Food and Agriculture Organization of the United Nations

RuLIS BRIEF

Adoption of farm inputs, mechanization, irrigation and gender gaps in sub-Saharan Africa: insights from the Rural Livelihoods Information System (RuLIS)

HIGHLIGHTS

→ Data from 21 household surveys display evidence of highly heterogeneous use of agriculture and livestock inputs, mechanization and irrigation among farmers in sub-Saharan Africa.

→ The adoption of agriculture inputs such as improved seeds and inorganic fertilizers is high in countries where national input subsidy programmes are implemented.

→ In most of the surveys considered, the use of agricultural inputs, mechanization and irrigation is higher for non-small scale food producers as compared to small scale food producers.

→ Nigeria and the United Republic of Tanzania show an increasing trend in the use and adoption of modern inputs over time.

Rural Livelihood Information System (RuLIS)

RuLIS is a tool to support policies for reducing rural poverty, jointly developed by the Food and Agriculture Organization of the United Nations (FAO) Statistics Division, the World Bank and the International Fund for Agricultural Development (IFAD). RuLIS brings together harmonized indicators and comparable data across countries and over time on rural incomes, livelihoods and rural development.

INTRODUCTION

Using the RuLIS data, this brief focuses on the observations made in the adoption of agricultural inputs, along with improved technology such as irrigation, and mechanised tools among crop farm households in sub-Saharan Africa. Agricultural inputs include improved seeds, chemicals and inorganic fertilizers, whereas, mechanized tools include crop sprayers, peeling machines, tractors and trailers. Furthermore, the brief looks at the scope of vaccination of animals among farm households, in order to understand the heterogeneiety in livestock health and productivity within the 21 household surveys. The results are represented not only at the national level, but are also disaggregated based on whether the households are classified as small-scale food producers or non-small scale food producers. Small-scale food producer status is defined on the basis of the methodology endorsed by the inter-Agency and Expert Group on Sustainable Development Goals (IAEG-SDG) of the United Nations Statistical Commission. The methodology combines three criteria: households involved in farming that are in the bottom 40 percent of the cumulative distributions of (i) land size (in hectares), (ii) number of livestock (measured in Tropical Livestock Units, TLUs), and (iii) agricultural revenues, are classified as small-scale. The variable used to segregate farmers as small-scale or non-small scale is calculated as long as information on one of the three criteria is available in a given survey.

The recall period of the questions examining the use of agricultural inputs, mechanization, irrigation, and the scope of animal vaccination is consistent across surveys, and is equal to 12 months. For some countries, such as the United Republic of Tanzania, Malawi, and Uganda, the recall period is further disaggregated in two cropping seasons, however, the answers for both the seasons are aggregated before computing the indicators. Therefore, with respect to the recall period, the results represented in this brief are comparable across different countries, and also across time for the same country.

RESULTS

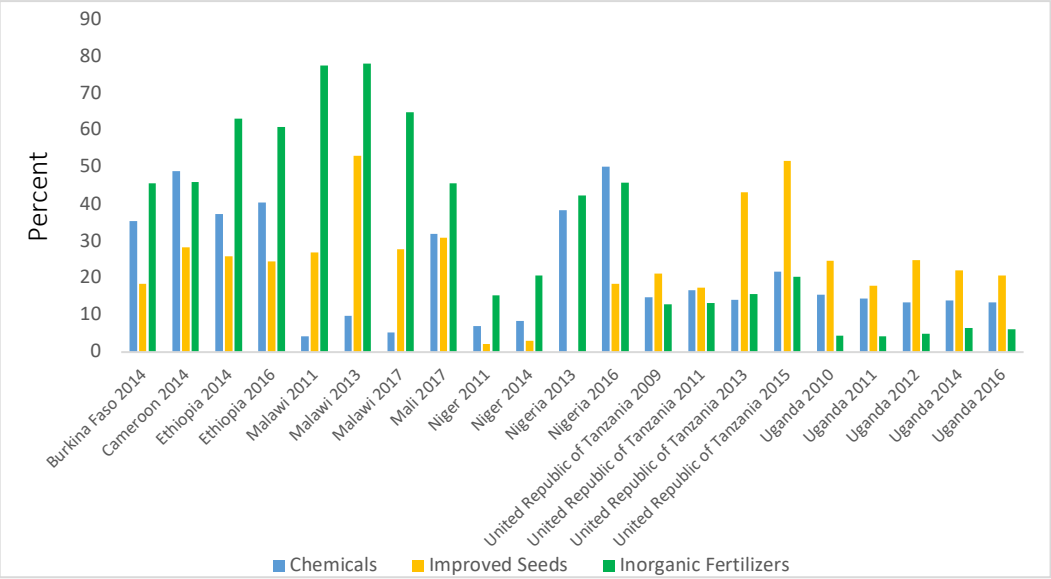
Figure 1 shows the share of crop farm households[1] that have used improved seeds, chemicals and inorganic fertilizers over the survey period.[2] The inputs considered are among the most common inputs farmers rely upon to increase harvest productivity (Sheahan and Barrett, 2016). The use of improved seeds varies significantly among countries, ranging between two percent in Niger in 2011 to 53 percent in Malawi in 2013.

