

# Supplementary Material S2: Results from the Rapid Rural Appraisals

## Abstract

Summary of the results from the Rapid Rural Appraisals (RRA) conducted in ten communities in the Vietnamese Mekong Delta. The objective of these RRA was to understand the components of rural livelihoods and agricultural systems from a household's perspective in each socio-ecological system. Data collection was conducted between May 12th and May 17th, 2018.

## Contents

<b>Results</b>	<b>2</b>
My An, Đông Tháp (triple rice)	2
Hung Thanh, Đông Tháp (triple rice)	4
Phú An, An Giang (triple rice)	6
Hòa Lạc, An Giang (triple rice)	9
Bình Sơn, Kiên Giang (double rice)	11
My Thái, Kiên Giang (double rice)	14
Đien Hai, Bạc Liêu (shrimp farming)	16
Đình Thành, Bạc Liêu (shrimp farming)	20
An Truong, Trà Vinh (triple rice, orchards)	22
Nhi Long, Trà Vinh (orchards)	26
<b>Discussion on land systems</b>	<b>28</b>
Triple rice	28
Double rice	31
Agroforestry	33
Shrimp aquaculture	34
Mixed rice-aquaculture	36

## Results

### 2.1 My An, Đông Tháp (triple rice)

#### Participants

Eight farmers doing triple rice, including one farmer who is also doing orchards.

#### Agricultural systems

The calendar for triple rice is different for each pumping unit and is given by the department of agriculture at the district (DARD).

#### Triple rice

1. October until December
2. January until mid-April
3. June until end of August
4. "Land rest" and flood

#### Others

- Orchards: all year long
- Fish, frogs, pigs, cows: all year long (but high price for frogs between September and November)
- Upland crop: February until December (high price for watermelon between November and December)

#### Natural hazards

- Storm and rain: July until August (during the rice harvest) → leads to inundated fields and breaks the rice (up to 50% loss)
- Rice disease: all year but high season between May and December because of the rain and the heat.

#### Sediments

No more sediments for more than ten years (since the implementation of dykes). Before farmers were using 40kg of fertilisers (for 0.1ha), now they are using 50-60kg. They suggest to let the water in to get more sediments but the problem is that there are also orchards in the same flood compartment.

#### Pumping units

The pumping unit is run by a company. It pumps the water to the canals and then farmers just need to open their field sluice gate (except for the 5% of farmers who have upland crops and need to pump). The district government decides when the water should be released and then they meet the farmers to let them know. Farmers have a contract with the pumping unit. Last year, the company did not let the water in because of the rain (government decided 10cm water height in the canals but it rained 8cm so the company did not let the water in, as they have to pump the water out if the level is more than the height required).

### Rice marketing

Farmers sell to businesses from Can Tho. Many people come to the province to buy rice, farmers don't know the price they can get. They just sell to the buyer that offers the best price. Buyer is in charge of paying for transportation.

### Land use choice

- The price for rice per hectare is higher than coconut (main orchard crop).
- Other orchards have a better price than rice but the market is limited and the investment costs are high (they would like to change though).

### Difficulties and proposed solutions

- **Access to market:** the price of rice is unstable, would like the government to help stabilise the market. The government should plan and allocate different rice varieties in the delta in order to stabilise the price. There is a need for more big businesses to buy the rice from them, at the moment there are only small businesses.
- **Seeds:** there is a need for seeds of higher quality, the local government should certificate high quality rice and control the quality of seeds.
- **Labour:** little labour force available and the price to hire people is high, they would like mechanisation or a union of labour force they could refer to.
- **Fertilisers:** BIGGEST DIFFICULTY, bad quality of fertilisers and not certified. They want the government to check the quality of fertilisers.
- **Water resources:** in general there is enough water to irrigate but some canals are not wide enough (there is a need to widen them). The water is polluted by pesticides and fertilisers, maybe the government should help farmers to use bio-fertilisers.
- **Diseases:** need control on quality of pesticides and better calendar/forecast.
- **Financial capital:** would like the local government to lend money to farmers for buying pesticides and fertilisers.

### Livelihood systems

#### Rich households (50%)

Big farm area doing triple rice (3-4 ha, including some land in other communities), run business (e.g. sell fertilisers), fish and frogs combined together. "Having fish helps but depends on luck" (woman participant).

#### Average households (30%)

Farm with triple rice (0.2 - 0.3 ha), they do not run businesses, might have cows, pigs and fish.

#### Poor households (20%)

Labour for richer households (e.g. cut flowers in lotus farms of rich households), no land.

- One participant says that in his village there is 60% of poor and 40% of average. According to him, there are no rich households because the price of rice is low. Lots of poor households because there are a lot of migrants from other places who have no land. Only 30% of

- them have access to water: the location of the community is near a small canal (but there is no river) with good road infrastructure.
- The key asset is access to water in order to develop income-generating activities and have a good harvest.
  - There are more than 20% of farmers from other provinces that come to rent land, especially in remote villages where there is a lot of land available.
  - Men are in charge of the farm, women in charge of financial capital.
  - Some people from the commune work in industry, this is why there is a shortage of labour (only poor households work as agricultural labourers).
  - **Livelihood dynamics:** farmers lose their land after facing a crop failure (they have to get a loan from other people to cope, and they need to provide their land as guarantee. If they cannot pay the loan back, they lose their land). Some people have little land -> they sell it to switch their main livelihood activity.

## 2.2 Hung Thanh, Đông Tháp (triple rice)

### Participants

Triple rice (1.5ha, 2.7ha, 2ha, 3ha, 1ha, 5ha) and mixed triple rice and coconut (4ha and 300 trees).

### Agricultural systems

#### Triple rice

1. Mid-September until mid-December (fertilisers: 40kg/0.13ha)
2. Mid-January until mid-April (fertilisers: 70-80kg, more because of heat)
3. May until August (fertilisers: 50-60kg)
4. August until September: let water in

#### Others

- Aquaculture: less than 2%
- Orchards: tea tree (aluminium soil) but price unstable (10,000 to 40,000VND)

#### Natural hazards

- Diseases: high season between November and February
- Heavy rain: mid-March until mid-July, leading to 7 up to 70-80% of crop damage (average of 10%)

#### Sediments

Lack of sediment -> they have to use more fertilisers.  
Fiver years ago: 45-50kg but now 70-80kg.

#### Pumping units

Company open sluice gates depending on the government's decision in order to guarantee that farmers get enough water. Water gets in but there are no sediments. Farmers control field sluice gates depending on low/high land.

### Land use

Difficult for farmers to convert from rice to orchards because land is inundated in August (water management issue). They also need permission from the government but the government only allows to change in some areas where it is difficult to grow rice.

### Difficulties

- **Diseases**
- **Weather (storms):**
- **Fertilisers and pesticides:** too expensive. They are thinking of using bio-pesticides (ducks to kill snails). Want subsidies from the government and to control prices (tag bags with the price so they are sure of the real price), would like a cooperation between companies selling fertilisers and companies buying rice in order to stabilise the market. Farmers can get fertilisers and pay later at harvest (but 10% interests).
- **Market:** they can not decide the price of rice nor when to harvest (the buyer/company decides when to harvest). Buyers are mainly from Can Tho.

### Livelihood systems

#### Rich households

- Rice farming (more than 4 ha)
- Business and agricultural services (tractor operation, etc.)
- Own big houses and cars

#### Average households

- Rice farming (1-1.5 ha)
- Small business and provide small agricultural services

#### Poor households

- Little land (less than 0.5 ha) or landless
- Agricultural labour
- Get benefits from the government (policy to build concrete houses, local government loans 0.5% → 30 million VND for house, 8 million VND for toilet)

### Dynamics

- **Poor** → **rich:** migration of children overseas
- **Rich** → **poor:** problem in agricultural production or in business, shocks

### Livelihood capitals

1. Natural
2. Social
3. Human (one farmer put financial before: “if I have money I can buy human capital – labour”)
4. Financial
5. Physical

### Unions

- Farmer's union: tontine to get money to invest in farm (better than banks as it doesn't have interests), does agricultural extension about farming and equipment maintenance (membership 12,000VND/year)
- Most farmers join the farmers union (75%) except in one village because the union leader is not active and it wastes time (according to farmers)

## 2.3 Phú An, An Giang (triple rice)

### Participants

1. 0.5ha, sticky rice
2. 0.2ha, sticky rice
3. 1.5ha, sticky rice, pigs and small area of fish
4. Three other sticky rice farmers: price of fertilisers is high (want government to stabilise it), price of rice depends on buyer, sometimes very low.
5. sticky rice farmer: price of rice is low, he can not decide when to harvest. More than 15% affected by diseases. Problem of quality of fertilisers and pesticides.
6. 4ha, sticky rice. Weather not favourable for farmers. Price is very low, have to harvest every 4 months and farm investment is very costly. Many farmers convert from rice to orchards. Better planning from the government to decide which type of seed and to reduce the price of inputs. Want to have certification of rice and brand (famous sticky rice).
7. vice-chairman of farmers' union. Want to have better farming techniques.
8. Price of rice too low. Price of inputs too high.

