

Agricultural Mechanisation & Rural Employment



Concept paper developed in the framework of the GIZ project “Agricultural Mechanisation and Technology for Smallholder Productivity” (AMTP) in Ethiopia.

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The challenge

Across Africa, large shares of the population reside in rural areas, primarily active in small-scale farming. Young people below the age of 35¹ typically form the largest groups of the populations—**half of sub-Saharan Africa's population is under the age of 25** [Filmer and Fox, 2014]. Most of them have a farming background, e.g. through helping on their parents' farms. Although job opportunities are very limited in urban areas—indicated by high unemployment rates, especially among young people—a **migration of rural young people to urban areas** can be observed across sub-Saharan Africa. This results in **high unemployment rates among young people** as well as “**ageing farm populations**”, and as a consequence it further decreases agricultural productivity of the left-behind elderly people. This, in turn, decreases overall agricultural output and contributes to **food insecurity**. Many countries are net-importers of agricultural commodities despite favourable soils and agro-climatic conditions as can be found in many places in sub-Saharan Africa.

Unattractiveness of agriculture to young people

There is certainly a multitude of factors, varying from context to context, leading to this rural-to-urban migration trend. However, it appears that **farming is largely not attractive for young people** anymore [see for example Asciutti et al., 2016; FAO, 2014; Brooks et al., 2013]. **Traditional farming methods** (based on hand tools or animal draft) dominate the farming sector, which implicates **high levels of labour input** and **drudgery**. When asked what a “bad job” is to them, young rural Africans across different countries gave the following characteristics: with **poor, insecure returns; physically damaging/demanding conditions; and/or illegal status** [Petsch and Caillava, 2012]. Small-scale farming in Sub-Saharan Africa tends to possess all of these characteristics. Despite working conditions of a day labourer (e.g. on a construction site) being as bad as (or worse than) those in agriculture, it appears that many young people **prefer to be unemployed or day labourer in a town over pursuing a life as a farmer**. The lifestyle of a farmer, bound to the village, is often perceived as “**backward**”, **out of touch with the modern world** [IDS, 2012, pp. 33-43; and own investigations, 2017]. Alike, agricultural work appears to be that unattractive that in fact, **seasonal agricultural labour in some places becomes scarce** – and accordingly expensive for farm owners – despite overall high unemployment rates².

Social pressure

Additionally, **social pressure** appears to push young people out of agriculture. Parents and/or other members of the communities do not expect young people to return to agriculture, especially if they successfully completed school or higher education, because it would be a “**wasted investment**”. Farming is perceived as a **degrading occupation** even by farmers themselves [IDS, 2012, pp. 33-43; and own investigations, 2017].

Scarcity of arable land

Furthermore, where population growth is high, there is an increasing scarcity of arable land per capita. While one or two sons of a family might be able to **sustain their families' livelihoods through farming**, the prevailing **low productivity levels** often do not allow parents to divide their farm land to all of their children. At the same time, communal land and land for lease is equally scarce, leaving young people who are willing to stay in agriculture no option to do so, since land is a fundamental input for farming [IDS, 2012, pp. 33-43; own investigations, 2017].

Modern mechanisation as a game-changer

The following sections demonstrate how **modern agricultural mechanisation of field operations³** can contribute to decreasing the rural-to-urban migration trend of young people, by generating employment opportunities both on and off-farm.

On-farm employment

In order to incentivise young people to stay or become active in agricultural production, farming needs to be attractive: It needs to sustain and improve the farmers' living conditions (financial aspect); and the reputation of farming needs to be improved (social aspect). Hence, agriculture needs to be **modernised**, increasing land and labour productivity and **turning farming into a profitable business**, or as Brooks et al. [2013, p. 2] put it: "The agriculture that attracts them will have to be profitable, competitive, and dynamic".

Increased productivity

Agricultural mechanisation has the direct intention to improve processes and increase productivity. The use of machines allows for **precise and timely field operations** including application of plant nutrition and protection, which results in higher yields. Furthermore, harvest and post-harvest losses can be decreased through improved technologies. A combination of mechanisation, improved inputs (such as seeds, fertilisers and plant protection), and Good Agricultural Practices can significantly increase labour and land productivity—and even productivities of all input factors—making farming a **profitable business**.

Decreased pressure on arable land

Especially the aspect of increasing land productivity is an important aspect where arable land is scarce. Having a higher output from one hectare of land can enable farmers to **sustain their livelihoods even from relatively small plots of land**. Furthermore, employing machines, especially for land preparation (ploughing) and transport **decreases the need for draught animals**. This has the following effects:

1. It **reduces the need for grazing land** and thus makes grazing land available for other utilizations—which, in turn, decreases pressure on arable land.
2. It can be more **cost-effective** to pay for mechanisation services than maintaining and feeding oxen (as well as cows and calves for reproduction of oxen) during 365 days for just 4-8 weeks use for ploughing per year.
3. Through the access to mechanisation services, young people and females who often **do not own oxen for ploughing** (and other productive assets) are enabled to farm.

