Comparative Cost of Maize Production Study in East and Southern Africa

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Presentation Outline

1. Background to Study
2. Introduction of *Agri Benchmark* framework
3. Country Reports:
   a) Malawi
   b) Tanzania
   c) Kenya
4. Initial Regional Results
RENAPRI’s Initial Activities – 2013/14

• Costs of Maize Production and Marketing
• Part of Broader AGRI-Benchmark Network
  – Over 32 countries worldwide participating
• Why is ReNAPRI focusing on COP?
  – Costs of production and marketing are the basis for competitiveness
  – By taking a common methodological approach across countries, ReNAPRI is building an empirical foundation for subsequent analysis on regional food trade
  – Comparing production costs for different production systems (e.g., low-input vs. high-input)
  – Identify sources of high cost
  – Identify policy actions to reduce production and marketing costs
Future directions for ReNAPRI research

• Impact of input subsidy / subsidy removal on costs of maize production and maize price levels

• Impact of public investments in port/rail/road infrastructure on maize marketing margins, regional trade flows, and price levels
  – Income distributional effects on producers and consumers in the COMESA/SADC region
1. Context: What is *agri benchmark*?

2. Expanding the Network into Africa: Initial results
What is *agri benchmark*?

A global research network of agricultural economists, advisors and farmers

Understanding global Agriculture

Provide accurate and relevant data to decision makers in Policy, Industry and Farming sectors

Coordination by vTI (public funded research) and DLG
Present in all major Countries

Crop coverage:
- Corn
- Soybeans
- Wheat
- Sugar beet
- Rice
- Rapeseed
- Oats
- Rye
- (Malting) barley
- Sunflower
- Sorghum
- Cotton
- Palm oil
- Beans

Pipeline:
- Sugar Cane

Legend:
- Countries participating in *agri benchmark* Cash Crop
- Priorities for new countries
### Europe

<table>
<thead>
<tr>
<th>Country</th>
<th>Partner Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>Lantmännen</td>
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<tr>
<td>Sweden</td>
<td>Kaposvari Egyetem</td>
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<td>Hungary</td>
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<td>Italy</td>
<td>CRPV</td>
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<td>Novus</td>
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<td>France</td>
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<td>Russia</td>
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### North America

<table>
<thead>
<tr>
<th>Country</th>
<th>Partner Organization</th>
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<tbody>
<tr>
<td>Canada</td>
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<tr>
<td>USA / Iowa</td>
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<tr>
<td>USA / North Dakota</td>
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<tr>
<td>USA / Kansas</td>
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</tr>
</tbody>
</table>
agri benchmark – Partners (II)

South America

Brazil
Argentina / Uruguay

Asia

China
Malaysia
Vietnam
Kazakhstan
Thailand
Japan

Africa

Tunisia
BFAP
South Africa
Morocco

Transoceania

Australia
agri benchmark – Global Commercial Partners

- Syngenta: Crop Protection
- John Deere: Machinery
- UFOP: Rapeseeds
- DLG: Growers
The *agri benchmark* project

**Key idea**
⇒ Merge data + experts globally

**Methods**
⇒ create **typical farms**
⇒ validate data with **panels** (experts, growers, advisors)
⇒ establish **a globally uniform data base**
⇒ combine farm level results with **ag sector statistics**
A typical farm…

⇒ represents the origin of a major share of the national output for a given crop

⇒ is defined by a certain production system and a combination (if any) of enterprises

⇒ has certain structural features re. ownership of land as well as labor organization (family vs. hired)

⇒ is regularly being re-assessed to track changes

A standard operating procedure (SOP) to define typical farms was developed and is used by all partners involved.
Procedure to establish a Typical Farms

- Panel: advisor, farmer, scientist
- Standard questionnaire: farm data
- Calculation of: farm overview, profit and loss account, productivity indicators
- Result: typical farm
- Update
- Prices, costs and yields, exchange rate: annually (network experts)

All data: every 3 years (panel)
Advantage of the Typical Farm Approach

(1) Cost and revenues can be broken down to *prices* and *quantities*. This allows identification of *causalities* for differences.

(2) Effects of *rotations* and *production systems* can be analyzed.

(3) Global *uniform database* to which network members have access.

(4) Dataset is *consistent* and *up to date*

(5) Limited representativeness
Value of *agri benchmark*

1. Exploring the on-farm competitiveness of crops under changing framework conditions such as technical progress.

2. Analyzing strength and weaknesses of production systems (e.g. plowing vs. low till) under different natural and economic conditions.

