



## Synopsis: Agricultural Mechanization in Rwanda

### A review of current mechanization status and discussions of potential mechanization support strategies for smallholders in Rwanda

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Optimal agricultural mechanization strategies in Rwanda can be better informed by a closer assessment of diverse production environments and experiences in other countries with similar topography. The findings from Rwanda's latest agricultural surveys, review of recent experiences in countries with rugged terrain and smallholder farming systems similar to Rwanda and reviewing mechanization support strategies from other countries suggest that identifying mechanization technologies suitable for different types of farms, promoting greater private-sector innovations while focusing on the relevant public goods aspect of mechanization is the most promising way forward. Key findings include the following:

- Variations in agroecology and cropping systems, irrigated/rainfed systems, farm size, and labor use intensity, among other factors, characterize the key types of mechanization use in Rwanda.
- In the medium term, smallholders cultivating rainfed maize and legumes, in addition to irrigated rice, can benefit from the use of tractors, as well as irrigation pumps.
- However, farm wages may still be too low and tractor-hiring fees may still be too high in Rwanda to induce a shift to mechanization in the short term.
- Policy support for mechanization can focus on improving the understanding of mechanization needs among each type of farmers identified, knowledge of suitable machines, and required skills for their operations and maintenance.
- Developing competitive markets and supply networks for promising machines, parts, and repair services at a viable and integrated market scale is also important.

<sup>1</sup> Takeshima, Hiroyuki; Benimana, Gilberthe; Spielman, David J.; and Warner, James. 2024. [Agricultural mechanization policy options in Rwanda](#). Rwanda Strategy Support Program Working Paper 9. Washington, DC: International Food Policy Research Institute.

## Background

Optimal agricultural mechanization strategies in Rwanda can be partly informed by a closer assessment of diverse production environments and experiences in other countries with similar topography. This policy note highlights patterns of agricultural mechanization in Rwanda, key types of mechanized farm households, medium-term potential for smallholder mechanization, and possible policy interventions that address market and information failures that influence the mechanization process.

## Typology of agricultural mechanization in Rwanda

We assess current agricultural mechanization patterns in Rwanda using microdata from the latest available datasets. These include the Integrated Household Living Conditions Survey 2016/17 (EICV 5), the Agricultural Household Surveys (AHS) from both 2017 and 2020, and the Seasonal Agricultural Surveys (SAS) from 2019 to 2022. These datasets all originate from the National Institute of Statistics of Rwanda (NISR 2022).

In Rwanda, the use of tractors for plowing remains quite rare, particularly on smallholder-operated plots under 1 ha. The 2022 SAS data indicates that about 0.8 percent of plots in Rwanda were plowed by tractors in the 2022 season (Table 1). Among plots smaller than 1 ha—which accounts for 93 percent of all plots in the SAS data—just 0.1 percent of plots (0.3 percent of all plot area) were plowed by tractors.

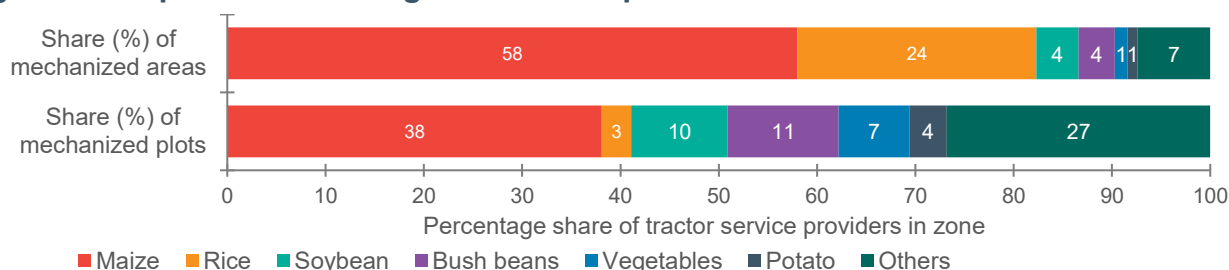
**Table 1. Farm size distribution and mechanization use in Rwanda in 2022**

Plot sizes	Share (%) of total plots	Share (%) of plots mechanized
Less than 1ha	92.8	0.1
1ha or greater but smaller than 10ha	5.3	8.0
10ha or above	1.9	14.5
<b>Total</b>	<b>100.0</b>	<b>0.8</b>

Source: Authors' estimation based on 2022 Seasonal Agricultural Survey data from NISR (2022).

Cereal and legume crops that are viable in medium- to large-scale farming tend to be mechanized first in Rwanda. In 2022, maize, rice, soybeans, and bush beans account for about 62 percent of mechanized plots and 90 percent of mechanized areas (Figure 1).

**Figure 1. Crops shares among mechanized plots in Rwanda in 2022**



Source: Authors' estimation based on SAS (2022).

The current use of mechanization, proxied by the use of tractors and based on typology analysis, can be generally characterized into one of four categories (Table 2).