### Agricultural systems

#### 3/3/2 sticky rice

8 crops for 3 years (triple, triple, double and flood to get sediment) with rotation between fields

1. October until end-January (invest much more money)
2. February until mid-May (less fertiliser because there might be crop failure)
3. June until mid-September

Government controls when and how much water is let in (they let farmers know about 1 month before).

### Natural hazards

- Heavy rain and storms (May-August): breaks rice and inundation
- High temperature
- Diseases: all year but different for each crop

### Sediments

Now there is less sediments, they just let water in to wash the fields. Enough water for irrigation but no sediment → they have to use much more fertilisers (before → 50kg/0.13ha; now → 100kg/0.13ha).

**Water management**

- Managed by cooperative and not a pumping company, role of pumping the water in or out.
- Water compartment divided in sub-areas. Farmers vote for 5 elected farmers to control that they get enough water for irrigation.

**Marketing**

- Price of rice based on quality: beginning crop (6,000VND/kg) vs. after harvest (4,900VND/kg)
- Want the government to link them with businessmen to stabilise the price. Sometimes they agree on a price (e.g. 5,600VND) but after harvest, businessmen buy only for 5,400VND.
- Businessmen don't want to buy from small poor farmers because they only have a small harvest. They can get more benefits with large-scale farmers (effects of scale). Also small farmers are not mechanised -> harvest takes longer.

**Land use**

- Sticky rice (growing period of 4 months) -> difficult to convert to normal rice (growing period of 3 months) because if the rice is ready before the surrounding fields which are sticky rice, then agricultural machines for harvest cannot come in the field.
- Some farmers (very few) have converted from sticky rice to orchards because they had mice in their field -> they asked the permission to the government to be able to convert. Also government allows high elevated fields near roads to convert.

**Difficulties**

- Fertilisers (high price): want credit and more stable price, want regular quality checks
- Weather
- Market (not stable): want agricultural extension for farmers
- Soil quality has decreased
- Diseases due to seeds of low quality from 1993
- Lack of money to invest
- Not enough labour, want mechanisation

**Livelihood systems****Rich households**

- Agricultural services, some have agricultural machines
- Big area of farming (up to 50-70 ha)
- Business
- Big house, motorbike, higher education

**Average households**

- Farming (4-5 ha)
- Grow pigs, cows
- Small business but no money to invest

### Poor households

- Labour (agricultural and industrial)
- Very small business (sell vegetables at the market)
- Landless, sometimes have pigs, cows, chickens
- Low education, can loan up to 50 million VND
- 40% migrate to industrial provinces (Binh Dng), all year and come back for Tt holidays

### Dynamics

- **Poor** → **average**: many family members do labour or some go on migration → e.g. of one farmer who used to be an agricultural labourer and now how has 4ha after buying land from other farmers.
- **Average** → **poor**: shocks (external or internal) → e.g. of one farmer who has now only 0.5ha (before he had a large farm) because is wife was sick and he had to sell part of his land.

### Livelihood capitals

1. Human
  - a. Skills (most important)
  - b. Education
  - c. Labour force (NB: for poor farmers, labour force is the most important)
2. Natural (weather) – *farmers can not control*
  - a. Weather
  - b. Water
  - c. Land
3. Physical – *farmers can control*
  - a. Electric system
  - b. Agricultural machine
  - c. Road infrastructure
  - d. Vehicle
4. Financial – *farmers can not control*
  - a. Money from themselves to invest
  - b. Loans from banks
  - c. Loans from government
5. Social – *farmers can not control*
  - a. Cooperative (small and big) for agricultural services
  - b. Unions

The local government is very important for them because it controls the irrigation system and sets the agricultural calendar.

### Unions

- **Tontine**: 15 farmers per group, contribute up to 1 million/month/farmer. No interest rates
- **Farmers' Union**: agricultural extension



## 2.4 Hòa Lạc, An Giang (triple rice)

### Participants

1. 1.2 ha sticky rice
2. 0.5 ha sticky rice → renting to someone else. Now cows and vegetables
3. 80 ha sticky rice
4. 6 ha sticky rice
5. 1 ha sticky rice
6. Changed from sticky rice to normal rice (higher price → sticky rice = 5,200VND/kg; normal rice = 6,000VND/kg)
7. 4 ha sticky rice
8. 0.5 ha sticky rice and motorbike taxi (xe ôm)
9. Sticky rice, fish and orchards
10. 0.4 ha (woman) and cows
11. 2.5 ha sticky rice, part of the irrigation cooperative
12. 10 ha

### Agricultural systems

#### Triple rice and sticky rice

- November → February
- March → July
- August → November
- Sticky rice: same as normal rice but 10 days longer
- Calendar is defined by district, communes need to adjust
- Policy 3/3/2 (let water 5-7cm): they were following the policy but in 2017 the provincial government had a policy to not let the water in → they has to adjust their calendar to triple crop
- 3/3/2 they let the water in in turns.

### Others

- Fish: all year long

### Natural hazards

- Diseases: December → February (+++) 10-30% crop failure
- Water: scarcity (March → April) and polluted. Lack of water in the centre of dyke system
- Weather: crop 1 too hot, crop 2/3 heavy rain and strong wind, unpredictable and 20-30% crop loss because rice breaks and cannot be harvested by the combine harvester
- Flood: July to October but now unpredictable because of the dam upstream

### Sediments and fertilisers

- More than 10 years ago: enough water and sediment
- Since 10 years: not enough
- Fertilisers: before 35/40kg but now 60 (after flood) to 70kg

### **Agricultural marketing**

- One year ago, the price of sticky rice was higher than normal rice, but now it's the opposite.

### **Difficulties**

- Price of fertilisers and pesticides increase everyday (also cost of living) but price of rice remains the same
- About 50% of the input cost is from borrowing loans from banks,. But now they are not able to get loans anymore.
- Quality of fertilisers and pesticides → impact farming. They want the government to encourage farmers to use bio-fertilisers and a better control of resellers.
- Price of rice is not stable → they want more stable price through contract farming with companies. Government to control the contracts between buyers and farmers. one farmer says he wants his rice to be bought at a price based on humidity (at the moment, only based on contract)
- Diseases, polluted water and lack of sediment → want quality seeds and agricultural extension
- Weather (most important)
- Not enough money to invest in their farms
- Some farmers do not follow government planning, they want the government to plan which seeds/where
- Not enough labour
- Canals are too small → not enough water, nobody to widen them → would like to widen every 3 years.
- One farmer suggests to collect money from farmers in the area to pay for widening the canals (another one disagrees because they say it is the responsibility of the cooperative and not of farmers)
- The cooperative work is not effective (says one farmers) because his field is flooded. The cooperative members says that they couldn't pump the water out this year because of heavy rain
- Road system → to be improved so machines can come in their fields
- Conflicts between farmers and cooperatives to widen canals → it would take part of farmers' fields

### **Livelihood systems**

#### **Rich households**

- Farming (>5ha)
- Business, agricultural services and agricultural machinery
- One family member works overseas

#### **Average households**

- Farming (<3ha)
- Small business, small agricultural services
- Raise animals, some have agricultural machinery

### Poor households

- Labourers, migrate to other places
- Poor housing (before house with leaves, but now trees and concrete thanks to scheme)
- No animals
- Poor because of heritage, shocks (sickness) or gambling

### Dynamics

- Poor → average: one farmer was poor but family member works in Bình Dng so they became average
- Rich → poor: gambling, sickness, crop failure

### Livelihood capitals

- Human: education and skills are the most important

### Unions

- **Women union:** tontine → support to poor households for small business and raise animals
- **Farmers union:** tontine, technical support, input cost, company cooperates with farmers' union to buy rice from farmers. Membership is 12,000VND/year. In 2017 (crop failure), the farmers' union helped farmers to get financial support from the local government
- **Cooperative:** access to market and joint money (one needs to buy stocks to be a member, 1 stock=100,000VND)
- **Co-operating group:** water management
- **Old soldier union:** joint money (up to 10 to 20 million VND for poor households)

## 2.5 Bình Sơn, Kiên Giang (double rice)

### Agricultural systems

#### Double rice

1. Mid-October until end-February
2. Land rest
3. May until end-August
4. Flood
5. ⊗ Seasonal calendar imposed by district

