Economic impacts of developing a biofuel industry in Mozambique

by Faaiqa Hartley[1], Dirk van Seventer [2], Emilio Tostao[3] and Channing Arndt [4]

[1]Researcher, Energy Research Centre (ERC); faaiqasalie@gmail.com; [2]Consultant with UNU WIDER; [3]University Eduardo Mondlane in Maputo; [4]UNU WIDER

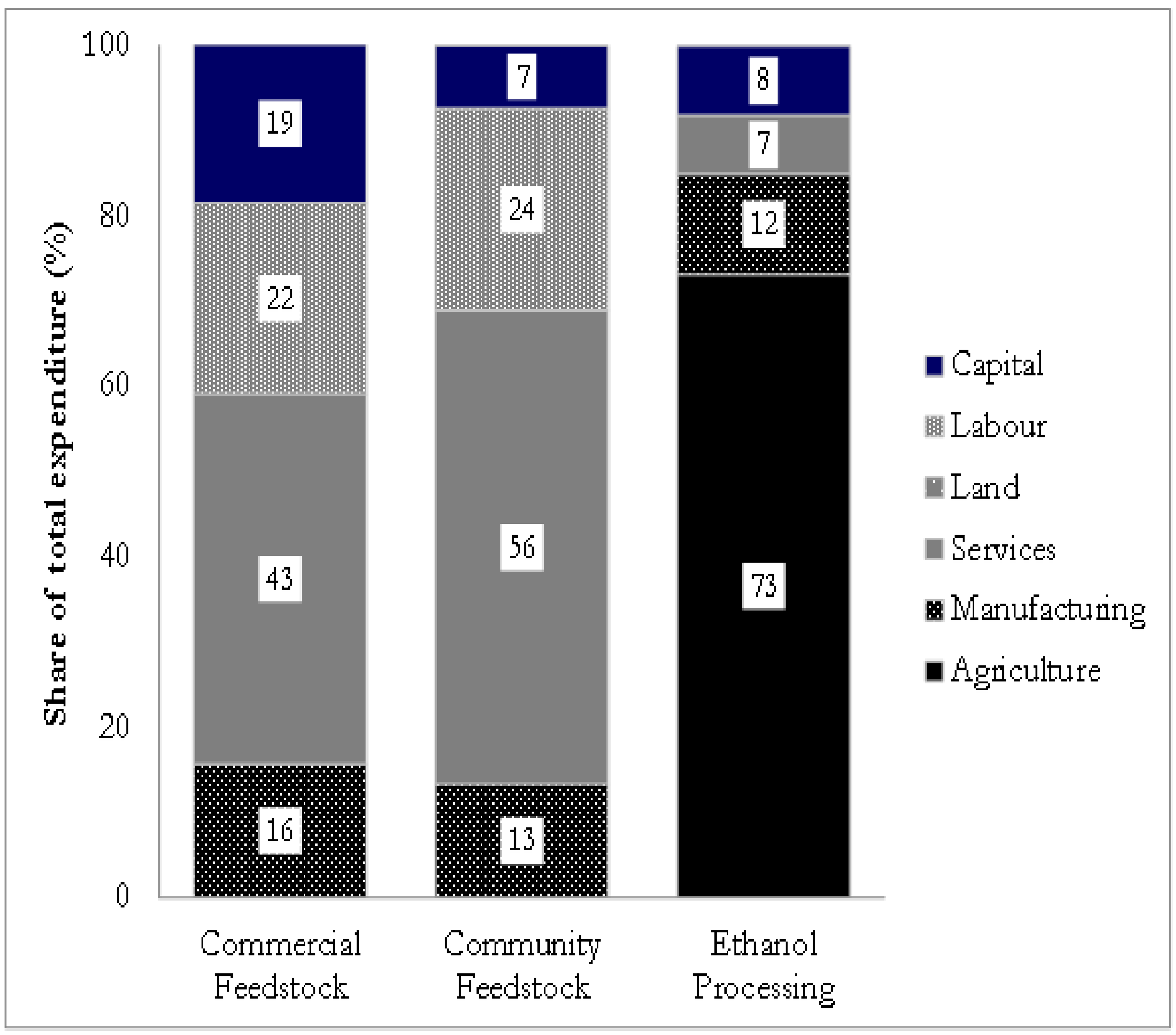
Background and objective

- Biofuels demand in SADC expected to increase with blending mandates
  - Main market expected to be in SA
- Mozambique potentially key producer: favourable climate / land availability
  - National Biofuel Policy Strategy 2009: 10% in 2015 ➔ 20% in 2021
- Literature suggests many benefits to biofuels production
  - Rural income / employment / BoP / climate change
- Crops identified in Mozambique:
  - Sugar: growing potential but lower global demand ➔ alternative use
  - Sweet Sorghum: drought resistant, new but ignored here
  - Jatrova for biodiesel: implementation issues, previously investigated
- This analysis: impact of increased biofuels production for the SA market.
  - Concern for food security / food prices
  - Potential for cogeneration of electricity: successful elsewhere

