ECONOMIC PERFORMANCE OF CLAM AQUACULTURE IN NAM THINH COMMUNE, TIEN HAI DISTRICT, THAI BINH PROVINCE

Nguyễn Thúy Hằng[1]*, Nguyễn Thị Dương Nga[2*]

[1]Institute of Water Resources Planning, [2]Hanoi University of Agriculture

Email: lunevn@yahoo.com/ngantd@hua.edu.vn*

Received date: 07.01.2013 Accepted date: 19.02.2013

ABSTRACT

Clam aquaculture has been practiced in Nam Thinh commune, Tien Hai district since 1989, but exhibited instabilllity recently, especially in terms of economic aspect. The study aimed to analyze the economic performance of clam aquaculture and propose recommendations to develop clam aquaculture in a more sustainable manner. A household survey of 48 clam farmers and key informant interviews were conducted in 2012. Gross margin analysis and comparative statistics with t-test and F - test were employed to analyze data. Results show that given the existing resources, technical level, and farmers' expertise, farms specializing in meat clam aquaculture, and/or operating at medium size, have highest economic performance. A number of problems relating to resources, seed, techniques, knowledge, water conditions, and social conflicts were addressed and recommendations to develop clam aquaculture were proposed accordingly.

Key words: Economic performance, clam aquaculture, Nam Thinh.

Hiệu quả kinh tế nuôi ngao ở xã Nam Thịnh, huyện Tiền Hải, tỉnh Thái Bình

TÓM TẮT

Nghề nuôi ngao ở xã Nam Thịnh, huyện Tiền Hải đã bắt đầu từ năm 1989, tuy nhiên gần đây có xu hướng phát triển không ổn định, đặc biệt về mặt kinh tế. Nghiên cứu này nhằm phân tích hiệu quả kinh tế của các hộ nuôi ngao và đề xuất một số giải pháp nhằm phát triển sản xuất ngao một cách bền vững hơn tại địa phương. Nghiên cứu sử dụng số liệu điều tra 48 hộ nuôi ngao và phỏng vấn sâu một số tác nhân liên quan vào năm 2012, sử dụng phân tích chi phí - lợi ích, thống kê mô tả và so sánh với kiểm định T và kiểm định F. Kết quả cho thấy với điều kiện hiện tại về nguồn lực, trình độ kỹ thuật, và kinh nghiệm của nông dân, các hộ chuyên sản xuất ngao thịt ở quy mô trung bình là có hiệu quả nhất. Các hộ nuôi ngao đang đối mặt với các khó khăn liên quan tới nguồn lực, giống, kỹ thuật, kiến thức, chất lượng nước nuôi, và các mâu thuẫn xã hội. Trên cơ sở đó, nghiên cứu đề xuất một số giải pháp nhằm khắc phục các vấn đề trên và phát triển sản xuất ngao tại địa phương.

Từ khóa: Hiệu quả kinh tế, ngao, Nam Thịnh.

1. INTRODUCTION

Fishery sub-sector has become increasingly important in Vietnam's agriculture with contribution in agriculture GDP of 21% in 2010 and annual growth rate of 8.8% during the last two periods. Farmers have gradually responded to market demand and switched to produce aquatic products, which are more economically beneficial. Spreading over about 23 km coastline, Tien Hai district in Thai Binh province has expanded clam aquaculture area to more than 4,077 ha in 2010 and made clam production one of the key drivers for local economic growth recently. However, clam aquaculture has exhibited unsustainable patterns in terms of income among farmers and over recent years, especially in Nam Thinh commune. This calls for actions of the government and farmer for sustainable development of clam production, demanding reliable and updated information on the current

evaluation of economic performance of clam aquaculture in the commune. This study aimed at evaluating economic performance of clam aquaculture and identifying problems to clam aquaculture in the commune to arrive at proposing recommendations to develop clam aquaculture in Nam Thinh commune in a more sustainable manner.

2. METHODOLOGY

2.1. Data collection

Secondary data relevant to clam aquaculture in Tien Hai district and Nam Thinh commune were collected through official sources from the district. Primary data were collected through a household survey with 48 clam farms in Nam Thinh commune using a structured questionnaire, which focused on clam production activities in the most recent clam season (2010-2011). The study employed stratified sampling strategy with 48 clam farmers (10% of total population) in 3 groups according to farming size suggested by local staff: small farms (≤ 2ha), medium farms (2 < - ≤5ha), and large farms (> 5ha). In-depth interviews with the commune officers, Farmers' Union, agricultural extension workers, fishery extension workers, small traders and input suppliers were also conducted.