#### Others

- **Upland crops** (corn, chillies) → November until September
- **Intensive shrimp farming** → two crops per year (February → July // November → January), rest of the time is flooded
- **Raising animals** (goats, chickens) → all year

### Brackish shrimp aquaculture

- Convert because many crop failures because of salinity intrusion (farm between dyke and river, closer to sea than other rice fields). Had to ask for permission from the government. They allowed only the area between dyke and river where her field was.
- Had to invest 100 million VND/pond, 50 million VND/crop for food
- Earns around 100 million VND/crop
- Many companies come to buy directly because many shrimp farmers in the region

### Natural hazards

- **Salinity intrusion:** November - December
  - Before 2000 could not cultivate (6 months of saline water, 6 months brackish).
  - After 2000 build dykes, can cultivate rice but low yield because poor soil. Sometimes high yield but low production or low yield but high production.
- **Strong wind:** June - July → breaks rice, destroy houses
- Diseases because of micro-organisms
- **Water:** lack of water, lack of sediments (50-60% of the sediments that they had before), pollution
- **Pests:** mice but now they catch them and sell in the market

### Fertilisers and seeds

- Before 50kg of fertilisers /0.13ha
- Now 75kg/0.13ha
- More fertilisers because they changed seeds because of the lack of sediments. New seeds take longer to grow.
- Changed seeds 2 years ago because old seed had many diseases. Comes from cooperative together with company, they have a contract with company (buys rice at 5,800VND/kg). If price in the market changes they keep the original price. Some farmers don't follow the contract because they think they can sell for more.

### Dyke system

- In some places there is a full dyke system to prevent flooding. But there is no pumping station.
- Even with full dyke, farmers do double rice because the water in canal is saline and acid soil for 3rd crop.

### Difficulties

- Domestic and agricultural water: polluted and salinity intrusion → solution is to use groundwater and have big tanks to retain rain water but not a solution for agriculture (because water management linked to other farmers from province). Maybe full dyke system with pumping stations to control water depending on tides (to flush accordingly)
- Diseases → solution is to use more pesticides and technical skills
- Quality and price of fertilisers and pesticides → want government to check quality and stabilise the price
- Need more loans to invest in farm with low interests (now 10.5%, want 0.6%). With 1ha they can get 40 million VND loan (they would like 100 million VND)

## **Livelihood systems**

### **Rich households (20-40%)**

- Fishermen at sea
- Big area of land (>10ha)
- Big business, agricultural and other services
- Education > secondary school

### **Average households**

- Small area of land (<5ha)
- Small business, small services
- Average education

### **Poor households (10%)**

- Knit nets, work for fishermen
- Agricultural labour, motorbike driver (xe ôm)
- No land, house in poor condition (leaves and trees)
- Poor because sickness, elderly
- Own motorbike (2-3 million VND) but no access to enough domestic water (main source of water is rain). Loan from government bank to get access to water.
- Education less than secondary school

## **Migration**

- During flood season → many go away for labour. Other stay to take care of land
- Migration to Bình Dng (50%, every household has at least one member going to work there)
- People who do not have land used to do labour here (fixing nets): 50,000VND/day. But now if they migrate they earn 100,000VND/day

## **Ethnic minorities**

- No difference between Khmer and Kinh (main)
- But the majority of khmer are the poor, landless
- Reason: “more superstitious”, “backward thinking”

## **Dynamics**

- Become poor: crop failure, sickness, boat sinks
- Become rich: labour and go at sea to catch fish
- One farmer says that some people have boat and money (so considered as rich) but they have many loans from the bank (so not so rich)

**Livelihood capitals**

- Access to water (most important)
- Weather very important as well
- Financial capital to invest in farms
- Labour and skills
- Cooperatives and companies (inputs and sell outputs)
- Road system in general: main way of transport is through boat (because bad road) but slower and more costly because of labour

**Unions**

- Farmers union: extension for farmers
- Women union: joint money

**2.6 My Thái, Kiên Giang (double rice)****Participants**

1. Man. 7ha. Double rice.
2. Man. 7ha owned + 25ha rented. Vegetables
3. Man. 5ha. Double rice (20 years ago he had only 0.5ha)
4. Woman. 1.4ha. Double rice (lend to others as well). Several hundred chickens.
5. Woman. 3ha. Double rice.
6. Woman. 1.9ha. Double rice (just bought).
7. Woman. 3ha (inherited from family). Double rice. Part of the local government.
8. Woman. 2ha (inherited from family). Double rice. Sells metal sheets for roof.
9. Woman. 8ha. Double rice.

**Agricultural systems****Double rice**

1. Beginning-October until end-February → high yield and good weather (70kg/0.13ha fertilisers, 45kg in the past)
2. Beginning-March until end-June → use more fertilisers (100kg/0.13ha, 60kg in the past)
3. Let water in (July until end-September)
4. △ some people do triple crops (in full dyke system). Also some people without full dyke do triple rice (around 40%) but very low yield and high cost → this is why most farmers don't do it (earns 3million/0.1ha for the two first crops but only less than 500k for the third crop)
5. Most people want to do triple but they don't have a dyke and they see many farmers fail

**Upland crop**

- All year
- Sweet potatoes (March - May)
- Watermelon (October - December)

**Others**

- Chickens: all year (diseases April - May and December)
- Business (agricultural services) all year but more income March - September because farmers harvest their crops
- Price of land: 35-40 million VND/0.13ha
- Snakehead fish in flood season in river (July - October)

**Natural hazards**

- Rice disease mainly during second crop (and end of first crop)
- Rain and storm (May - June)

**Water management**

- No pumping station -> each farmers have their own canal and pump
- 20% have tap water, the rest use rain water or surface water

**Agricultural marketing**

- All farmers harvest at the same time so the price is low and buyers want to buy at lower and lower price
- 50% farmers have contract with companies (2 main companies)
- Others: cooperative or no contract -> sell to individual buyers and small companies
- Companies change humidity quality criteria every year -> difficult for farmers to adjust

**Difficulties**

- Weather -> follow seasonal calendar and technical improvement
- Price of rice not high because they all harvest at the same time
- Diseases -> switch to bio-fertilisers
- Farm investment -> farmers need to contract loans before each crop investment. Want government to cooperate with companies to increase price of rice so labour stays and does not migrate
- Lack of labour especially for vegetables -> solution is mechanisation
- Water is polluted

**Livelihood systems****Rich households (30%)**

- Big agricultural area (>15ha)
- Agricultural services

**Average households**

- Average agricultural area (3-6ha)
- Work for the local government
- Small business and catch aquaculture (nest in river)

**Poor households (5%)**

- Agricultural labour, catch fish and mice, sell vegetables and fish at the market
- Work in other provinces
- Local government support building houses for poor households
- Some have motorbikes
- Reason: no agricultural land, family was poor

**Migration and labour**

- 20/30% of the commune migrate
- labour cost: 150,000 - 200,000VND/day (labour force asks for 300,000VND/day)

**Dynamics**

- Average → poor: crop failure, diseases, gambling
- Poor → average: example of one household with many labourers who earned up to 1 billion VND and now became big farmers by renting land from others

**Livelihood capitals**

- Road system is good and boats can carry up to 50 tonnes of rice from their field

**Unions**

- Women union → trainings for women
- Farmers union → loan money, training course (agricultural development)
- Cooperative (big and small), managed by farmers union. For rice farmers and vegetables. If farmers want to join they have to buy stocks. Each farmer will have a contract with the cooperative (e.g. stable price for sweet potatoes, support in mechanisation/irrigation, buy fertilisers and pesticides at lower price). Criteria for farmers to join: enough money, suitable land
- Tontine → support money for agriculture and raising animals

**2.7 Điện Hai, Bạc Liêu (shrimp farming)****Participants**

1. Man. 2ha ≈ 10 ponds aquaculture (shrimps)
2. Man. 2ha ≈ 7 ponds intensive shrimp
3. Woman. 1ha ≈ 2 ponds intensive shrimp + 0.5ha extensive shrimp
4. Man. 3ha ≈ 15 ponds intensive and more than 3ha extensive
5. Man. 4.9ha extensive
6. Man. 6ha ≈ 15 ponds + 10 ponds super-intensive
7. Man. 1.5ha ≈ 5 ponds intensive + 1.5ha extensive + 0.5ha orchards
8. Man. 3ha extensive
9. Man. 3ha extensive



## **Agricultural systems**

### **Aquaculture (30% intensive, 60% intensive, 10% others)**

- 2 main types of shrimps: tiger (tôm sú) and whiteleg (tôm th)
- Main difference: density and growing time