Decreased drudgery

Employing machines for field operations directly **decreases the drudgery** of farmers. Especially mechanising **back-breaking operations such as ploughing, planting, harvesting and transportation** improves the conditions of small-scale farming. Furthermore, smallholder farmers often manually apply plant-protection chemicals (e.g. by using knapsack sprayers) without appropriate protective gears, and—due to lack of literacy or information—in wrong concentrations, which can result in **health hazards and environmental pollution**. Mechanised chemical spraying can be regulated easier than individual farmers' manual spraying and can therefore—when applied according to rules and regulations—avoid these negative externalities.

In addition, mechanising field operations **reduces the required labour input (time)**, allowing farmers to pursue **additional income-generating activities**, which **increases farming families' incomes and spreads risks**. This is possible since the non-farm sector is in many places expanding into rural areas due to developments in physical infrastructure (such as roads and bridges), and communication technologies (e.g. phone network), enabling farm household members to simultaneously work in the farm and non-farm sectors **without having to move away from the rural area** [Ahmed and Goodwin, 2016].

Pre-farm employment

Mechanising farm operations does not only improve the conditions of farming itself, but also—directly and indirectly—creates off-farm employment opportunities in rural areas.

Agricultural mechanisation pre-farm employment

Smallholder farmers do usually not own modern agricultural machinery as it is too expensive and not profitable for a small plot of land. Often, so-called *mechanisation service providers* who own machines offer the service to smallholder farmers.

With increasing coverage of modern mechanisation, such **service providers need to employ more staff**. Usually, at least three staff are required per tractor, particularly:

- Operators (usually two per tractor to work in shifts)
- Logistics: time keepers / land measurers
- Accountants
- Managers (particularly for larger enterprises)

Agricultural mechanisation service providers often operate on a seasonal basis, focusing on land preparation (ploughing) and harvesting. This leads to temporal employment of the related staff. However, modern mechanisation includes the **full range of field operations** and will thus extend the **seasonal employment towards constant employment**.

In addition to employees of service providers, increased mechanisation activities in a geographical area increase the following economic activities with corresponding generate employment opportunities:

- Garages for small repairs and maintenance of machinery (mechanics and welders)
- Protection of the machines in rural area during night (guards)
- Fuel provisioning (petrol stations or informal fuel provisioning)
- Accommodation (hotels) for service providers
- Small shops, restaurants; service sector
- Financial services for the purchase or lease and insurance of machinery (employees of financial institutions, such as credit officers)

Crop production pre-farm employment

Agricultural mechanisation also has effects on the crop production value chain. As it leads to increased productivity and profitability, farmers' demand (and willingness-to-pay) for agricultural inputs will increase, thus leading to more employment in the following areas:

- High quality seeds / seedlings (breeders)
- Agro-chemicals (producers)

- Farm input dealers
- Financial services for smallholder farmers for the purchase of inputs and mechanisation services

Post-farm employment

Agricultural mechanisation also generates economic activities which occur after the farming operations.

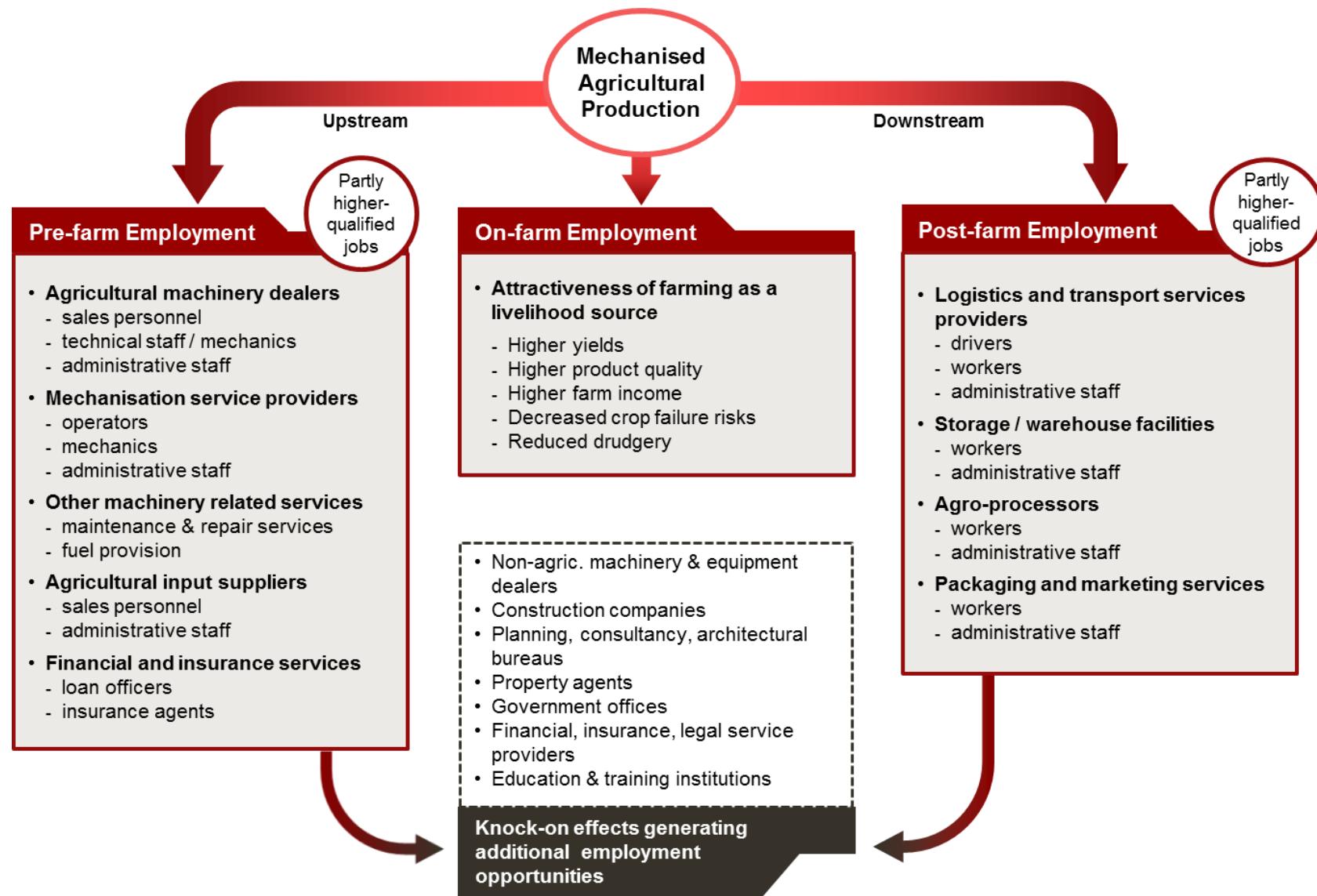
Agricultural mechanisation post-farm employment