2.2. Data Analysis

Gross margin analysis was used to evaluate economic performance of clam aquaculture, with following indicators: total revenues, total variable cost, total fixed cost, net farm income or profit (NFI)[1], profit/cost ratio, and family labor income, as defined by EC(1989) and used in various studies (Gelan, 2011; Colson, 2008; Geoffrey, 2008; Egrano, 2006; Ivana, 2011). T-test and F- Test were used to compare means of the indicators among groups. All the results from the household survey were for the clam season harvested in 2011.

[1] Net farm profit and profit, thereafter, are used interchangeably

3. RESULTS AND DISCUSSIONS

3.1. Overview of clam aquaculture in Nam Thinh commune

Meretrix is the most popular clam in the coastal area in Thai Binh province, mostly in Dong Minh and Nam Thinh communes in Tien Hai district (Thiet and Martin, 2008). Natural clam catching had been practiced by farmers located along the coastal line. Since 1990, farmers started to culture clam as the main occupation by using poles and polyethylene nets to enclose natural clam area, to manage and harvest. Clam aquaculture area in Nam Thinh commune has increased from 250 ha in 2001 to 600 ha in 2010 (Table 1).

Despite the impressive expansion of area, clam aquaculture productivity has slowed down recently, from 36.7 tons/ha in 2009 to 25.8 tons/ha in 2011. This is reasoned by (i) increased area is mostly marginal, because most of the favorable intertidal banks had already been exploited, (ii) mass death of clam caused huge loss in 2010 for a number of large clam farmers. In 2011, total production reached 19,500 tons, valued at 297 billion VND (Table 1). Most of the clam is sold to traders and then transported to the South for export to EU markets or to the North for Chinese markets, or for domestic consumption. There is only one private company (Thai Binh Shellfish Company) located in the commune that operates cleaning, grading, packaging and conserving live clam for export (capacity of 5 tons/day).

There was no any direct public investment on clam aquaculture documented. However, recently, the Cua Lan fishing port has been enlarged[2] to accommodate heavier and more intensive transport in the commune. This port together with the newly upgraded sea dike system facilitate clam transportation to markets and stop the high risk and cost of clam transporting by boats.

[2] Decision 346/QD-TTg of the Prime Minister on March 15, 2010 approving the national network of fishing ports up to the year 2020 and orientation to 2030

Table 1. Selected indicators of clam aquaculture in Nam Thinh commune

Indicator	Year			Comparison (%)		
	2009	2010	2011	2010/2009	2011/2010	Average
Area (ha)	450	600	756.5	133	126	129
Average yield (ton/ha)	36.7	30	25.8	82	86	84
Production (ton)	16,500	18,000	19,500	109	108	108
Output value (billion VND)	112.53	192	297	171	155	163

Source: Nam Thinh Commune People's Committee, 2012

3.2. Cost and benefit of clam aquaculture at farm-level in Nam Thinh commune

3.2.1. Basic characteristics of clam farmers

Average age of clam producers is about 47 years and average family size is 4-5 people. Most of clam households are headed by men who have attended school for about 10 years and have about 12.5 years of experience in clam aquaculture. Three-fourths of them were not fishermen before joining clam aquaculture, reflecting the fact that clam aquaculture has become more attractive as compared to other means of livelihoods in the commune.

There are three types of clam aquaculture system in the commune, namely seedling clam production, meat clam production, and combined (producing both seedling and meat clam), practiced by 58%, 19% and 23% of total clam farmer population, respectively. Average clam production cycle is 7.33 months, 17.32 months, and 25.73 months for seedling, meat clam, and combined farms, respectively. Farm size ranges from 0.4 to 25 ha, making an average of 3.52 ha per farm (Table 2). There is no large seedling farm, and average farm sizes of seedling, meat, and combined types are 1.12 ha, 4.11 ha, and 3.99 ha, respectively. The large meat clam farm size shows the widest variation among the types (Table 2).

Seedling farms gained about 6.31 tons/ha in the previous season, while meat and combined farms attained an average yield of 38.51 tons/ha. It is observed that meat clam yield inversely correlated with farm size, small farms attained highest yield because family labors concentrated more on production and clam production area mostly favorable - this is in contrast with the large farms. Medium meat clam farms attained highest yield of 46.5 tons/ha, while the large could produce around 27 tons/ha (Table 3). Coefficient of variation is highest for large farm (0.33), followed by seedling farms (0.22), indicating higher risk in production.