#### **Intensive tiger shrimps**

- 1st crop: April until October
- 2nd crop: October until February
- Drain the pond: March - April
- Input costs for 2000m<sup>2</sup>
  - Pond without liner (40-50 million VND/crop)
  - Seeds, food, electricity (100-110 million VND/crop)
- Harvest: 20-30 shrimps/kg, harvest with net and wait until they have the right number of shrimps depending on weight
- Yield: 1.2-1.5 tons/pond
- Price: 150-200,000 VND/kg

#### **Intensive whiteleg shrimps**

- 1st crop: January until April
- 2nd crop: April until July
- 3rd crop: fish (July until October)
- Drain the pond: October - December
- Input costs for 1000m<sup>2</sup>
  - Pond with liner (300-350 million VND/crop) or without liner (60-70 million VND/crop)
  - Seeds, food, electricity (70-80 million VND/crop with liner or 90-100 million VND/crop without liner)
- Harvest: 40 shrimps/kg, harvest with nets, choose big shrimps
- Yield: 6 tons/pond (with liner) or 2 tons/pond (without liner)
- Price: 100-150,000 VND/kg

#### **Extensive shrimps**

- Prepare pond (15 million VND/year)
- Drain and treat pond every 3 years
- Input costs (food, bio-pesticides): 10-15 million VND/ha/year
- Harvest: 50-100 million VND/ha/year
- Lot of free time (reason why one farmer does not want to switch from extensive to intensive)
- For extensive shrimp → need to have good quality water and enough water. Many farmers try to do extensive but fail so they go for intensive
- Labour: no need for extra labour, only family
- One extensive farmer says he does not want to change to intensive because he does not have enough labour + he has good location (good quality and quantity of water)

### Marketing

- Price depends on weight and shape of shrimp
- People want to buy shrimps from China because they are cheaper (because input costs cheaper)
- Government tried to stabilise the price for farmers → many cooperatives with price higher than market (>15,000) but farmers need to ensure good quality and have certification

### Land use

- **Orchards:** because of highlands. Need to pump groundwater to prevent salinity intrusion. This farmer is the first person to grow orchards (dragon fruit) in the area. Three other farmers in his commune have tried but not successful.
- **Plan:** still not clear, three zones (rice/shrimps/orchards). This area is shrimp but government investment for infrastructures (electricity, roads) depends on the number of farms (and their density).

### Difficulties

#### Overall

- 30% farmers success
- 70% farmers fail → for example last year one farmer harvested for only 10-20 days and then the shrimps died. He had to do a 4th crop (thus more investment)
- No union to support shrimp farming
- Problems of theft (aquaculture pumps)

#### Tiger shrimps (extensive)

- Water: canals are small and shallow → lack of water
- Electricity: not enough to run machines
- Transportation: not good so it reduces the price of shrimp
- Market: farmers cannot control shrimp price → government encourages farmers to grow good quality shrimps (150k VND for 100 shrimps) but they do not guarantee the price
- Input price (food, medicines) → price increase

#### Whiteleg shrimps (intensive)

- Shrimp starters: have to buy from other provinces, price is high
- Weather: when it rains too much → shrimps get sick
- Market: cannot control price
- Price of inputs is not stable

### Solutions

- **Water:** widen and deepen the canals so they can have enough water. At the moment, both input and output water go in the same canal, leading to pollution
- **Government:** want government to invest in better electricity, transportation system and guarantee price of shrimps. Also control quality of inputs

## **Livelihood systems**

### **Rich households (30-40%)**

- Intensive shrimp (>10ha) + extensive (>5ha)
- Business (sell shrimp food, medicines, seeds)
- Car and good houses

### **Average households (40-55%)**

- Intensive shrimp (1-2ha)
- Raise animals
- Vegetables
- Average business

### **Poor households (15-20%)**

- Labourer (construction, shrimp processing factories)
- Catch snails and fish in coastal areas
- Some have very small business
- Medium standard house, own motorbike
- Reason: family is poor, crop failure, no land, gambling

## **Dynamics**

- **Rich/average** → **poor**: crop failure, gambling
- **Poor** → **rich**: success in crop, family member abroad

## **Labour and migration**

- Labour in excess, poor people migrate to Binh Dng
- Because of mechanisation, poor do not have jobs to do → many move to Binh Dng for industry

## **Livelihood capitals**

- Electricity: good only in planned areas (land use plan for shrimps by the government)
- For intensive farmers
  1. Water
  2. Location
  3. Union
  4. Financial capital
- For extensive farmers
  1. Good quality seeds (most important)
  2. Skills
  3. Financial capital
  4. Water
  5. Company and cooperatives

## 2.8 Đình Thành, Bạc Liêu (shrimp farming)

### Participants

1. Man. 1.3ha. Extensive shrimp. Recently crop unsuccessful because too hot -> invasive plant in pond.
2. Man. 1.3ha. Extensive shrimp. Problem of water pollution because of companies that release water in river.
3. Man. 2ha. Extensive shrimp. Shrimps grow slow because he didn't drain the water from his pond.
4. Man. 2ha. Extensive shrimp. Difficulty with water -> polluted.
5. Man. 1ha. Extensive shrimp. Water pollution.
6. Woman. 1ha. Extensive shrimp. Chair woman of women union.
7. Man. 1ha. Used to have 5 ponds in 2014-2016 but now only 2 ponds.
8. Man. 4.5ha (extensive) + 0.5ha (intensive)
9. Man. 3ha. Extensive shrimp. Climate change (heavy rain, too hot), water pollution (companies north of 1A highway) -> fails shrimp farms.
10. Man. 1.5 ha. Extensive shrimp.

### Agricultural systems

#### Shrimps (90% extensive tiger, 10% intensive whiteleg)

1. January -> April (main crop)
2. May -> August (add new seeds every 1.5months)
3. Drain pond (August - September)
4. October -> December
5. Costs and profits
  - 1ha: sell 60-70 million VND/year, profit 40 million VND/year
  - 1.5ha: input costs 15-20 million VND/year, profit 50 million VND/year

#### Advantages of extensive farm

- Less disease
- No extra food
- Add seeds every 0.5-1.5 months (every 2-3 months if lack of money)

#### Others

- Crabs: high price between November until April
- Hot (March - April) -> not enough oxygen for shrimps, algae
- Rain (April - November) -> unpredictable, heavy

#### Sediments

- Before lot of sediment -> plants in water could not develop
- Now less sediment -> plants grow more

**Water management**

- Each pond has its own sluice gate built by farmers → no need for pumping system
- Big flood gate north of 1A highway is closed between July and August because of tidal effect. Ponds are not flooded (but houses are)

**Agricultural marketing**

- Many intermediaries (brokers) between farmers and companies
- Reason 1: farmers don't produce enough so companies don't buy from them
- Reason 2: companies don't buy directly from farmers
- Remote farms → price from buyers is lower

**Difficulties and proposed solutions****Difficulties**

1. Weather (too hot, rain)
2. Water pollution, including the problem of farmers who fail their crop and drain their pond in the same canal in which the other farmers pump from → they fail too
3. Bad quality seeds
4. Technical problems → no more agricultural extension
5. Need a lot of financial capital to buy fertilisers and food
6. No clear planning from the local government → don't give specific calendar to farmers, many different types of shrimps
7. Price of shrimps too low

**Solutions**

- Want government to have policy to treat waste water from intensive farmers
- Want local government to have technical staff for aquaculture who would visit fields regularly to teach farmers about aquaculture
- Want government to check quality of seeds
- Cooperative should arrange farmers to dry ponds at the same time

**Livelihood systems****Rich households (20-30%)**

- Shrimp farm (>4ha)
- Shrimp trader and aquaculture services

**Average households (50%)**

- Shrimp farm (<2ha), family member work in Binh Dng

**Poor households (20-30%)**

- Women work in shrimp factories
- Men work in construction labour
- Work all year in Binh Dng and come back for Tt
- Reason: no land, "lazy", gambling, many children, diseases, sickness, "social evil" (drink, fight, etc.)

