How can agricultural development strategies effectively reduce poverty in Africa?

T.S. Jayne, Kwame Yeboah, Lulama Traub, Milu Muyanga, Jordan Chamberlin, Ferdinand Meyer

Ag. Learning Lunch seminar, Bill and Melinda Gates Foundation, Seattle, October 6, 2015
Organization of seminar:

1. Structural transformation
   – what is it?
   – how it is affecting African economies

2. Unpacking the smallholder farm sector

3. Implications for policies and programs to reduce poverty in Africa
Structural Transformation 101
Sectoral shifts in labor force: China

Source: Groningen Global Development Centre, 2013
Sectoral shifts in labor force: Ethiopia

Source: Groningen Global Development Centre, 2013
Sectoral shifts in labor force: Tanzania

Source: Groningen Global Development Centre, 2013
Sectoral shifts in labor force: Nigeria

Source: Groningen Global Development Centre, 2013
Labor productivity per worker, Ghana

![Graph showing labor productivity per worker in Ghana](graph.png)
Jobs by sector, Sub-Saharan Africa

Source: World Bank (Filmer and Fox), 2014
Jobs by sector, Sub-Saharan Africa

Source: World Bank (Filmer and Fox), 2014
Features of structural transformation

1. Gradual shift of labor force from farming to off-farm
2. Pull vs. push forms of ST
3. Rise in labor productivity $\rightarrow$ rising p.c. incomes
4. Rising labor wages leads to tech change in agriculture (e.g., mechanization)
5. In early phase, pace of ST related to rate of farm productivity growth
6. In middle/late phases, pace of ST related to growth in agribusiness and non-farm sectors
Summary so far:

• In early phases of countries’ development process, agricultural growth is a major driver of structural transformation

• The relationship between agricultural productivity growth and poverty reduction is quite variable
Factors influencing the contribution of ag. productivity growth to poverty reduction:

1. Size of agriculture in overall economy
2. % of poor people engaged in agriculture
3. Distribution of assets/resources
   – multiplier effects from agricultural growth
   – how inclusive is ag. growth
III. Unpacking the smallholder farm sector
Crop sales by farm size over time (2011 Zmk prices)

Largest smallholder farms (8%) consistently doing better

Source: MACO CFS 2000/1 to 2010/11 and authors’ computations
## Disparities within smallholder agriculture, Zambia

<table>
<thead>
<tr>
<th></th>
<th>N=</th>
<th>Farm size (ha)</th>
<th>Asset values (US$)</th>
<th>Gross rev., maize sales (US$)</th>
<th>Gross rev., crop sales (US$)</th>
<th>Total hh income (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top 50% of maize sales</td>
<td>30,150</td>
<td>4.1</td>
<td>3,703</td>
<td>3,199</td>
<td>4,213</td>
<td>7,324</td>
</tr>
<tr>
<td>Rest of maize sellers</td>
<td>467,320</td>
<td>1.9</td>
<td>257</td>
<td>181</td>
<td>330</td>
<td>1,021</td>
</tr>
<tr>
<td>Households not selling maize</td>
<td>1,010,014</td>
<td>1.1</td>
<td>129</td>
<td>0</td>
<td>128</td>
<td>456</td>
</tr>
</tbody>
</table>

Source: Central Statistical Office / IAPRI / MSU Supplemental survey
Rural headcount poverty rates, Zambia

Rural poverty rate (%)

<table>
<thead>
<tr>
<th>Year</th>
<th>Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>82</td>
</tr>
<tr>
<td>1998</td>
<td>83</td>
</tr>
<tr>
<td>2004</td>
<td>78</td>
</tr>
<tr>
<td>2006</td>
<td>80</td>
</tr>
<tr>
<td>2010</td>
<td>78</td>
</tr>
<tr>
<td>Agro-ecological Potential</td>
<td>Distance to town</td>
</tr>
<tr>
<td>---------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td></td>
<td>accessible</td>
</tr>
<tr>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td></td>
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</tbody>
</table>
## % of total farm population

