INCATA: Linked Farms and Enterprises for Inclusive Agricultural Transformation in Africa and Asia

Complete Report: LSMS-ISA Analyses

January, 2025

RIMISP
Centro Latinoamericano para el Desarrollo Rural

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Research questions and about this report

Working with: MICHIGAN STATE UNIVERSITY · EGERTON UNIVERSITY · IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

- **INCATA's Objective** is to study the relationship between commercial small-scale producers (cSSPs) and micro, small, and medium enterprises (MSME) in the hidden middle of agrifood value chains to explain how it underpins and contributes to an inclusive agricultural transformation.
- INCATA Project aims to answer:
  - 1) What kickstart the dynamic of commercialization and engagement with MSMEs in the hidden middle?
  - 2) Which, how, and why do some cSSPs and some MSMEs move along in the transformation process while others don't?
  - 3) To what degree does increasing commercialization and development of MSMEs translate into poverty reduction and women's economic empowerment (WEE)?
  - 4) What investments and policies have the potential to accelerate the symbiotic co-development of cSSPs and MSMEs, and what are the inclusion effects of that dynamic?
- Through two workstreams:
  - LSMS-ISA data analyses for six countries
  - Horticulture and aquaculture value chain analyses in two countries (Kenya and Odisha in India).

This document is the complete report of the complete LSMS-ISA analyses for six Sub-Saharan African countries aiming to provide evidence to respond to questions 1 to 3.

Main Messages

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I. Determinants of Commercialization Intensity

- Farmers who purchase agricultural inputs consistently sell more of their production
- Bigger farms sell a greater proportion of their production

II. Crop Choices and Diversification

- Crop diversified SSPs obtain more income from crops per hectare

III. cSSP and MSME symbiosis

- In areas with greater economic activity between cSSPs and MSMEs, farmers sell a larger share of their production.
- cSSPs in these more dynamic areas grow more cash crops and hire more labor per hectare.

IV. Inclusion Opportunities for SSPs

- Higher commercialization is associated with more well-being and better inclusion outcomes (WEE, resilience, poverty, food security). This is increased for cSSPs in highly clustered areas.

V. Labor Patterns and Time Allocation

- SSPs account for over 64% of all hired agricultural labor. cSSPs employ 1.6 to 5.5 times more hired labor than non - selling farmers.
- Evidence shows that hired farm labor can free up family labor for other enterprises.

Main Messages

I) Determinants of Commercialization Intensity in cSSPs

- Farm size has opposite effects on commercialization: while larger farms produce more kilograms per hectare and sell a greater proportion of their production, they generally achieve lower sales value per hectare.
- Input market participation is a key driver of commercialization - farmers who purchase agricultural inputs consistently sell more of their production.
- Input intensification (more kilograms of fertilizer applied and days of hired labor generated per hectare) is associated with a greater production per hectare.

II) Crop Choices and Diversification

- Crop diversification has complex effects. While it may reduce the sales proportion in some countries, it generally increases the sales value per hectare.

Main Messages

III) cSSP and MSME symbiosis

- In areas with more economic activity between commercial SSPs and downstream MSMEs (more revenue and quantity of value chain actors per capita), SSPs sell a more significant proportion of their production, have more sales value (local currency) and more harvested quantities (kilograms) per hectare.

- These dynamic areas also show a greater likelihood of commercial SSPs growing cash crops and, in Tanzania and Ghana, more hired labor days per hectare (labor intensive).

IV) Inclusion Opportunities for SSPs

- Higher commercialization is associated with better inclusion outcomes (food security, WEE, resilience, off-farm employment, and multidimensional poverty), particularly in lower-income countries (Ethiopia and Malawi).

- Commercial farmers in areas with more cSSP-MSME show better outcomes in terms of multidimensional poverty reduction and resilience, even when clustering or commercialization alone might show negative associations.

- In highly clustered areas (more economic activity between cSSPs and MSMEs), both selling and non-selling farmers show higher probabilities of not being food insecure and having adequate food consumption.

- Participation in input markets and growing cash crops consistently correlates with higher inclusion scores across countries.

Main Messages

V) Labor Patterns and Time Allocation

- Small-scale producers (SSPs) account for over 64% of all hired agricultural labor.
- Commercialized SSPs employ 1.6 to 5.5 times more hired labor than subsistence farmers.
- In Tanzania and Nigeria (middle- and high-income countries), cSSPs who operate MSMEs hire more days of external labor overall than non-MSME cSSPs. cSSPs are more family-labor intensive.
- The relationship between farming and non-farm enterprises varies by country, but there's evidence that hired farm labor can free up family labor for other enterprises in some contexts.

I. SSPs Commercialization

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Determinants of Proportion of Production Sold among Producer SSPs

- Table 1 summarizes results from fixed effects panel regressions where the dependent variable is proportion of production sold (Kg Sold / Harvested), conditional on producing anything.
- In all countries, there is a positive association between purchasing inputs and an increased proportion of sales.
- Full regression outputs are available in Annex, Table 1.

Factors	Ethiopia	Malawi	Uganda	Tanzania	Nigeria	Ghana
Farm Size (cultivated ha)	↑	↑	↑	○	○	↑
Production (kg harvested)	○	○	↑	↑	↑	↑
Crop Diversification	○	↑	○	○	○	↓
Grows Tree/Industrial Crops	↑	↑	↑	↑	↑	↑
Grows Cereals	↓	↓	○	↓	○	↓
Grows Roots & Tubers / Grain Legumes	↓	↑	↓	↓	↓	↓
Grows Oilseeds / Fruits & Vegetables	○	○	○	↑	↑	○
Input Purchase	↑	↑	↑	↑	↑	↑
Input Intensification	○	○	-	○	○	-
Family Labor (hours/hectare)	↑	○	○	○	○	○
Household Size	○	○	↓	↓	↓	↓

Legend:

↑ - Positive correlation ↓ - Negative correlation ○ - No significant correlation - - No data available

Table 1. Factors associated with Proportion of Production Sold in all countries. Other controls omitted.