The data also shows considerable variations betweens surveys of the same country in the adoption of these inputs over time. For example, the share of crop farm households in Malawi that used improved seeds doubled between 2011 (27 percent) and 2013 (53 percent), but then dropped in 2017 (29 percent). Conversely, in the United Republic of Tanzania, the adoption of improved seeds more than doubled over six years, increasing from 21 percent in 2009 to 52 percent in 2015.

[1] Households are classified as “crop farm households” if they produce crops in at least one of the harvest seasons during the cropping year and exhibit any related income/expenditure.

[2] The recall period of the countries considered for the survey is 12 months. Furthermore, for some countries, such as the United Republic of Tanzania, Malawi, and Uganda, the recall period is further disaggregated in two cropping seasons.

Figure 1. Share of crop farm households using improved seeds, chemicals and inorganic fertilizers



Source: Rural Livelihoods Information System, 2021.[3]

The use of agro-chemicals, such as herbicides, pesticides and fungicides, is the highest in Cameroon (49 percent) in 2014 and Nigeria (50 percent) in 2016, while it is the lowest in Malawi (4 percent) in 2011. At the same time, no sizeable within-country variation is observed over time relating to the use of agro-chemicals.

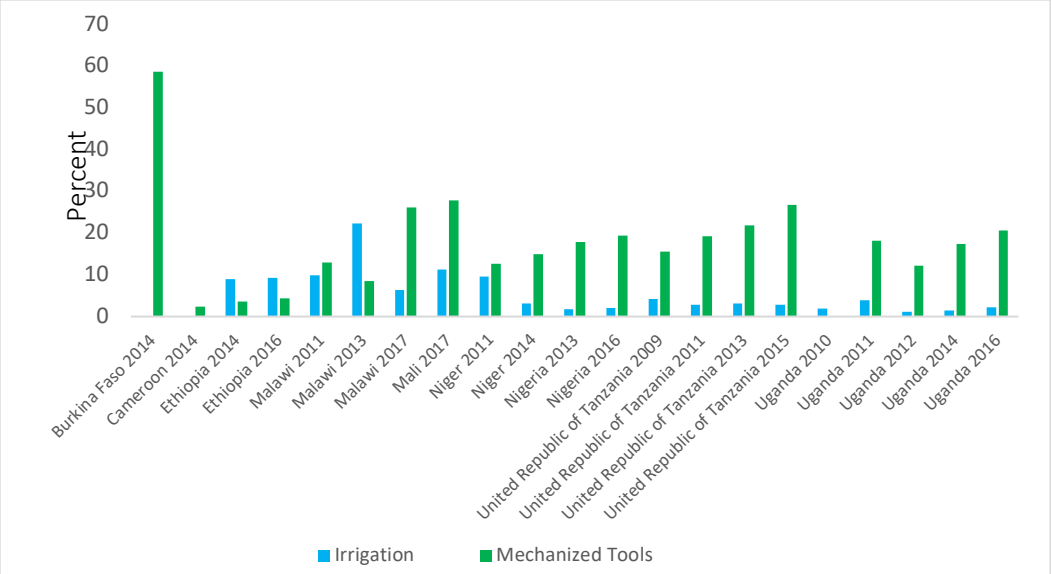
The adoption of inorganic fertilizers is uneven across countries, ranging between four percent in Uganda in 2011 to up to 78 percent in Malawi (2011 and 2013). In Malawi, Niger and the United Republic of Tanzania, the use of inorganic fertilizers varies significantly overtime. For example, in the Niger it increased from 15 percent in 2011 to 21 percent in 2014.

