DETERMINTANTS AFFECTING TO TECHNICAL EFFICIENCY OF SENG CU RICE IN REMOTE AREAS OF VIETNAM: A CASE STUDY IN LAO CAI

Gembloux Agro-Bio Tech
Université de Liège

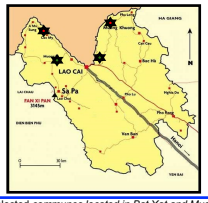
BUI Thi Lam[1*], TRAN Huu Cuong[2], Philippe LEBAILLY[3]

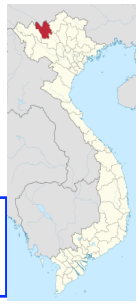
I - INTRODUCTION

- Seng Cu rice, a special product in the Northwestern region of Vietnam, provides high economic value and it is one of the main crops for poverty reduction and rural development. Lao Cai, a mountainous province, has various natural advantages for growing Seng Cu rice such as soil, climate, water resource and so on. However, Seng Cu rice production are facing with several challenges related to poor farming practices and input management in both upland and lowland areas.
- This paper aims to analyze the determinants of the economic efficiency in rice production by 123 randomly selected farmers. The Cobb-Douglas Stochastic Frontier Model was employed to analyse the data, using the FRONTIER 4.1. Given the results, the research proposes reasonable solutions, especially related to farming practice and input management, to improve the economic efficiency, better price for smallholders resulting in improve incomes and living standard for the local.

II - RESEARCH SITE

Figure 1: research study





4 selected communes located in Bat Xat and Muong Khuong district, the highest planted areas of Seng Cu rice in Lao Cai, and represented for lowland and upland regions.

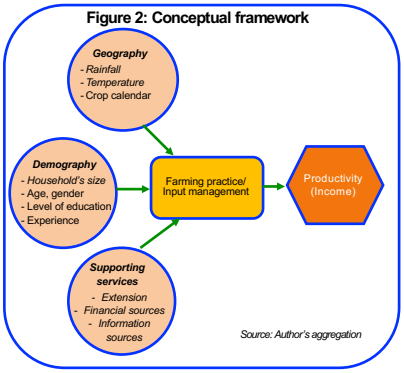
Muong Vi, Bat Xat and Ban Xen, Muong Khuong

Trinh Tuong, Bat Xat and Nam Lu, Muong Khuong

Upland **Lowland**

III - METHODOLOGIES

Figure 2: Conceptual framework



Source: Author's aggregation

Data collection

•***Secondary data***: Historical data in statistical yearbook of Lao Cai

•***Primary data*** was conducted to collect information about on endogenous characteristics of households, social – economic situation of household and farming practices for growing Seng Cu, etc.

Data analysis methods: regression; comparison mean of quantities or ratio between upland and lowland areas

A Cobb-Douglas stochastic frontier model incorporating inefficiency effects was employed to analyse the data, using the FRONTIER 4.1 (Farell, 1957)

$$\mathrm{Ln}(Y_i) = \beta_0 + \sum_{i=1}^{n} \beta_i \ln X_{ij} + \varepsilon_i \quad (1) \qquad \mu_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \ldots + \delta_k Z_k \quad (2)$$

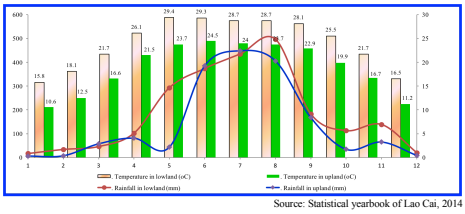
In which, Y_i: Productivity of household i; X_{ij} : technical factors

Z_k : non-technical factors in the inefficiency model (u_i)

IV - RESULTS AND DISCUSSIONS

The biggest differences between lowland and upland areas is natural condition, including rainfall, monthly temperature (figure 3), that causes difference in seasonal calendar in Seng Cu rice production (Figure 4). Beside this, farming practices of producers in upland and lowland areas have strongly remarkable.