<table>
<thead>
<tr>
<th>Agro-ecological Potential</th>
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<tbody>
<tr>
<td></td>
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</tr>
<tr>
<td>High</td>
<td>Ethiopia: 9%</td>
</tr>
<tr>
<td></td>
<td>Nigeria: 75%</td>
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<tr>
<td></td>
<td>Tanzania: 26%</td>
</tr>
<tr>
<td>Low</td>
<td>Ethiopia: 6%</td>
</tr>
<tr>
<td></td>
<td>Nigeria: 4%</td>
</tr>
<tr>
<td></td>
<td>Tanzania: 1%</td>
</tr>
</tbody>
</table>

• “accessible” defined as <4hrs to urban area >100,000;
• high-potential defined on basis of agro-ecological zones
### % of total farm population

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<tr>
<th>Agro-ecological Potential</th>
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<tr>
<td></td>
<td>accessible</td>
<td>remote</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>Ethiopia: 9%</td>
<td>Ethiopia: 48%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nigeria: 75%</td>
<td>Nigeria: 20%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tanzania: 26%</td>
<td>Tanzania: 67%</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>Ethiopia: 6%</td>
<td>Ethiopia: 37%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nigeria: 4%</td>
<td>Nigeria: 2%</td>
<td></td>
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<tr>
<td></td>
<td>Tanzania: 1%</td>
<td>Tanzania: 7%</td>
<td></td>
</tr>
</tbody>
</table>

- “accessible” defined as <4hrs to urban area >100,000;
- high-potential defined on basis of agro-ecological zones
<table>
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<th>Agro-ecological Potential</th>
<th>Distance to town</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>accessible</td>
</tr>
<tr>
<td>High</td>
<td>40% commercialized</td>
</tr>
<tr>
<td>Low</td>
<td>15% commercialized</td>
</tr>
</tbody>
</table>
Value of Crop Production in Relation to time in hours to Towns of 100,000 and over

Source: Paul Dorosh et al., 2013
Rural population & travel time to the nearest city over 250 k in population

UGANDA

Rural population
- within 1 hour
- within 2 hours
- within 3 hours
- within 4 hours
- over 4 hours (56 %)

Urban Areas
Potential "ST" metrics

1. Extent of smallholder commercialization:
   - % of hhs selling > $2000 in value
   - HCI: value of sales / value of production

2. Wage rates
   - Agricultural wage rates relative to CPI
   - Off-farm wage rates relative to CPI

3. Agribusiness GDP to agricultural production GDP

4. Growth over time in mean off-farm incomes

5. Growth over time in mean farm incomes

6. Rural and urban poverty rates
Main conclusions:

1. For the next 2-3 decades, most Africans will be engaged in farming
   - Rule of thumb:
     1. ~ 10% African farmers are already commercialized and contributing to ST
     2. ~ 30% --with appropriate support -- have potential to produce moderate/high surplus production value
     3. ~ 60% : difficult to “move the needle” directly, but raising their productivity will contribute indirectly to poverty reduction and growth and metrics
        - Productivity growth reduces their food expenditures → greater disposable incomes for non-farm goods
        - Generally the more inclusive is ag growth, the greater the multipliers
Main conclusions (ii):

2. Agriculture will remain central for generating the income and employment multipliers to reduce national poverty rates
   - Necessary but not sufficient condition
   - Other conditions: lower costs of commerce, policies encouraging equitable growth, sustainable forms of intensification

3. Hence need to encourage inclusive ag growth (within reason) as an intermediate objective in the process of economic transformation

4. The strategies to engage smallholders are different in the 2x2 matrix
Some farmers are better marketing negotiators than others

Farm-Gate Prices in Accessible Villages in Rumphi District versus Retail Maize Prices in Rumphi District

Farm-Gate Prices in Remote Villages in Rumphi District versus Retail Maize Prices in Rumphi District

Mean Retail Prices  Farm-Gate Prices
Six “mega-trends”

1. Youth bulge/labor force expansion
2. Growth in non-farm employment – urbanization - rising labor productivity
3. Food consumption outstripping production (region is deficit in most food products)
4. Rise of investor farmers → rising share of African farmland under MS/LS production
5. Rising land scarcity
   → price of land rising relative to other inputs
   → soil mining → land degradation
6. Climate change
Correlation between district medium-scale landholdings and measures of tractor use, northern/central Ghana.