Table 2. Production scale of different clam farming types (ha)

Farming type/size	Production scale			All farms
	Small farm	Medium farm	Large farm	
Seedlings	0.93	2.70	-	1.12
	(0.12)	-	-	*(0.22)*
Meat clam	1.40	3.71	13.57	4.11
	(0.17)	*(0.26)*	*(5.85)*	*(0.86)*
Combined	1.90	3.48	6.93	3.99
	(0.10)	*(0.41)*	*(0.52)*	*(0.64)*
Overall	1.28	3.62	10.25	3.52
	(0.12)	*(0.21)*	*(3.02)*	*(0.54)*

Source: Household survey, 2012
Note: standard error in parentheses, (-): not available

Table 3. Averaged yield and output by production scale and farming type
(per hectare/season basis, million VND)

Indicators	Production scale[a]			Farming type			All farms[a]
	Small	Medium	Large	Seedling	Meat	Combined	
Yield	43.49	46.50	26.67	6.31	38.20	39.31	38.51
	(6.12)	*(4.54)*	*(8.68)*	*(1.23)*	*(4.31)*	*(4.20)*	*(3.33)*
Output	66.82	170.16	273.33	7.08	156.89	156.86	156.88
	(10.59)	*(21.82)*	*(41.61)*	*(1.40)*	*(21.09)*	*(33.36)*	*(17.59)*

Source: Calculated from the household survey (2012)
Note: standard error in parenthesis.[a]: for meat and combined types only

3.2.2. Costs

Fixed cost. Farmers need to invest in nets, poles, guarding houses and simple warehouse, boats, pumps, plastic clothes and other working tools. Normally, each farm has a big guarding house where guards of the farm can cook and eat, and small guarding houses for each guard. All other materials and equipments are locally available. On average, a farm incurred a fixed cost of 55.89 mil.VND/ha, of which salary for guards and interest charge accounted for about 80% (Table 4). Small farms incurred highest fixed costs (VND 75.23 mil. per ha) and large farms incurred lowest fixed cost (VND 34.49 mil. per ha). This probably resulted from advantages of economies of scale.

Variable cost. Variable costs cover largely seed, pumping service cost, seasonal labor, and others. For seeds, (Ben Tre clam), were often bought from southern provinces and carried by airplanes. The mortality of larvae is still high due to differences in climate conditions and water quality, therefore, majority of seedling farms start from "tấm" or "dắt" clam. Sand pumping services are now widely applied by most of the farms to improve the habitat for clam.

Average variable cost is estimated at VND 419.78 mil./ha (Table 4), of which seed accounts for 88%, followed by sand pumping service cost (7%) and labor cost (5%). Clam seeds are costly, especially the larvae, "cám" and "tấm" because of higher mortality rate. Seedling farms have the highest variable costs of VND 468.74 mil./ha due to high cost of seed inputs (larvae, cam), while the combined one incurred lowest variable cost because seed is produced internally. Also, variable cost is found to be inversely correlated to the farm sizes, where the small farms incurred highest variable cost (Table 4).

Table 4. Variable cost by farm size and farming type
(per ha/season basis, million VND)

Cost item	Farm sizes[a]			Farming types			All farms
	Small	Medium	Large	Seedling	Meat	Combined	
Total fixed costs	75.23	51.31	34.90	57.45	56.55	52.95	55.89
Of which, salary for watchmen and interest rate	61.64	41.58	25.27	47.55	45.05	43.91	45.26
Total Variable cost	428.02	406.93	378.37	468.74	411.62	400.50	419.78
Of which, seed	381.95	357.29	339.53	404.35	363.66	356.04	369.55
Total cost	503.27	458.09	413.33	526.19	468.17	453.44	475.67
F-test for difference in total cost/ha		0.962^{NS}			0.71^{NS}		

Source: Calculated from the household survey (2012)
Note:[a] for meat and combine types only, NS: non-significant

Total cost. On average, a farm incurred a total cost of VND 475.67 mil./ha in clam production (Table 4), which is quite high and demands for large amount of capital. There exist relationships between cost and farming type, and between cost and farm size. For meat clam-producing farms, small farms have the highest total cost (VND 503.27 mil./ha) while the large farms have the smallest total cost (VND 413.33 mil./ha). Seedling farms, as expected, have the highest cost, estimated at 526.19 mil.VND/ha (Table 4). However, F-test shows that there is no statistical difference in total of production per ha among the types and sizes of clam production (Table 5).