One of the reasons that may explain such variations in the adoption of farm inputs in countries such as Malawi and the United Republic of Tanzania, is the implementation of national interventions such as the Farmer Input Subsidy Program (FISP) of Malawi and the National Agricultural Input Voucher System (NAIVS) of the United Republic of Tanzania. These programmes had the capacity to reach nearly half of the farm population in the country, helping farmers increase the uptake of modern inputs (Masinjila and Lewis, 2018; Duchoslav and Kenamu, 2018). For example, in the United Republic of Tanzania, the population covered by NAIVS saw an increase of 26.4 percent from 2009 to 2015 (Masinjila and Lewis, 2018), which consequently led to a steep rise in the use of fertilizers, improved seeds, and chemicals from 2009 to 2015. Similarly, in Malawi, the population covered by FISP drastically dropped by 27 percent between 2011 and 2017 (Duchoslav and Kenamu, 2018)[4], which consequently led to a steep decline in the use of fertilizers, improved seeds, and chemicals in 2017.

[3] RuLIS is a set of harmonised data from 39 countries (and increasing). The data covers aspects of agricultural livelihoods including crop and livestock production, off-farm and non-farm income activities, households' composition and demographics, agricultural inputs and technology use, access to social protection, time use, shocks and migration, among others. (http://www.fao.org/in-action/rural-livelihoods-dataset-rulis)
[4] The estimates on participation in FISP are based on the Integrated Household Survey (HIS) collected in 2011 and 2017, which is also part of the RuLIS database.

Figure 2 shows the share of households that use technology such as irrigation, as well as mechanized tools.[5] The use of irrigation among crop farmers is highest in Malawi in 2013 (22 percent), followed by Mali (11 percent) in 2017, while it is the lowest in Uganda (one percent) in 2012.

Figure 2. Share of farm households using irrigation or mechanization



Source: RuLIS, 2021.

The use of mechanized tools is highest in Burkina Faso (59 percent) in 2014 followed by Mali in 2017, and the United Republic of Tanzania in 2015, respectively standing at 28 percent, and 27 percent. Conversely, mechanization is lowest in Cameroon (two percent), and Ethiopia (four percent).The main reason for the heterogeniety is due to the use of different local tools specific to each country depending on the type of crop production and the overall development of the agricultural system. In RuLIS, specific agricultural equipments qualify as mechanized tools and are used for the calculation of this indicator. As a result, countries where local tools (that do not qualify as mechanized tools) are more prominent as compared to the mechanized tools included in calculation of this indicator, the share of farm households using mechanization tends to be lower.

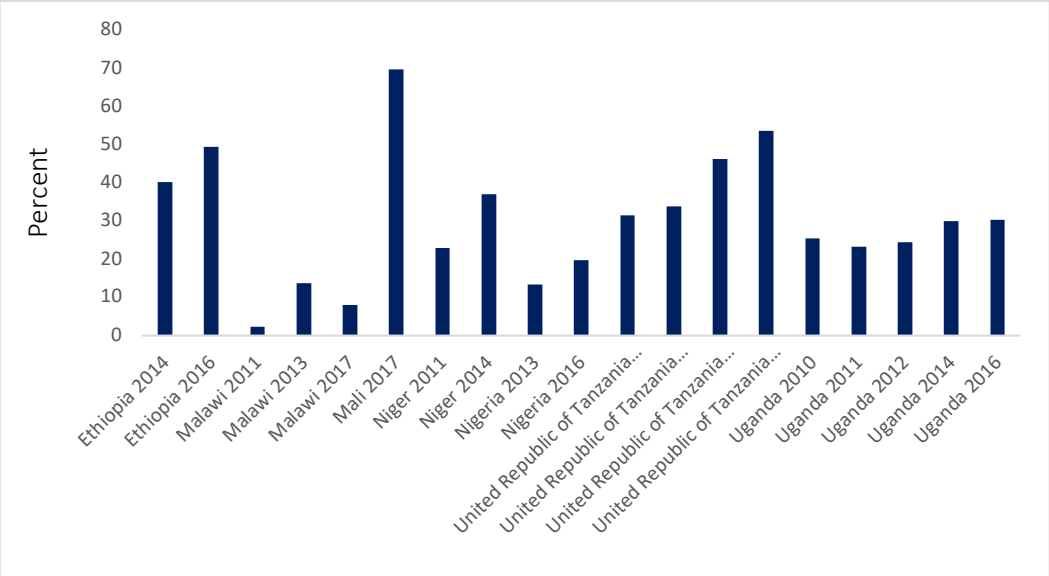
Figure 3 displays the percentage of livestock farm households[6] with at least one animal vaccinated. In developing countries, livestock is relevant to the livelihood of farmers, especially the small ones. It allows them to diversify income sources, improve food security and nutrition, and mitigate the adverse effects of market failures (Arslan *et al*., 2017). Countries like Mali (2017), the United Republic of Tanzania (2015), and Ethiopia (2016) have the highest percentage of vaccinated livestock while Malawi (2011) has the lowest.

