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Socioeconomic impacts in Mozambique due to sustainable sugarcane bioethanol production scenario

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Content of the presentation

- Introduction and objective
- Socioeconomic impacts and scenarios
- Methodology – What is Input-Output Analysis?
- Possible results
- Next steps

Introduction and objective

- The Millennium Development Goals (The Millennium Declaration, UN – 2000)

Goal 1: eradicate extreme poverty and hunger

Considering the period between 1990 and 2015, reduction of 50% on (i) the proportion of people whose income is less than US$ 1 per day and (ii) the proportion of people who suffer from hunger
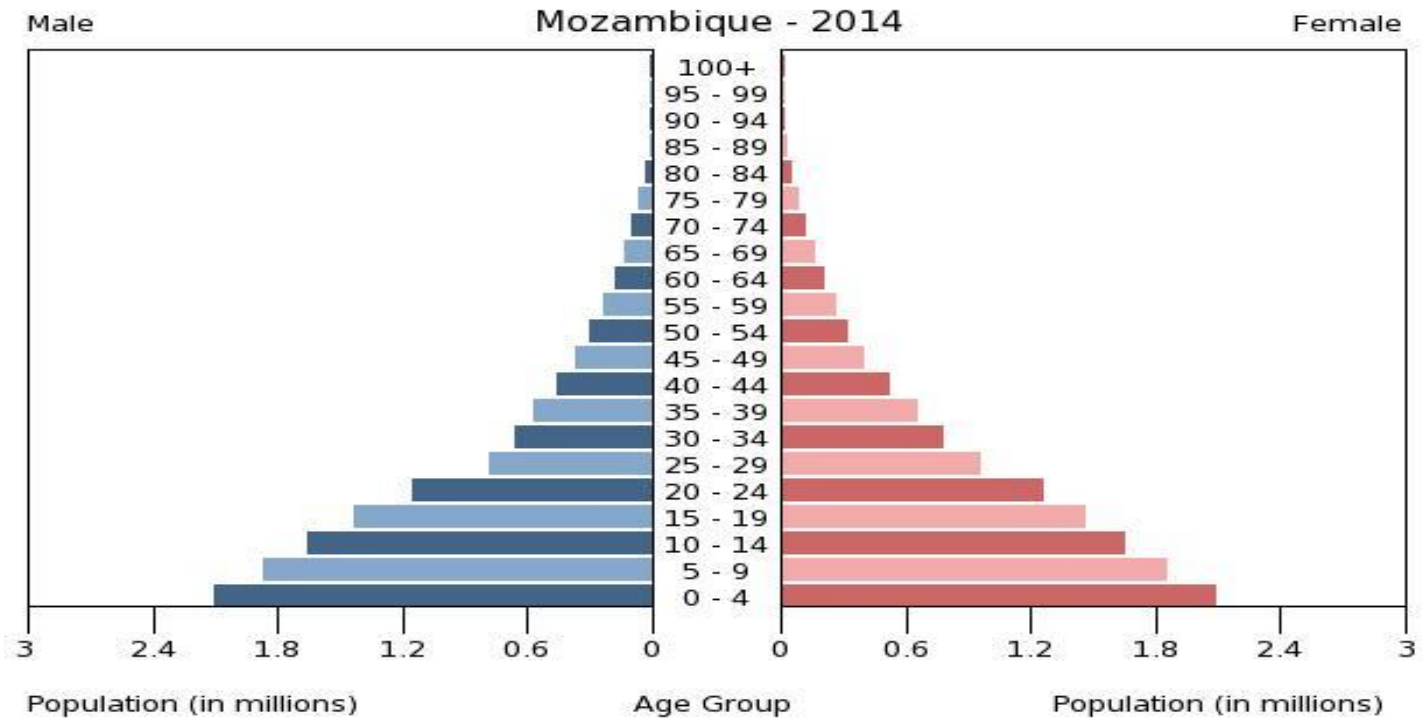
Introduction and objective

- Some data of Mozambique

→ Population : about 20 million

   70 % live in rural areas

   30 % live in urban areas

→ HDI : 0,393 (178 place)

→ Unemployment rate: 27 %

→ It is estimated that 300,000 youths join the labour force every year

Source: CIA (2014) and UNDP (2014)
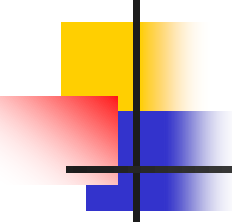
Introduction and objective

- Demography

Source: CIA (2014)
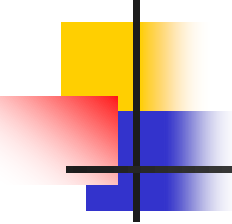
Introduction and objective

- Some data of Mozambique

→ Gross Domestic Product by sector

   Agriculture: 28,7 %

   Industry: 24,9 %

   Services: 46,4 %

→ GDP per capita (PPP, 2013)

   1,200

→ 80 million hectares; 30 million hectares potential for agriculture. Today, only 5 million hectares is being used

Source: CIA (2014) and UNDP (2014)

Methodology – What is Input-Output Analysis?

