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Assessment on the technical and financial characteristics and livelihood strategy of while leg shrimp (*Litopenaeus vannamei*) and tiger shrimp (*Penaeus monodon*) farms in Cu Lao Dung district, Soc Trang province

Truong Hoang Minh*

College of Aquaculture and Fisheries, Can Tho University, Vietnam

*Correspondence: Truong Hoang Minh (email: thminh@ctu.edu.vn)

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ABSTRACT

This study was conducted from May to August, 2015 in Cu Lao Dung district, Soc Trang province. One hundred and fifty households were randomly interviewed directly through prepared questionnaires on technical and financial aspects of farming system and five capitals of livelihood strategy. The results showed that white leg shrimp (WLS) is the more popular cultured species compared to tiger shrimp (TS) accounting for 80% of the total interviewed farmers (120 households). In particular, pond areas of WLS and TS were 0.33 and 0.35 ha, respectively. Shrimp stocking density of WLS and TS were 83 ind./m² and 31 ind./m². The yield of WLS and TS farms were 8.8 tons/ha/crop and 4.7 tons/ha/crop respectively. Total production cost of WLS and TS were 690 VND million/ha/crop and 466 VND million/ha/crop. The profits of WLS and TS farms were non significant difference (173 and 251 VND million/ha/crop, respectively). In general, farmers were dealing with many obstacles such as shrimp diseases, environmental degradation, high feed cost, especially the fluctuated selling price of shrimp that caused 36.6% of WLS and 27.5% of TS households losses. In terms of livelihood strategy, natural capital has the highest score (4.03), social capital (3.04), while the other three capitals (human, physical and financial capital) were 2.75, 2.93 and 2.25, respectively. Therefore, a planning for shrimp culture area in Cu Lao Dung should be carried out to optimize favorable natural and social conditions.

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1 INTRODUCTION

According to Ministry of Agriculture and Rural Development-MARD (2013), brackish water shrimp culture has been an important sector contributing significantly to the national economy such as gaining foreign currency, reducing unemployment and increasing income for households. After the last decade, brackish water

shrimp culture in the Mekong delta rapidly increased in the cultured area, production and exporting value. In particular, in 2014 the cultured area of brackish water shrimp reached 604,954 ha, increased by 1.21% compared to that of in 2005 (541,982 ha) with the production of 532,895 tons. Cultured area was mainly in 8 coastal provinces including Long An, Tien Giang, Ben Tre, Tra Vinh, Soc Trang, Bac Lieu, Kien Giang, and Ca Mau with

two main species are tiger shrimp and white leg shrimp. Total national shrimp cultured area in 2015 obtained 691.8 thousand ha, reduced 2,3% compare with 2014; total production was 596 thousand tons, less that 9,5% compared to 2014 (Directorate of Fisheries, 2015).

The farm gate price of white leg shrimp (WLS) increased from 145,000 VND/kg (size 40 ind./kg) in November and 125,000 VND/kg (size 60 ind./kg), 93,000-105,000 VND/kg (size 100 ind./kg) and, size 115,000-158,000 VND/kg (size 70 ind./kg). Farm gate price of tiger shrimp (TS) was 250,000-260,000 VND/kg (size 20 ind./kg) and 175,000-190,000 VND/kg (size 30 ind./kg) (MARD, 2015).

Total national production in 2014 was 6,311 thousand tons, increased 4.8% compared to 2013, of which quaculture production obtained 3,393 thousand tons, increased 5.5% compared to 2013. Export value of fisheries obtained 7.92 USD billion, increased 18.4% compared with 2013 (MARD, 2014).

Soc Trang is one of the vital provinces producing aquaculture in the Mekong Delta. With the geographical features abutting the East Sea, it has favorable conditions for widening aquaculture activities, especially brackish water aquaculture, while aquaculture has been recognized as the key sector for province’s developing strategy. In 2013,

aquaculture production exceeded 138 thousand tons. In 2014, there was 46,700 ha of brackish shrimp culture area accounting for 104% of province’s plan, increased by 3%.

Cu Lao Dung (CLD) district (Soc Trang province) has been attracting several concerns because its brackish water shrimp culture has significantly developed in recent years including TS (*Penaeus monodon*) and WLS (*Litopenaeus vannamei*). However, the development is still spontaneous, and there are lacks of plans whereas the sudden shift from cultivation into aquaculture is out of control and may result in unsustainable development. Therefore, the aim to study was to assess the current of financial and technical status and likelihood strategy of brackish water shrimp farms in CLD, Soc Trang.

