ECONOMIC & ENVIRONMENTAL COMPARISON BETWEEN SHRIMP FARMING SYSTEMS IN THE BUFFER ZONE OF XUANTHUY NATIONAL PARK - VIETNAM

Nguyen Thi Trang Nhung[1*], Tran Huu Cuong[2], Philippe Lebailly[1]
([1]) Economics & Rural Development, Gembloux Agro-Bio Tech, University of Liège, Gembloux 5030, Belgium;
([2]) Faculty of Accounting and Business Management, Vietnam National University of Agriculture, Hanoi 100000, Vietnam;
(*) Correspondence: thuytrangnhung@gmail.com; Tel.: +32 488 365 113.

INTRODUCTION

- Xuan Thuy National Park (XTNP), the first Ramsar site in Southest Asia, is the largest coastal wetland ecosystem in the North of Vietnam (7,000 ha of core zone & 8,000 ha of buffer zone);
- 1,699 ha of shrimp aquaculture is playing a crucial role in ensuring economic development for the local communities;
- Many business shrimp farmers there see natural resources as free for taking. Thus, a great deal of environmental damages has arisen from poor management by small-scale shrimp culturists.
- Some shrimp models would make this culture become more sustainable in long-run if famers receive benefits while managing farms with more friendly responsibility.

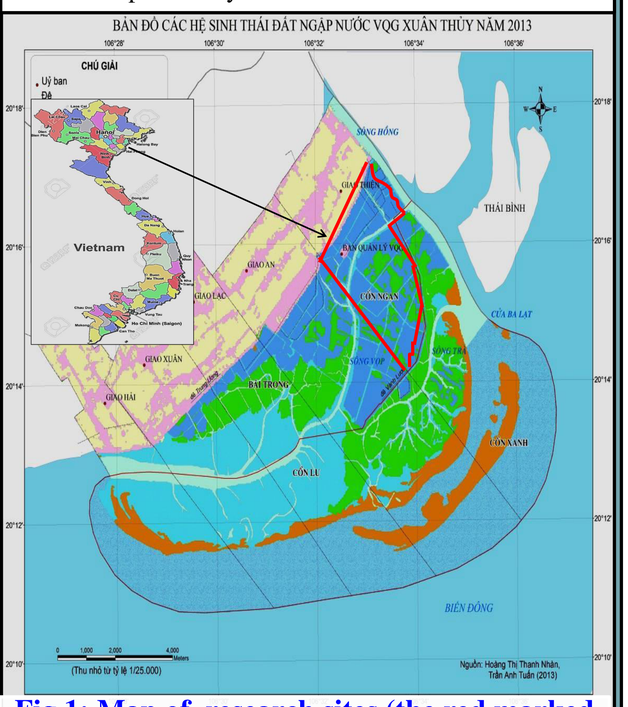


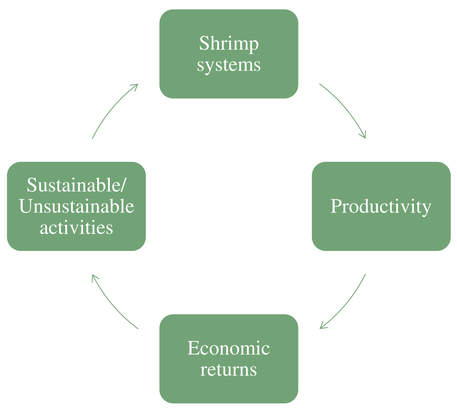
Fig 1: Map of research sites (the red marked areas – shrimp farms)

OBJECTIVES

This paper aims at providing detailed comparison between two shrimp models in XTNP's buffer zone in terms of economic and environmental perspectives. Lesson learned from review are considered recommendations of enhancing shrimp models' performances and minimize negative impacts to the ecosystem in the long term.

