable for smallholder farmers.

Therefore, in order for Kenya to raise agricultural land and labour productivity, to generate rural employment and make it more attractive and to achieve future growth and poverty reduction agendas, governments must embrace the technological, policy, and institutional innovation opportunities afforded by sustainable agricultural mechanization. In implementation of SAM and associated service provision as businesses, skilled labour force is critically needed to encourage efficiency and effectiveness as well as enhanced quality of service.

A study was carried out to profile potential mechanization hire models that can be developed to support sustainable agriculture transformation in Kenya. This study was carried out under the Ukama Ustawi: Diversification for Resilient Agri-food in East and Southern Africa, an initiative by the CGIAR that aims to help millions of smallholders intensify, diversify and de-risk maize-mixed farming through improved extension services, institutional capacity strengthening, targeted farm management bundles, policy support, enterprise development and private investment.

APPROACH AND METHODOLOGY

This component on mechanized hire service models was carried out as part of the larger study on Profiling of Adoption and Practice of Conservation Agriculture (CA) and CA- Based Mechanization in Ukama Ustawi Project Sites in Kenya. The study covered Nakuru, Kakamega and Narok Counties.

The study was organized into three main interlinked phases that include (i) Analysis of the scope/overview of conservation agriculture in the project sites in Kenya; (ii) Targeting conservation agriculture areas of investment for impact and scaling; and (iii) Recommendations and proposed call for action. Mechanization is a key component in driving CA adoption.

A field survey was conducted in November and December 2022, sampling Nakuru, Narok and Kakamega Counties in Kenya, to profile and assess performance of agricultural mechanization service providers. A comprehensive survey tool was developed and pre-tested prior to use in data collection. Specifics included establishment of the business models used by the private sector service providers with a view to determine profitability of mechanization service provision as a business, affordability of services to farmers and overall sustainability.

The data and information required to deliver this study included primary and secondary data collected either quantitatively or qualitatively from different sources using different techniques and methods depending on the aspects and issues under consideration and the stakeholders involved.

Review of documents involved the identification, collection, review and analysis of the relevant documents and reports. The participatory and inclusive process included interviews and consultations with key stakeholders, using different instruments and tools, to provide a deeper understanding of critical issues from the perspectives of these stakeholders. The data collected was consolidated, collated and processed using simple Excel analysis and results of the analysis were summarized into tables and graphs for presentation and report preparation.

Conservation Agriculture mechanization mostly used by farmers

Analysis of the data shows the pivotal role of mechanization in the adoption of CA. Mkomwa et. al., (2017), found that 71.3% of the area under CA in Kenya is under large scale commercial mechanized farming. ACTN estimates that 50% of the smallholder farmers practicing CA are either using animal traction or hiring tractor operated equipment for ripping, subsoiling or spraying. Smallholder farmers

single out inaccessibility of CA machinery/equipment as the number one challenge, followed far below by maintenance of soil cover and crop diversification opportunities.

The survey revealed that hand hoe (33% for land preparation and 50% for planting) was the most commonly used tool in the surveyed area due to small land holding with about 25% of the respondents practicing tractor sub-soiling and tractor ripping respectively especially in areas with better land holdings for various reasons and 17% using hand ripper to prepare ripe lines (furrows). 30% used jab planter in planting and 20% used tractor planters.

Knapsack sprayers were also mostly used for the application of herbicides by 27% of the respondents while 33% using hand hoe for weeding control. 7% only used tractor boom sprayer for herbicides and other chemical application (Figure 1).