2 METHODS

The study was conducted in CLD from May to August, 2015. Primary data was collected by interviewing 150 shrimp farmers who culture TS and WLS in 5 communes (An Thanh Nam, An Thanh Ba, An Thanh Nhi, An Thanh Dong and Dai An), based on prepared questionnaires.

Main variables indicating potential by livelihood strategy analysis method (five capitals)

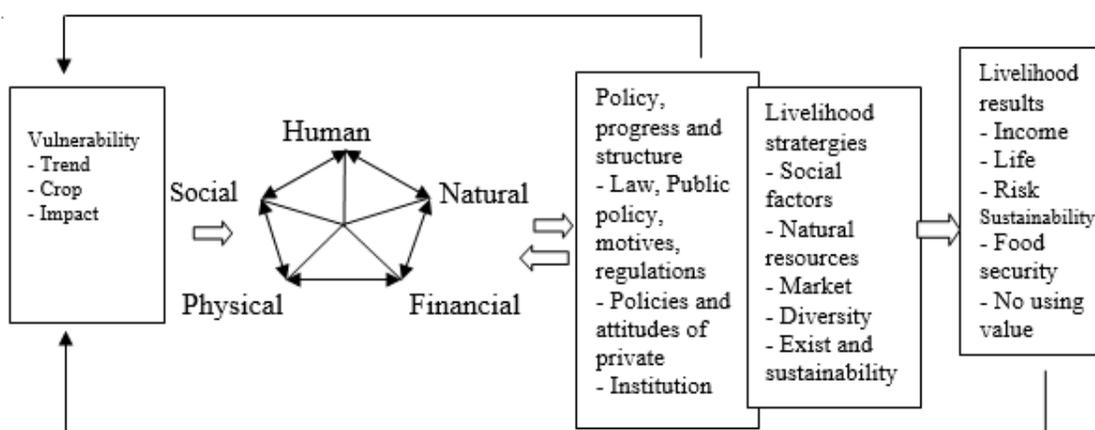


Fig. 1: Sustainable livelihood analysis framework

(Koos Neeffes, 2013)

The secondary data was collected from journals or annual report from Department of Agriculture and Rural Development of Soc Trang and other related research such as specialized magazines, projects, related master thesis.

The data was analyzed by Excel 2010 software to describe statistical properties (qualitative and quantitative analysis) such as frequency, mean,

variance, standard deviation, percentage, max and min and statistical verifying T-test was used. The livelihood strategy indicators were demonstrated by the average score (1-5) of all main variables describing for each. The strengths, weaknesses, opportunities and threats (SWOT) analysis was also employed to find out advantages and difficulties of households.

3 RESULTS AND DISCUSSION

3.1 General information

Most of famers was male and in middle age of 46

Table 1: General information about households

Content	Value	
	TS	WLS
Number of labors in family (person/household)	3±1.25	2.89±1.41
Number of hired labors (person/household)	0.45±1.0	0.52±1.08
Years of farmer's experience	7.87±5.0	4.10±4.17

In terms of level of farmers's qualification, there was just around 3 to 4% in total going to colleges. The illiteracy of TS farmers was higher than that of WLS farmers which was 3.3 and 1.7%, respectively, while the rest, roughly 80%, had primary, secondary and high school education. In general, most of WLS farmers had about 4.01 years in experience that was shorter than that of the study of Nguyen Thanh Long *et al.* (2009), with experience year of farmers culture WLS was roughly 5.29 years.

Table 2: Level of education of farmers

Level of education	TS (%)	WLS (%)
Illiteracy	3.3	1.7
Primary school	36.7	27.5
Secondary school	40.0	44.2
High school	16.7	22.5
Vocational/college	3.3	4.2
	100.0	100.0

Table 3: Main reasons for selecting farming system

Reason for culturing	TS	WLS
1	High value	High growth rate
2	Low investment cost	High profit
3	Less disease	Easy to culture

Table 3 showed three main reasons for choosing farming systems among farmers. High economic value was the main reason for farmers to culture