### Dynamics

- **Downward:** crop failure, sickness, gambling
- **Upward:** high skills, hard working, children working overseas or in other provinces

### Livelihood capitals

1. Money
2. Skills
3. Water
4. Cooperative
5. Electricity, transportation system

### Others

- Commune with 37.9% poor and 20% rich → far from urban areas, transportation system is bad, majority of people are khmer, average education level, lack of land
- 30-40% migrate to industrial areas (all year, come back for Tt)
- 30% of households don't have electricity for domestic purposes → have to buy from neighbours at high price (6,000VND instead of 5,000VND for 2,600kW/h)
- Lack of electricity investment: government justifies by saying "it's low density"

### Unions

- Farmers union → share information about farming, 70-80% of farmers are members. Joint money (200-300,000 VND/month/farmer) then lend to someone
- Women union → joint money, raise pigs, vegetable, tailor crafting
- Cooperatives (<10% of farmers): farmers grow shrimp together in big scale → more effective
  - Their crop calendars are synchronised (add seeds at the same time)
  - Only 10% of farmers join because lack of unity between farmers and also lack of financial capital
  - Membership: many criteria (synchronisation of calendars, financial input) but some farmers need money at different time so they don't want to follow the imposed schedule
  - Joint money: 200,000 VND/3 months
  - Cooperate with companies: buy probiotic from them with the condition that the company buys shrimps in return

## 2.9 An Truong, Trà Vinh (triple rice, orchards)

### Participants

1. Woman. 1.5ha triple rice + pigs + fish
2. Man. 1ha triple rice + pigs + fish + chickens
3. Man. Retired, gave land to his children. Before he had 1ha triple rice + cows
4. Man. 2ha triple rice + pigs
5. Man. 1.5ha coconut
6. Man. 0.4ha orchards (coconut, mandarine) + 0.5ha triple rice
7. Man. 0.7ha coconut + wild pigs + porcupine
8. Man. 2ha triple rice + 6 cows

9. Man. 1ha triple rice
10. Man. 1ha triple rice + 0.3ha coconut + 2,000 chickens
11. Man. 0.5ha triple rice + 0.2ha coconut + 4 cows
12. Woman. 0.3ha triple rice + 0.5ha coconut + fish

## **Agricultural systems**

### **Triple rice**

1. Mid-October until mid-February (10kg)
2. Beginning-March until mid-June (50kg)
3. Beginning-July until end-September (>50kg)
4. Mechanisation used for land preparation and harvest
5. Input costs: 4.5 million VND/0.1ha/year
6. Sell: 10 million VND

### **Orchards**

- Coconut: need financial capital to invest. Harvest all year but October until February -> more coconut while March until September -> less coconut because of weather
  - Input costs: 1.5 million VND/0.1ha/year
  - Fertilisers: 2-3 times per year (1kg/tree)
  - Sell: 5 million - 10 million VND
  - 4-5 years before production: prepare land (3 million VND/0.1ha) + seeds (750,000VND/0.1ha)
- Mandarines and oranges: harvest October until February

### **Natural disasters**

- Rain (July - September) -> break the rice
- Too hot (March until mid-June) -> lack of water (very severe 4 years ago but now better thanks to sluice gates)
- Salinity (March - April) -> because of the hydro-electric dam, but only outside because they have flood gate
- Flood (August - September) but not in highland (where coconuts)

### **Sediments and water management**

- In the past many sediments but now very little (now triple the amount of fertilisers)
- Sediments -> more mid-August until mid-October (now 40-50% compared to the past because of the dam upstream and flood gates to prevent salinity intrusion and floods)
- Flood gates to prevent saline water
- Some farmers do not follow calendar because of the lack of water
- Different land elevation -> low land (just open gate to let water in) and high land (pump water in)

### **Labour force**

- Rice: to make borders of fields higher, cut grass, add fertiliser and pesticides, transplanting -> 100,000VND/0.1ha (1 labourer = 0.5ha)
- Coconut: fertilisers and irrigation (1 labourer = 1ha)

### Land use

- Need to ask permission from government to change from rice to coconut (the government has planning defining rice areas and orchards areas). Permission is granted depending on land. If they do not have the permission → get fined
- Many farmers want to convert to orchards because low land and rice inundated → want to make land higher to do coconut because rice is not effective.
- Farmers can get more money from orchards and can grow vegetables and have fish during the first 5 years (when there is no production yet)

### Problems and proposed solutions

#### Difficulties

- **Heavy rain:** usually 15-20% crop damage but 50% for the last 2years
- Diseases (increase)
- Fertilisers and pesticides: price is not stable, bad quality, farmers cannot know the quality of fertilisers until they buy and use. Variety of products but farmers don't know which one to use and how → they have to ask the seller
- Labour: lack of labour (cut the grass, apply fertilisers and pesticides) and price is high
- **Price of rice:** traders lower the price and decide when to harvest. Farmers want to harvest at 90 days but traders want to harvest at 100-105 days (because rice dries up → less weight → cheaper)
- Transportation system is good
- Lack of financial capital to buy inputs → buy fertilisers from traders but pay after harvest △ problem if crop failure

#### Solutions

- Price of rice → support from the local government, establish cooperative, guarantee price of inputs and price of rice
- Diseases → farmers want to use bio-fertilisers but not as effective as chemical products
- Price of coconut and other fruits → want to sell to companies to process
- Fertilisers and pesticides → want government to check quality and list which one are good/bad
- Animals → price of medicine and food very high, price of animals not stable

### Livelihood systems

#### Rich households (15%)

- Farm: triple rice (>3ha) and coconut
- Business: agricultural products, agricultural services
- Member doing labour overseas or who migrated to other provinces

#### Average households

- Triple rice (<1ha) and coconuts
- Raise animals
- Business



**Poor households (4-5%)**

- Labour (construction, agriculture)
- Small business (vegetables, lottery, recycle products)
- Worker in processing companies
- Reasons: ethnic minorities, family, no land, lazy, sickness, crop failure, gambling

**Dynamics**

- **Downward:** sickness, animal die, fail in business
- **Upward:** raise animal and success, family has many labour work overseas or in industrial zones
- 80% of people aged 18-60 migrate

**Livelihood capitals**

1. Location of land (get easy access to water and accessibility for trucks and tractors)
2. Seeds of quality
3. Cooperative
4. Skills and labour
5. Financial capital

**Unions****Farmers union**

- Support farmers to get financial help from the government
- Share information about effective cultivation systems, technical support
- Joint money (pooling at the district level) and credit

**Women union**

- Financial support
- Provide income-generating activities for women (tailor, vegetables) and small business

**Cooperative**

- Raising animals
  - Certification for wild animals
  - Buy seeds/babies
  - Support the registration procedure with government in order to sell
  - Need to buy stocks to get into it: fee of 50,000VND/month (goes into joint money)
- Rice cooperative: buy seeds at lower price and support farmers to sell 2 tons per crop
- Seed cooperative: produce high quality seeds

## 2.10 Nhi Long, Trà Vinh (orchards)

### Participants

1. Woman. 0.3ha coconut (for the last 10 years, used to grow rice before) + 0.1ha raise animals
2. Woman. 0.5ha coconut + 0.3ha dragon fruit (used to grow rice in the past)
3. Man. 0.6ha orange
4. Man. 0.3ha triple rice + 1.1ha coconut (used to have 0.6ha rice but converted 0.3 to coconut)
5. Man. 0.5ha triple rice + 0.3ha grass + 8 cows (used to have 0.8ha rice but switched to cows 5 years ago)
6. Woman. 0.2ha triple rice + 0.2ha mandarine (10 years)
7. Man. 0.7ha triple rice + 0.8ha vegetables (2 years, used to be rice only)
8. Man. 1.2ha rush (juncaceae)

### Agricultural systems

#### Triple rice

1. October until February: 10kg fertilisers
2. March until June: 30-36kg fertilisers (20kg in the past) – lack of water for the 1st crop at the start and heavy rain at the end (20% crop damage)
3. July until September: 30-36kg fertilisers (20kg in the past) – too hot and rain (20-40% crop damage)
4. Costs and profits (for 1000m<sup>2</sup>)
  - Input costs: 0.9 - 1.5 million VND/crop
  - Production: 20-40 bags of 20kg/crop
  - Sell total: 9-11 million VND/year

#### Orchards and others

- **Mandarine and orange:** main crop October - January. Below costs for 1000m<sup>2</sup>
  - Input costs: 15-20 million/year
  - Sell: 50 million VND/year
- **Pomelo:** Costs for 1000m<sup>2</sup>
  - Input costs: 5 million/year
  - Sell: 10-15 million VND/year
- **Coconut:** all year. Below costs for 1000m<sup>2</sup>
  - Input costs: 1 million VND/year
  - Production: 120 coconuts/months
  - Sell: 6-10 millions VND/year (12 coconuts = 40-50,000VND)
- Rain June - September → carry diseases

#### Others

- Vegetables: 4 crops/year, fallow January until April (because it is too hot and there is no water)
  - Input costs: 15 million VND/year
  - Sell: 45 million VND/year
- Cow: all year, sell 5 baby cows/year

- Input costs: 10 million VND/year
- Sell: 50 million VND/year

### **Water management**

- Farmers pump the water in their field themselves with individual pumps

### **Labour**

- Rice: 1 labourer = 1ha
- Cows: 1 labourer = 8 cows
- Vegetables: 1 labourer = 0.1ha (lack of labour for vegetable farmers)
- Coconut: 1 labourer = 0.8-1.5ha
- Orchards: 1 labourer = 2ha
- 1 labourer = 150,000VND/day

### **Land use: why converting from rice to orchard**

- Nature of land is not effective to grow rice
- Profit of rice not high
- Lack of water for irrigation because dyke
- Lack of labour
- Local government encourages land use change
- Orchards more effective to grow compared to rice

### **Problems and proposed solutions**

#### **Difficulties**

- Weather
- Diseases
- Market: price unstable in general, farmers don't know the price. They sell their products to traders
- Financial capital: lack of capital to invest in irrigation systems for orchards and vegetables
- Water: February and March (flood gate closed to prevent salinity) but water in the field become acidic (affects crops).