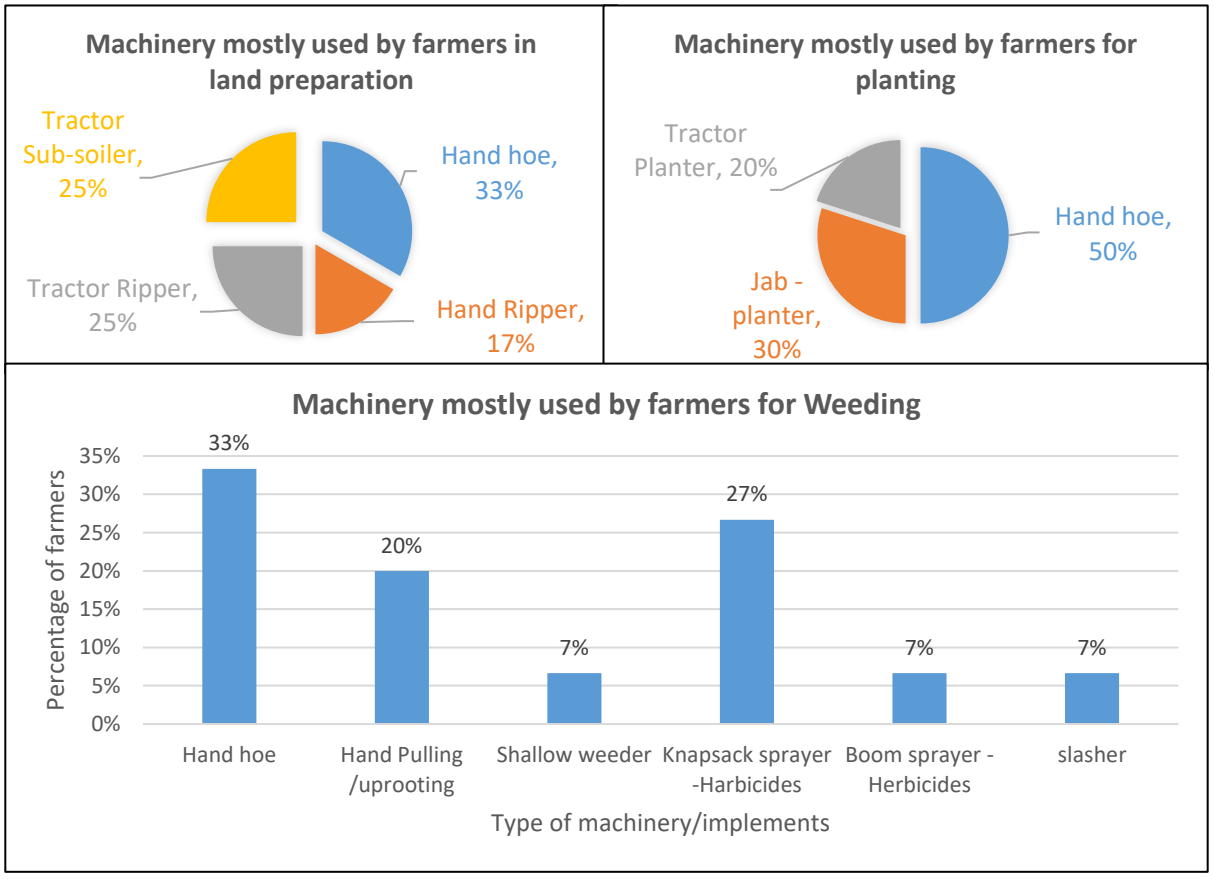


Figure 1: Type of machinery used by farmers in various farm operations

Access to CA mechanization services: Mechanization Model

The majority (81%) of the respondents with more than 0.5 ha access CA mechanization services from hire service providers in regions. Only 25% of the responded owned machinery for use in their CA field operations (Figure 2). This is case majorly in Narok, Kakamega, Nakuru among other counties with large smallholder land holdings. The CA mechanization services in question here refers to the reduced tillage operations of jab planting, ripping, sub-soiling (chiselling) or direct/No-till seeding.

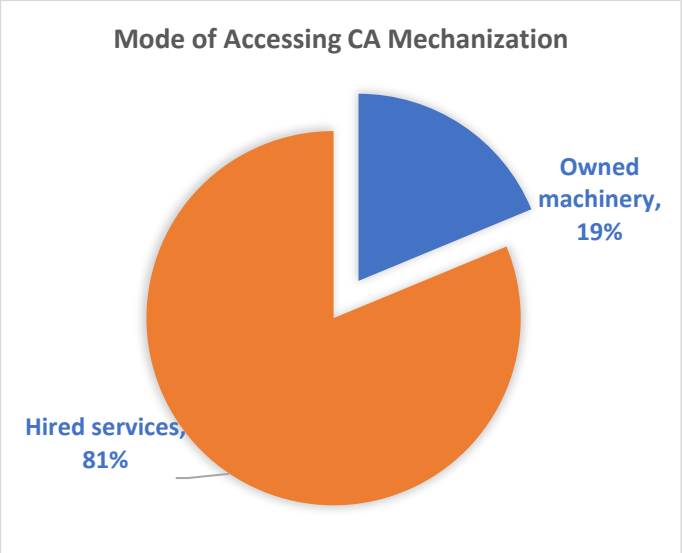


Figure 2: Mode of accessing Mechanization.