- To evaluate these socioeconomic impacts at the scenarios established, we will use the economic model developed by nobel prize Wassily Leontief in the late 1930's, known as Input-Output Model;

- In 1993, UN standardized IO matrix as a component of the National Accounts for all countries;

- IO analysis is one of the most widely applied approach in economics, such as to evaluate a variety of policies and changes in technologies over many sectors – Agriculture, Energy, Services and others;

Methodology – What is Input-Output Analysis?

- This methodology can be used in a regional, national and international geographic level;

- The fundamental purpose of IO framework is to analyze the interdependence of industries in an economy , taking into account the direct and indirect effects over the production chain;

- This model is constructed from economic observed data for a specific region (usually is a country).

Methodology – What is Input-Output Analysis?

|		PRODUCERS AS CONSUMERS								FINAL DEMAND			
		Agric.	Mining	Const.	Manuf.	Trade	Transp.	Services	Other	Personal Consumption Expenditures	Gross Private Domestic Investment	Govt. Purchases of Goods & Services	Net Exports of Goods & Services
PRODUCERS	Agriculture												
	Mining												
	Construction												
	Manufacturing												
	Trade												
	Transportation												
	Services												
	Other Industry												
VALUE ADDED	Employees	Employee compensation								GROSS DOMESTIC PRODUCT			
	Business Owners and Capital	Profit-type income and capital consumption allowances											
	Government	Indirect business taxes											

Source: Miller and Blair (2009)

Possible results

- Some output multipliers for Mozambique

Sector	Output multiplier	Indirect effect
Maize	1.32	10.2%
Other export crops	1.26	10.0%
Wood industry	1.82	19.0%
Food processing	2.04	21.2%
Beverages and tobacco	1.95	23.0%
Graphic industry	2.07	25.4%
Chemicals	1.64	18.4%
Industries excluding metal	1.93	23.1%
Other manufacturing	1.74	20.6%
Electricity and water	2.48	29.9%
Construction	1.95	22.0%
Restaurants and hotels	1.95	20.6%
Public administration and defence	1.90	21.6%
Other services	1.83	20.2%

Introduction and objective

- 5 Mha of sugarcane in Mozambique to produce ethanol would double GDP per capita in the country → impact of 0.07 in HDI
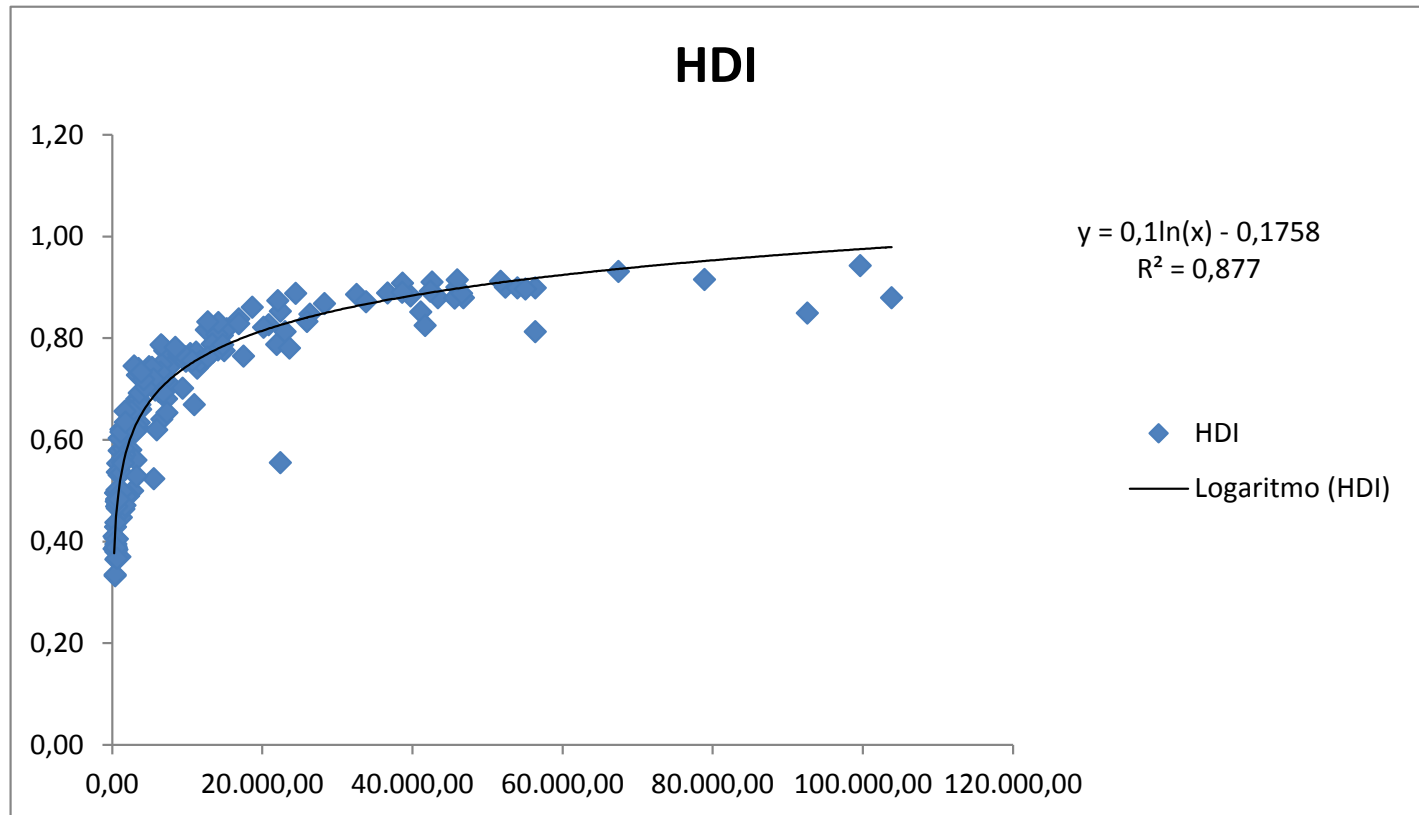
Introduction and objective