3. Understanding farm level profitability of intensification in input usage (e.g. GM seeds).

4. Reliable data for farms in developing and emerging economies; special focus on small holders in mid-term.
1. What is *agri benchmark*?

2. Expanding the Network into Africa: Initial results
Comparative Cost of Maize Production in East & Southern Africa: The Case of Malawi

By: Richard Kachule
Macro-economic Data

- Landlocked country
- Area: 118,484 sq km (Land 94,080 sq km, Water 24,404 sq km)
- Population: 15 Million people
- Capital City: Lilongwe
- Currency: Malawi Kwacha (MK)
- GDP(2012): $4,263,794,983
  - GDP Growth rate: 1.8%
- Agric. Contribution to GDP: 30%
- Land Tenure system:
  - Public land
  - Customary land
  - Leasehold
Agricultural Sector & Agro-ecological zones

- **Agricultural Sector:** Dualistic
  - Smallholder Sub-sector
  - Estate Sub-sector

- **Agro-ecological Zones**
  - Country divided into eight agro-ecological zones
    - Agricultural Development Divisions (ADDs)
    - Comprised of several districts
    - An ADD is manned by a Programme Manager (PM)
    - Specialists/officers at ADD level such as;
      » Crops Officer
      » Livestock Officer
      » Extension Officer
      » Irrigation Officer
Agricultural Sector & Agro-ecological zones

• Each ADD is subdivided into Extension Planning Areas (EPAs)

  • An EPA is manned by an Agricultural Extension Development Coordinator (AEDC)

• An EPA is subdivided into Sections

• A section is comprised of several villages
  
  – Manned by an Agricultural Extension Development Officer (AEDO)
MAP of Agro-ecological Zones
Study Site

- Lilongwe ADD
  - Highest maize producing ADD

- Ukwe EPA
  - Highest maize producing EPA
Location and Characteristics of UKWE EPA

- Situated on the North West of Lilongwe city about 30km from Lilongwe city
- Covers a total land area of 38,801 ha
- An estimated total arable land of 33,401 ha
- Out of the arable land, 32,297 ha are under customary land
- 30,296 ha under smallholder cultivation
- 1,104 ha are under estate farming
- 5,400 ha are considered non-arable.
- Predominant soil type is sandy loam
A total of 24,879 households
- 16,482 Male Headed Households (MHH)
- 8,293 Female Headed Households (FHH)
- 104 Child Headed Households (CHH).

Average household size is 6 people.

Landholding size (ha):
- Minimum 0.4
- Maximum 2.0
- Average 1.2
Enterprises and Type of Implements

• Common Enterprises:
  – Maize
  – Cassava
  – Tomato
  – Tobacco
  – Groundnuts
  – Soyabean

• Common tools:
  – Hand hoes
  – Axes
  – Panga knife
  – Sickle
  – Hammer
<table>
<thead>
<tr>
<th>MONTH</th>
<th>ACTIVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>July- August</td>
<td>Land clearing</td>
</tr>
<tr>
<td>End August</td>
<td>Ridging</td>
</tr>
<tr>
<td>End Nov-Mid Dec</td>
<td>Planting</td>
</tr>
<tr>
<td>End Dec. Jan</td>
<td>Weeding</td>
</tr>
<tr>
<td>End Jan</td>
<td>Banking/weeding; Fertilizer Application</td>
</tr>
<tr>
<td>April</td>
<td>Stooking</td>
</tr>
<tr>
<td>May</td>
<td>Harvesting; Transporting; Storage</td>
</tr>
<tr>
<td>June</td>
<td>Shelling</td>
</tr>
<tr>
<td>Mid-end June</td>
<td>Plant protection; bagging &amp; stacking in dwelling houses</td>
</tr>
</tbody>
</table>

10/4/2013
Operating Costs $/ha

- Hired labor, 48.64
- Family labor, 89.40
- Contractor, 6.06
- Machinery, 2.68

[Bar chart showing the distribution of costs]
Crop Establishment Costs ($/ha)

- Seeds: 28.65
- Nitrogen: 48.05
- Phosphorus: 16.89
## Price Levels

<table>
<thead>
<tr>
<th></th>
<th>MK/kg</th>
<th>$/kg</th>
<th>$/t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>40</td>
<td>0.114</td>
<td>114</td>
</tr>
<tr>
<td>Maximum</td>
<td>180</td>
<td>0.514</td>
<td>514</td>
</tr>
</tbody>
</table>
Total cost and gross revenue

