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THE STATE OF FOOD AND AGRICULTURE

The (continued) potential of motorized mechanization

Mechanization is fundamental to agricultural development, but uptake has been uneven and has led to environmental concerns

Motorized mechanization is an important form of agricultural automation and has the capacity to transform agriculture and rural livelihoods. By allowing producers to perform agricultural operations faster and more effectively, it can lead to enhanced agricultural productivity and resilience, higher incomes, labour and cost savings, and reduced drudgery, among others benefits. Consequently, mechanization can free up time for non-agricultural activities, such as food preparation – thus potentially improving nutrition – or off-farm work. It can further support the creation of new jobs, e.g. mechanics to maintain and repair equipment. Mechanization can also lead to improved food safety and less food loss through preservation and storage technologies (e.g. dryers and cold storage).

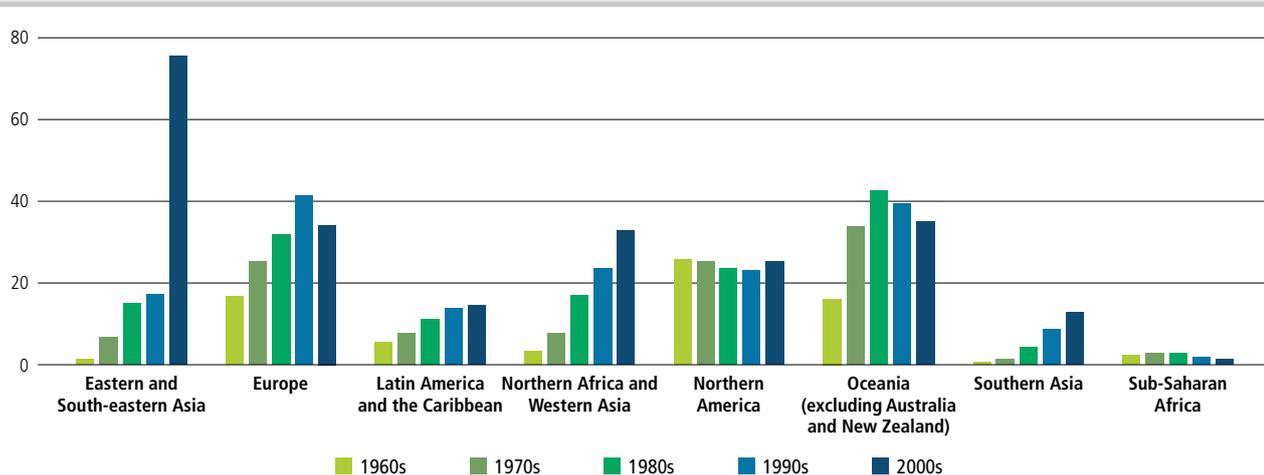
Its benefits have resulted in a substantial increase in mechanization worldwide, although adoption has been uneven.

KEY MESSAGES

- ▶ Mechanization still has great potential to reduce production costs and expand production and productivity; however, adoption has been uneven and particularly limited in sub-Saharan Africa.
- ▶ Inclusive access to mechanization requires a conducive business environment through a range of (coherent) policy instruments and investments.
- ▶ Tailoring mechanization to local conditions through technological and institutional innovations (e.g. development of small-sized machinery) will be key to ensuring inclusive adoption.

In the 1960s, high-income countries (Northern America, Europe and Oceania) were already highly mechanized, while regions dominated by low- and middle-income countries less so (Figure 1).

FIGURE 1. Tractors per 1 000 hectares of arable land



Source: FAO. 2022. *The State of Food and Agriculture 2022. Leveraging automation in agriculture for transforming agrifood systems*. Rome. <https://doi.org/10.4060/cb9479en>

This is particularly true for sub-Saharan Africa, despite efforts to promote mechanization (e.g. subsidies). Such efforts proved costly and mostly failed due to, *inter alia*, poor infrastructure, inadequate investments in knowledge and skills, and poor maintenance capacities.