Specifically through the use of combine harvesters, crop residues can be marketed as animal feeds, for instance to cattle fatteners. Furthermore, animal husbandry (including dairy production) can be expanded since the utilisation of modern agricultural machinery substitutes the utilisation of livestock as draught animals.

Crop production post-farm employment

Increased crop productivity makes it more attractive for downstream value chain actors to engage in a geographical area, when critical quantities (and qualities) of the respective commodity can be sourced. Commodity traders (transportation services) and aggregators (including warehouses) as well as processors (including packaging and marketing) can then generate additional employment in the rural area.

Direct and indirect employment effects of mechanised agricultural production:



Experiences from Ethiopia's Arsi zone

On-farm employment

Data from Ethiopia show that employing a full range of on-farm mechanisation through service providers can increase smallholders' gross margins by up to 100% compared to the common technology of using draught animals [GIZ, 2016]. Through interviews with rural young people as well as employees of district authorities, the effects of modern mechanisation regarding on-farm employment were confirmed:

- “Through the use of improved inputs and especially modern mechanisation, farming is increasingly seen as a business.”
- “The perception of being a farmer is changing as farming becomes profitable.”
- “Farming can generate even more income than an office job”; “Today, the richest people in the region are farmers, they are the ones with the neat clothes.”
- “If you use good technology and inputs, the yields can support you—and the perception of agriculture can be changed.”
- “As farming becomes ‘scientific’, it is more acceptable for parents that their children who studied return to agriculture.”
- “Even people in the civil service want to invest in agriculture now, because it is easier, less labour intensive.”
- “There is less over-grazing because the number of oxen reduced as they are not needed for ploughing anymore.”
- Youth in 5 Woredas stated they are interested in going back to agriculture when it is mechanised.

Pre-farm employment

- About 735 people are directly employed in agricultural mechanisation service provisioning by 150 mechanisation service provider enterprises that are operating in the Arsi zone (own investigations, 2017).
- “The hotels are fully booked during the ploughing and harvesting seasons.”
- Initiative to establish fuelling station by a service provider (in Digalu Tijo woreda).
- “Small towns such as Itaya [town in Hetosa district] are growing”, which was attributed to increased mechanisation activities.

Post-farm employment

- Three wheat flour mills established during the last five years (which was attributed to increased productivity through improved inputs and mechanisation). Each mill is directly employing 20-25 people; There is a total of 300 flour mills and 10 pasta factories in Ethiopia.
- “People are now generating income from cattle fattening since the cattle is no longer needed for ploughing.”
- “When using combine harvesters, the crop residues can be sold as animal feeds”

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Foot notes

¹ There are different definitions of "youth" or "young people". While the United Nations include people in the age of 15 to 24, the African Youth Charter describes youth as people between 15 and 35. Furthermore, although we deploy the term "young people", it is important to differentiate between different sub-groups among young people. Factors such as gender, level of education, household characteristics, and proximity to markets result in different livelihood opportunities and choices [IDS, 2012].

² This was found for instance in rural areas of Ethiopia (see *Central Statistical Agency (CSA), Key Findings of the 2013 Labour Force Survey, Addis Ababa, March 2014, page 6*; and based on statements of farmers in the project area).

³ While this paper shows the effects of mechanisation of field operations, the positive effects on pre- and post-farm employment could be enhanced by engaging in supporting these activities, e.g. through fostering mechanisation of processing technologies.