In Ethiopia, Niger, Nigeria, and the United Republic of Tanzania the scope of vaccination steadily increased over the years. For example, it almost doubled in Nigeria, increasing from 13 percent in 2013 to 20 percent in 2016. Moreover, in the United Republic of Tanzania, it

[5] Examples of mechanical inputs are crop sprayers, peeling machines, tractors and trailers.
[6] Households are considered as "livestock farm households" if they are involved in livestock activities and exhibit any related income/ expenditure.

increased by two-thirds over six years, ranging between 32 percent in 2009 and 54 percent in 2015. On the other hand, Malawi is an exception where the vaccination coverage peaked at 14 percent in 2013 and then it dropped to 8 percent in 2017.

Figure 3. Percentage of livestock farm households with access to animal vaccination



Source: RuLIS, 2021.

The variation in the scope of vaccination across countries can be explained by the importance of the livestock sector within each country and by national policies adopted to improve livestock health and productivity. In Malawi, livestock holders have on average 0.5 TLU units of livestock (2015)[7], whereas in Nigeria and the United Republic of Tanzania, the value is higher, standing at 5 units (2017) and 4 units (2015) respectively.[8]

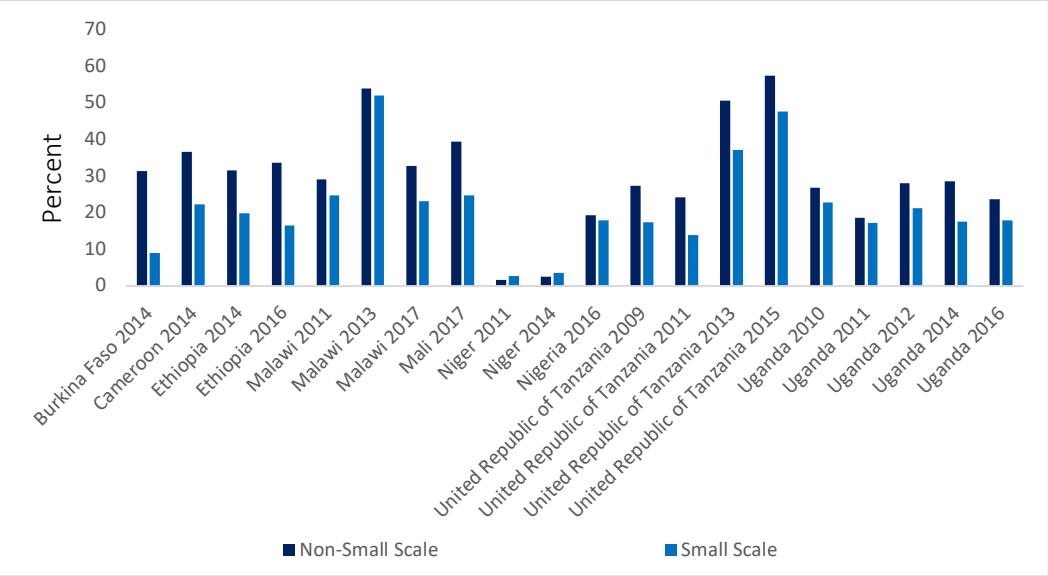
Figure 4 shows the share of crop farm households that use improved seeds, disaggregated by the status of the household as a small-scale or non-small scale food producer. Overall, households classified as small-scale food producers are less likely to use improved seeds for agricultural purposes relative to their non-small scale counterparts. For example, the share of small-scale food producers using improved seeds in Ethiopia is 20 percent in 2014 and 17 percent in 2016, which is well below the values for non-small scale food producers (32 percent and 34 percent respectively). The gap between the two categories is the highest in Burkina Faso in 2014, and it is the lowest in Nigeria in 2016.