METHODOLOGIES

✓ **Analytical Framework**



Source: Adapted from IRRI[1]

Sample size: 56 intensive & 78 extensive farms, situated in the Ngan islet (buffer areas) & they were ajacent to Hong river and Balat estuary to the East, were chosen to gather information through fish bowl draw sampling method.

✓ **Data collection:** The author conducted a fieldwork in period from March to June 2017 to collect data through structure questionnaires .

✓**Data processing:**

○ Descriptive statistical analytical tools and statistical graphics were used to analyze indicators differences (cost, gross output, profit, etc.)

○ Multiple regression model was used to determine the environmental and other factors affecting shrimp productivity.

RESULTS

1 Different attributes of shrimp systems

Intensive shrimp model in XTNP

Extensive shrimp model in XTNP

	INTENSIVE	EXTENSIVE
Year to start in XTNP areas	2014	1990s
Land types		
- Tidal mudflat with mangrove (% respondents)	0	88
- Tidal mudflat without mangrove (% respondents)	100	12
Average farm size (ha)	1.31	5.47
Average pond size (ha)	0.110	5.47
Cultural species (post-larvae)	Penaeus vannamei (white leg shrimp - WLS)	Penaeus monidon (black tiger shrimp - BTS)
Stocking density (PL/m^2)	79.4	7.3
No of crops/ year	1.98	1
Growth period (days/cycle)	85	120
Duration of 1 crop cycle (days)	120	180
Diversity of species	Mono-culture (WLS)	Poly-culture (BTS, greasybock shrimp, fishes, seaweed
Feed Conversion Ratio (FCR)	1.07	Natural feed
Water exchanges (per crop)	7.8 times	Base on tidal regime (36 times)
Productivity (kg/ha/crop)	7,783 (WLS)	82.44 (BTS), 30 (crab), 54.03 (greasybock), 3.21 (fishes), 690 (seaweed)

Source: Survey, 2017

2 Factor effecting shrimp's productivity

There are three group of factors effecting shrimp productivity including: *attributes of farming* (stocking density, feed); *characteristics of farmers* (education) and; *environment* (surrounding environment, water exchanges, mangrove areas and, natural food) as explained:

✓ While increasing stocking density leads to improvement of intensive productivity, reduction of stocking density contributes to improve extensive shrimp productivity.

✓ Pellet feed is the one dominant factor has positive impact on intensive productivity. In extensive model, natural feed plays an crucial role.

✓ While training attendances have positive influence on both shrimp culture, affect from external environment leads to reduce shrimp production.

✓ Increase of water exchanges from intensive shrimp pond leads to improve its shrimp production.

✓ Mangrove areas can help to improve extensive shrimp's productivity.

Table 2: Shrimp system effecting its productivity – Multiple regression estimation results

INTENSIVE			EXTENSIVE		
Factors	Unstandardized Coefficients (Beta)	P-value	Factors	Unstandardized Coefficients (Beta)	P-value
(constant)	-.280	.381	(constant)	1.850	.000
❖ Stocking density	.572	.001	❖ Stocking density	-.270	.002
❖ Pellet feed	.154	.003	❖ Natural food	.356	.006
❖ Training	.047	.000	❖ Training	.37	.000
❖ Effect from the surrounding areas	-.140	.007	❖ Effect from the surrounding areas	-.317	.019
❖ Water exchange (times)	.074	.045	❖ Mangrove areas	.057	.045
Adjusted R^2 = .719			*Adjusted R^2 = .728*		

3 Economic performances of shrimp systems

- Intensive ponds needs 4.7 times as high total production cost as extensive model requires, then it brings only 2.8 times profit higher compared to the extensive model.
- Intensive production requires 11 main kinds of inputs, in which 4 natural related inputs (electricity, gasoline, sand, lime)
- While extensive farms apply 8 of inputs with mainly natural feeds, some rice bran and miscellaneous bivalve, a little lime, none of electricity nor gasoline.