I. SSPs Commercialization

Determinants of SSPs' Production

- **On average, larger farms present a lower quantity produced per hectare.**
- **Input market participation and intensification are crucial: buying and being input-intensive is associated with more harvest (Kg) per hectare.** (Annex, Table 15)

Factors	Ethiopia	Malawi	Uganda	Tanzania	Nigeria	Ghana
Input Purchase	↓	↑	○	○	○	↑
Input Usage	↑	○	↑	↑	↑	↑
Crop Diversification	○	↑	○	○	○	↓
Farm Size (ha)	↓	↓	↓	↓	↓	↓

Legend:

↑ - Positive significant correlation ↓ - Negative significant correlation ○ - No significant correlation - - No data available

Table 2. Factors associated with Quantity Harvested (Kg/Ha). Household, farm and meso controls omitted.

Crops Grown and Diversification

- Cash crops (tree crops and industrial crops) are mainly grown for selling, while growing traditional food crops typically shows lower sales proportion values than average. (Annex, Table 1).
- Farmers who grow staple crops sell a portion of them but in a lower proportion than cash crop growers on average.
- **Crop diversification** (1 = perfect diversification) shows complex effects: while it may reduce the proportion of marketed harvests in some countries, it **is associated with higher value per hectare of crop sold.** (Figure 1 and Annex, Table 2)

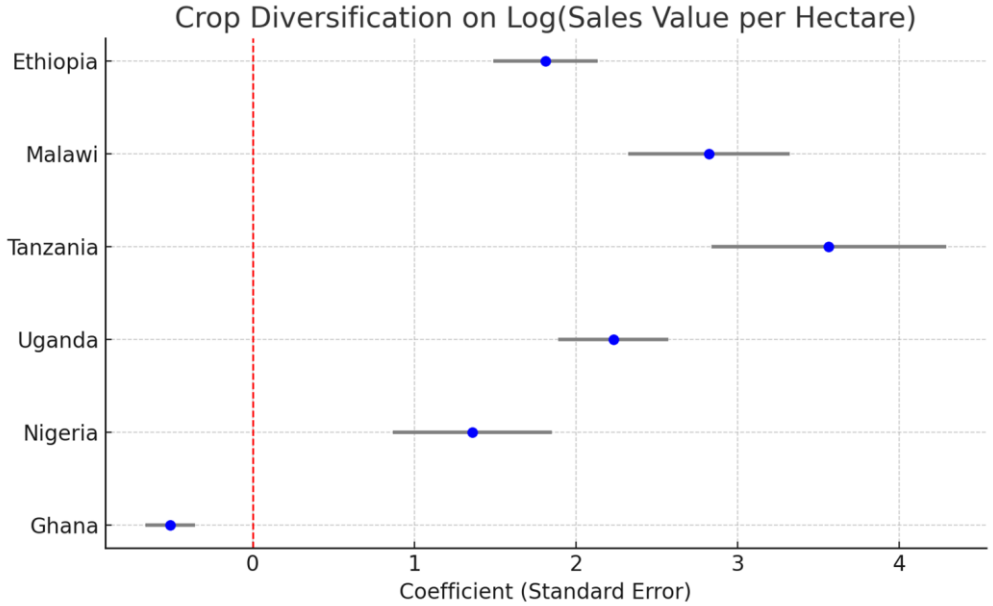

Figure 1. Crop Diversification on Sales Value (Local Curreny) per Hectare.

Clustering of cSSPs and MSMEs

We analyze the results of a cluster index, which measures how active and interconnected agricultural businesses are in an area. It combines several important factors into a single score from 0 to 1:

- How much land is used by commercial farmers (normalized by total regional farmland area)
- The number and aggregate revenue of downstream agricultural MSMEs (like retailers and food manufacturers) per capita
- The quantity (Kg.) of crops being sold per capita
- The number of traders buying from commercial smallholder producers per capita

A higher score (closer to 1) suggests a more **dynamic agricultural economy where farmers, traders, and MSMEs work together more actively.** A lower score (closer to 0) indicates less commercial agricultural activity and fewer connections between these market players.

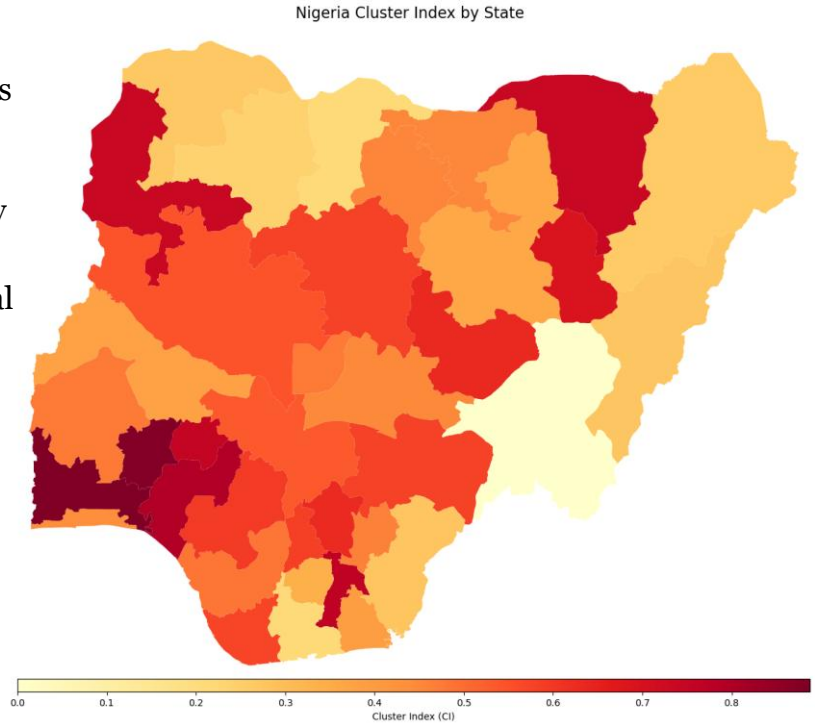

Figure 2. Choropleth map of Cluster Index for Nigeria by state, 2018.