#### **Solutions**

- Establish cooperative to buy inputs, to guarantee stable price and to ensure good procedure (and to stop selling to traders)
- Technical support

### **Livelihood systems**

#### **Rich households (20%)**

- Lot of farm land (>3ha)
- Business
- Agricultural services

**Average households**

- Farm (<2ha)
- Small business
- Raise animals

**Poor households (<5%)**

- Labour (construction, agriculture)
- Small business
- Work in other provinces
- No land
- Reasons: no land, sickness, high dependency ratio, laziness, gambling, low education

**Dynamics**

- **Upward:** family members work in industrial zone, hard working
- **Downward:** sickness, fail in business, fail in raising animals

**Livelihood capitals**

1. Farmers' skills
2. Weather / cooperative / processing companies
3. Land / water
4. Seeds / transportation system / financial capital

**Unions**

- Farmers union (70-80% of farmers)
  - Support irrigation and technical support
  - Better contact with the government
  - Joint money (50,000VND/month)
- Women union (90% women)
  - Teach handicraft
  - Joint money
- Old soldiers union (100% old soldiers)
- Cooperative (20% of farmers)
  - Only 1 in village, not efficient, nothing to buy/sell collectively
  - Meeting every month, joint money, share technical experience
- Tontine

## Discussion on land systems

**3.1 Triple rice****Cropping system**

The first season starts when the water recedes. Farmers pump the rainwater out of the polders to prepare the land for the first crop. After the first harvest, the land is let lie fallow

for two weeks before the second crop is sown. During this second crop, water has to be pumped in the fields from the surrounding canals at two weeks intervals. Again, the third crop is sown after a two weeks break following the harvest of the second crop. During this crop, water has to be pumped out of the fields at two weeks intervals. After the harvest of the third crop, some farmers release water into the field until there is a layer of standing water of 60cm in low lying part. The standing water is left for about 20 days before it gets pumped out. During the two weeks interval between two crops, farmers either burn or plough over to bury the stubble from the previous crop. Heavy tasks are mechanised and the lack of sediment supply is compensated by an extensive use of fertilisers and herbicides. In some places, the government has imposed 3/3/2 cropping system, meaning that every three years farmers do only double crop. They usually rotate their fields so there is always one in double rice system. The calendar is imposed by the commune agricultural officials (farmers sow and harvest at the same time).



■ **Figure 1 Seasonal calendar for the triple rice irrigated system.** The first crop (Winter-Spring) is cultivated from November until January. The second crop (Summer-Autumn) is sown in February and harvested at the end of May. The third crop (Autumn-Winter) is sown in June and harvested at the end of October.

### Access to markets

Price of rice based on quality but unstable. Companies from Can Tho come to buy the rice directly from farmers (mainly from big farmers for effects of scale). There is a wish for bigger companies to come, under agreement with the government.

### Difficulties and vulnerabilities

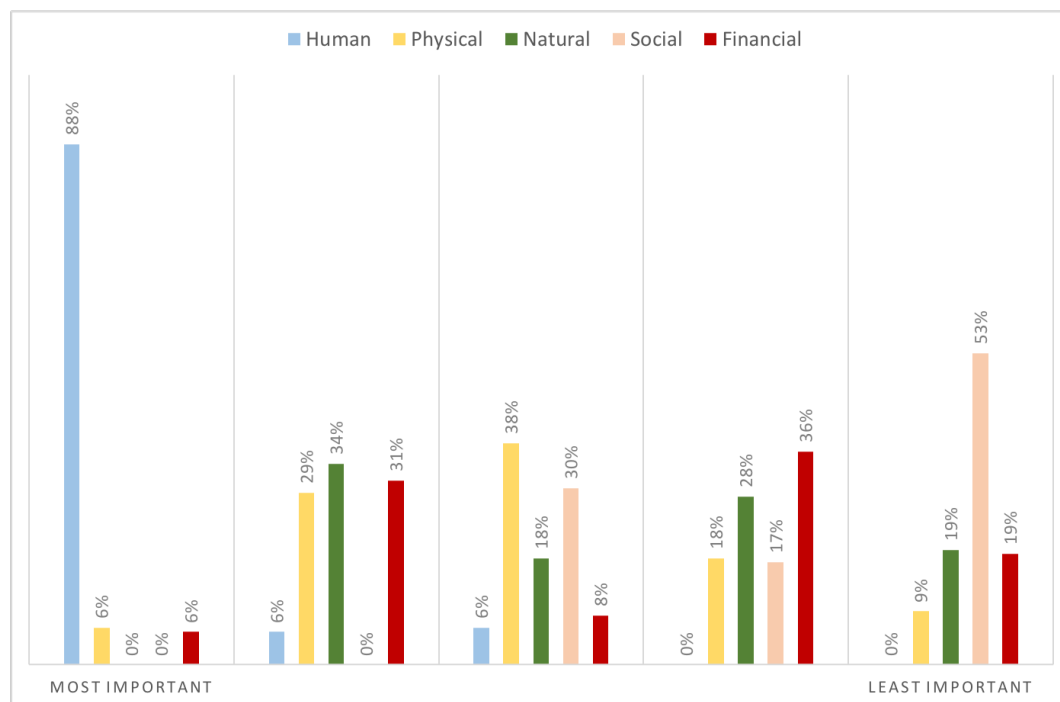
The main difficulty for farmers concerns fertilisers and pesticides. There is very little control over quality and they argued that fertilisers were of bad quality and too expensive. This is probably linked to the loss of yield that many experience due to the absence of flood in the cropping system. Sediments and the attached nutrients do not enter the field to replenish the soil. Three main environmental risks are faced by this system: (i) hot temperatures during the rainy season might lead to heat stress for the rice; (ii) prolonged rain during the wet season might flood the field inside the dykes, increasing the costs to pump the water out (might lead to crop failure); and (iii) heavy floods, which increase the risk of dyke breaks.

### Water management

Water is mainly pumped out from the field during the flood season (when there are sediments). Water is only pumped in during the dry season when there is little sediment in the water. For each polder, there is an electric pump station that is operated either by an external private investor (company) or by a cooperative of farmers. The level of water in the canal and the calendar are fixed by the district agricultural department. In both cases, the owner is in charge of maintaining the dyke.

### Livelihood systems

In the triple rice cropping system, poor households are landless and work as agricultural labourers. As most of the work is mechanised (ploughing, pumping, harvesting, trashing and transport), only petty tasks (land preparation, fertiliser broadcasting, compensation planing and chemical spraying) provide employment to labourers (1-2 person=days of work per ha). Weeds are controlled by herbicides so weeding work is limited. However, the demand of labour during sowing and harvest is high and short as most farmers harvest at the same time. Farmers find themselves with a lack of labour force as there are not enough local agricultural labourers. They have to hire large organised groups of labourers from other provinces. This practice drives landless locals into migration to the industrial zones (Binh Duong).



**Figure 2 Livelihood capitals ranking by participants.** Participants were asked to rank the different livelihood capitals from 1 to 5. The figure shows compiled rankings for a total of 26 participants.

### Land use planning

The flood-free environment enables farmers to have fruit tree gardening, animal husbandry and pond aquaculture in the back of their house or fields. Triple rice systems with high dykes are perceived to be the less risky of rice systems by farmers. Two main adaptation models are considered at the policy level: (i) double rice-aquaculture system; and (ii) orchards.

## 3.2 Double rice

### Cropping system

In this system, land plots are surrounded by low dykes. Their height of 2 meters above the ground allows floodwater to flow into the floodplain field after the second crop. The land is let lie fallow and inundated during the entire flood season, allowing people to do catch aquaculture, as fields are considered common property during the flood season. The flooded fields are used for fishing for home consumption (for better-off households) or income (for landless households), enabling the poorest households the opportunity to generate some incomes. When the water level recedes at the end of the flood, farmers pump water out of their land to sow the Winter-Spring crop.



**Figure 3 Seasonal calendar for the double rice irrigated system.** The first crop (Winter-Spring) is cultivated from November until March. The second crop (Summer-Autumn) is sown at the end of March and harvested in July. During the flood season (July to October), fields are either let to lie fallow or they are used for aquaculture.

