

## Promoting appropriate mechanization options in Ethiopia: Lessons learned and the way forward

### Background

Smallholder agriculture in Ethiopia involves mixed crop-livestock farming systems with maize, wheat, teff and barley as the major food security cereal crops. Faba bean, lentil, common bean and chickpea are key food security pulse crops. Production, post-harvest processing and transportation of these crops rely on human and animal power, and the labour burden is largely placed on women and children. High value crops produced in home gardens also involve high labour input during watering using the bucket system or drag horse. Appropriate mechanization technologies have opened opportunities for reducing the drudgery on smallholder farms in Ethiopia.

Since 2016, Africa RISING, together with the International Maize and Wheat Improvement Center (CIMMYT), has implemented agricultural mechanization technologies for land preparation and planting, harvesting, post-harvest processing and micro-irrigation. Mechanization technological options have been tested and promoted on smallholder farms in the four regions (Amhara, Tigray, Oromia, and Southern Nations, Nationalities, and Peoples' [SNNP]) of Ethiopia. These mechanization technologies, powered by low horsepower two-wheel tractors (2WT), include ploughing, planting, harvesting, threshing, shelling, water pumping and transport services.

### Research and scaling approach

The technologies have been demonstrated and scaled out through individual and youth group service provision models. The service providers

received technical and agribusiness training to ensure correct and efficient operation of equipment and proper running of their businesses. Mechanization based on 2WT powered technologies has opened opportunities for employment creation for the rural youth who are organized in groups and are providing different services. Additionally, more employment opportunities have been created by individual service providers who employ the youth at peak periods in the farming calendar. The promotion of these mechanization technologies has succeeded due to strong partnerships with the Ethiopian Ministry of Agriculture and Livestock Resources (MoALR), agriculture equipment manufacturers and importers in the private sector, and micro-finance/leasing companies in Ethiopia.

### Lessons learned (2016–2021)

Over the years, the partnership between Africa RISING in the Ethiopian highlands and CIMMYT has enabled the carrying out of various generic research technologies and scaling out of these technologies in the maize and wheat growing regions of Ethiopia. The followings are some of the major lessons and achievements of this partnership.

*(i) Aligning activities with government agriculture development priorities*

The Ethiopian government through the MoALR developed a national mechanization strategy for the country. Consequently, Africa RISING and its partners aligned mechanization projects with the government strategy. Eventually, the MoALR jointly invested in equipment, which has

enhanced the scaling out of mechanization services in Ethiopia. Additionally, the MoALR co-invested in capacity development of service providers and frontline staff from the Bureau of Agriculture in different project sites. This partnership has set a strong base for the ongoing scaling out of different mechanization technologies in rural farming communities of Ethiopia and enabled the licensing of 2WT operators who use the official road network when they are conducting their daily businesses.

*(ii) Appropriate niches for different mechanization technologies*

Experience from Ethiopia indicates that appropriate mechanization technologies can be implemented in dryland and irrigated crop and livestock production systems and peri-urban centres. Mechanization services required in each community depend on farmers' needs and the biophysical conditions of the area (e.g. topography and soil types where direct seeding is targeted). Harvesting and threshing services are highly requested by farmers and are lucrative for service providers in the wheat and barley growing communities. Shelling, rather than direct planting, is highly needed in maize growing smallholder farms. Access to reliable water sources and production of high value crops are critical for the provision of water pumping services. Rural communities where different services are required by farmers at different times of the year are ideal for service providers to invest in a wide range of equipment. Additionally, availability of good road network, spare parts, fuel and oil supplies is critical for the sustainability of mechanization businesses. Consequently, needs analysis is a critical first step in the large-scale promotion of appropriate mechanization technologies in rural communities.

*(iii) Characteristics of an ideal service provider*

Selection of service providers is an important first step for the success of scaling out appropriate mechanization technologies in rural communities. An individual who is business-minded,

enterprising and prepared to invest financial resources into expanding their businesses is an ideal candidate for service provider. Service providers who invest time in looking for clients, maintaining their equipment, and seeking additional training were effective service providers than those that always sought assistance from the project even after 4–5 years after engaging in mechanization services. Selection of service providers by the community led to challenges when an individual was selected based on their social status in the area.

*(iv) Importance of partnerships*

The importance of partnerships in delivering project outputs in difficult times was demonstrated in 2020 when the COVID-19 pandemic began. Partnering with organizations with a similar research and development vision allows leveraging of resources (e.g. human and financial), and more effective use of available financial resources in scaling out of promising technologies in smallholder farming communities. With the active participation of MoALR in the promotion of mechanization technologies, more government departments got involved in mechanization as demonstrated by the involvement of the police and road transport authority in licensing 2WT operators. The ministry involved SMEs in registering the service providers, and the Ministry of Finance exempted imported agriculture equipment from tax.

*(v) Engaging key stakeholders*

The process of bringing stakeholders to participate in the promotion of mechanization technologies is best implemented in a stepwise manner. Roundtable discussions to introduce mechanization technologies forms the initial stage of the process. Exposure and learning visits to project sites was a critical stage of the process as it afforded new stakeholders a chance to see technologies in use and interact with rural communities participating in projects. The private sector stakeholders had an opportunity to identify possible entry points for their own businesses during

these learning and exposure visits. Continued participation of potential stakeholders in field days and awareness creation campaigns further enhanced relationship development and securing mechanization business opportunities in the rural farming communities.