Table 4: Structure of shrimp cultured systems

Structure of cultured system	TS	WLS
Total used area for farming (m ² /household)	11,450±8,527	10,839±10,881
Total water surface of reserviors (m ² /household)	762±889	1,046±1,767
Area of sedimentation pond ('000 m ²)	0.661±0,482	0.631±0,683
Total culture area per crop (m ² /crop)	6,153±4,142	6,245±5,698
Number of pond (pond/crop)	1.83±1.23	1.88±1.38
Number of crop/year	1.90±0.60	2.44±0.53

for TS farmers and 45 for WLS ones. This result agreed with the study of Le Xuan Sinh *et al.* (2006) in which the percentage of men in shrimp activities accounts for 75.7%.

these species followed by simple technique. Besides, WLS had higher growth rate compared to TS, whereas the former also needed higher investment cost. Most of interviewed households could make good use of available land and cheap labors in their family and neighbourhood.

3.2 Technical aspect of marine shrimp culture

The total area used for farming TS and WLS were 11,450 m² and 10,893 m² on average with the culture water surface per crop of 6,153±4,142 and 6,245±5,698 m², respectively. The number of cultured pond in both system were approximately 1.8 pond that was farmed 1.90 crop/year for TS and 2.44 crop/year for WLS.

For shrimp culture, pond management was a crucial factor affecting shrimp's productivity, quality as well as disease prevention. Exceeded feed and excretion from shrimp could produce some toxic gases such as H₂S, NH₃, CH₄, etc. that could cause serious disease to shrimp. Therefore, using reserviors is one of important steps to reduce risks. However, 46.6% of WLS farmers did not use reserviors 36.6% of TS farmers. Therefore, farmers need to improve their technique and invest more in their farming system.

The average water surface area of sedimentation pon were 1,046 m² and 762 m², respectively with the number of reserviors was just roughly 0.6 ha, there was no significant difference between the two farming systems (p<0.05).

The results showed that WLS was cultured in shorter period than TS with the farming duration of 73.33 and 107.57 days, respectively. Both species were farmed more than one crop during a year with the common stocking time in April, October and November because of the favorable weather with less rain and high salinity that was stable condition for shrimp to growth.

The harvest size for TS and WLS was 57.8 and 76.2 ind./kg at the yield of TS farming system was significantly lower than that of WLS system with the productivity of 4,704 and 8,763 kg/ha/crop, respectively. This results of productivity were all lower than the study of Vo Nam Son *et al.* (2014) comprising 6.63 and 12.9 ton/ha/crop for TS and WLS, because some farmers faced shrimp disease during

their crop, so they had to harvest before shrimp reached their market size. Moreover, that may be proved by the lower survival rates for both TS (65.1%) and WLS (80.5%).

Stocking density of WLS was significantly higher than TS with 83.3 and 31.1 ind./m² which were both higher than that of Vo Nam Son *et al.* (2014) study in Soc Trang including 80.67 and 26.47 ind/m² in order.

Both farming system used commercial feed with the feeding frequency was 3-4 times/day by mostly hand spreading. Feed conversion rate (FCR) was 1.32 for TS farms that was significant larger than 1.14 of WLS farms.

Table 5: Technical parameters in shrimp culture

Contents	TS	WLS
Culturing duration (day/crop)	108±34.1	73±18.2
Stocking density (individual/m ²)	31.2±19.1	83.3±25.0
Size of seed (PL)	PL10-PL15	PL8-PL12
Price of seed (VND/individual)	102±17.5	96.8±10.6
Harvesting size (individual/kg)	57.8±64.0	76.2±37.3
Survival rate (%)	65.1±27.4	80.5±22.2
Yield (tons/ha/crop)	4.7±3.4 ^a	8.8±5.3 ^b
FCR	1.32±0.262 ^a	1.14±0.142 ^b

Note: The letters (a, b) in the same row are significantly different

The price of seed was 102±17.5 VND/ind. for TS and 96.8±10.6 VND/ind. for WLS. This price is not stable and changes depending on season. This shrimp seed of both species is original from the central Vietnam that was sold to some hatcheries adjacent provinces in the Mekong Delta such as Bac Lieu, Soc Trang, Ca Mau, then farmers can buy from these hatcheries or directly from the central region.

The seed size for TS and WLS was PL10-PL15 and PL8-PL12, respectively. There were 10% of farmers tested PCR for checking TS seed quality, and 4% of WLS farmer checked seed by PCR technique. Therefore, controlling seed quality should be paid more attention by households.

