South-South learning for mechanization in Africa: smallholders, supply side issues, and policy-engagements

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Mechanization issues under FSP project

- **Mechanization and smallholders**
  - Determinants and impacts – new insights

- **Supply side issues**
  - Supply-side market imperfections
  - Insights from regional comparative perspectives (Africa vs Asia)

- **Policy engagements and key policy outcomes**
  - Ghana's arrangements with Brazil's More Food International (MFI) Program
  - Nigeria's promotion of small tractors

Mechanization by smallholders

- **Mechanization spreading among medium-to-large farmers**
  - Farmer investments in tractors to expand farm size (Ghana)
  - Informal sector (Ghana, Nigeria)
  - Provide tractor services for non-owners

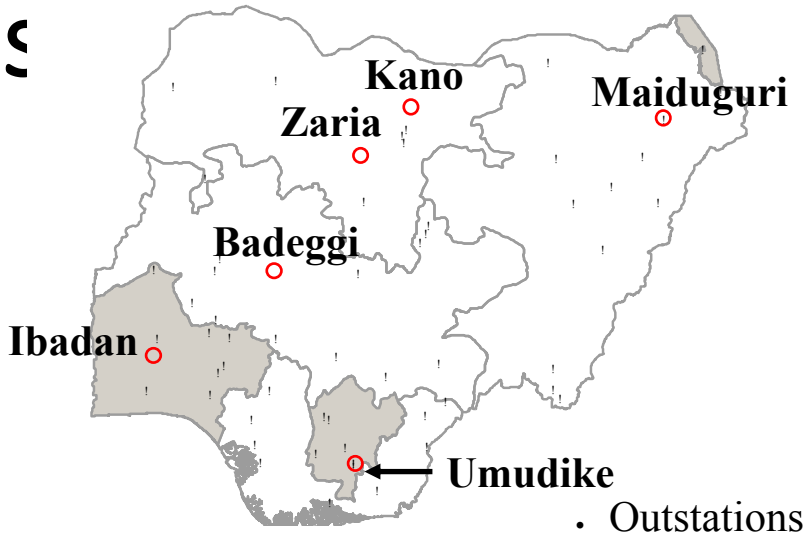
- **What about smallholders**
  - Lower adoptions due to limited complementarity / scale economies

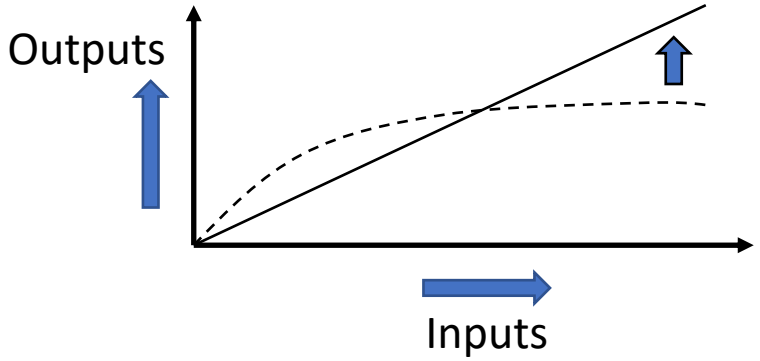
- **Smallholders face options: exit farming, instead of mechanizing farming**
  - However, smallholders seem to remain in farming
  - For them, mechanizing farming seems to raise incomes (Nepal)

  => Mechanization for smallholders remains important policy issues

Mechanization by smallholders: Some insights from FSP studies

- **Adoption induced by higher yielding technologies**
  - ***Agroclimatic similarity*** with R&D institutes – affect yield potentials
  - Nigeria, Nepal, Ghana
- **Affects crop diversification through economies of scope** – dietary diversity
- **However, benefits of mechanization still realized through scale-effects**
  - Scope to exploit operational scale (not necessarily farm size) – important for smallholders





Supply side issues – regional perspectives

- **Scope**
  - Historical evolution of mechanization
  - Demand-side factors
  - Supply-side factors
  - Effects on agricultural transformation
- **8 Asian countries**
- **5 African countries**