There are only two exceptions found among the surveys – Niger 2011 and Niger 2014. In both of these surveys, a higher proportion of small scale food producers use improved seeds as compared to non-small scale food producers. However, the difference between the two categories is only one percent – one of the possible explanations is the initiation of the PAA Africa[9] targeting in Niger. Although the program is aimed at promoting small scale farmers' food

[7] For detailed information on the characterization of livestock systems, please refer to: http://www.fao.org/3/t0828e/T0828E07.htm
[8] ESS, Social Statistics team calculation.
[9] The Purchase from Africans for Africa (PAA Africa) programme is a joint initiative between the Food and Agriculture Organization of the United Nations (FAO), the World Food Programme (WFP) and the governments of Brazil, the United Kingdom, Ethiopia, Malawi, Mozambique, Niger and Senegal to support pilot initiatives of purchasing food locally from small-scale family farmers to supply school feeding programmes. For more information, see http://paa-africa.org

security and access to institutional markets, and enhancing the food security of school pupils through the provision of regular school meals, however, productive support provided by FAO to small scale farmers also consisted of the distribution of inputs such as seeds, fertilisers, agricultural defensives and storage bags[10]. As the program is targetted at small scale farmers, it is indeed possible to expect a higher share of small scale farmer households using improved seeds as compared to the non-small scale farmer households.

Figure 4. Share of crop farm households using improved seeds



Source: RuLIS, 2021.

Figure 4 also observes that the difference in the share of crop farm households using improved seeds between small-scale and non-small scale food producers is consistent across time for most countries surveyed for more than one year. For example, in Ethiopia, the difference between the groups was 12 percent in 2014, and 17 percent in 2016.

By definition, small-scale food producers own small areas of land, very few livestock in TLUs, and make low agricultural revenues. Low income combined with the lack of physical assets, diminishes their risk-bearing abilities, and hence, their reluctance to invest in untried technologies, including improved seed (Langyintuo, 2020). Lack of knowledge of the availability of ecologically adaptable varieties is another reason for their low adoption rates. There are a number of new and unfamiliar varieties that are released in the market for which there is inadequate awareness among farmers regarding the types of varieties and the economic benefits of each. The presence of some fake varieties of improved seeds in the market further deteriorates farmer confidence in improved seeds leading to a lower adoption rate. (Langyintuo, 2020). Unfortunately, the coverage of extension services that provide advice to farmers is weak and sometimes skewed towards the relatively richer farmers (Langyintuo

[10] 'PAA Africa targeting in Niger' by Rosana Pereira de Miranda, Israel Klug and Amadou Diop, FAO.

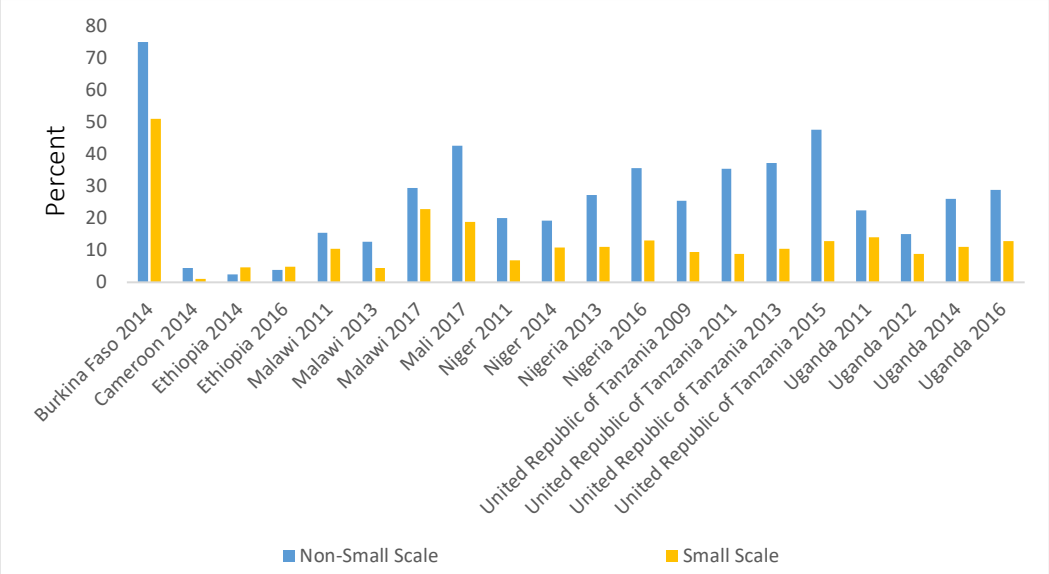
and Setimela 2007). Households classified as small scale food producers are also less likely to use chemicals, and inorganic fertilizers for agricultural purposes relative to their non-small scale counterparts[11].

