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## **Technical and Environmental Efficiency of SMEs in Agro-processing in Cameroon**

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# INTRODUCTION

- The rate of treatment, processing and packaging of crops in Cameroon is low and remains at a small scale and often informal (FAO and BAD, 2011). Need for sustainable growth of existing agro-processing firms.
- Unfortunately, little is known about the quality of that sustainable growth in terms of firms' performance.
- Literature on efficiency: from technical efficiency to environmental efficiency due to adverse effects of industry on the environment (Reinhard et al., 1999)
- Implication for firms: efficient use of environmentally detrimental inputs. Combustible/fuel as main environmentally detrimental resources use in industries (OCDE and IEA, 2003).
- Studies that analyse the technical and the environmental efficiency of firms (Reinhard et al., 1999; Kamande, 2010; Yagi et al., 2015; Sowunmi et al., 2016).
- **The objective of this study is to analyze the technical and environmental efficiency of SMEs in agro-processing in Cameroon.**

# METHODS and DATA (1)

## Estimation of the Technical Efficiency: output-oriented TE

- Translog functional form for the stochastic production frontier given in equation (1) following the framework developed by Reinhard et al. (1999) is:

$$\ln Y_i = \beta_0 + \sum_{j=1}^m \ln X_{ji} \beta_j + \ln Z_i \beta_z + \frac{1}{2} \sum_{j=1}^m \sum_{k=1}^m \ln X_{ji} \ln X_{ki} \beta_{jk} + \frac{1}{2} \sum_{j=1}^m \ln X_{ji} \ln Z_i \beta_{jz} + \frac{1}{2} \ln(Z_i)^2 \beta_{zz} + v_i - u_i \quad (1)$$

## Estimation of the Environmental Efficiency: input-oriented EE

- the logarithm of the output  $Y'_i$  of an environmentally efficient firm using  $X_i$  and  $Z_i$  is obtained by setting  $u_i = 0$  and by

replacing  $Z_i$  by  $Z_i^F$  ( $Z_i^F = EE_i * Z_i$ )

- $\ln Y'_i = \beta_0 + \sum_{j=1}^m \ln X_{ji} \beta_j + \ln Z_i^F \beta_z + \frac{1}{2} \sum_{j=1}^m \sum_{k=1}^m \ln X_{ji} \ln X_{ki} \beta_{jk} + \frac{1}{2} \sum_{j=1}^m \ln X_{ji} \ln Z_i^F \beta_{jz} + \frac{1}{2} \ln(Z_i^F)^2 \beta_{zz} + v_i \quad (2)$

## METHODS and DATA (2)

- Setting (1) = (2) and solving the obtained equation yield the logarithm of environmental efficiency :

$$\ln EE_i = \frac{\left\{ -\left( \beta_z + \sum_{j=1}^m \ln X_{ji} \beta_{jz} + \ln Z_i \beta_{zz} \right) \mp \left[ \left( \beta_z + \sum_{j=1}^m \ln X_{ji} \beta_{jz} + \ln Z_i \beta_{zz} \right)^2 - 2\beta_{zz} u_i \right]^{\frac{1}{2}} \right\}}{\beta_{zz}} \quad (3)$$

### Determinants of Environmental Efficiency

$$EE = \sigma_0 + \sigma_1 rural + \sigma_2 age + \sigma_3 equipment + \sigma_4 credit + \omega \quad (4)$$

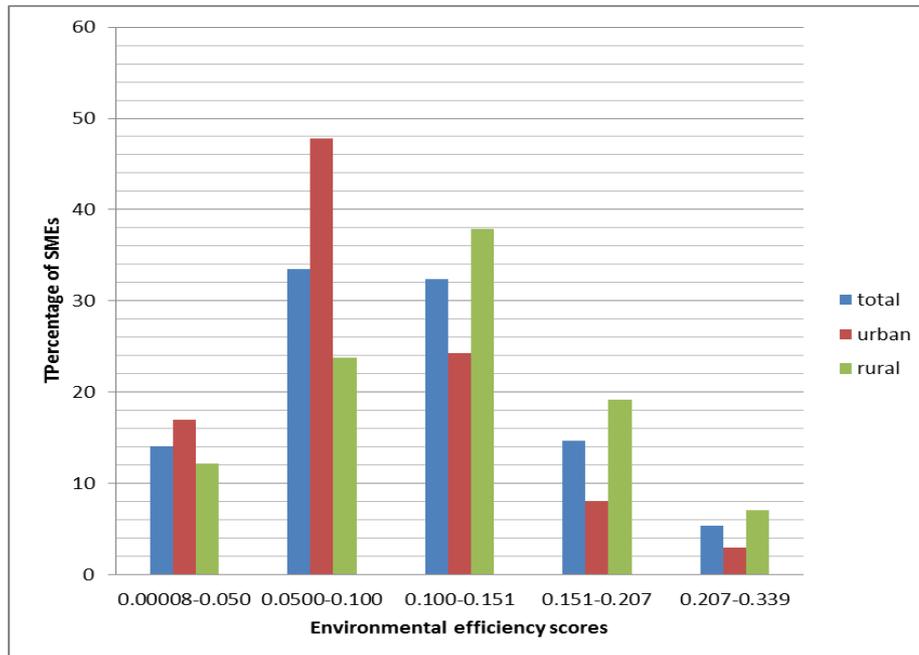
### DATA

- Data source : 2nd National Survey on Employment and Informal Sector
- 4538 non-agricultural informal production units (IPUs) surveyed
- 757 IUPs in agro-processing in Cameroon are concerned in this study. They represented 55.7% of the industrial sector and 19% of the total sample (INS 2011)

# RESULTS

Table 1	Descriptive statistics on TE			Descriptive statistics on EE		
	Total sample	Urban sample	Rural sample	Total sample	Urban sample	Rural sample
Men	0.711	0.712	0.710	0.1071	0.0905	0.11846
Std. Dev.	0.091	0.095	0.089	0.05900	0.0529	0.06033
Min	0.3032	0.303	0.308	0.00008	0.00008	0.00016
Max	0.8784	0.878	0.868	0.33916	0.31585	0.33889

**Table 2 Distribution of EE according to location**



**Table 3 Determinants of EE**

Variables	Coefficients
Rural	0.0335*** (0.00647)
Age	
[5, 10[	-0.0282*** (0.00780)
[10, 15[	-0.0246** (0.00957)
[15, [	-0.0234*** (0.00894)
Equipment	-0.0161* (0.00855)
Credit	0.00337 (0.00673)
Constant	0.103*** (0.00587)

# CONCLUSIONS AND RECOMMENDATIONS

- **Conclusions:**
- Agro-processing SMEs in Cameroon are less environmentally efficient
- Rural SMEs seems to be environmentally efficient than urban SMEs
- Environmental efficiency decreases with age of SMEs
- **Recommendations:**
- Creation of an environment that should increase the use of cleaner sources of energy (like electricity) that offers to SMEs some environmental and financial gain
- Provide incentives to encourage SMEs to adopt clean production technologies by rewarding those that endeavor to adopt clean production technologies. Special attention should be paid to urban and old firms