3.3 Financial aspect of marine shrimp culture

The investment cost of WLS farms was 404±313 VND million/ha/year which was significantly higher than that of TS farms (211±158 VND million/ha/year). For WLS, the cost for facilities and pond preparation accounted for the highest parts 52.7% and 47.5% respectively. Similarly, in TS farms pond preparation took for the highest cost with 54.9% followed by facilities with 45%. Almost farmers (96%) used their own land or rent the land

with the low price. Therefore, land cost in both systems made up nearly 1% of the investment cost. The total fixed cost of TS and WLS farms were 63.2±48.8 and 86.4±64.6 VND million/ha/crop.

In terms of variable cost, the feed cost, seed, drug and chemical accounted for 82.4% and 80.0% in TS and WLS farms, respectively. This outcome was similar with the study of Le Xuan Sinh *et al.* (2006), i.e. seed, feed, drug for aquaculture were three largest expenditures that affected directly shrimp culture efficiency and raw shrimp quality.

For TS culture system, feed cost made up 53.7% with 231±129 VND million per ha in total cost, drug and chemical (78.6±80.5 VND million) and seed cost with 38.6±52.2 VND million per ha. The similar pattern was true for WLS farm with nearly 49.3% in total cost covered by feed cost, followed by drug and seed cost with 148±135 and 85.0±45.2 VND million. Moreover, WLS required a significantly higher cost of these expenditures compared to that of TS (P<0.05), the total variable cost of WSL farm was significantly higher than that of TS with 602±331 and 397±214 VND million/ha respectively (Figures 2 and 3).

Table 6: Fixed cost and variable cost in shrimp culture farms

Fixed cost (VND million/ha/crop)	TS	WLS
Land cost	3.82±9.38	2.95±16.3
Pond preparation	116±112	192±210
Facilities and equipment	95.1±105	213±160
Total investment cost	211±158 ^a	404±313 ^b
Total fixed cost	63.2±48.8 ^a	86.4±64.6 ^b
Variable cost (VND milion/ha/crop)		
Feed	213±129 ^a	297±173 ^b
Seed	38.6±52.2 ^a	85.0±45.2 ^b
Drug and chemical	78.5±80.5 ^a	148±135 ^b
Electricity and fuel	35.9±28.5	47.1±33.9
Pond preparation	22.7±26.4	17.9±16.2
Labor	2.11±6.81	5.93±13.7
PCR test	4.81±18.1	0.110±0.694
Bank interest	1.70±4.34	1.26±3.61
Total variable	397±214 ^a	602±331 ^b

Note: The letters (a, b) in the same row are significantly different

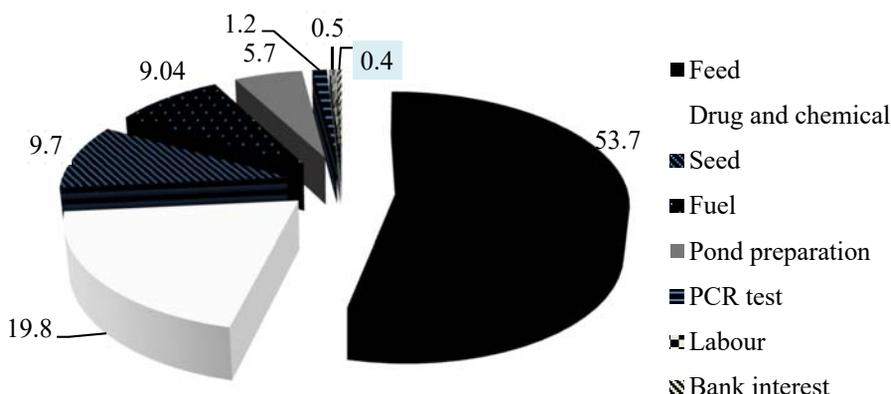


Fig. 2: Percentage of variable costs of tiger shrimp farm

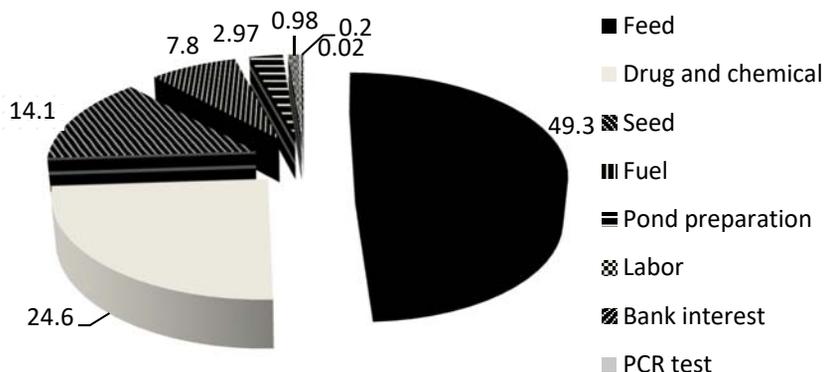


Fig. 3: Percentage of variable costs in white leg shrimp farms

The other variable costs of these two species accounted for roughly 20% in total variable cost, including electricity and fuel, pond reparation, labor,