Most of the farmers in Africa import chemicals and fertilizers which often increases the price of these inputs several times above output prices due to currency devaluation (Langyintuo and Setimela, 2007). Moreover, the slow emergence of the private sector and consequent lack of a vibrant market results in uncompetitive prices of chemicals and fertilizers (World Bank, 2006). Prices are further increased by poor road infrastructure and the cost of finance. Low incomes, high prices of fertilizers and chemicals, the incapacity of small scale farmers to seek financial support along with the risk of fertiliser/chemical use are possible explanations for the low adoptions rates of small scale farmer households.

Similar to agricultural inputs, Figure 5 shows that small scale food producers are less likely to employ mechanized tools to improve the productivity of agricultural activities in most of the surveys considered. The difference between the two categories is the highest in Burkina Faso (2014) and the United Republic of Tanzania (2015), respectively 75 percent and 48 percent of the non-small scale food producers use mechanical inputs as opposed to 51 percent and 13 percent of small scale farmer households. On the other hand, the difference is the lowest in Cameroon in 2014 (3.4 percent). Ethiopia is an exception, where the use of mechanization is substantially the same when comparing the two groups.

In the United Republic of Tanzania, the gap between the small-scale and non-small scale food producers has gradually food profucers in the country has increased two-fold - from 25 percent in 2009 to 48 percent in 2015; while during the same period, the small scale food producers experience a marginal rise from 10 percent to 13 percent.

Figure 5. Share of farm households using mechanized tools



Source: RuLIS, 2021.

[11] Please refer to Annex A for the results.

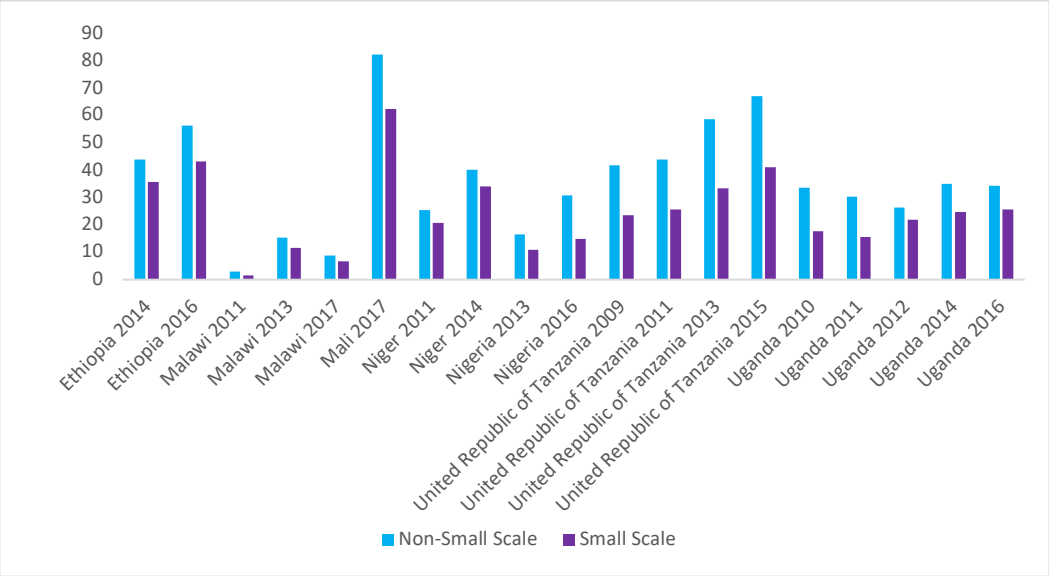
As previously discussed, small-scale food producers tend to be resource-poor with correspondingly low incomes and low savings. Hence, they are more likely to put pressure on natural resources which results in their consequent degradation. Low levels of disposable income makes it difficult for the small-scale food producers to purchase mechanization inputs. As a result, land and labor productivity remain at low levels. This implies that there is a continuing cycle of poverty from which is difficult to escape (Sims and Kienzle, 2016). There is also a parallel cycle of pressure on natural resources (especially soil and water), which leads to the same unfortunate end, increased poverty. This helps in explaining the consistent gap between the small-scale and non-small scale food producers over time in most of the countries. A similar result can be observed for the use of irrigation systems.[12]

Figure 6 shows the percentage of livestock farm households with at least one animal vaccinated, disaggregated by the status of the household as a small scale or non-small scale farmer. With no exceptions, small scale food producers are less likely to have atleast one animal vaccinated when compared to their non-small scale counterparts. The difference between the two categories was the highest in the United Republic of Tanzania in 2015 (26 percent), followed by Mali in 2017 (20 percent). On the other hand, in Malawi, the gap between the two groups has been substantially low – 1.4 percent in 2011, 4 percent in 2013, and 2 percent in 2017.