Figure 3: Rainfall and temperature in selected regions of Lao Cai



Source: Statistical yearbook of Lao Cai, 2014

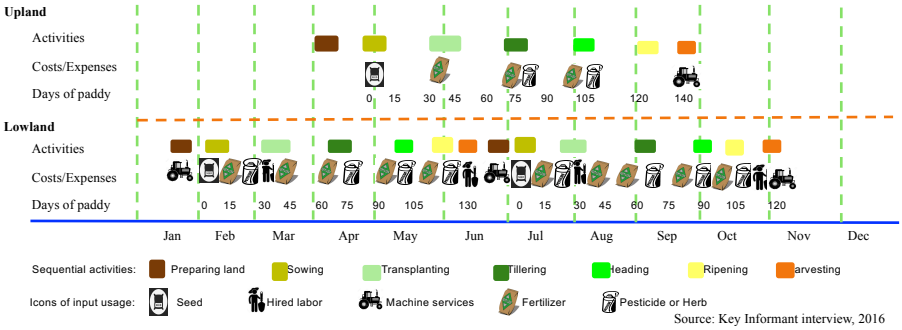
Table 1: Geographical differences in farming practices of Seng Cu rice production

Items	Lowland	Upland
Main features of field	Height under 400 m Large and flat field	401 – 800 m Small terrace field
Main water resource	Irrigated	Rainfed
Sowing date	Middle of February for Spring season; June for Summer season	Early May
Seedling age (days)	18 - 25	35 - 45
Hill spacing and No. of seedling per hill	20 x 25 cm; 30 – 35 hills m^{-2}; 1 – 2 seedlings per hill	20 x 20 cm; 40 – 45 hills m^{-2} 3 – 5 seedlings per hill
Crop establishment method	Transplanting and direct seeding	Transplanting
Seedling sources	53.70% of seed were bought from local market; others were stored by themselves	Almost seed (92.75%) were brought from the local market with high quality

Source: Household survey, 2016

Seasonal calendar for Seng Cu rice growing in upland and lowland areas of Lao Cai province

Figure 4: Production cycle and cash costs in Seng Cu rice production of surveyed farmers



Source: Key Informant interview, 2016

Using the Stochastic Production Frontier Model (SPF) to estimate effecting factors to technical efficiency of farmers

Table 2: Summary statistics for different variables in the model

Items	Lowland	Upland	P value
Productivity (ta/sao)	1.43	1.74	0.000***
Level of Technical Efficiency	78.43	79.30	0.7258
Technical factors in the Stochastic Production Frontier Model			
Seed (kg/sao)	2.08	1.53	0.000***
Fertilizer (1000 VND/sao)	377.95	467.20	0.038*
Pesticide (1000 VND/sao)	43.20	206.22	0.000***
Labour (working days/sao)	8.28	5.00	0.000***
Age of HH's head (years)	46.63	37.01	0.000***
Experience (years of SC rice production)	9.06	5.07	0.000***
Level of Education (years of schooling)	6.90	6.12	0.2423*
Percentage of farmers accessed extension service	59.42	53.70	0.009***

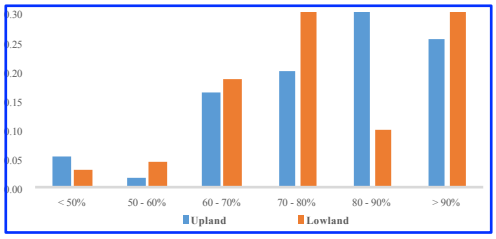
***, ** and * are significant level at 1%, 5%, 10%, respectively.