3.2.3. Market of product

Clam produce are marketed quite easily through different channels. Seeds are usually sold locally to other meat clam farms, while meat clam are sold to local collectors/traders and Thai Binh Shellfish Company Limited who then grade and transport to the South for export to EU countries, US or Japan, to regional markets for domestic consumption or to China for unofficial export. EU and the US are those of promising markets but exported volume is now very limited due to strict regulations of clam sizes and sanitation parameters. Nearly half of transaction between farmers and the collectors/traders were done through verbal agreements or very simple written agreements. In the last two years, clam farmers were happy with the meat clam price varying from VND 20,000-22,000 per kg. Small-sized farms sold clam at a bit higher price as compared to the medium and large-sized ones.

3.2.4. Gross margin analysis

Average total gross output per ha of a clam farm was estimated at VND 872 mil., varying among sizes and farming types. Seedling farms generated lowest gross output of VND 651.9 mil./ha while meat farms produced highest gross output of VND 964.17 mil./ha (Table 5).

On average, clam aquaculture created a gross margin of about VND 451 mil. and generated a profit of NVD 396 mil./ha (Table 5). Gross margin also varies strongly among the

Table 5. Selected indicators of performance of clam aquaculture by farm size and farming type *(per ha basis)*

Indicators	Farm sizes[a]			Farming types			All farms
	Small	Medium	Large	Seedling	Meat	Combined	
Gross output *(mil.VND/season)*	957.69	954.42	743.16	651.85	964.17	817.65	872.03
Gross margin *(mil.VND/season)*	529.67	547.49	364.79	180.96	552.54	417.15	451.84
Net farm income *(mil.VND/season)*	454.44	496.18	329.89	123.51	495.99	364.20	395.95
Net farm Income *(mil.VND/year)*	346.83	338.71	194.01	199.56	378.72	166.06	296.39
Income/family labor/month (*Mil.VND)*	14.45	10.69	6.50	7.71	13.09	6.05	10.47
Profit/cost ratio	0.47	0.52	0.44	0.19	0.51	0.45	0.45
F-test for mean difference							
Net farm income/season		0.51^{NS}			4.54^{**}		
Net farm income/year		0.72^{NS}			3.670**		
Profit/cost ratio		1.002^{NS}			4.706**		

Source: Calculated from the household survey (2012)

*Note: [a] for meat clam -producing farms only; **: significant at 5%, NS: non-significant*

types and scales of clam production. The meat clam farms generated highest gross margin as compared to the seedling and combined farms. Among the farming types, meat clam farming created highest gross margin as well as profit of VND 552.54 mil. and VND 496 mil./ha, respectively. The profit/cost ratio is highest also for the meat clam farms (0.51), followed by the combined farm (0.45) and seedling farm (0.19) and F-test shows that the difference is statistically significant at 5% (Table 5). However this should be interpreted in consideration with production cycle of different farm types. Among the meat clam farms, the medium farm produced highest profit/cost ratio of 0.52, indicating that a VND invested in clam production generated VND 0.52 profit (or net farm income). Large farms are probably the least productive and profitable among the three, with gross margin of VND 364.79 mil./ha, profit of VND 330 mil./ha, and profit/cost ratio of 0.44. However, F-test shows that net farm income/ha/season and per year basis is not statistically different among the meat clam farms (Table 5). On average, clam aquaculture could generate a net farm income of VND 199.56 mil., VND 378.72 mil. and VND 166.06 mil. per hectare and per year for seedling, meat, and combined production, respectively (Table 5).

3.3. Problems hindering clam aquaculture in the commune

3.3.1. Arrangement of farms

Due to very high profit brought about by clam aquaculture, clam farms have been expanded quite spontaneously without a long-term planning. This, coupled with the absence of legal documents on the rights of using intertidal banks, led to an uncontrolled arrangement of clam farms, as most of the clam farmers thought the intertidal banks belong to them. This can be reflected by a very high density of guarding houses, narrowing the distance between farms and the disappearance of passages that hinder the natural flows in the intertidal banks. High density of farms reduces food source for clam and the existence of too many nets and poles somehow hampers the growth of clam. High density of clam farms also increases the risk of mass death of clam in case of disease outbreaks or extreme climate events. Moreover, the promising potentials of seedling farms attract more farmers to convert their shrimp and fishponds into clam nursery plots that is very risky because the former shrimp/fish ponds may contain germs, possibly leading to high mortality rate of clam seeds.