Over the years, the difference between the two groups has steadily increased for Ethiopia, Niger, Nigeria, and the United Republic of Tanzania. For example, in Ethiopia, the gap increased from 8 percent in 2014 to 13 percent in 2016. Similarly, in Niger, the gap increased from 4.7 precent in 2011 to 6 percent in 2014. However, over the years, there is no clear pattern observed for the difference between the two groups in Malawi and Uganda. For example, in Uganda, the gap initially decreased between 2010 (16 percent) and 2012 (4.4 percent), however, there was a sudden increase to 11 percent in 2014 which was again followed by a marginal decrease in 2016 (8.8 percent).

[12] Please refer to Annex B for the results.

Figure 6. Percentage of livestock farm households with at least one animal vaccinated



Source: RuLIS, 2021.

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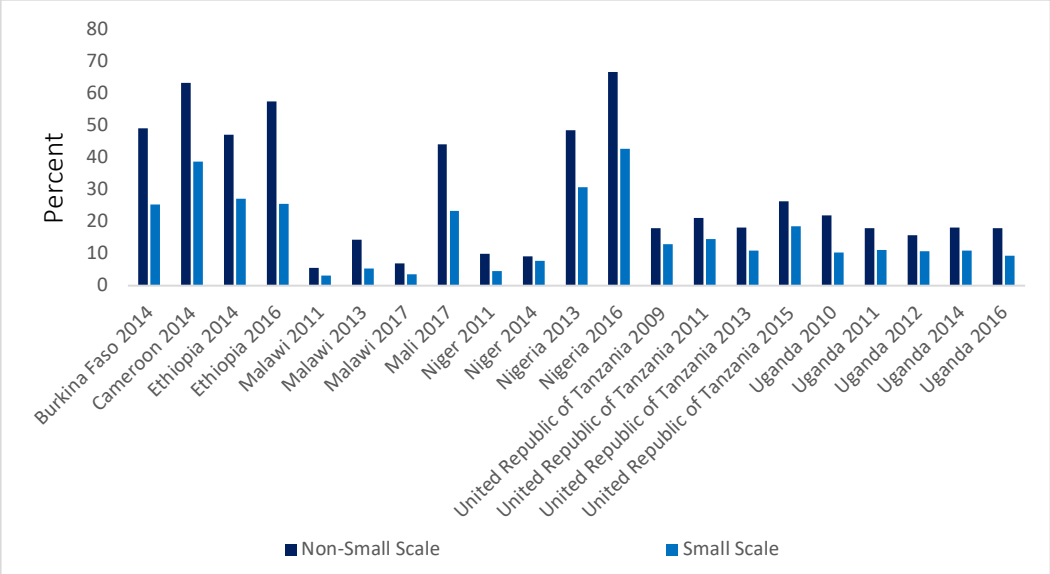
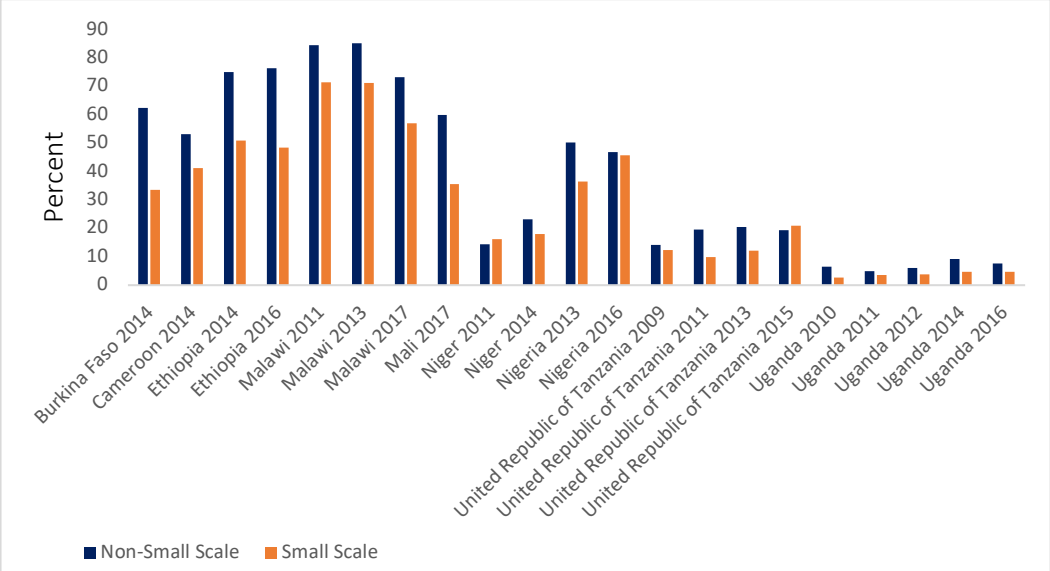
ANNEX