- South Africa, Mozambique, Colombia and Guatemala have different opportunities and challenges regarding the possible expansion of sugarcane for energy purposes;

- These differences contemplate the three pillars of sustainability – environmental, social and economic;

- In this context, an important question is: What are the possible ways (probably more than one!) that bioenergy from sugarcane can be a real attractive option for a sustainable development in these countries?

Introduction and objective

- What are the socioeconomic impacts to be evaluated? How to measure them?

- Of course, they will depend on the sugarcane (agricultural and industrial phase) production model, i.e., the scenarios chosen;

- In LACAf I project, the purpose of this study is to contribute to this evaluation.

Socioeconomic impacts and scenarios

- Considering the economic cross-sector effects (not "only" over sugarcane industry), some of the major socioeconomic impacts are related to:

→ Sectoral production level;

→ GDP (including the possible substitution of gasoline by ethanol);

→ jobs creation;

→ income generation and distribution;

→ tax revenue;

→ increased energy availability.

Socioeconomic impacts and scenarios

- **Scenarios need to combine these issues:**

→ Large and/or small scale?

→ Vertical integration and/or outgrowers?

→ High amount of output looking for exports and domestic markets and/or bioenergy/biofuel production itself towards smaller-scale markets (e.g., ethanol for cooking fuel)?

→ Necessity of investments? Infrastructure, distribution, transport and storage.

Possible results

- Impacts due to a distillery in Brazil crushing 2 Mtc per year, producing 170 ML of ethanol and 80 GWh (40 kWh/tc) of surplus electricity:

→ 170 ML: US$ 100.6 million

→ Total output: US$ 283.4 million

→ Total GDP: US$ 124.8 million

→ Jobs: 2.9 thousand

→ Economic surplus of electricity: 71.5 GWh

Possible results

- Ethanol vs gasoline in Brazil – indicators

Item/product	Gasoline	Ethanol	Eth/Gas
Energy balance	0.85	9.26	10.89
GHG (gCO_2 eq/MJ)	77.52	20.62	0.27
Output (US$/GJ)	32.55	53.95	1.66
GDP (US$/GJ)	10.43	26.75	2.56
Jobs (per TJ)	0.26	1.29	4.96
Wages (US$/month/job)	1,147.85	567.22	0.49

Next steps

- Obtaining (and maybe "correct" it) the most recent IO table for Mozambique;

- Building a flex IO model to combine different scenarios for all technologies routes taking into account sustainable sugarcane ethanol production scenarios in Mozambique at the LACAf project;

- Inclusion of these technologies (i.e., sugarcane and biorefineries) in the model;

- Analysis of the socioeconomic impacts at the whole economy in all sectors: output, GDP, income, jobs, remuneration, Government tax revenue and economic surplus of electricity.

Thank you very much!

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