Mechanization hire service provision in Kenya

For agricultural mechanization to be accessible to all, it is crucial to address challenges related to affordability, capacity development, rural infrastructure including information communication technologies, and conducive environments for mechanization interventions. Most farmers, smallholders in particular, are unable to invest in buying machinery and equipment, thus, one business model that is especially well suited to Kenya to support mechanization of smallholder farmers is the **hire services provision.**

Therefore, this brief report analyses and showcase a variety of business models of private-sector businesses providing agricultural mechanization hire services in Kenya with an extended look at government led model, comparing these business models, and identifying success factors. Most of these business models were defined and classified based on the ownership of the business – including farmer groups and individual entrepreneurs, and types of services being provided – including agricultural mechanization hire services, other services related to agricultural activities or agricultural mechanization supply chain and acting as an intermediary between farmers and service providers.

Some of the hire service business model in agricultural mechanization promotion and implementation are defined and classified as business models provided in Table 1. This excluded the government led hire service which is discussed separately.

Table 1: Examples of mechanization hire service business models in Kenya:

Typology	Model I	Model II	Model III	Model IV	Model V	Model VI
Ownership	Individual farmers/ entrepreneur service providers	Farmer groups / cooperative service providers	Private entrepreneurs	Private entrepreneurs	Entrepreneurs as intermediary hire service providers	Government providing service
Services	Agricultural mechanization hire service	Agricultural mechanization hire service	Agricultural mechanization hire service and agricultural services	Agricultural mechanization hire service & mechanization supply chain services	Intermediary for agricultural mechanization hire service and digital services	Infrastructural services e.g. destumping, etc.

Model I: Individual farmer / entrepreneur service providers

This is the most common machinery hire service provision model. In most cases, the individual farmers with machinery meet the needs of their own farms and then provide services to neighbouring farmers (Figure 3). However for the entrepreneurial service provider in this model moves from one region to another say after land preparation season they move to areas with ongoing post harvest activities like harvesting, shelling and threshing of maize or wheat to provide commercial services. This model is less conducive to innovation in hire service provision; farmers typically operate within a small radius of their location and the service providing sservices cover all operations in the agricultural value chain. Some of the large-scale farmers operates under this kind of model, offering farm machinery services to small-scale farmers, but this model is common to medium scale farmers. Our review reveals that this model is largely practiced in Nakuru county, Narok County and Kakamega countries.

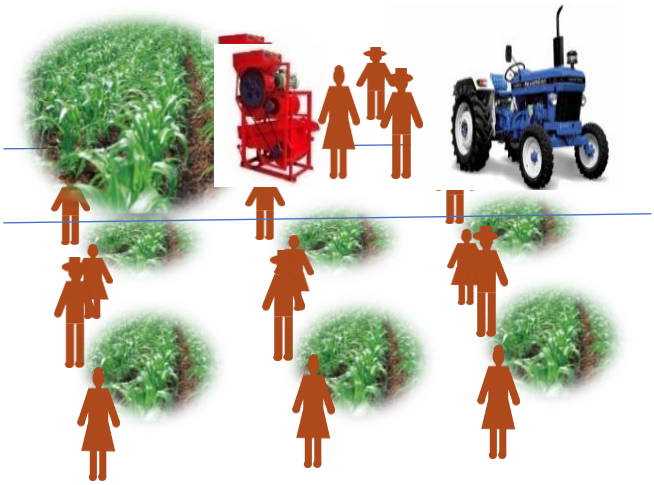


Figure 3: Individual farmer / entrepreneur service providers

Model II: Farmer group/ cooperative service providers

In this type of model, a group of farmers come together and acquire machinery to provide mechanization service to its members and later to the neighbours (Figure 4). Normally they have a committee that manages the machinery service. Services first meet the needs of members and are then extended to neighbouring non-member farmers. This model represents an interesting means for farmers to pool their resources and increase access to agricultural mechanization services. It covers all operations in the agricultural value chain.