3.3.2. Seed

Seed represents nearly 90% of cost of production, therefore, quality, prices, and availability of seed are crucial to farm performance. There are attempts to produce seed locally in seedlings farms but not yet successful with low productivity and high mortality rate, even with technical support from Chinese experts. In 2010, about 32% of the seedling farms lost 30-100% of their harvest because of clam death. Many farmers sourced seed from local seedling farms because of familiarity with seed suppliers, convenience, purchase in credit, and good quality, but the supply is often not enough due to limited capacity of local seed production. Seed is also provided by other suppliers importing from the South. However, the adaptability is not quite good, and seed quality is never warranted by the suppliers.

3.3.3. Access to technical support, credit, and market information

Inappropriate arrangement of farms and high mortality of clam reflect the fact that there is a lack of technical consultancy on clam aquaculture. Although the commune has more than 20 year-history of clam aquaculture and is now the leading commune, there is no any permanent (full-time) fishery/aquaculture extension worker in the personnel of the Commune People's Committee . The absence of such a technical support channel partly limits economic performance of clam aquaculture on the one hand and pushes farmers to other

support channels on the other hand, for example traders and other farmers, which may neither be credible nor effective. Nearly half of the clam farmers wish to be trained in clam aquaculture, especially those have less than 10 years of experiences and engage in small and medium sized farm production.

Credit is crucial for clam farmers because of the capital-intensive nature in production. Access to credit is not difficult as farmers can use fixed assets (houses) as collaterals, however, the amount of loan is always much lower than needed. None of them incurred bad debt to banks. In 2012, more than 80% of farmers want to borrow more than VND 200 mil., half of them want to borrow more than VND 500 mil.. Farmers also expect incentive policies from banks in case of harvest loss (disease or natural disasters).

So far, market access has been favorable for clam product of Nam Thinh commune through a high number of local collectors/traders, but market information is limited. Clam farmers do not have any official source of information about seed prices, good suppliers or demands of the markets, making farmers disadvantaged in negotiations with suppliers, collectors or in production and marketing decisions. Specifically, the price of seed and meat clam is always imposed by suppliers and collectors/traders. Farmers want to have better information on market prices, and consumer's requirements on meat clam, especially in potential markets such as in big cities or export markets.

3.3.4. Selection of appropriate farming types and size of production

In the context of capital and skills, farmers should consider appropriate operation scale, as well as farming type. Seedling production (either specialized or combined) should be encouraged but it is suitable for only farmers with high expertise and/or farms with limited resources (aquaculture area). Testing of selected economic performance indicators shows that meat farm is economically advantaged than the other types, with indifferent total cost, but statistically higher profit/ha/year as well as total farm profit/year (Table 6). Therefore, if a farmer has an area large enough for meat clam production, he/she should consider specializing on meat clam production. Economic performance between the seedling and combined types are not statistically different. However, farmers feel more confident when produce seeds by themselves and seedlings should be encouraged, local government and line agencies should pay attentions to this.

At present, oversizing could be seen in large farms with lower performance as shown earlier and test results presented in Table 7. There is not sufficient data to confirm the economy of scale in clam production, but the analysis showe that producing at medium scale is the most efficient. The large-sized farms attain lower yield than the medium-sized ones, but do not exhibit economic advantage over the medium-sized farms, with non-significant difference in

Table 6. Comparison of selected economic performance of clam aquaculture by farming types

Indicator	Combined - Seedling		Combined -Meat		Meat - Seedling	
	Difference	t-stat	Difference	t-stat	Difference	t-stat
Total cost/ha	-72.98^{NS}	-0.96	-14.87^{NS}	-0.31	-58.11^{NS}	-1.03
Profit/ha/year	-33.50^{NS}	-0.49	-212.66**	-3.40	179.16**	2.10
Total profit/farm/year	58.51^{NS}	0.37	-584.24**	-2.00	642.75**	2.00

Source: Calculated from the household survey (2012)

*Note: ***, **, *: Significance at 1%, 5%, and 10%, respectively. NS: non- significant*

Table 7. Comparison of selected economic performance of meat and combined clam aquaculture by farming size.