Further, agricultural mechanization has been so far dominated by large and heavy machinery, putting small-scale producers at a disadvantage due to their lower capacity to afford large, more costly, machinery that often does not suit their small, irregular, or hilly terrains. Moreover, such machinery contributed to environmental problems such as biodiversity loss, land degradation and soil erosion.

Towards harnessing the full potential of agricultural mechanization

Reaping the full benefits of mechanization in achieving productive, sustainable, resilient and inclusive agrifood systems requires policies, investments and interventions on various fronts. Some of which should target the broader context aiming to establish or promote a conducive business environment for all. Others, however, need to be more specific and target specific regions or socioeconomic groups viewed as more vulnerable and disadvantaged in access. For example, small machinery (e.g. two-wheel tractors and power tillers) is particularly important for small-scale agriculture, as they are better suited to hilly terrain and small, fragmented plots.

The prioritization of actions largely depends on context, including the overall development level and the agroclimatic and topographic characteristics. These actions should be guided by national strategies, aimed at building a conducive business environment.

Towards a conducive business environment

It is worth noting that creating a conducive business environment requires first general public investments and interventions that do not necessarily target mechanization. Policies that encompass improving land tenure security, infrastructure transportation, communication, and energy are all essential, and should not be ignored. However, building a conducive environment requires also targeting the mechanization sector itself. The following includes important areas of focus to guide policies and investments.

- ▲ **Building knowledge and skills.** Agricultural machinery needs to be operated and maintained; otherwise, its profitability and sustainability can be undermined. Vocational training centres, which combine applied training with theoretical information, can be suited to provide the needed knowledge and skills.
- ▲ **Providing mechanisms for quality assurance.** A lack of quality assurance can undermine mechanization, as it increases the uncertainty and risks associated with the purchase of machinery, spare parts, and fuels. Governments can support the process of

testing and certification by strengthening the institutions setting standards of manufacturing and trade of technologies.

- ▲ **Policies for improving affordability of mechanization.** When machinery is imported, its cost can be affected by duties. Improving customs procedures can lower mechanization costs. In addition, limited access to finance often constrains the scaling-up of mechanization. Investment loans, loan guarantee schemes, joint liability groups, and leasing are options that governments can promote to improve financial access to mechanization.

Tailoring mechanization to local needs to enhance inclusive adoption and environmental sustainability

A wide variety of mechanization solutions exists but these are not always fit for purpose for low- and lower-middle-income countries, and small-scale producers in particular. Governments and other stakeholders, such as research institutions and producer's associations, can play crucial roles in adapting mechanization solutions to the specific needs of end users.

Conducting applied research and development. Mechanization hinges less on public research and more on the private sector. Governments can support research with needed funding and by coordinating research efforts across all involved stakeholders. Especially when larger machinery is not suited to local topographic conditions or farm sizes, governments can promote the development and the dissemination of small machinery, such as two-wheel tractors, power tillers, drum seeders and rotary dibbers. These machines are cheaper and easier to operate, and can therefore lead to less drudgery, and improved productivity and efficiency. Being also more environmentally friendly because they require little or no fossil fuels to operate, they contribute to environmental sustainability and can be suitable for agroecological approaches, such as rice–fish systems. In some contexts, they allow for greater gender equality because women can operate them easily. Linking research and development efforts to local needs is a public good in which governments play a central role.

Facilitating the pooling of resources and hire service markets. Where machinery is unaffordable by small-scale producers, governments can promote institutional innovations such as hire service markets and cooperative solutions to enable access. In such cases, supporting digital infrastructure can help since digital tools hold great promise for improving hire services as they reduce transaction costs and improve and facilitate supervision of equipment by providers.

Together, these policies form a roadmap to ensure that mechanization contributes to more efficient agricultural production and resilient livelihoods, while respecting environmental sustainability.

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