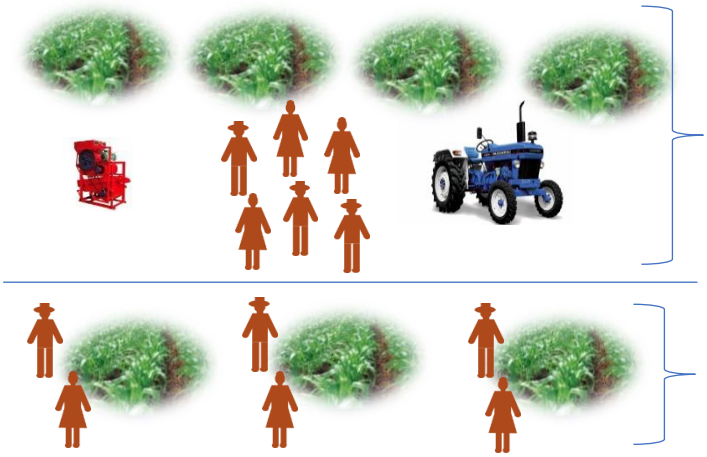


Figure 4: Farmer group/ cooperative service providers

The motivation for creating these groups is not to make a profit but to meet members' needs in an equitable manner. Examples of this type of model is largely with cooperative societies, but majorly practiced in the project sites. However, some groups of farmers have adopted this model on low scale mechanization based on the hand tools in Nakuru and Kakamega counties.

Model III: Entrepreneur service providers involved in agricultural activities

This model is upcoming in Kenya given the new interest of many commercial privately-owned companies in the sector in providing mechanization services (Figure 5). The service provider in most cases in this model provides bundled services covering all activities in the agricultural value chain. The model is run by managers with entrepreneurial skills who are more inclined to adopt new ideas and innovation. Enterprises are characterized by the diversification of their activities, which are not limited to agricultural mechanization hire

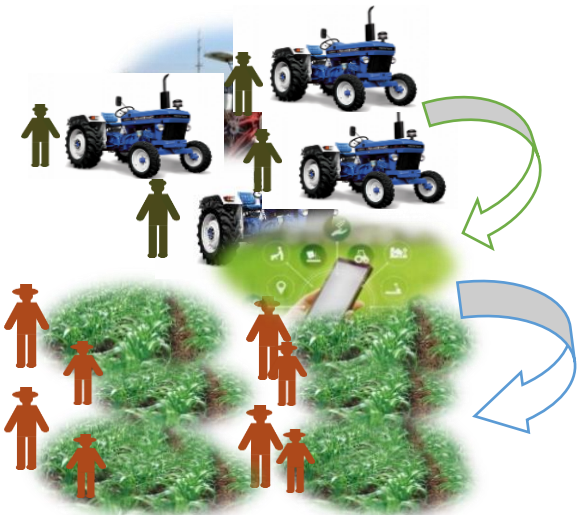


Figure 5: Entrepreneur service providers involved in agricultural activities

services but include, as example, sale of agricultural inputs. Examples of organizations practicing this model are TingA Rental stores and AgVenture. TingA rental stores own a fleet of tractors in hubs available for hire to farmers for different farm operations. AgVenture limited provide CA based production mechanization services to the farmers within their outreach program besides processing their produce especially Canola to produce oil and other livestock products.

Model IV: Entrepreneur service providers involved in the agricultural mechanization supply chain

This model comprises businesses supplying machinery and equipment while also providing agricultural mechanization hire services (Figure 6). They are limited to on-farm operations.



Figure 6: Entrepreneur service providers involved in the agricultural mechanization supply chain

Model V: Entrepreneurs as intermediary hire service providers

This model is based on The 'Uberization' of agricultural mechanization services. Here, **Entrepreneurs as intermediary hire service providers** involve business not having agricultural machinery at its disposal, but rather playing the role of intermediary between the owners of the machinery and farmers (Figure 7). The business is limited to on-farm operations and allows tractor owners to use Global Positioning System (GPS) to monitor the movement and work progress of their equipment. Intermediary use an on-demand platform to optimize local resources and provide timely agricultural mechanization services to farmers in the vicinity. The examples of this type of service providers include Hello Tractor and TingA Tractor. The two companies offer digital solutions based on mechanization.