- Cash cost: 162.85
- Opportunity cost: 119.84
- Total cost: 282.69
- Gross revenue: 723.75
Government Support

Farm Input Subsidy

– One bag (50kg) Basal dressing fertilizer
– One bag (50kg) Top dressing fertilizer
– 5Kg hybrid maize seed or 7kg OPV
– 2kg legume(either soyabean or groundnuts)

10/4/2013
Shortfalls (Grey Areas)

• Ad hoc Trade Bans
• Weak Regulatory Mechanism
• Influx of foreign traders
• Lack of transparency
  – On food reserves
  – Poor Post Harvest handling (loss of grain in SGR)
• Doubtful crop production estimates
• Inefficient Subsidy programme
  – Inadequate fertilizer quantities
  – Poor targeting
• Pan-territorial setting of maize floor price
• Gvt thinking of commercialising maize
THANK YOU FOR YOUR ATTENTION
TYPICAL FARM COP FOR THE SMALL SCALE FARM IN TANZANIA
by Adam Akyoo
Tanzania features and resources

Capital: **Dodoma**
Currency: **TZS with exch. rate**

1US$=TSH ± 1600
Population: **over 46.9m**
GDP (PPP total) = **US$ 63.892billion**
Per capita = **US$ 1515**
GDP growth: **6.5%**
Agric. Contribution towards GDP: **21%**
Total Area: **947300 Km² arable 4.2%**
Unemployment rate:
Share of agri. Labor: **80%**
Small-scale category: **70%**
Natural restrictions on land: **hilly steep areas, mad terrain in peak rain periods, rocky terrain**
Maize production in Tanzania

Small holder crop production categories: **70% hand hoe, 20% ox-plough and 10% tractor**

**Labor:** Hugely Family labor with 70% women

**Maize output:** 4.3m tons (2012)

**Maize yield:** 3.3tons/ha
Food self sufficiency in Tanzania

Food security in Tanzania refers to maize availability

Almost 1:1 ratio on the number of surplus : deficit regions

Cross border maize trade is restricted only when food self sufficiency situation is threatened (annual vulnerability assessment by NFRA)
Methodology

• Official opening of panel discussion
• Composition of the panelists
Methodology: Typical farm approach

- Data collection moderation and inputting
  - Further processing e.g. on fertilizer costs
  - Cost verification with dealers
## Cropping system

<table>
<thead>
<tr>
<th>Description</th>
<th>Typcrop results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotation type</td>
<td>monoculture</td>
</tr>
<tr>
<td>Crop acreage</td>
<td>4 acre</td>
</tr>
<tr>
<td>Crop yield</td>
<td>1.8 tons/acre</td>
</tr>
<tr>
<td>High crop price</td>
<td>TZS 800,000/ton</td>
</tr>
<tr>
<td>Average crop price</td>
<td>TZS 350,000/ton</td>
</tr>
<tr>
<td>Low crop price</td>
<td>TZS 345,000/ton</td>
</tr>
<tr>
<td>Hybrid maize seed</td>
<td>TZS 5000/kg (100% cs)</td>
</tr>
<tr>
<td>Quality declared seed</td>
<td>TZS 2000/kg (0% cs)</td>
</tr>
<tr>
<td>Composite/recycled seed</td>
<td>TZS 4500/kg (0% cs)</td>
</tr>
</tbody>
</table>
## Cropping system