Clustering and Commercialization

- **Higher Commercialization:** In **areas with a higher cluster index**, the average proportion of production sold is, on average, higher, except for Malawi, Uganda , and Ghana. This association is stronger in the middle- and high-income strata (Tanzania, Nigeria). (Annex, Table 13)

- **More Sales Income:** Same - wise, **being in a district/region with high clustering is associated with higher sales value per hectare across all strata** (Except Uganda). (Annex, Table 14)

- **Greater Production:** In Ethiopia (lower stratum), Uganda (middle stratum) , Nigeria, and Ghana (high per-capita income), a higher clustering is associated with more kilograms of crops harvested per hectare. (Annex, Table 15)

- **Input Market Participation:** **SSPs who purchase inputs** like fertilizer, pesticides, external labor, and seeds or have agricultural credit **are associated with more sales value and production per hectare.**

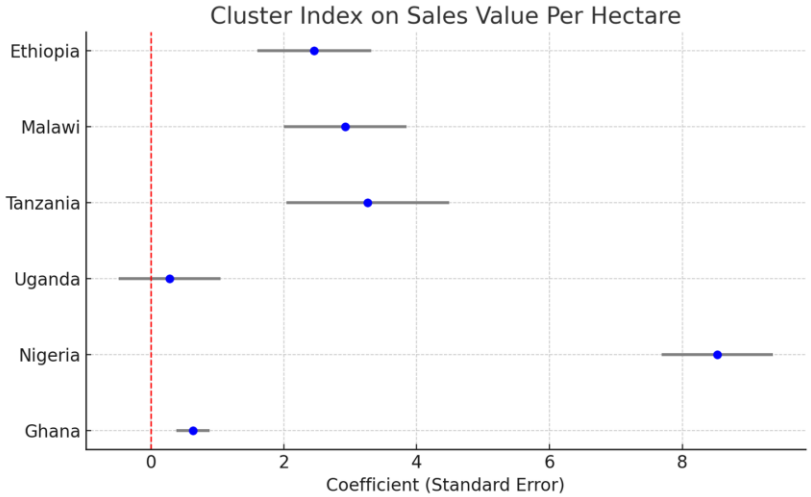

Figure 3. Association of Cluster Index on Sales Value (Local Currency) Per Hectare

III. cSSP and MSME Symbiosis

Clustering and Growing Cash Crops, Input Intensification

- **Growing Cash Crops:** being a **selling SSP (cSSP)** is associated with a **higher probability** of growing higher-value cash crops (Ethiopia, Malawi, Uganda, Tanzania, Nigeria and Ghana). Being a cSSP in a **highly clustered area further boosts these probabilities (Ethiopia, Malawi, Uganda, and Ghana, with** weak evidence in Tanzania). Cash Crop growers are also more likely to participate in the input markets. (Annex, Table 16)

- **Input Intensification:** in **Ghana and Tanzania,** being a selling SSP (cSSP) in an area with high clustering is positively associated with more hired labor employed per hectare (Annex, Table 10). No apparent association with fertilizer intensification.

Figure 4. Interaction Term of cSSP (binary) and High Cluster Index (continuous) on Likelihood of Growing Cash Crops

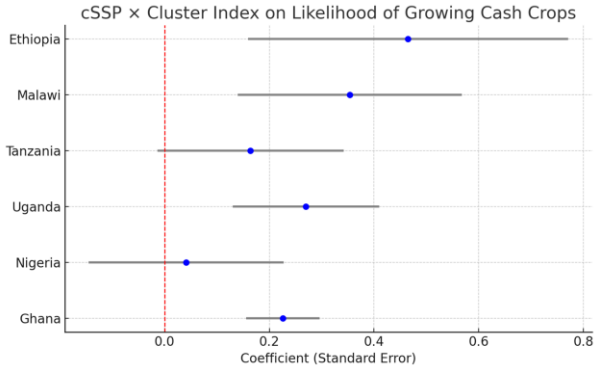

Figure 5. Interaction Term of cSSP and High Cluster Index on Hired Labor Days per Hectare

Inclusion Opportunities for SSPs

- We define an **inclusion score (0 to 1),** where we track five dimensions: food security, resilience against shocks, off-farm work, multidimensional poverty and women's economic empowerment (each assigned a weight of 0.2 given a certain threshold).
- Positive correlation between income strata and percentage of households having off-farm employment, increased resilience, better food consumption, and lower multidimensional poverty (Malawi, a low-income country, has the highest % of non-poverty).
- In most cases, low-income countries have greater levels of empowerment.

Figure 6. Time average values of the five inclusion dimensions by country (higher is better).