Figure 7: Entrepreneurs as intermediary hire service providers

Model VI: Government providing service

This model is where the government provides mechanized services to farmers through it various programs at national and county level. Kenya has deployed the Agricultural Mechanization Hire Service Model: Huduma Machinery hub model. Huduma centers/Hubs secured by government but fully ran by private sector (PPP) consisting of tractors, plough equipment, sprayers (tractor or drone), harvesters, grain dryers, sorters, animal feed mixers; Ration formulation expertise; Soil testing labs or agents; Commodity marketing platforms; Financial/ Insurance services; Meteorological information and Emergency response units. The County Governments operate Agricultural Mechanization Service (AMS) stations offering services to farmers. The services are categorized into two types namely Plant Hire Service (PHS) and Tractor Hire Service (THS) for farm tractors. More plant and farm tractors are being acquired by individual Counties following the devolution of agricultural services. Some of the machinery is support through grants from development partners and governments through Agriculture Development Corporation (ADC).

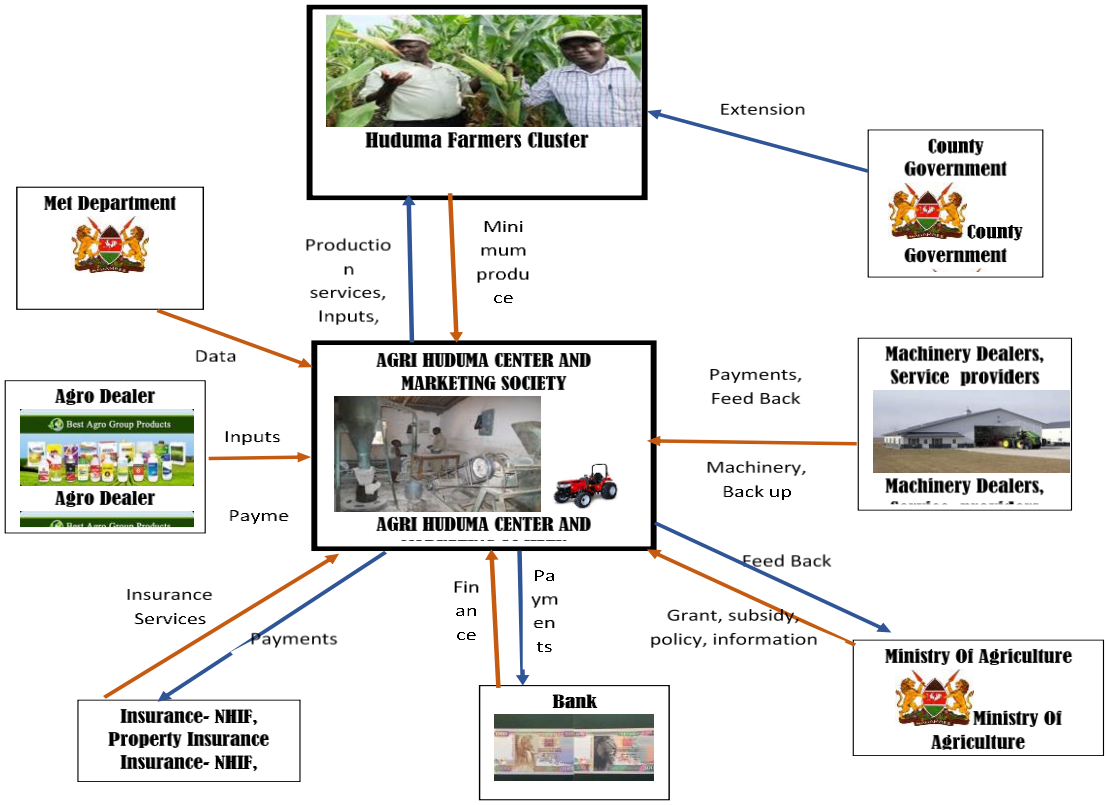


Figure 8: Huduma Machinery hub model

Conclusion

This rapid survey highlights the situation of mechanization hire service provision in UU target sites in Kenya. It can be concluded that many small-scale farmers are still not using mechanized solutions such as tractors either because the tractors and associated implements are unavailable, or the few available cannot serve all farmers on time because Kenyan agriculture is rain dependent. It is clear that mechanizations demands – albeit at the land preparation stage- needs to be given due consideration for wide-scale adoption of conservation agriculture. There are various models for mechanized hire services in agriculture that can be tapped depending on context of the farmers. Access to mechanization services by smallholder farmers is dependent on the business model linking them to accessing mechanization services, including individual service providers, contract farming arrangements with processors/off-takers, machinery manufacturers, or traders. The most ideal model is individual farmers owning the machinery for their own use and providing services to farmers. The best practical service provision would be small and medium service providers owning several tractors and exclusively providing services to other farmers. Hire service enterprises of whatever type and offering whatever services have shown in the past that they are a challenging business undertaking. Entrepreneurs are sometimes faced with daunting constraints in investing in