<table>
<thead>
<tr>
<th>Type of fertilizer</th>
<th>N</th>
<th>P</th>
<th>K</th>
<th>Mg</th>
<th>S</th>
<th>CaO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal (Minjingu Mazao)</td>
<td>10</td>
<td>20</td>
<td>0</td>
<td>1.5</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>PRICE (TSZ)</td>
<td>608.70</td>
<td>597.21</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>538.37</td>
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<tr>
<td>UREA (46)</td>
<td>46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRICE (TZS)</td>
<td>608.70</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Farm Activity</td>
<td>Month</td>
<td>Technology used</td>
<td>Tech. units</td>
<td>Rep. price (TZS/unit)</td>
<td>Capacity (acre/hr)</td>
<td>Work depth (cm)</td>
</tr>
<tr>
<td>---------------------</td>
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<td>-----------------------</td>
<td>--------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Land clearing</td>
<td>Sept</td>
<td>Machete</td>
<td>4 pcs</td>
<td>3000</td>
<td>0.11</td>
<td>0</td>
</tr>
<tr>
<td>Ploughing</td>
<td>Oct</td>
<td>Ox-plough</td>
<td>Per acre</td>
<td>50,000</td>
<td>0.83</td>
<td>15</td>
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<tr>
<td>Seeding/sowing</td>
<td>Nov</td>
<td>Hand hoe</td>
<td>4 pcs</td>
<td>4000</td>
<td>0.169</td>
<td>5</td>
</tr>
<tr>
<td>Plant protection</td>
<td>Dec</td>
<td>Hand hoe</td>
<td></td>
<td></td>
<td>0.11</td>
<td>3</td>
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<tr>
<td>Fertilizer</td>
<td>Feb</td>
<td>Fertilizer pole</td>
<td>1 pc</td>
<td>1</td>
<td>0.169</td>
<td>3</td>
</tr>
<tr>
<td>Spraying</td>
<td>Feb</td>
<td>Backpack sprayer</td>
<td>1 pc</td>
<td>60,000</td>
<td>0.333</td>
<td>0</td>
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<tr>
<td>Plant protection</td>
<td>Mar</td>
<td>Hand hoe</td>
<td></td>
<td></td>
<td>0.11</td>
<td>0</td>
</tr>
<tr>
<td>harvesting</td>
<td>Jul</td>
<td>machete</td>
<td></td>
<td></td>
<td>0.11</td>
<td>0</td>
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<tr>
<td>transport</td>
<td>Jul</td>
<td>carts</td>
<td>2 trips/acre</td>
<td>9000</td>
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</table>
# Inputs application rates

<table>
<thead>
<tr>
<th>Input</th>
<th>Application rate</th>
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<tbody>
<tr>
<td>Basal (Minjingu mazao)</td>
<td>100kg/acre</td>
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<tr>
<td>Top dressing UREA (46)</td>
<td>50kg/acre</td>
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<tr>
<td>Seed</td>
<td>10kg/acre</td>
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<tr>
<td>Seed for gap filling</td>
<td>0.5kg/acre</td>
</tr>
<tr>
<td>Thionex</td>
<td>1 liter/acre</td>
</tr>
</tbody>
</table>
Farm story and P&L: TYPICROP small scale model results

Iringa region

Microsoft Office Access Database
Concluding remarks

- Not yet final inferences as this is still work in progress
- We think the model’s theoretical background needs to be elaborated to enable wide scale usage in research
- The immediate expectation is to compare the model results with on going survey-based methodology on maize COP
Thank You
COST OF PRODUCTION FROM A TYPICAL SMALL SCALE FARM IN TRANZOIA COUNTY IN KENYA
by
RAPHAEL GITAU

TEGEMEO INSTITUTE OF AGRICULTURAL POLICY AND DEVELOPMENT
Background

• Capital; Nairobi
• Currency is Kenya Shillings (KES) = 1US $:80 KES
• Population 40 million (2009 census)
• GDP growth of 4.6% in 2012
• Agriculture contribution to GDP 26%
• Total Area 5,083,670 sq km
• Main staple food is Maize, wheat and Rice
• Agriculture share in labor 75%
• Unemployment rate 40%
Kenyan Soils
Transnzoia County

- Kwanza
- Saboti
- Cherangani

Density: People per km²
- 211
- 310
- 520

Urban centres with population of more than 2000 people.
Transnzoia County (Kitale)

• Rift Valley is the bread basket of Kenya producing 22 million bags (55% of Kenya maize)
  – About 30% maize comes from T/Nzoia county alone
• Small scale farmers produce 41% of maize, Medium and large scale 36%, 23% respectively.
• Maize produced for commercial & subsistence
• Small scale farmers in Cherangany & Kwanza while Large scale farms in Saboti.
Small Scale typical farm

• Total farm size 5.5 acres
• Rainfed intercrop system of production
• Intensive tillage (Ploughing)
• Land mainly used for **Maize** (82%), Dairy, Poultry, Sheep & Horticulture
• Land costs/acre in 2012
  – Buying KES 350,000 (4,375 US $)
  – Rent KES 6,000 (75 US $)
• Private/Individual land ownership
• Well drained sandy-loam soils & Well distributed rainfall of 1200mm/annum
Cropping System & Prices

• Maize & Bean Intercrop system (intensification)
  – 2 Bean crops relay-cropped in the Maize
  – Maize yield = 1.62 tons/acre (4 tons/ha)
  – Bean yield = 0.14 tons/acre (0.35 tons/ha)