checking seed cost and banking interest. Labor cost made up a relatively small part in total cost, just 2.11±6.81 for TS shrimp farms and 5.93±13.7 VND

million/ha/crop, the main reason was that most of households used their family labor. Checking seed quality (by PCR test method) and banking interest also shared a lower cost compared to the others, predicting that farmers may have not focused much on technique factors and investment.

Total cost of WLS farming system (690±348 VND million/ha/crop) was higher significantly that of TS shrimp (466±240 VND million/ha/crop). The total costs was higher than previous studies of Nguyen Thanh Long and Huynh Van Hien (2014), total cost of WLS farms in Ca Mau was 390±154 VND million/ha/crop, and 537±229 VND million/ha/crop in WLS in Ben Tre (Do Minh Vanh *et al.*, 2015). The main reason of this cost differences due to increasing feed, drug and chemical, and facilities prices.

The total income of WLS farm (863±547 VND million/ha/crop) was higher than that of TS farm (715±585 VND million/ha/crop). However, the profit of these two farming systems showed no significant difference, which of TS and WLS farms were 251±477 VND million/ha/crop and 173±395 VND million/ha/crop. The profit of WLS in this

study was much lower than that of the study of Nguyen Thanh Long and Huynh Van Hien (2014), with the profit of 657±503 VND million/ha/crop. that could be explained by the lower selling price of raw WLS at the survey period and low yield.

The production cost of TS culture (118,000 VND/kg) was significantly higher than that of WLS (87,000 VND/kg), the farm gate price of TS and WLS were 137,000 VND/kg and 99,000 VND/kg, respectively. Most of households was lost profit shrimp culture.

The benefit per cost of both systems was relatively low (0.556 for TS and 1.0 for WLS) because of the high percentage of number of loss farms which were 36.6% and 27.5% respectively due to the fluctuation of raw shrimp price and shrimp disease due to harsh weather. This result was lower than the study of Pham Cong Kinh *et al.* 2014, Do Minh Vanh *et al.* 2015 that the profit ratio in TS farms was 0.66.

Most farmers (97.6%) sold raw shrimp directly to traders because they were usually available at all time and help farmers harvest shrimp easily.

Table 7: Financial efficiency of shrimp culture

Financial efficiency	TS	WLS
Total income (VND million/ha/crop)	715±585 ^a	863±547 ^b
Total cost (VND million/ha/crop)	466±240 ^a	690±348 ^b
Profit (VND million/ha/crop)	251±477 ^a	173±395 ^a
Benefit per cost (%)	0.451±1.01 ^a	0.271±0.812 ^a
Production cost (1000 VND/kg)	118±49 ^a	87 ± 27 ^b
Selling price (1000 VND/kg)	137± 62 ^a	99±26 ^b
Percentage of net loss farm (% of households)	36,6	27,5

Note: The letters (a, b) in the same row are significantly different

3.4 Livelihood strategy of shrimp farmers

The results from assessing likelihood strategy on five capitals (based on band score 5) showed that natural capital had the highest score at 4.03 followed by social capital with 3.04 while the other three capitals including human, physical and financial capital were 2.75, 2.93 and 2.25, respectively.

Natural condition such as weather, environment was the strongest point for shrimp culture in CLD, thanks to good quality and rich quantity source of water. In fact, it was recognized as an islet that was surrounded by both sea and river. Farmers can take a significant advantage of large water surface to conduct shrimp culture. In addition, the district has convenient waterway system with two large estuaries to the East Sea through Tran De and Dinh An, ensuring for transportation, low cost and high safety.

In general, most of farmer interviewees expressed their satisfaction in social activities, local security, neighbor relations, except for the frequency of workshops and short training courses towards improving technique for shrimp culture.