Inclusion Score Results by Country *(Re-scaled to 0-100)*

		Average Inclusion Score (0-100)	Distribution of Producers by Number of Indicators Above the "Sufficient" Threshold					
			0 out of 5	1 out of 5	2 out of 5	3 out of 5	4 out of 5	5 out of 5
Low-income stratum	Malawi	62	2%	8%	20%	29%	30%	11%
	Ethiopia	47	1%	16%	41%	32%	9%	1%
Medium-income stratum	Tanzania	61	2%	10%	20%	30%	26%	12%
	Uganda	69	1%	3%	13%	34%	36%	14%
High-income stratum	Nigeria	61	3%	10%	18%	28%	30%	11%

Table 2. Average inclusion score and distribution of producers by number of sufficient indicators by country, latest wave available.
Note: For visual purposes, we re-scaled the inclusion score to values ranging from 0 to 100.

Inclusion Score and Commercialization

- **Commercialization:** In Ethiopia, Malawi (low per-capita income) , and Tanzania (middle stratum), SSPs who sell a higher portion of their produce show, on average, higher inclusion scores. (Annex, Table 3)

- **Cash Crops Growers:** In Ethiopia, Malawi, and Tanzania, those who grow cash crops are also associated with higher scores on average. (Annex, Table 3)

- **Other Characteristics:** Those who score higher are usually wealthier, present larger household sizes, have more years of education in their workforce, and participate in at least one input market (buy fertilizer, pesticides, hire labor, have agricultural credit, and/or purchase seeds).

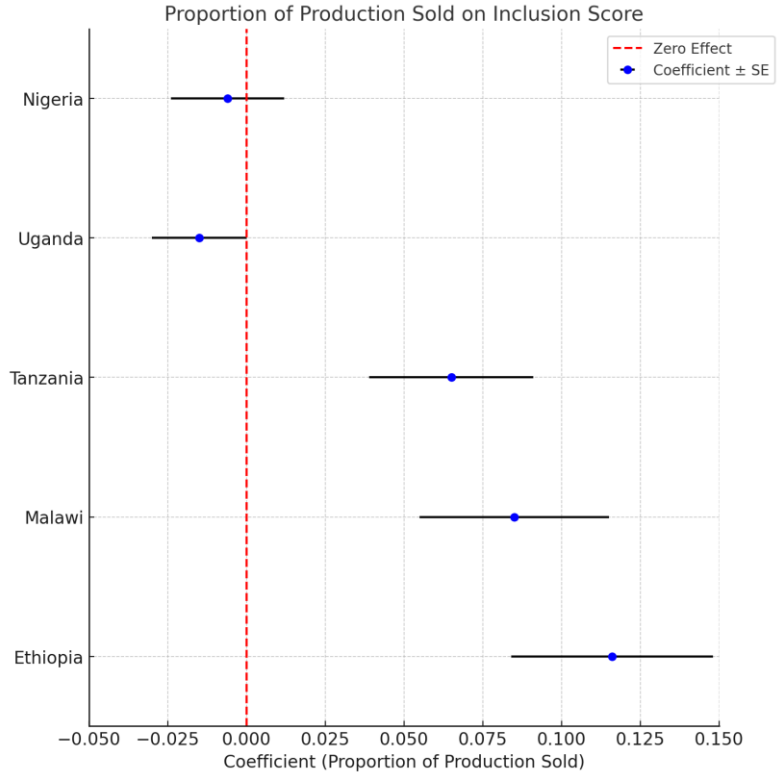

Figure 7. Association of Proportion of Production Sold on Inclusion Score

Commercialization Intensity and Inclusion Sufficiency

- *We define a household as "sufficient" in our inclusion indicators if it meets at least 4 of the criteria.* *(More details about these thresholds are contained in the appendix at the end of this report)*
- In low per-capita income countries: Malawi, being in the lowest and highest tertile of commercialization is associated with a positive likelihood of being sufficient. In Ethiopia, this is true for the highest tertile. (Annex, Table 4)
- In the middle income countries (Uganda and Tanzania) we see no apparent association. (Annex, Table 4)
- In **Nigeria,** a high per-capita income country, we see a **positive likelihood for the low and middle tertiles of commercialization.** (Annex, Table 4)

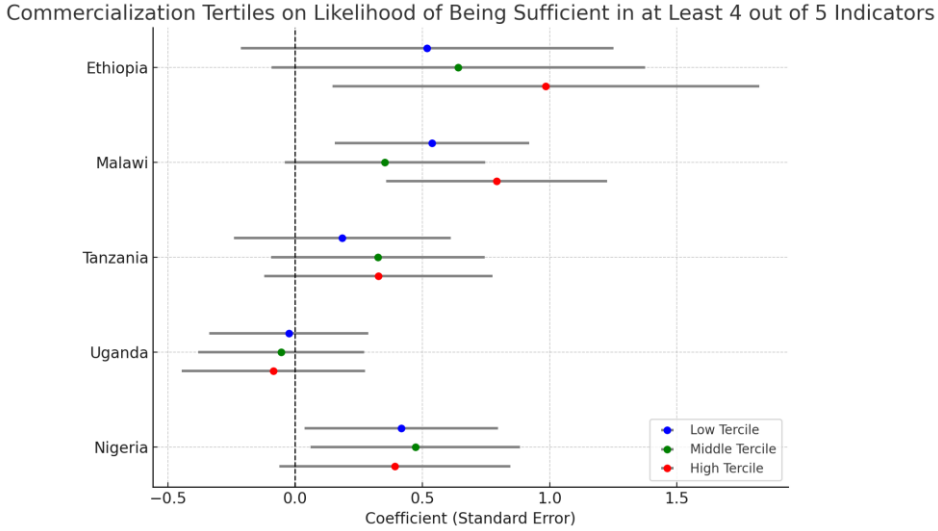

Figure 8. Commercialization Tertiles on Likelihood of Being Sufficient in at least 4 of our 5 inclusion indicators. Odds Ratios presented.