*(vi) Capacity development of stakeholders*

Different stakeholders operating along the mechanization value chain require training in order to efficiently deliver their contributions. Repeated technical and agribusiness training conducted during the implementation of projects played a critical role in ensuring efficient delivery of mechanization services. Training of mechanics on repair and servicing of new equipment complemented the training given to service providers in ensuring sustained promotion of mechanization technologies. Twice a year, technical training of new service providers and government frontline staff has sustained the ongoing promotion of mechanization technologies in Ethiopia. One of the major outcomes of the technical training was the ability of service providers to continue providing services during the COVID-19 pandemic when physical technical backstopping was halted due to travel restrictions.

*(vii) Income generation by value chain actors*

Different value chain actors generate income during the promotion of different mechanization technologies in rural communities. Smallholder farmers reduce production costs by mechanizing some of the field operations. Rural entrepreneurs operating as service providers generate income by providing different mechanization services throughout the year. Business opportunities for service providers vary with location and time of the year. During peak harvesting and post-harvest processing (threshing and shelling) stages, service providers generated the highest income compared with other periods of the year. Equipment manufacturers and importers generate income through equipment sales while microfinance/leasing institutions provide loans and

equipment to service providers at a given interest rate.

*(viii) Employment creation*

Employment opportunities arise at different levels in the process of promoting and utilizing mechanization technologies and services. Service providers get engaged in income generation for their own livelihoods. Additionally, service providers recruit machine operators particularly during the peak seasons such as post-harvest processing. In the private sector, employment opportunities are created in the equipment importing and manufacturing companies when demand for certain machineries has increased. This was demonstrated by Amio Pvt. Ltd., which increased its casual labour force in order to meet equipment demand. Employment opportunities were also created in the aftersales services sector as more machines were acquired by the increased number of service providers in rural farming communities. However, youth employment through service provision of mechanization services must be competitive in order to attract and retain the youth in agriculture.

*(ix) Access to new equipment, spare parts, repair and maintenance services*

As service providers get more experience and expand their businesses, availability of farming equipment on the local market in the country is critical. When equipment is not manufactured locally, its importing should be a smooth to allow service providers to get equipment in time for the different peak periods of demand. Delayed access to equipment during peak periods of farm operations can be a major bottleneck in scaling out mechanization technologies. Equipment breakdown during service provision happens and can derail business activities for service providers. Therefore, setting up of a network of spare parts dealers and aftersales services (e.g. fuel and engine oil supply, repair workshops etc.) is important for sustainable scaling out of mechanization technologies. Regular technical backstopping of service providers ensures that rural dealers

stock the right spare parts for the equipment providing services to farmers.

#### *(x) Communication channels*

Information dissemination to achieve different objectives requires the use of various channels that can reach target communities in a country. Experience from Ethiopia indicated that radio and television are quite effective in awareness creation beyond the project sites. Short videos and social media platforms (e.g. Twitter) are important channels when internet connectivity is available. In some rural communities, village meetings convened by traditional leaders were quite effective in advertising mechanization services available from service providers.

### **Way forward and opportunities for promoting mechanization technologies**

The Africa RISING project and CIMMYT work closely with government and private sector partners to improve the livelihoods of smallholder farmers. During the implementation of projects, new opportunities for increasing the impact of appropriate mechanization on rural livelihoods were noted. Additionally, the potential for integrating appropriate mechanization with other technologies was also observed in different parts of the Ethiopian highlands. The notable opportunities include:

- Linking post-harvest appropriate mechanization technologies and improving grain storage technologies need to be explored in communities where crop productivity has improved due to increased precision in inputs use through mechanization. The potential for integrating mechanization and grain storage was evident in the maize growing areas of western Ethiopia.
- High soil acidity is one of the major biophysical constraints limiting crop productivity in smallholder farming systems. The recently developed tractor powered lime spreader prototype has the potential of playing a key

role in lime application, and hence soil acidity alleviation on smallholder farms.

- Some service providers are now aiming at upgrading from the 2WT to low horsepower 4-wheel tractors that can perform the same farm operations as the 2WT. Small horsepower 4-wheel tractors are now available in the market from a few private sector equipment importers in Ethiopia. In addition, some of the tested and validated equipment can now be manufactured locally, and this will help in meeting the increasing demand for it.
- Leasing scheme for new equipment acquisition: The leasing scheme for agricultural equipment offers service providers an opportunity to acquire additional equipment and expand mechanization services for rural communities.
- Livestock is a key component of mixed smallholder farming systems in Ethiopia. Farmers observed that threshers used for processing wheat and barley often leave the straw of these crops in an appropriate size for livestock feeding at the homestead. Additionally, straw/stover choppers can be integrated with the set of equipment which are being promoted in maize and wheat/barley growing parts of the Ethiopian highlands.
- Through the mechanization forum and awareness creation activities conducted during the project, national and international non-governmental organizations are keen to be part of scaling out mechanization technologies in their operational areas.
- Recently there are indications that linkages can be created to integrate the current portfolio of appropriate mechanization technologies with private sector companies involved in food processing. Such companies require adequate and reliable supply of raw materials (i.e. grain from smallholder farmers through contract farming arrangements) in order to supply the demand for their products on the food market. Therefore, linking planting, harvesting and post-harvest processing, as well as lime application with food processors can increase the impact of mechanization on the value chain.



*Two-wheel tractor powered technologies tested, validated and scaled out in different regions of Ethiopia (photos: CIMMYT/Mupangwa, Walter)*

The Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research for development projects supported by the United States Agency for International Development as part of the U.S. government's Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads an associated project on monitoring, evaluation, and impact assessment.

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