appropriate tools, animals, equipment and machinery. A hire service enterprise should be developed in close coordination with other stakeholders to define needs and select the most appropriate solutions. Thus, it is important for the service provider to assess and understand the local dynamics that dictates or support the business as well as the potential market of the enterprise. With the high cost of purchase of the equipment, private sector-led approaches to accessing mechanization promise to offer sustainable agricultural mechanization solutions to the millions of smallholder farmers in the target sites. There is a need to create awareness among farmers on the use of mechanization and introducing affordable business models for providing services to farmers.

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To learn more about Ukama Ustawi and other initiatives in the CGIAR research portfolio, please visit https://www.cgiar.org/research/initiatives-dashboard/

References

African Conservation Tillage Network (ACT) (2012) Strategic Plan 2013-2022. African Conservation Tillage Network, Nairobi, Kenya.

AgVenture website. https://www.agvke.com/. Accessed June 2022.

Bymolt R and Fred Zaal F (2015) Moving to Mechanisation: Mechanisation in maize farming systems in Kenya, Tanzania and Ethiopia. KIT (Royal Tropical Institute), Amsterdam, Netherlands. 561e6391c647c_moving-to-mechanisation.pdf (kit.nl) (Accessed 18 June 2023)

GoK (2007). Kenya Vision 2030: A Globally Competitive and Prosperous Kenya. Government of Kenya (GoK), Nairobi.

GoK (2009). National Land Policy. Sessional Paper No 3. Government of Kenya (GoK), Nairobi Kassam, A.; Friedrich, T.; Derpsch, R. Successful Experiences and Lessons from Conservation Agriculture Worldwide. Agronomy **2022**, 12, 769. https://doi.org/10.3390/agronomy12040769

Kassam AH, Mkomwa S and Friedrich T (Eds.) (2017) Conservation Agriculture for Africa. CABI: Wallingford

E-Tinga: Time to mechanize https://e-tinga.com/ (Accessed 18 June 2023)

Hello Tractor: Growing Together https://hellotractor.com/ (Accessed 18 June 2023)

Kanui R (2019) Current situation of agricultural mechanization in Kenya. Presentation made at the Grand Imperial Hotel Kampala, Uganda, 9-12 December, 2019. Eng. kanui current situation of agricultural mechanization in kenya (slideshare.net)

Mkomwa S, Lugandu S, Kuria P, and Mutai W (2017) Empowering Smallholder Farmers with Profitable and Sustainable Farming Using Conservation Agriculture: The Case of East Africa. In: Kassam AH, Mkomwa S, Friedrich T (eds) Conservation Agriculture for Africa: Building Resilient Farming Systems in a Changing Climate; CABI: Wallingford, UK; Boston, MA, USA, 2017; ISBN 1780645686

Mrema GC (2016) An Overview of Agricultural Mechanization in Sub Saharan Africa By: Presentation to the Nairobi Consultative Meeting on New Models for SAM in SSA, 1st December, 2016. An-Overview-of-Agricultural-Mechanization-in-Sub-Saharan-Africa-GCMREMA-FINAL.pdf (act-africa.org)

Mrema GC, Kienzle J, Mpagalile JJ (2018). Current Status and Future Prospects of Agricultural Mechanization in Sub-Saharan Africa [SSA]. Agricultural Mechanization in Asia, Africa & Latin America 49 (2): 13-30

Wawire NW, Bett C, Ruttoh RC, Wambua J, Omari FG, Kisilu R, Kavoi J, Omari J, Wanyonyi NW and Ketiem P (2016) The Status of Agricultural Mechanization In Kenya. kafaci_report.pdf (kalro.org). (Accessed 10 June 2023)

Republic Of Kenya (2021) National Agricultural Mechanization Policy. Ministry Of Agriculture, Livestock, Fisheries and Cooperatives. Draft-Agricultural-Mechanization-Policy-for-national-Validation-06_06_2021.pdf (kilimo.go.ke) (Accessed 18 June 2023)