Input and Output Markets and Food Security, Women's Empowerment

- **In Ethiopia and Tanzania,** SSPs in the highest tertile of commercialization present a **positive likelihood of being adequate in food consumption** (as per WFP). (Annex, Table 7).
- **In all countries** except for Ghana and Uganda, being on **any commercialization tertile** is positively associated with **greater likelihood of being empowered.** (Annex, Table 8).
- **Input market participation** (buying or using agricultural inputs) is also positively associated with both outcomes on all countries.

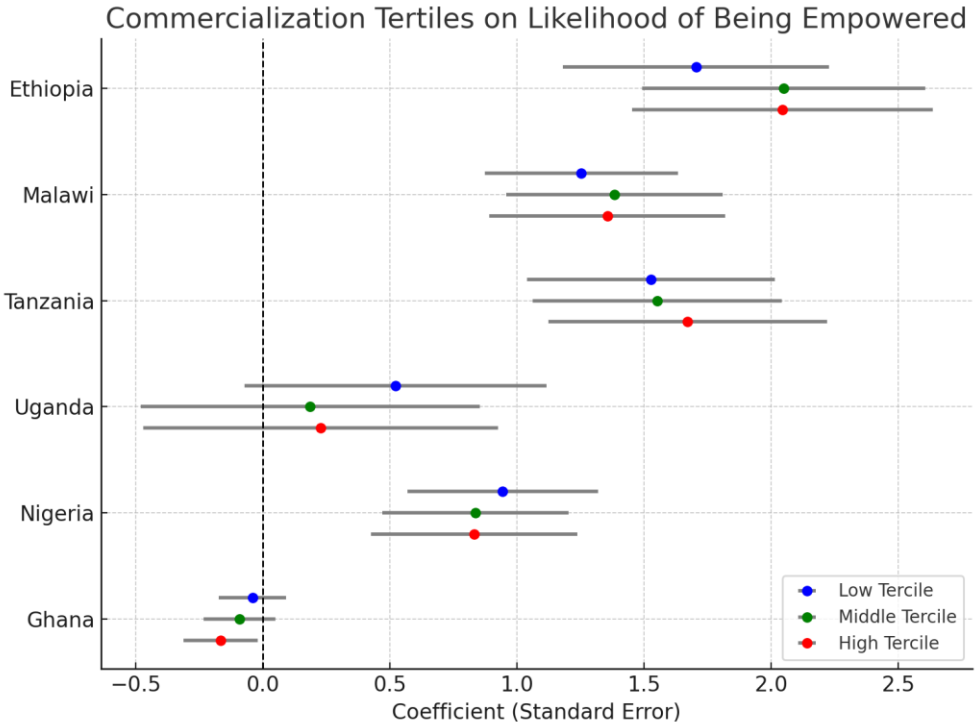

Figure 9. Commercialization Tertiles on Likelihood of Being Empowered (A-WEAI Methodology).

Clustering and being food consumption adequate, lifting SSPs out of Food Insecurity

- **Clustering on likelihood of not being food insecure:** In Malawi and Tanzania, a high clustering is associated with less likelihood of being food insecure. Weak evidence in favor of Uganda. (Annex, Table 7A).

- **Likelihood of being adequate in food consumption:** In **areas with a higher cluster index**, there is a greater probability of an SSP household being adequate in food consumption as evidenced in Tanzania. Weak evidence for Malawi but likely to have positive association as well. (Annex, Table 7)

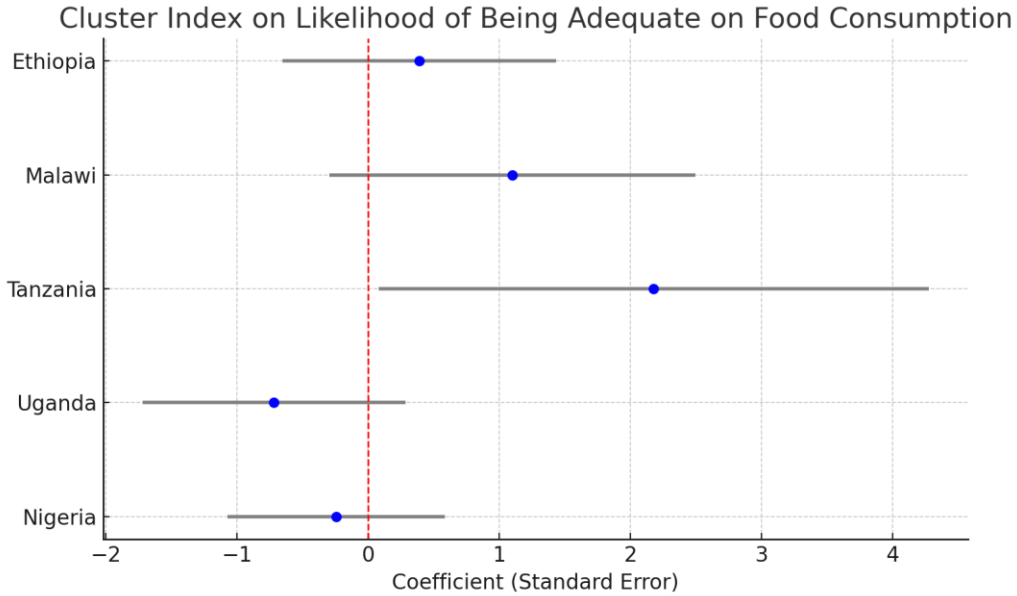

Figure 10. Association of Cluster Index and Likelihood of Being Food Secure (WFP Methodology)

Clustering and Commercialization on Multidimensional Poverty

In Nigeria and Ethiopia, there's an interesting interaction:

- In **Ethiopia**, areas with higher clustering index show a positive probability of being multidimensionally poor for subsistence SSPs, but **commercial farmers in highly clustered areas actually show a negative association with being multidimensionally poor.**
- In **Nigeria**, while commercialization shows a positive association with poverty risk, **commercial farmers in highly clustered areas show a lower probability of being multidimensionally poor.**
- In Malawi, Uganda, and Tanzania, the data does not reveal statistically significant associations between either commercialization or clustering and multidimensional poverty. (Annex, Table 6)

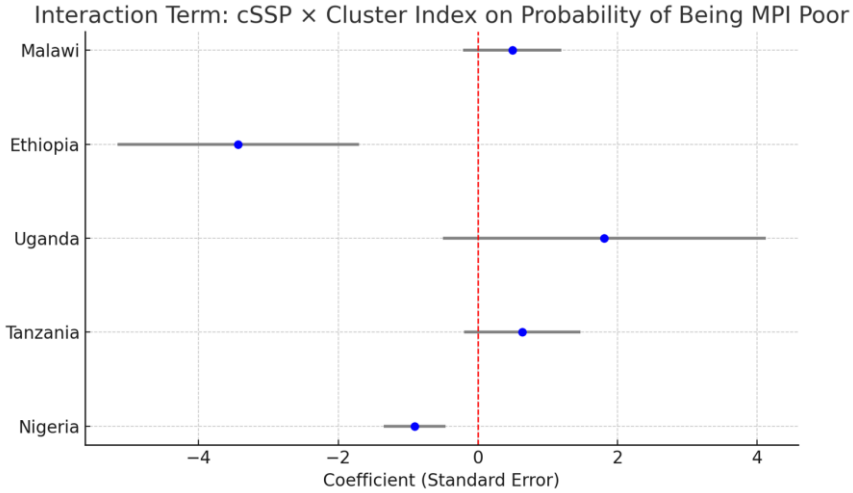

Figure 11. Association of being a cSSP in High Cluster Index Area and Probability of being Multidimensionally Poor.

Clustering and Commercialization on Resilience Capacity Index

In Uganda and Tanzania, we observe notable relationships between clustering, commercialization, and resilience:

- While commercialization and clustering individually show negative associations with resilience, **commercial farmers in highly clustered areas show positive associations with resilience.**

In Nigeria, commercialization shows a negative association with resilience

In Malawi and Ethiopia, the data does not reveal statistically significant associations between these factors and resilience. (Annex, Table 8A)

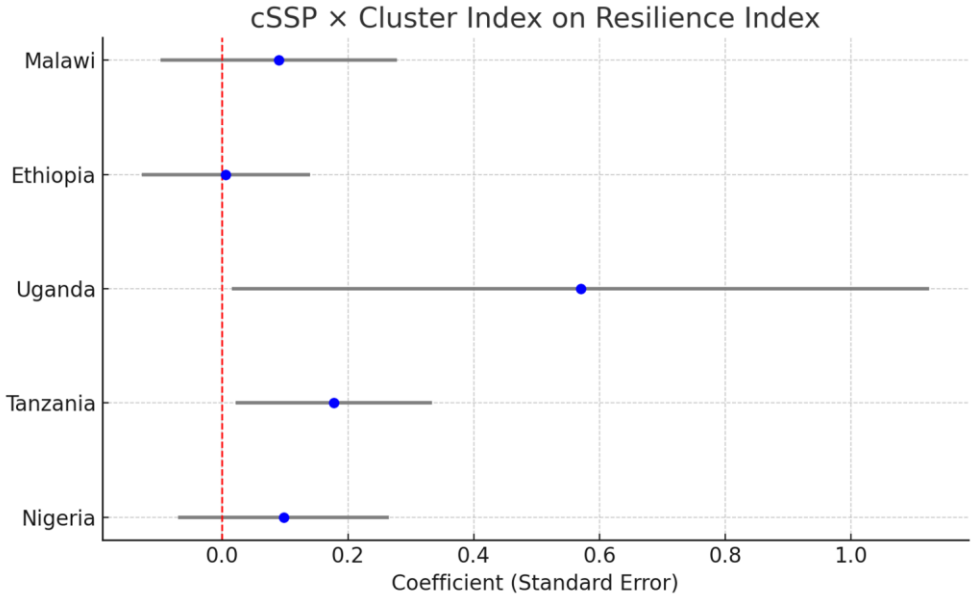

Figure 12. Association of being a cSSP in High Cluster Index Area and Resilience Index.

SSPs are responsible for over 64% of all hired labor

- Hired labor is measured in days of work on the farm generated by producers for planting and harvesting activities. In middle— and high-income countries, commercial SSPs are responsible for over half of the days of work generated.

Table 3. Days of hired labor attributed to each type of producer (%). Calculated over all available waves

Per-capita income Stratum	Low	Low	Middle	Middle	High
Type	**Ethiopia**	**Malawi**	**Tanzania**	**Uganda**	**Nigeria**
Years of data available	2011, 2013, 2015, 2018	2010, 2013, 2016, 2019	2012, 2014, 2020	2010, 2011, 2013	2012, 2015, 2018
cSSPs	58	39	55	62	52
Non-selling SSPs	24	25	10	13	12
Non-SSPs	18	37	35	25	36

V. Hired and Family Labor Analyses

Commercial SSPs demand more hired and own-family labor than non-selling producers

cSSPs generate more agricultural labor opportunities compared to subsistence producers, measured as days of hired labor generated across planting, weeding, fertilizing, harvesting , and threshing activities per season:

- **Low-income countries:** cSSPs generate 1.6 (Malawi) to 2.4 (Ethiopia) times more hired labor days than subsistence SSPs
- **Middle-income countries:** cSSPs employ 4.7 (Uganda) to 5.5 (Tanzania) times more hired labor days
- In Tanzania and Nigeria, **cSSPs who operate MSMEs hire more days of hired labor** overall than non-MSME cSSPs, thus generating more on-farm labor work opportunities through which wages can be earned.