Source: Household survey, 2016

Table 3: Estimated coefficients in the SPF Model

		Standard-error
Constant	1.10***	0.99
Technical factors in the model		
Seed	-0.14***	0.85
Fertilizer	0.03	0.53
Pesticide	0.06	0.48
Labour	0.06	0.86
Seeding source	0.16***	0.86
Machine	0.01	0.39
Inefficiency factors		
Area (sao)	0.01*	0.02
Ethnic (1. Kinh; 0: Others)	-0.02	0.78
Age of HH's head (years)	0.01	0.01
Location (1. Lowland; 0. Upland)	-0.01***	0.85
Level of Education (years)	0.06	0.91
Experience (Years)	0.01*	0.20
Extension (1. Yes; 0. No)	0.023*	0.018
Variance parameters		
Sigma-squared	0.012*	0.06
Gamma	0.08	0.10
Log likelihood function	35.57	

Figure 5: Relative frequency distribution of Technical Efficiency selected farmers



Discussions

The parameters of seed is negative and highly significant that means farmers in upland areas should reduce number of seedling, increase hill spacing following the guideline of extension staff. Moreover, seeding source has strongly significant effect to TE. So small producers should buy seedling from the market with high quality instead of stored ones in the last season.

It is not clear that fertilizer nutrients and pesticide cost had directly effect on SC rice production. This result is difference in comparison with those of Abedullah et all (2007). From the results we can conclude that even though level of investment of farmers living in lowland regions had much higher than that of farmers in upland but their technical efficiency was lower. So they should reduce chemical usage to decrease input cost and increase income as well as protect environment.

The coefficient for the age variable is positive but non-significant so we can not say that older farmers are technically less inefficient than the younger farmers. This result is in line with those of Dang (2012).

The coefficient for the ethnic variable is also negative but is non-significance. This does not imply that Kinh group has more advantages than others in rice production.

The coefficient of agricultural extension service and year of experience are positively significant. The results imply that technical guideline from official authorities play an important role to improve output of rice in the area.

CONCLUSIONS AND RECOMMENDATIONS

- Seng Cu rice production of household in lowland had much higher investment level than upland area. However its effectiveness was much lower in comparison with that of upland. It is provide an empirical work for the inconclusive argument about relationship between agricultural investment and effectiveness as well as traditional farming practices and extensive methods.
- There are strongly effects of number of seeds and seedling source on technical efficiency in the area. So, official authorities in the field should increase number of high quality seeds providing to farmers. Beside this, farmers living in upland area have to follow the guideline of extension staff to have reasonable farming practices.
- It is not clear that level of pesticide and fertilize using affect to output of rice. Moreover those costs accounted for more than 80% of total cost for growing in lowland area. To increase effectiveness, those farmers should decrease chemical cost.
- Meanwhile level of education has no affectation to productivity, years of experience has strongly influence. According to household surveyed, the most difficulty in rice production is pest and water management which required farmer has enough experience.

REFERENCES

- Abedullah et al (2007). "Analysis of technical efficiency of rice production in Punjab (Pakistan): Implications for Future Investment Strategies". *Pakistan Economic and Social Review*. Volume 45, No. 2 (Winter 2007), pp. 231-244
- Coelli, T. J. (1994), A Guide to Frontier Version 4.1: A Computer Program for Stochastic Frontier Production and Cost Function Estimation. Mimeo, Department of Econometrics, University of New England, Armidale.
- *Nguyen Huu Dang (2012). Hiệu quả kỹ thuật và các yếu tố ảnh hưởng đến hiệu quả kỹ thuật của hộ trồng lúa ở Đồng bằng sông Cửu Long, Việt Nam trong giai đoạn 2008 – 2011. University of Can Tho.*
- Ngo Minh Hai et al (2014). Phân tích hiệu quả kỹ thuật trong sản xuất rau hữu cơ: Trường hợp nghiên cứu tại xã Thanh Xuân, huyện Sóc Sơn, thành phố Hà Nội. Journal of Science & Development. Volume 13, No. 6, pp. 1043-1050
- Sarfraz Hassan and Bashir Ahmad (2005). "Efficiency of Wheat Farmers in Mixed Farming System of the Punjab, Pakistan". International Journal of Agriculture and Biology

1: PhD student, Gembloux Agro Biotech, University of Liege, Belgium. *Corresponding Author. Email: Btlam.hua@gmail.com
2: Associated Professor, Vietnam National University, Hanoi, Vietnam.
3: Professor, Gembloux Agro Bio tech, University of Liege, Belgium.