Supply side constraints in Africa

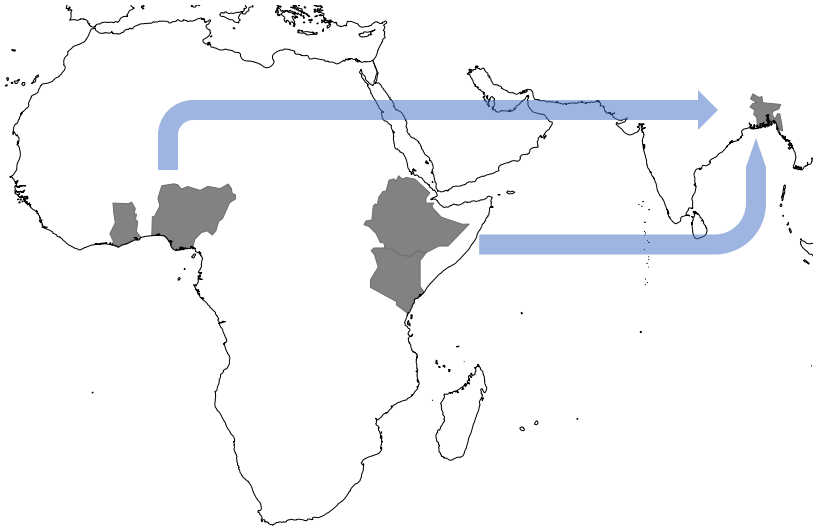
- High horsepower (HP), expensive tractors still dominant
  - Ethiopia, Kenya > 100 hp, Ghana, Mozambique, Nigeria, Zambia – 60 ~ 85
  - 4wt in Asia < 50 hp
  - Perceptions (without evidence) of heavy soils in Africa
- Limited commercial credit
  - Dealers-provided credit
  - Land as collateral
- Limited government capacity to research markets
  - Limited information about efficient, informal sector hiring service providers
  - Lower efficiency of government-selected service providers
- Slow manufacturing growth
  - Manufacturing of spare parts, attachments
- Limited knowledge of tractor use
  - Eg., tractor breakdown by tree-stumps in Ghana

Supply side strategies for Africa

- **Reduce market distortion**
  - Lift import restrictions, allow importation of a variety of machines, tractors of various brands, horsepower
  - Promote universal subsidies than selective subsidies (if subsidies are needed)
  - Concessional-loans based arrangements should also develop supply-chains for spare parts and repairs
- **Trust markets to select efficient service providers, viable service provision models, machine designs**
- **Invest in public goods**
  - Knowledge / technologies
    - Engineering research on suitable designs for local conditions (local soil conditions, suitable plow-depth, tractor horsepower, etc.)
    - Study of market / informal-sector (eg., tractor census)
    - Knowledge transfer from the informal-sector to formal-sector service providers
    - Other complementary technology (irrigation), rural infrastructure
  - Effective coordination (eg., China)

Policy engagements and some outcomes

Bangladesh mechanization study tour for 9 African officials



- November 3 – 7, 2015
- 9 officials from 4 African countries
- With collaboration with Bangladesh consultants
- Visited
  - Ministry of Agriculture
  - 2 Agri. machinery Importers
  - Agri. Machinery manufacturer
  - Machinery dealers & spare parts distributors
  - Farmers (rainfed region)
  - 2 Agri. machinery research institutes

FSP Brief 11 & 12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Agricultural Mechanization and South-South Knowledge Exchange:
What can Ghanaian and Nigerian policymakers learn from Bangladesh's experience?

Patrick O. Aboagye, Abdullahi Gazba Abubakar, Abdulai Iddrisu Adama, Akeem Oyeyemi Lawal, and Aliyu Abdullahi Musa

Synthesized by Hiroyuki Takeshima

Introduction

Bangladesh recently has experienced fast growth in agricultural mechanization. Nationally, the share of area cultivated by tractors and power tillers increased from 30 percent in the mid-1990s to 95 percent in 2015, with power tillers being used on three-quarters of the mechanically cultivated area. Moreover, agricultural machinery is not only used on large farms in Bangladesh, but has spread among smallholder farmers that own an average of 0.5 hectares (ha) of cropland. Supply of machinery for this rapid growth of mechanization has been based primarily on imports, as the capacity for local manufacturing of agricultural machinery is still limited.