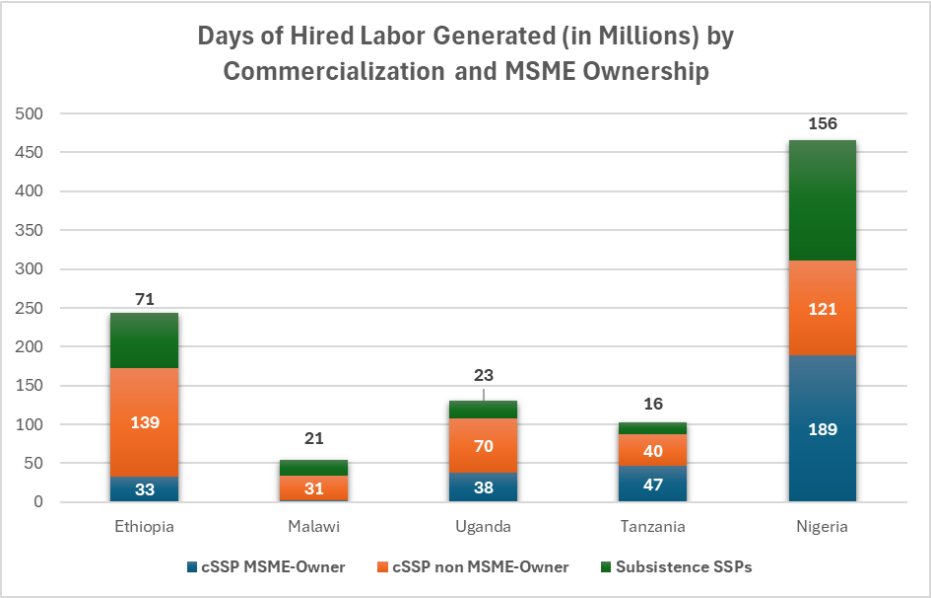

Table 4. Days of labor generated (in millions). Calculated over all available years.

V. Hired and Family Labor Analyses

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Family and hired labor intensification, and household time allocation for MSME owners

- We analyze both days of hired labor generated and family hours dedicated to own-farm work for **planting, weeding, fertilizing, harvesting and threshing activities.**
- Except for Nigeria, **cSSPs dedicate, on average, more family hours per hectare for own-farm work.** (Table 5)
- In most cases, MSME owners (both commercial and subsistence) are more intensive in terms of **days of hired labor generated per hectare.** (Table 6)

Table 5. Family hours dedicated to farm work per hectare by MSME Ownership and Commercial status.

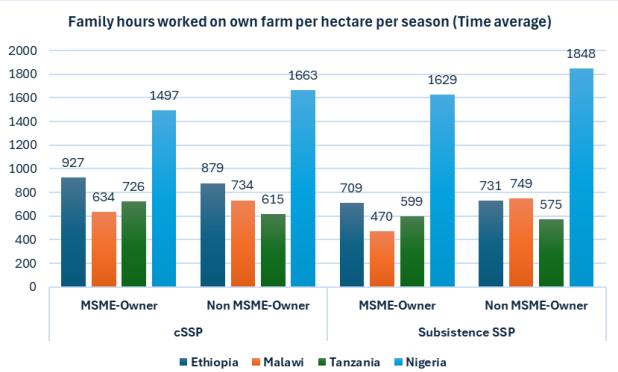
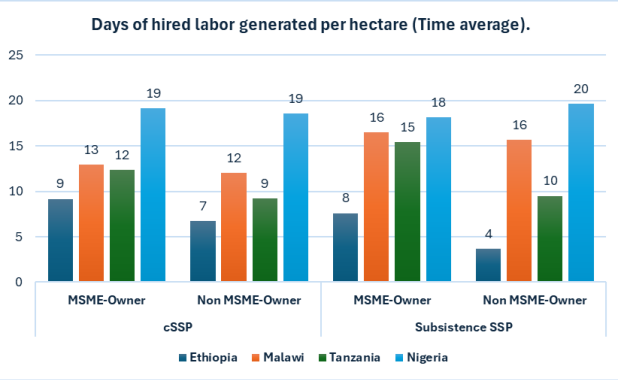


Table 6. Days of hired labor generated per hectare by MSME Ownership and Commercial status.



V. Commercialization and Labor Allocation

Effect of commercialized farming on family labor allocated to MSMEs varies across countries

- By regressing family labor days allocated to operating non-farm enterprises (Annex, Table 17) in Malawi, Nigeria, and Uganda, selling farmers, on average, allocated less time to operate MSMEs in the last 12 months. However, commercialization is associated with more labor days in running MSMEs in Ghana.
- There is no clear correlation between the volume of crops a farmer sells and the amount of time they devote to their MSMEs. Whether they market a small portion or a large share of their harvest does not consistently predict their level of engagement in business activities.
- A negative association between commercialization and family hours dedicated to running own MSME does not necessarily entail less income generated: households' consumption needs may be satisfied through profits generated from agriculture alone.
- Usage of hired laborers on-farm frees up household labor force to operate MSMEs. More family labor allocated to other off-farm wage/salaried jobs decreases the days devoted to running family-owned MSMEs.