Indicator	Large-Small		Large- Medium		Medium-Small	
	Difference	t-stat	Difference	t-stat	Difference	t-stat
Yield	-19.83***	-5.12	-16.82***	-4.78	3.01^{NS}	0.54
Total farm cost/season	2720.1***	6.13	1799.3***	3.94	920.8***	5.97
Total net farm income/season	1536.85**	2.47	373.48^{NS}	0.42	1163.37**	2.95
Total net farm income/year	780.07*	1.94	11.18^{NS}	0.02	768.89**	2.58

Source: Calculated from the household survey (2012)
*Note: ***, **, *: Significance at 1%, 5%, and 10%, respectively. NS: non- significant*

profit/ha (Table 5) and in total farm profit per season and per year (Table 7). The can be explaied that in fact all farmers do not hire managerial labor. With the medium sized farms, farm's resources (labor, capital) are concentrated and better managed with proper techniques and afford sufficient sand pumping services. Therefore, large farmers should either downsize their farm or hire expertise labors to have better management of the farm.

3.3.5. Water quality and climate change

Rising temperature, especially in period of low tides, leads to sudden change in water temperature and higher salinity, which likely cause mass death for clam. The intertidal banks for clam aquaculture are affected by water release from Tra Ly, Lan and Red Rivers. As reported by all the farmers, in recent years clam death sometimes happens in February-March, when water release to the sea is limited due to low rainfall and high demand for crop production, but released water usually contains very high content of pollutants including agricultural chemicals so water release is not always favorable for clam aquaculture. For example, during April-May, there are days of high temperatures when freshwater from rivers is needed to cool down clam farms and reduce salinity but the response is very often negative. A regular water quality-monitoring carried by the Institute of Water Resources Planning since 2009 at Lan river mouth showed that in most of the observations, dissolved oxygen (DO) content is better than the required level of 4-6 mg/l whilst pH is sometimes very high at 9, which is far beyond the favorable range of 6-7 for clam.

Social order and public security. Aside from benefits brought about by clam aquaculture, this activity unfortunately is accompanied with social disorder and insecurity. The competitions for better farms and inevitable land disputes between clam farmers sometimes cause social disorder. In recent years, social security such as clam steals and fighting among clam farmers has emerged as an urgent issue in the intertidal banks. According to the commune annual reports, there were six cases of clam steals and seven cases of fights due to land disputes in the intertidal banks in 2006. In 2010, these increased to 28 cases of clam steals, fights and disputes in the intertidal banks and did not reduce in 2011. This has caused instability in clam aquaculture.

3.4. Recommendations to develop clam aquaculture in Nam Thinh commune

The local government and farmers share the same objective to develop clam aquaculture in a more efficient and sustainable way as a key economic driver of the commune in the future. Possible recommendations include:

First, the local government should develop and realize a detailed planning for clam aquaculture and policies related to user right of intertidal banks. This helps re-arrange clam farms in order to improve feed sources and environmental conditions for clam, as well as to minimize the social disputes within the community.

Second, local seed production should be encouraged to save cost, produce more healthy seed, and conserve the Meretrix meretrix clam - an indigenous, well adapted to local conditions, but in threat of distinction due to overexploitation in past years. The provincial government and fishery agencies should have adequate spending for R&D to improve local seeding production capacity.

Third, the local government should establish a strong, harmonized coordination among farmers, water managers and other agencies for better water management for clam production. Given abnormal changes to climatic conditions, number and intensity of typhoons in the intertidal banks are very concerned by clam farmers. This requires accurate forecast by responsible agencies and improved preparedness by the local authorities and farmers in order to combat climate change. For example, mangrove forest in the coastal areas, which acts as not only a belt to protect the seedling farms behind, but also a natural source of food for clam and a regulator of water quality and temperature, should be maintained and developed, especially in the context of climate change and global warming.

Fourth, there is a need to strengthen the Clam Farmers' Association, which has not been well operated so far. The majority of farmers expressed desire of a strong and operational Clam Farmers' Association to link all the clam producers/traders/service providers for a more effective clam aquaculture in the commune, and provide technical as well as market information for its members, and help farmers raising voice to the local government in enforcing legislations on environment protection upon water polluters. Also, the Association should recommend and encourage farmers to strictly follow regulations and technical guides in clam production in order to produce clam satisfied with the standards of the EU and US and improve the added value for farmers.