A. 1. Share of crop farm households using chemicals, disaggregated by the status of the household as a small scale or non-small scale food producers



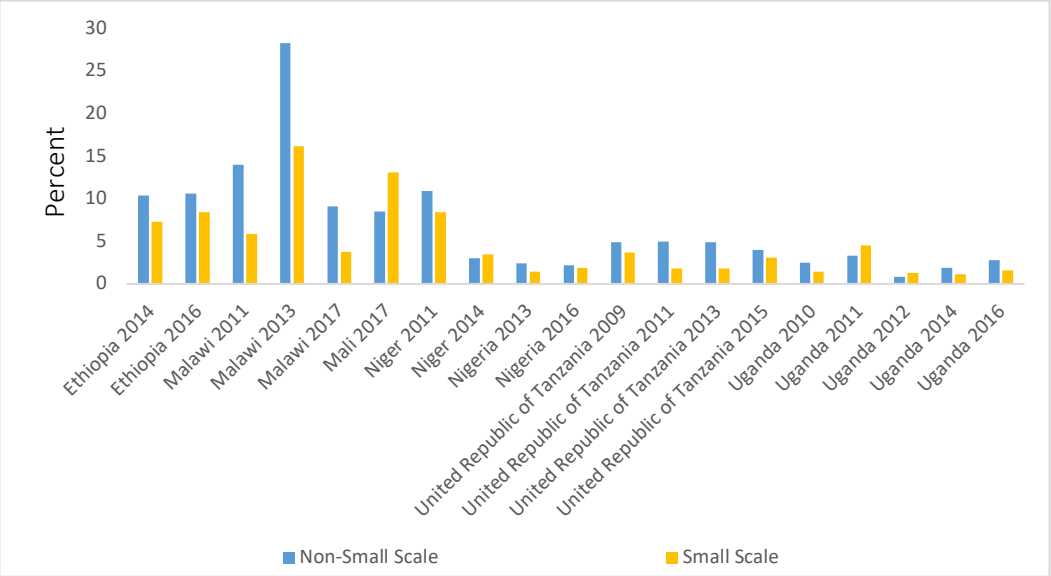
Source: RuLIS, 2021.

A. 2. Share of crop farm households using inorganic fertilizers, disaggregated by the status of the household as a small scale or non-small scale food producers



Source: RuLIS, 2021.

B. 1. Share of crop farm households using irrigation, disaggregated by the status of the household as a small scale or non-small scale food producers



Source: RuLIS, 2021.

The **Rural Livelihoods Information System (RuLIS)** is a set of harmonized household- and individual-level data and indicators on different aspects of livelihoods, including crops and livestock production, off-farm and non-farm income generating activities, households' composition and demographics, agricultural inputs, technology use, access to social protection, time use, shocks and migration. RuLIS currently includes information from 39 countries, with increasing data coverage in time and space as more micro-data becomes available. RuLIS aims to provide critical information for understanding medium- and long- term trends in the structural transformation of agriculture and rural economies; and for the design of policies that promote and accompany social and economic transformation and enhancement. RuLIS provides data on a wide set of indicators, cross-tabulated by rural vs urban areas, gender and other variables; and standardized variables at the household and individual level.[13]

[13] For further information on RuLIS, and for accessing the data and indicators on the platform, please refer to ttp://www.fao.org/in-action/rural-livelihoods-dataset-rulis

This analytical brief was proposed and initially worked on by Alessandro Romeo, and further formulated by Yonca Gurbuzer and Nidhi Chaudhary. The authors would like to thank all reviewers for their valuable inputs and observations. The Social Statistics Team is part of FAO Statistics Division and it is led by Piero Conforti.

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