Appendix: Definitions

- **Two definitions of Small-Scale Producer (SSP):**

  1. Below 90th percentile cultivated area at survey baseline
     - Ranges between **1.4 ha** for Malawi in 2011 to **5.3 ha** for Ghana in 1993

  2. Country-specific definition: less than 2 ha cultivated area, on average
     - Ranges from **<0.8 ha** for arable crops in Ghana to **<5 ha** for tree crops in most countries

- **Commercial Small-Scale Producer (cSSP):**

  1. Percentage of SSPs that sell any harvested output

  2. Non-selling SSP + 3 levels of commercialization using terciles of the commercialization distribution for cSSP
     - Non-selling SSP (subSSP)
     - Bottom Tercile cSSP (btcSSP)
     - Middle Tercile cSSP (mtcSSP)
     - Highest Tercile cSSP (htcSSP)

Appendix: Definitions

- **Micro, Small & Medium Enterprises (MSMEs):**

1. We classified micro, small, and medium enterprises using country-specific definitions based on workforce size and value of capital.

2. We distinguish between enterprises that work upstream and downstream from SSPs
   - By upstream, we mean enterprises that supply inputs (mainly seeds, fertilizers, and pesticides) to farmers
   - By downstream, we mean wholesalers, retailers, and manufacturers of raw or processed agricultural products.
   - Because the LSMS surveys are household surveys (rather than enterprise surveys per se), they capture home-based processing enterprises that are vertically integrated and/or purchase raw materials from farmers.
   - We also examine the role of non-agro enterprises as forward and backward linkages in the rural economy

Appendix: Definitions and datasets

- **Country strata:**
  - We categorize the six countries into three strata based on per capita income and general economic conditions
    - ♦ Upper income (Stratum 1): Ghana and Nigeria
    - ♦ Middle income (Stratum 2): Tanzania and Uganda
    - ♦ Lower income (Stratum 3): Ethiopia and Malawi

Table 7: Selected country characteristics and classification

Country	GDP per capita (const. US$): recent 5-yr avg.	GDP per capita (const. US$): survey period avg.	Agric GDP share (%) recent 5-yr avg.	Agric GDP growth (%) recent 5-yr avg.	Stratum name
Ghana	2,011	1,301	19	6	Upper
Nigeria	2,449	2,529	23	2	Upper
Tanzania	1,050	912	25	3	Middle
Uganda	930	858	24	5	Middle
Ethiopia	836	649	36	5	Lower
Malawi	560	542	23	3	Lower

Source: World Development Indicators, World Bank

Appendix: Definitions and datasets

- **Survey data:**
  - We use LSMS-ISA survey data for 6 countries, focusing on the households who are part of the panel.
  - Years analyzed correspond to the longest series available.

Country	Waves	Waves excluded
Ethiopia	2011, 2013, 2015	2018, they refreshed the panel.
Malawi	2010, 2013, 2016, 2019	None
Uganda	2010, 2012, 2014, 2016, 2020	None
Tanzania	2014, 2020	2008, 2010, 2012. They started a new panel after these, and given cluster index limitations we used those two years.
Nigeria	2010, 2012, 2015, 2018	None
Ghana	1998, 2006, 2013, 2017	None. However Ghana is not a panel.

Table 8. Countries analyzed, survey names, and survey years.

Appendix: Definitions and datasets

Working with: RIMISP, Michigan State University, Egerton University, International Food Policy Research Institute (IFPRI)

- **Variables created:**

- **For the INCATA project, a set of variables was created:**

  - **Women's empowerment:** Abbreviated Women's Empowerment in Agriculture Index by IFPRI, adapted for the datasets.

Empowered household is a binary variable indicating that a household has achieved empowerment in three of four pillars, including input in productive decisions, control over income use, asset ownership, and workload.

  - **Resilience:** Resilience Capacity Index, RIMA-II methodology by FAO

We normalize this index to take values between 0 and 1, with 1 indicating higher resilience.

  - **Food Security:** Food Consumption Score using data available in the LSMS-ISA with 7-day recall

  - **Crop Diversification:**

We construct a Herfindahl index using KG produced for each crop by the farm. This value is subtracted from 1, so 0 indicates perfect specialization and 1 is full diversification.

Appendix: Definitions and datasets

- **Variables created:**

- **For the INCATA project, a set of variables was created:**

  - **Multidimensional Poverty:** Mainly based in the dimensions established by OPHI with small variations in the health dimension. See Annex, Table A1, for the full indicators.

  - **Cluster Index:** Already explained on slide 11, but it is an index at the district or regional level (depending on the country) that captures economic activity between cSSP and MSMEs, measured as total sales and quantity of these actors per capita.

Appendix: Definitions and datasets

Working with: RIMISP, Michigan State University, Egerton University, International Food Policy Research Institute (IFPRI)

- **Variables created:**

- **For the INCATA project, a set of variables was created:**

  - **Inclusion score and sufficiency thresholds:** The inclusion score is a composite measure designed to capture household-level inclusion across five equally weighted dimensions, each contributing 0.2 to the overall score. The index assigns a score based on **sufficiency thresholds** in these dimensions:

    (1) **Female Empowerment:** where a household meets the criteria if it is identified as female-empowered (A-WEAI methodology, IFPRI).

    (2) **Food Consumption Score (FCS):** deemed sufficient if it exceeds a score of 35 (out of 112) (as indicated by WFP methodology).

    (3) **Resilience (based on FAO's RIMA-II)**, sufficient if the household is not in the lowest 25% of the resilience score distribution.

    (4) **Off-farm Engagement**, marked sufficient if at least one household member holds a non-farm enterprise (NFE) or salaried job.

    (5) **Multidimensional Poverty,** where a household is sufficient if not deprived on 33.33% of the indicators (OPHI methodology).

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Centro Latinoamericano para el Desarrollo Rural