Fifth, credit institutions and local agriculture agencies should have more favorable policies to clam farmers in case of risks. Farmers expect more flexible policies from banks, considering that clam aquaculture was very productive and profitable in past years and none of the borrowers did not pay even in harvest loss. Preference such as delayed payment or debt clearance is also desired in force majeure such as natural disasters. Moreover, line agencies, the local government, and insurance companies should consider of providing insurance for clam farmers. According to the survey, 75% of farmers are willing to buy insurance for clam aquaculture but the service is not yet available in the commune. So far, agricultural insurance services have been experimented in 20 provinces including Thai Binh as one of the seven provinces with experimental insurance services for paddy whilst insurance services are experimented for livestock in other four provinces.

Sixth, farmers can engage in producing seedling or/and meat clam but should take resources and expertise into considerations. At the existing level of farming techniques, farmers should focus on the medium scale to achieve highest efficiency. For the large scale, farmers should allocate more experienced labors in managing clam production, as well as seek for reliable supply of good quality seeds.

4. CONCLUSION

Clam aquaculture in Nam Thinh commune, Tien Hai district continues to be a key driver of the local economic development. There exist three types of farming systems in the commune, namely seedling, meat clam, and combined production. Clam farms range from 0.4 ha up to 25 ha of intertidal banks with seeds mostly imported from the South at high cost and high risk of mortality. Some local seed producers have been established but not well developed. Data from a 48-farm household survey in 2012 reveals that the farms specialized in meat clam aquaculture had higher economic performance than the seedling and combined farms. Also, given available resources and expertise, farmers should keep at medium

production scale (both meat and combined types). Clam is now marketed both domestically and exported, mainly to EU and China. On average, clam aquaculture in 1ha generated a net income of VND 296 mil./year for a farm, which is very high as compared to other means of livelihood for farmers. Average monthly income for family labor in clam farms was estimated to be VND 22.9 mil., many times higher than the country per capita level. However, clam farmers in Nam Thinh commune face a number of problems and constraints, including inappropriate arrangement of farms, insecure seed availability and quality, limited farmers' technical knowledge, financial resources, supporting policies, uncontrolled water quality and climate change, and increased social disorder and public insecurity. Six recommendations were proposed, which relate to planning of clam aquaculture, R&D for seed and clam production, strong coordination among line agencies and the local government in water management, more effective operation of the Clam Farmers' Association, improved credit, technical support, and insurance information, and selection of production scale. These require not only high attention from the local government, line agencies, banks and insurance companies, but also great efforts from clam farmers.

REFERENCES

Colson. F, V. Chatellier and K. Daniel. (2008).Using the Farm Accounts Data Network (FADN) to identify the structural characteristics and economic performance of EU cattle systems. Download 10/10/2012 from http://www.macaulay.ac.uk/elpen/work1/fcab.html.

EC (1989). Farm Accountancy Data Network. An A to Z of methodology. Luxembourg: Office for Official Publications of the European Communities. Download 11/10/2012 from http://www.hq.nasa.gov/iwgsdi/SDI_Full_Issue_List.html.

Ergano K and A Nurfeta (2006). Economic performance of case study dairy farm in Southern Ethiopia. Livestock Research for Rural Development 18 (1) 2006. Download 12/10/2012 from http://www.lrrd.org/lrrd18/1/erga18008.htm.

Franco Baraldi, Rino Ghelfi and Sergio Rivaroli (2006). Performance of Farms in Emilia-Romagna and Tuscany Regions: An Analysis Based on the Bookkeeping Data. Download 12/10/12 from http://ageconsearch.umn.edu/bitstream/6632/2/cp06ba03.pdf.

Gelan A., B. Muriithi and I. Baltenweck (2011). Key economic performance indicator. Project Brief: East Africa Dairy Development Project Baseline Survey Brief No. 5.

Geoffrey A. Benson (2008). Pasture-Based and Confinement Dairy Farming in the United States: An Assessment. Journal of International Farm Management 4(2): 1-18.

Ivana BROŽOVÁ. 2011. The economic performance analysis of organic farms in the Czech Republic Agric. Econ. Czech, 57(5): 240-246.

Thiet C C, K S Martin (2008). Hatchery Manual of Clam (Meretrix lyrata Sowerby, 1851) Spat Production. Report of CARD project 027/05 VIE. Download 6/10/12 from http://www.card.vn.com.