Bangladesh's experience can provide useful insights for many African countries that are seeking sustainable ways to promote agricultural mechanization. In collaboration with IFPRI and CIMMYT, nine African public officials from four countries, Ethiopia, Ghana, Kenya, and Nigeria, participated in an agricultural mechanization study tour in Bangladesh from 3–7 November 2015. During the tour, African officials visited two major tractor importers, ACI Motors Ltd. and Metal Pvt. Ltd.; the largest agricultural machinery manufacturer in Bangladesh, Alim Industries Ltd.; tractor and spare parts dealers; farmers; and public institutions, including the Department of Agricultural Extension (DAE) of the Ministry of Agriculture, the Bangladesh Agricultural Research Council (BARC), the Bangladesh Agricultural Research Institute (BARI), and the Bangladesh Rice Research Institute (BRRI). While conditions in Bangladesh and the experience of agricultural mechanization there are unique to the country, nonetheless, the tour provided useful insights into how small-scale agricultural mechanization can expand in low-income countries.

This note synthesizes one of the two study tour reports written by the participating African officials. This report provides observations made by participants from Nigeria and Ghana, the two West African countries with participants on the tour.

Key Observations on Agricultural Machines Used in Bangladesh

In Bangladesh, tillage using two-wheel tractors (2WTs) and small four-wheel tractors (4WTs) accounts for greater than 95 percent of tillage activity. Irrigation in the country was rapidly mechanized when power tillers, imported from Japan, were introduced. Although initially too costly for common farmers, since then the use of power tillers has evolved from being used primarily for shallow tube-well irrigation purposes to increasingly being used for tillage. This is different from Ghana or Nigeria where mechanization has been promoted with higher horsepower (hp) tractors. However, mechanization levels are much lower in Nigeria and Ghana than in Bangladesh.

The predominant soils and topography of Bangladesh was likely a factor in the increase in mechanization of land preparation with 2WTs. In Ghana and Nigeria, the use of 2WTs is challenging in areas where the soils are heavy and agricultural practices are mostly rainfed rather than irrigated. However, where soils are suitable and irrigated farming is feasible in Nigeria and Ghana, 2WTs may be applicable for cultivation. In addition, the use of 2WTs for harvesting and transportation may be more widely applicable as these activities are less constrained by soil conditions.

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Impacts on programs in Ghana

- **Agricultural Mechanization Service Enterprise Center (AMSEC)**
  - Phase I (2007 -)
    - 90 centers by 2011
    - Minimum threshold of 5 tractors
    - Low machine utilization – few reached break-even points
    - High breakdown dues to improper operation / maintenance
    - High default rates (loan repayments to government)
  - Phase II (2016 -)
    - New concessional loan facility from **Brazil**
    - Incorporating recommendations by international agencies, including IFPRI
    - Dropping minimum threshold to 1 tractor
    - Exploiting multi-functionality – (maize shellers, multi-crop threshers, pneumatic or mechanical planters, cassava planters, and harvesters, seed drills, boom sprayers and maize/soya/rice harvesters attachable to tractors)
    - 1 free scheduled maintenance service (after 1,000-hour)
    - 12 mobile workshops set up with government subsidy - maintenance services run by private individuals
    - Spare parts provided by Brazilian manufacturers for 2 years
    - Mandatory participation in training (first-time buyers)

Impacts on programs in Nigeria

- **Utilization of power tillers - Mini Mobile Mechanization System (MMMS)**
  - Pilot with 150 power tillers – started in 2018 once the budget is released
  - Power tillers and other machines are provided to cooperatives of 25-30 people (not individual applicants)
    - Plowing
    - Transportation of light machines, including small harvesters, threshers, etc.
  - Bangladesh study-tour helped them see the multi-functional use of power tillers
- **Shifting from subsidized distributions of tractors to more market-oriented approach**
  - Kaduna state in Nigeria
  - Facilitating tractor market stakeholders, linking farmers' associations and tractor-supplying companies
- **Sharing Ghana's lessons on Brazilian arrangements, as** Nigeria is entering into similar agreements with Brazil

Conclusions

- **Mechanization for smallholders**
  - Remain important issues for inclusive growth
  - Yield-enhancing technologies may be key pre-requisite
- **Supply-side issues**
  - Significant market imperfections
  - Knowledge intensive nature
- **Policy-engagements**
  - Significant demand for evidence that can guide reforms

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Thank you !

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