### Access to markets

Due to their lack of bargaining power, farmers are required to harvest at the same time by buyers, resulting in lower prices. More than half of farmers have contract with companies. According to the farmers, these companies change the quality criteria every year (humidity).

### Difficulties and vulnerabilities

They need to use more fertilisers due to the lack of sediments. Compared to triple systems, there are no electric pumping stations that take care of irrigation, which means that farmers need to have their own pumping system (which is another source of expenses). Another problem for double rice cropping near coastal areas is water pollution and salinity intrusion, which prevents farmers to pump the water from canals (which also prevents them from growing a third rice crop). In low flood years, water might become too hot for fish or shrimps to survive during the flood season.

### Water management

Floodwater provides sediments to the fields and act as a pest control, thus reducing the use of fertilisers and pesticides for the following crop (thus less financial capital to be invested). Water is pumped in out from the field during the early part of the Winter-Spring crop and then pumped at 2-weeks intervals. The main issue raised by farmers for the Summer-Autumn crop are water shortages, hot temperatures and heavy rainfalls that break the stems. Contrary to the triple cropping system, households arrange water pumping on their own. The start of the first crop is dependent on the floodwater fluctuations: farmers have to wait that the water recedes in order to pump the water out from the field.

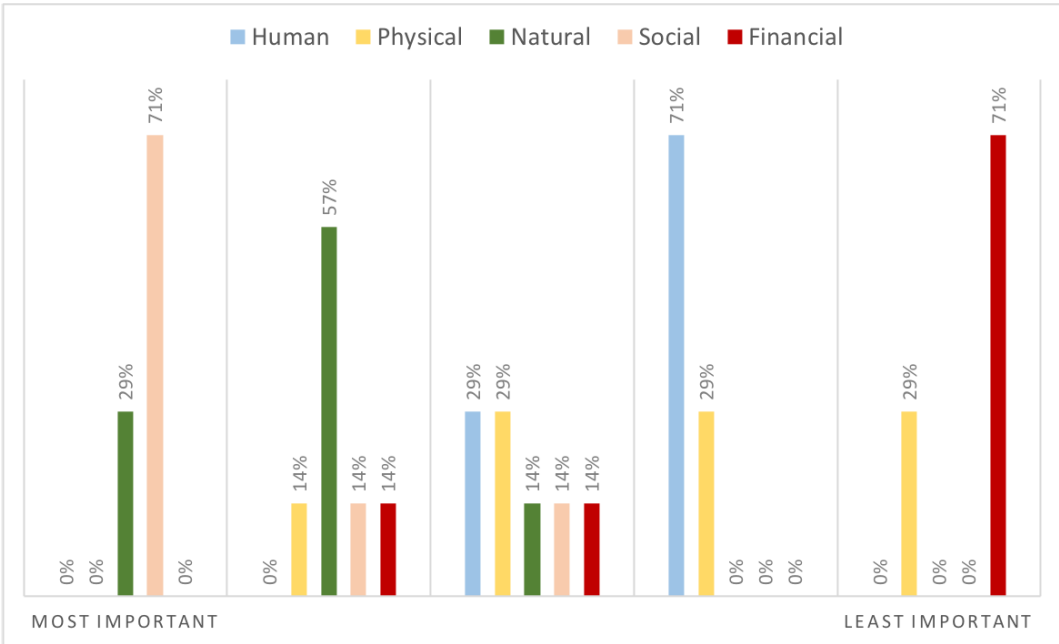
Livelihood systems

Rural poor

Households are considered as poor when they are landless or land-poor (owning less than 0.2 hectare per member). In this system, they mainly work as labourers for fishermen (on the coast) or for rice farmers. They are also engaged in petty trading (selling vegetables and catch fish at the market).

Livelihood capitals

Participants considered social capital as the most important livelihood capital for households in the area. They defined social capital as their bargaining power for negotiating the price of rice with buyers, which is one of the key issue faced by farmers in this system. It is also perceived as an important asset for poor households, as they rely on their networks to find jobs. Compared to the other agricultural systems, human capital was only perceived as the fourth most important capital. This result is probably due to the less-labour intensive requirements of double rice cropping.



**Figure 4 Livelihood capitals ranking by participants.** Participants were asked to rank the different livelihood capitals from 1 to 5. The figure shows compiled rankings for a total of seven participants located in the double rice system area.

Land use planning

The land is inundated annually, preventing households to develop orchards around their houses. Aquaculture fish ponds require high dykes around to protect them from floods. Government allow land use change only in lands where there is salinity intrusion or pests. Two main adaptation models are considered at the policy level: (i) rice-aquaculture systems (see Chapter 6); and (ii) cash crops-aquaculture systems. The rice-aquaculture system consists of a Winter-Spring rice from November to March and then either extensive shrimp



aquaculture (with low dykes and nets using floodwater) or fodder for cows (April-June) followed by capture fishery (July-October). The second system is based on a cash crop (December to March), followed by floating rice (April to November) and then the field is flooded enabling shrimp aquaculture or capture fishery.

### **3.3 Agroforestry**

#### **Cropping systems**

The main orchards cultivated are coconut, mandarine and oranges. Coconuts are harvested all year, although there is a peak of production between October and February. The harvest for mandarine and oranges is also between October and January.

#### **Agricultural marketing**

At the moment, buyers come to the farms to buy directly. Farmers mentioned that they would like to sell directly to processing companies or to go through cooperatives that would have a contract with processing companies.

#### **Difficulties and vulnerabilities**

Farmers mentioned that the main difficulty to set up this system was lack of financial capital to invest in irrigation systems for orchards and vegetables. This system is vulnerable to floods (August - September) and to salinity intrusion (March-April). Farmers perceived that salinity increased because of the hydro-electric dam. From February to March, the flood gates are closed to prevent salinity but it leads to the acidification of soils

#### **Water management**

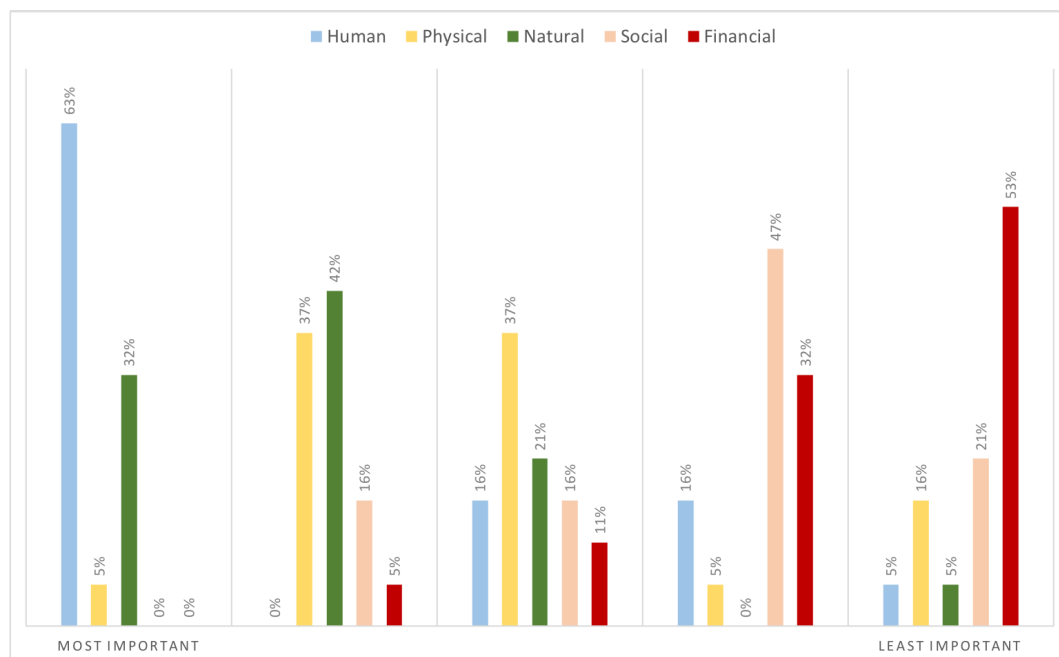
There are flood gates to prevent saline water intrusion that would damage orchard plantations. There is a need of irrigation (groundwater in saline areas). Farmers pump the water in their field themselves with individual pumps depending on the land elevation: low land (no need to pump, just open gate to let water in) and high land (pump water in). Regarding sediment requirements, perennial crops need less and although farmers mentioned the decline of sediments, most orchard farmers were not concerned by this issue.

#### **Livelihood systems**

Most orchards (except sugarcane) require a small labour force. For example, for coconut, the only tasks that are required are to apply fertilisers and irrigate (need of 1 labourer for 1ha). Poor households are landless labourers, doing either construction, work in processing companies or do agricultural labour. Some have small businesses (vegetables, lottery, recycle products). Participants argued that about 80% of people aged 18-60 migrate to industrial areas. One of the most important capital raised by farmers is the location of land in order to get an easy access to water and accessibility for trucks and tractors.