• Maize prices:
  – High: KES 27,689 (346 US $) per ton
  – Average: KES 24,356 (304.5 US $) per ton
  – Low: KES 21,022 (262.78 US $) per ton

• Beans
  – Average price: KES 51,111 (638.89 US $) per ton
## Small Scale typical farm

- **Direct costs of production**

<table>
<thead>
<tr>
<th>Item</th>
<th>Maize KES (US $)</th>
<th>Beans (US $)</th>
<th>Total (US $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed</td>
<td>1,500 (19)</td>
<td>918 (12)</td>
<td>2,418 (30)</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>9,252 (116)</td>
<td>7,499 (94)</td>
<td>16,751 (209)</td>
</tr>
<tr>
<td>Chemicals</td>
<td>400 (5)</td>
<td>400 (5)</td>
<td>800 (10)</td>
</tr>
<tr>
<td>Labor</td>
<td>10,900 (136)</td>
<td>9,500 (119)</td>
<td>20,400 (255)</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td><strong>22,052 (276)</strong></td>
<td><strong>18,317 (229)</strong></td>
<td><strong>40,369 (505)</strong></td>
</tr>
</tbody>
</table>

- Labor accounts for about 50% of total cost
- Fertilizers: DAP (75kg/acre), CAN (50kg/acre), Foliar feed (1 lit/acre)
Farm implements

- **Owned – self propelled**
  - Hand hoes
  - Knapsack pumps
  - Panga (machete)
  - Carry bags
  - Threshing sticks

- **Hired – Tractor drawn**
  - Disc plough
  - Seeder
  - Sheller
  - Trailer (Transport)
Yield

- **Beans**
  - 2012 KE2TNZ
  - #N/A

- **Beans**
  - 2012 KE2TNZ
  - #N/A

- **Corn**
  - 2012 KE2TNZ
  - #N/A
Cost decomposition

Crop Establishment (US $/Ha)

Operating costs (US $/Ha)
Total cost & Gross Revenue

- **Beans 2012** (KE2TNZ)
  - Cash cost: 400
  - Depreciation: 100
  - Opportunity cost: 300
  - Gross revenue: 100

- **Beans 2012** (KE2TNZ)
  - Cash cost: 200
  - Depreciation: 100
  - Opportunity cost: 200
  - Gross revenue: 10

- **Corn 2012** (KE2TNZ)
  - Cash cost: 1000
  - Depreciation: 200
  - Opportunity cost: 300
  - Gross revenue: 10
Thank you
A ReNAPRI Initiative Towards Comparative Regional Policy Analysis

Results from the Typical Small Scale Farms in the Region: Kenya, Malawi, Mozambique, Tanzania, South Africa and Zambia

Presented by Raphael Gitau
Yield levels across Sub-Saharan Africa

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</tr>
</thead>
<tbody>
<tr>
<td>KE2TNZ</td>
<td>MW3LADD</td>
<td>MZ1MD</td>
<td>TZ2IR</td>
<td>ZA1200NW</td>
<td>ZA1600EFS</td>
<td>ZM7SP</td>
<td></td>
</tr>
<tr>
<td>Kenya</td>
<td>Malawi</td>
<td>Mozambique</td>
<td>Tanzania</td>
<td>South Africa</td>
<td>Zambia</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Crop establishment cost (USD/ton)
Key cost elements
## Total cost (w/o land cost) and gross revenue (USD/ton)

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Depreciation</th>
<th>Cash Cost</th>
<th>Gross Revenue</th>
<th>Land Cost (w/o land cost)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE2TNZ</td>
<td>2012</td>
<td>$285</td>
<td>$284</td>
<td>$724</td>
<td>$284</td>
</tr>
<tr>
<td>MW3LADD</td>
<td>2012</td>
<td>$150</td>
<td>$150</td>
<td>$50</td>
<td>$150</td>
</tr>
<tr>
<td>MZ1MD</td>
<td>2012</td>
<td>$226</td>
<td>$284</td>
<td>$724</td>
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- **Depreciation**
- **Cash Cost (w/o land cost)**
- **Gross revenue**

The diagram illustrates the comparison of total costs (excluding land cost) and gross revenue for the mentioned countries and years.
Nitrogen productivity as a response rate indicator
N-technical productivity indicator – A global comparison

<table>
<thead>
<tr>
<th>Country</th>
<th>Productivity (kg maize/1 kg N)</th>
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<td>Farm name</td>
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Thank you