Human and physical capitals were still be limited factors compared to the others because of low education level of farmers (mostly under high school) and underdeveloped infrastructure, yet it should be noticed that most famers pay their attention on their next generation's education level.

Eventually, financial capital was the least asset that appears to become issue for households due to unstable incomes and low saving.

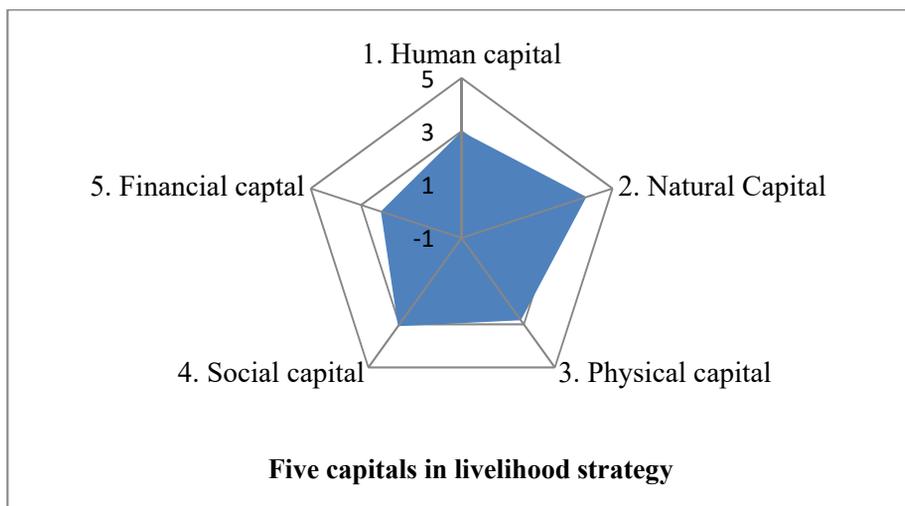


Fig. 4: Livelihood of shrimp farmer

3.5 Advantages and disadvantages of marine shrimp culture

CLD has some advantages for brackish water shrimp culture. In previous years, this practice belongs to zoned area of the province with available financial investment, high yield, plentiful water resources, available middlemen, and wide range of

services such as feed, chemicals for shrimp. Nevertheless, there are some difficulties confronting farmers such as unstable shrimp price, low labor cost, electricity shortage and culture technique (Nguyen Thi Minh Thu, 2012). The fluctuation of raw shrimp price was obstacle for farmers, besides high cost of feed, drug and chemical, shrimp disease (Table 8).

Table 8: Simple SWOT analysis

Strengths	Weakness
<ul style="list-style-type: none"> - Favorable natural conditions: plenty of water source, large surface area, high biodiversity,... - Available land - Cheap labors from family - High profit - Easy access to input and output 	<ul style="list-style-type: none"> - Low investment in infrastructure, facilities - Low skilled famers - Unstable shrimp price - Lack of adequate planning for shrimp culture - Weather change - High feed cost - Electricity shortage - Low control seed quality
Opportunities	Threats
<ul style="list-style-type: none"> - Improve farmers' skills and knowledge through short training courses - Practice planning and zoning - Open more clusters, associations - Provide financial help, subsidize 	<ul style="list-style-type: none"> - Water pollution - Disease - Switch back to horticulture - Reduce biodiversity

Shrimp culture in CLD has been recently reversed from cultivation; therefore, it needs more policies for planning as well as zoning, technique enhancing activities and financial help.

4 CONCLUSIONS AND RECOMMENDATION

4.1 Conclusions

Cù Lao Dung has favorable conditions for developing of shrimp culuture, but low yield and high risks.

The average yield of WLS farms was significantly higher than that of TS farms, besides, the survival rates are 80.5 and 65.1%, respectively.

Total cost of WLS farming system was significantly higher than that of TS shrimp. However, the profit of these two farming systems showed no any significantly statistical difference,

Financial and physical were two assets that should be paid more attention to improve livelihood strategy for households culturing marine shrimp. Besides, unstable raw shrimp price, shrimp disease and

high production cost were negative issues for shrimp farmers.

4.2 Recommendation

Local Government should plan for marine shrimp culture in Cu Lao Dung district in order to make good use of the strengths of the area as well as reduce the risks for farmers. To improve productivity and quality towards to develop more sustainable of shrimp culture.

Policies for controlling raw shrimp price should be implemented that will enable household feel more confident in invest more in their farms.

In order to encourage farmers to attend training courses to improve their technique and skills

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