#### **Land use planning**

Farmers need to ask permission from government to change from rice to coconut (rice areas and orchards areas are defined by the land use plan). The permission is granted depending



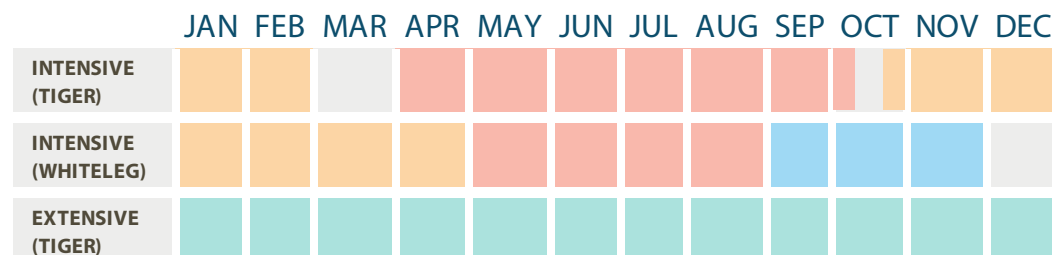
**Figure 5 Livelihood capitals ranking by participants.** Participants were asked to rank the different livelihood capitals from 1 to 5. The figure shows compiled rankings for a total of 19 participants.

on land. Farmers can get more money from orchards and can grow vegetables and fish during the first 5 years (when there is no orchard production yet). The main land use policy plan is to convert triple rice to orchards, but there is no policy to convert from orchard to another crop system.

### 3.4 Shrimp aquaculture

#### Cropping systems

Although the literature differentiates five types of shrimp farms, three main types were mentioned during the focus groups: (i) intensive with whiteleg shrimps; (ii) semi-intensive with tiger shrimps; and (iii) extensive with tiger shrimps. Intensive shrimp farming relies on added feeds with pellets and fresh feeds and has a high stocking density. One of the advantages of such a system is that the pond is constructed and enables farmer to control actively water supply and drainage. However, the drawback is that shrimps grow small in this system (thus have a lower price compared to other systems) and the input cost is high. Stocking density is high and ponds are usually around 1,000m<sup>2</sup>. Semi-intensive shrimp farming applies fertilisers to create natural feeds, in combination with additional feeds (rice bran). The stocking density is higher than extensive systems, with ponds that are usually around 2,000m<sup>2</sup>. Extensive shrimp farming entirely relies on natural feed, with a low stocking density. As a consequence, area of shrimp farms is large, leading to a low profit per unit of land.



■ **Figure 6 Seasonal calendar for the shrimp aquaculture systems.** Three types of systems are differentiated: intensive with tiger shrimps (two crops), intensive with whiteleg shrimps (two crops and one crop of fish) and extensive with tiger shrimps (production over three years).

### Agricultural marketing

Farmers cannot control shrimp price, the government encourages farmers to grow good quality shrimps (150k VND for 100 shrimps) but they do not guarantee the price. There is a lack of electricity, which prevents farmers to run machines. Finally, transportation infrastructures are not good according to farmers, which reduces the price of shrimp as buyers negotiate price down because of the cost of transport (price from buyers is lower in remote farms). There are many intermediaries (brokers) between farmers and companies, either because farmers don't produce enough so companies don't buy from them or because companies don't directly buy from farmers.

### Difficulties and vulnerability

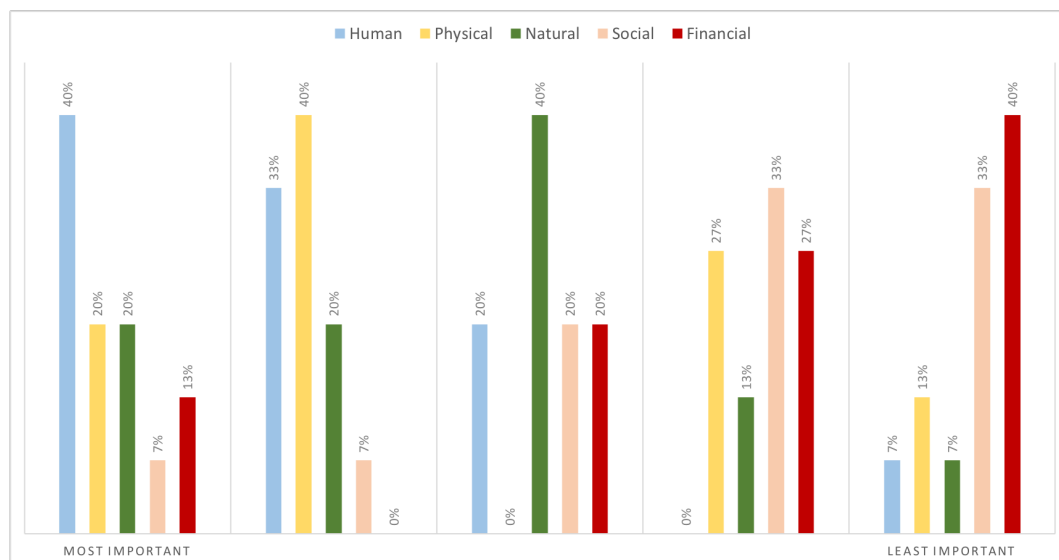
The main problems are the risk of failure and the lack of support from farmers' union. According to farmers, around 70% of farms fail. One of the key elements mentioned by farmers is the quality of shrimp seeds (no regulation). Access to clean water is also a major difficulty for extensive farmers: canals are small and shallow; and there is pollution from intensive farms. Financial capital is also a key factor as setting up a farm requires capital investment. There is no clear planning from the local government, they do not give a specific calendar to farmers that would account for the many different types of shrimps. Furthermore, in low flood years, the water might become too hot for the shrimps to survive.

### Water management

Each pond has its own sluice gate built by farmers so there is no need for pumping systems. The main issue in the area is the quality of water: farmers pump in and out from the same canals, leading to the contamination of the canals, which might lead to crop failures.

### Livelihood systems

Similarly to other systems, the poorest households are labourers (in construction or shrimp processing factories) They also catch snails and fish in coastal areas. Shrimp farming do not require much labour (partly due to the mechanisation of intensive farms), as a consequence there is labour in excess and poor people migrate to Binh Duong. For intensive farmers, the most important assets are access to water and the farm location, while for extensive farmers it is the quality of seeds and knowledge/skills.



**Figure 7 Livelihood capitals ranking by participants.** Participants were asked to rank the different livelihood capitals from 1 to 5. The figure shows compiled rankings for a total of 20 participants.

### Land use planning

There is no clear planning from the local government, they do not give a specific calendar to farmers that would account for the many different types of shrimps. Moreover, they are responsible for infrastructure investments, which they don't do if the farm density is low. Some farmers are planting orchards because their land is high. However, they need to pump groundwater to prevent salinity intrusion.

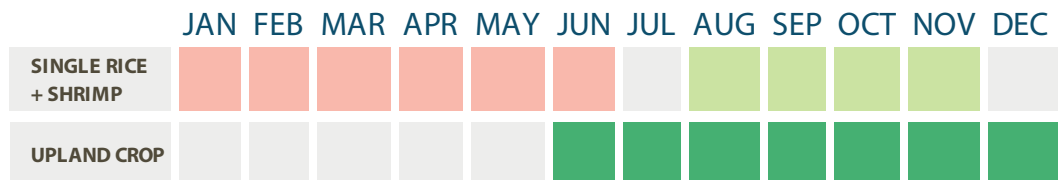
## 3.5 Mixed rice-aquaculture

### Cropping system

This system is found in brackish water areas and consists of one crop of saline tolerant rice alternating with one crop of brackish water shrimp (black tiger). This system is found in areas where salinity ranges between 8 and 20ppt, with a good water supply and drainage and an unpolluted input water. Soils are usually acidic and farmers keep the soil moist between crops to avoid its oxidation. Fields are surrounded by dykes that are higher than the flood pick. Fish can be added to the rice field.

### Sediments

The rice and shrimp support each other: shrimp farming adds nutrients to the soil and the rice purifies the soil for the next shrimp crop. It has been argued that this system is an effective adaptation to salinity intrusion and sea level rise.



■ **Figure 8 Seasonal calendar for the single rice irrigated system.** The rice crop (Autumn) is cultivated from August until November. During December, farmers prepare the shrimp ponds and shrimps are cultivated from January until June. July is used to flush the salinity by using floodwater.

**Difficulties and vulnerabilities**

This system faces two main types of threats: sea-level rise and water pollution that would prevent farmers to grow shrimps and to flush the salinity before planting the rice.