![Graph showing correlation between total area under cultivation by 5-100 ha farmers and number of households owning tractors in Districts.](image-url)
Trend #1: Youth Bulge/ Labor Force Expansion

-4% -2% 0% 2% 4% 6% 8% 10% 12% 14% 16% 18% 20%

[0-4] [5-9] [10-14] [15-19] [20-24] [25-29] [30-34] [35-39] [40-44] [45-49] [50-54] [55-59] [60-64] [65-69] [70-74] [75-79] [80+]

Male Female

Source: UN Pop Council, 2013

44% < 15 years old
Motivating fact: looming employment challenge in SSA

Source: UN 2013
African Population by Income Class: excluding North Africa and South Africa

Source: Potts, 2012: calculated from the AfDB (2010)

- Poor ($0 - $4): 81.8%
- Middle-class ($4 - $20): 13.4%
- Rich (> $20): 4.8%
Net Grain Exports for East Africa

Source: FAO, 2015
Food balances in sub-Saharan Africa

High-Value Commodity Production and Consumption Change
(2011/13 to 2023)

Cereal Production and Consumption Change
(2011/13 to 2023)

Source: FAOSTAT, 2014. acknowledgements to Holgar Matthey
The importance of SOM

# Review of maize-fertilizer response rates on farmer-managed fields

<table>
<thead>
<tr>
<th>Study</th>
<th>country</th>
<th>Agronomic response rate (kgs maize per kg N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marenya and Barrett (2009)</td>
<td>Kenya</td>
<td>17.6</td>
</tr>
<tr>
<td>Liverpool-Tasie (2015)</td>
<td>Nigeria</td>
<td>8.0</td>
</tr>
<tr>
<td>Burke (2012)</td>
<td>Zambia</td>
<td>9.6</td>
</tr>
<tr>
<td>Snapp et al (2013)</td>
<td>Malawi</td>
<td>7.1 to 11.0</td>
</tr>
<tr>
<td>Holden and Lunduka (2011)</td>
<td>Malawi</td>
<td>11.3</td>
</tr>
<tr>
<td>Pan and Christiaensen (2012)</td>
<td>Tanzania</td>
<td>11.8</td>
</tr>
<tr>
<td>Mather et al (2015)</td>
<td>Tanzania</td>
<td>5.7 to 7.8</td>
</tr>
</tbody>
</table>
Manifestations of land scarcity

• Increased cropping intensities
• Inadequate crop rotation
• Loss of soil organic matter
• Low crop response to fertilizer unless sustainable intensification practices are adopted
Primary activities of youth (15-25 years of age)

Source: Yeboah and Jayne (2015) using most recently available IPUMS and LSMS surveys
Variation in farmers’ efficiency of fertilizer use on maize, Agro-ecological Zone IIa, Zambia

Note: Zone IIa is a relatively high-potential zone suitable for intensive maize production
F2. Trends in fertilizer use and cropping intensity

Nitrogen application per hectare vs. Cereal cropping intensity (area harvested/area planted at least once)

- India 2009
- Thailand 2009
- Kenya
- Uganda
- Malawi 2009
- Nigeria 2009
F3. Trends in Irrigation and cropping intensity

Irrigated crop area (% total) vs Cereal cropping intensity (area harvested/area planted at least once)

- **India 2009**
- **Thailand 2009**
- **Uganda**
- **Kenya**
- **Malawi**
- **Nigeria**

The graph shows the trends in irrigation and cropping intensity for various regions, with data points indicating the proportion of irrigated crop area and the cereal cropping intensity for each region. The x-axis represents the cereal cropping intensity, while the y-axis shows the irrigated crop area as a percentage of the total.
Agricultural intensification

Agricultural output per hectare (2005 int. dollars)

Agricultural population density (person per sq km)

Africa

other
Clustering of rural populations: Zambia
Clustering of rural populations: Kenya