Potential for biofuel production in Mozambique

- Currently, sugarcane mainly produced by 4 companies
  - Outgrower program for medium large & community farmers (12.5%)
  - Land availability: no constraint expected / infrastructure adequate
- Data collected on sugarcane production by CEPPAG (representative)
  - Production costs
  - Includes separate data on supporting outgrowers (community farming)
  - Community farming similar to commercial
    - Commercial operations takes care of most input costs
  - Returns to capital assumed to be same as Zambian field study
- Feedstock costs are estimated to be less than $0.20 per litre
- Bioethanol processing cost data not available ➔ use international data
  - Total costs estimated to be about US$0.32-0.33 per litre

Figure 1: Feedstock and processing expenditure by component



Source: CEPPAG (2016); Own Calculations.

Model

- Standard Neoclassical CGE (Lofgren et al, 2002) using 2012 SAM
- Recursive dynamic, solve for each year
  - Investment current year ➔ new capital stock next year
    - Capital stock updating based on relative activity size & return
  - Exogenous population and TFP growth➔ base line GDP path
- Adjustment rules: flexible xrate & wage rates

Methodology biofuels modelling:

- Add biofuels activities to SAM with (close to) zero output
- Use cost structure from field data: mapped to model commodities
- Each feedstock is matched to its own ethanol production:
  - Separate value chains for large and small with or without cogen
  - Feedstock output is only supplied to matching ethanol
  - All ethanol is exported
- Cogeneration: ethanol input structure the same with or without
  - Use conversion factor of 70kWh/tonne @ cost of US$0.08/kWh
  - Electricity generation free: value of output ➔ additional to GOS
- Financing for all biofuels activities: foreign capital (no constraint)
  - After tax GOS repatriated

Scenarios: increase supply land exogenously to meet target

1. Expansion with existing shares of large (87.5%) / small (12.5%)
2. Expansion with bias towards small scale: equal shares
3. Cogen: Scenario 1. with electricity cogeneration
4. Displacement. 50% new small farmer feedstock from all other crops

Table 5: Sector Growth, 2015-2025

	Share, 2012 (%)	Baseline growth, 2015-2025 (%)	Deviation from Baseline growth rate, 2015-2025 (%-point) Sceanrio 1 Bioethanol, status-quo	Sceanrio 2 Bioethanol, 50-50	Sceanrio 3 Bioethanol + Cogeneration	Sceanrio 4 Bioethanol + Displacement
Total GDP	**100.0**	**7.200**	**0.002**	**0.001**	**0.018**	**0.001**
Agriculture	**28.5**	**5.4**	**0.017**	**0.015**	**0.016**	**0.013**
Food crops	20.6	**5.2**	-0.001	-0.001	-0.002	-0.007
Biofuel crops	0.0	**0.0**	187.276	184.713	187.276	187.276
Other agriculture	4.1	**3.7**	-0.004	-0.004	-0.004	-0.006
Forestry & Fishing	3.8	**7.7**	-0.017	-0.017	-0.017	-0.016
Mining	**3.4**	**13.6**	**-0.013**	**-0.014**	**-0.006**	**-0.012**
Manufacturing	**11.7**	**4.4**	**0.012**	**0.010**	**0.182**	**0.011**
Food processing	4.4	**3.3**	-0.003	-0.003	-0.003	-0.004
Biofuels processing	0.0	**0.0**	136.066	132.976	203.336	136.066
Other manufacturing	7.3	**4.9**	-0.002	-0.003	0.005	-0.003
Utilities & constructio	**6.4**	**6.4**	**0.001**	**0.000**	**0.001**	**0.001**
Services	**50.1**	**7.7**	**-0.003**	**-0.003**	**-0.001**	**-0.003**

Source: Results from the Mozambique CGE model

Results: small

- GDP: Agriculture is up but other activities are down
  - Negative impact due to more intense competition for labour
  - Cogeneration most positive on GDP, more negative on other agr
- Employment: compositional
- Income Distribution: rural benefit but with cogen this is reversed

Variation: abundant unskilled labour

- From other regions during peak season (currently not the case)
- Impact more positive, most sectors and both rural and urban benefit

Conclusions

- Previous mistake due to lack of guaranteed demand for biofuels must be avoided in order to reap potential benefits. How? SADC or local mandate
- Food security risks are low and manageable due to abundant land but requires coordinated infrastructure program