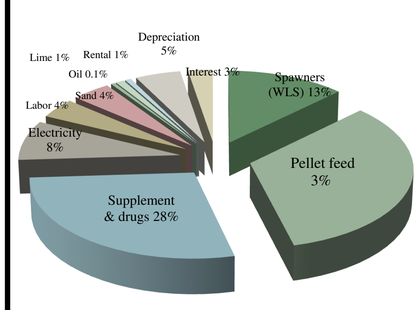


Fig.1: Cost structure of intensive model by ha (Production cost = 25,749 €/ha)

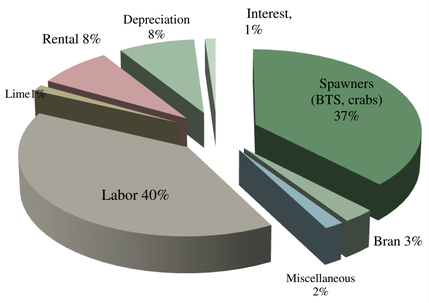


Fig.2: Cost structure of extensive model by ha (Production cost = 1,074,4 €/ha)

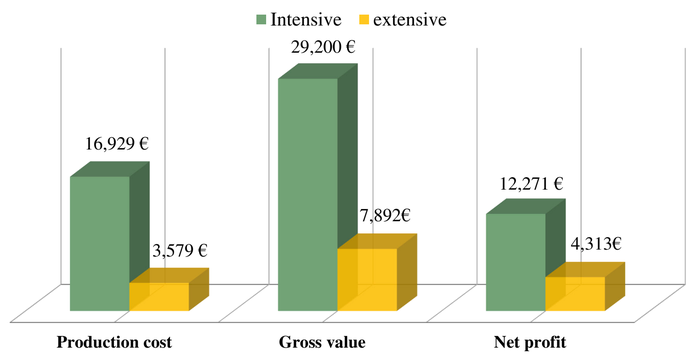


Fig.3: Economic performances by household

4 Farming practices toward sustainability

■ Extensive: Farmers have perception about advantages of their diversification system. They receive benefits from wild larvae (greasybock shrimp, fishes) and natural food which come in their farms from tidal water then grow up with mangrove area. Thus, many farmers currently try to remain mangrove and restrict chemicals in their ponds to produce good environment for shrimps and other habitat.

■ Intensive culturists apply several drugs in ponds then discharge sludge into the environmental surrounding without treatment carefully[2]. They try to recover their large amount of investment as soon as possible.

CONCLUSION & DISCUSSIONS

■ Intensive model produce higher profit compared to extensive.

■ Intensive model uses more kinds of inputs as well as natural inputs than extensive model does.

■ Efforts of farmers to improve productivity of intensive culturist including: increase stocking density, pellet feed amount and water exchange frequencies might create more potential negative impacts for the environment compare than extensive model:

○ *High stocking density and excessive use of feed lowers water quality result in stress and diseases among shrimp in intensive farming system[3].*

○ *More frequencies in water exchanges in intensive shrimp farms might be dangerous when redundant feed and waste discharged directly into the river[4].*

■ Efforts of farmers to replant and remain mangroves to improve extensive shrimp productivity is one of the sustainable activity. It can contribute to conserve ecosystem in the location for the long - run.

REFERENCES

1. IRRI (2006) Bringing hope, improving lives. Strategic plan 2007-2015. International rice research institute, Los Banos, Philipppines.
2. Nhung NTT, Cuong TH, Phillippe Lebailly (2016). Shrimp and rice farming in the buffer zone of Xuan Thuy National Park: Sustainable and unsustainable practices. The international conference on Agriculture development in the context of international integration opportunities and challenges. Vietnam National Unversity of Agriculture. Hanoi – Vietnam.
3. Flaherty M, Karnjanakesorn C (1995). Marine shrimp aquaculture and natural resources degradation in Thailand. Environmental Management 19(1):27–37.
4. Paez-Osuna Federico (2001) The environmental impact of shrimp aquaculture: Cause, Effects, and mitigating alternatives. Environmental Management Vol. 28, No.1, pp. 131-140.