**Table 2. Major types of mechanized farm households in Rwanda (2016 – 2022)**

Types of mechanized farms	Share (%)	Descriptions
<b>Type A: Irrigated medium-scale farmers in Eastern province</b>	32	Labor-intensive irrigated rice and other production systems where mechanization is used to supplement manual labor
<b>Type B: Rainfed medium-scale farmers in Eastern province</b>	25	Medium-scale farms where economies of scale in mechanization are more significant than manual power
<b>Type C: Rainfed, highland small-scale farmers in Northern province</b>	18	Farm households with younger heads, more educated, and implicitly, possibly more willing to experiment with modern technologies and practices
<b>Type D: Irrigated small-scale farmers in Western province</b>	25	Irrigated systems where mechanization is used to substitute for rising manual labor costs used for land preparation

Source: Authors' estimation based jointly on EICV 5, AHS 2017 & AHS 2020, SAS 2019–2022.

Mechanized farms are distributed relatively equally across these four categories, although a somewhat higher share (32 percent) is found in Type A and a lower share (18 percent) in Type C. Mechanization use characteristics vary distinctively across provinces, as well as across irrigation status, farm size, and other socioeconomic factors.

## ECONOMIC POTENTIAL OF SMALLHOLDER MECHANIZATION IN RWANDA BASED ON LESSONS FROM NEPAL'S HILL/MOUNTAIN ZONES

Historically and globally, smallholders in hilly and mountainous regions have experienced a slower rate of agricultural development and transformation when compared to lowland, and especially irrigated, regions. Nonetheless, some smallholders in hilly/mountainous areas of low- and middle-income countries, including those in Asia, have experienced meaningful growth in the use of machinery and equipment such as tractors and irrigation pumps. For example, the hill/mountain zones in Nepal share similar characteristics with Rwanda today in terms of small farm size, rugged terrain, and employment shares in the agricultural sector. During the last two decades, the hill/mountain zones of Nepal have seen significant growth in the shares of farm households using either four-wheel tractors (4wt) or two-wheel tractors (2wt), with adoption rates reaching 13% from almost zero in 2021. The hill/mountain zones of Nepal have also seen a significant increase in the use of mini-tillers (walking tractors smaller than 2wt) and irrigation pumps. Compared to Nepal, the current higher costs of hiring tractors and lower wages in Rwanda limit short-term returns to mechanization, the recent experiences in the hill/mountain zones of Nepal still offer promising medium-to-long-term strategies for Rwanda.

## POLICY OPTIONS TO PROMOTE AGRICULTURAL MECHANIZATION IN RWANDA

In Rwanda, markets linked to mechanization are thin, with too few buyers or users to make for a viable business in either the manufacturing or importation of machines, for mechanized service provision to farmers, or the distribution of equipment attachments and spare parts, machinery repair, or other maintenance services (Diao et al. 2017). However, the Rwandan government can play a facilitating role in mitigating these market failures. In particular, the government should prioritize the following:

- (1) Design mechanization support programs tailored to different types of farm households, rather than a one-size-fits-all approach**, by integrating mechanization into a more comprehensive, well-adapted set of packages (inputs, technologies, practices, and services), which vary across provinces, agroecology, cropping patterns, and irrigation systems;
- (2) Explore heterogeneity in machinery and equipment**, by studying the type of tractors and other machines currently used in the country, especially in the informal sector, and better understanding why they are in use;
- (3) Sensitize farmers to the use of small tractors and machines equally**, by gathering and disseminating information regarding smaller machines, and their broad uses not only in irrigated areas but also in rainfed areas emerging in other countries;
- (4) Develop spare parts and repair service supply networks**, by encouraging or placing fewer restrictions on imports and also local manufacturing and fabrication;
- (5) Explore various custom-hiring service models**, including services provided by tractor-owning medium-scale farmers who can both achieve sufficient machine utilization rates through intensive use on their own farm and yet have incentives to further enhance utilization rates by serving other farmers;
- (6) Resolve bottlenecks that limit machine utilization rates by machine owners**, by allowing the cross-country movement of machines, through R&D on multi-functional uses of machines;
- (7) Improve technical skills training on machine uses and related farming practices**, by bringing in expertise from the private sector, including the informal sector;
- (8) Encourage and facilitate value-chain financing**, whereby either machinery dealers or retailers provide references or a guarantee to a financial institution for machine buyers (“external value chain finance”) or the former directly provides loans/credit to machine buyers (“internal value chain finance”);
- (9) Maintain and encourage competition in markets for mechanized products and services**; for example, even when some support (such as subsidies) are considered, make them applicable for broader types/brands of machines while reducing subsidy rates applicable to each machine, instead of subsidizing a narrow set of machines with significant subsidy rates;
- (10) Expand capacity for research and development on agricultural mechanization**, as mandated by The Rwanda Agriculture and Animal Resources Development Board (RAB), especially in identifying promising machinery and equipment in and outside Rwanda, and better understanding the economics of mechanization use for farmers; and lastly,
- (11) Encourage engagement of women and youth**, by supporting female extension agents, engineers, and women-friendly machines, as well as showcasing the business opportunity of mechanized farming to youth and including youth representatives in the mechanization policy formulation process.

## References

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