

## Chapter 2:

# Livelihoods and Resource Use Strategies of Farmers in the Mekong Delta



© SEI/Roengchai Kongmuang

Nguyen Duy Can<sup>1</sup>, Le Thanh Duong<sup>2</sup>, Nguyen Van Sanh<sup>3</sup> and Fiona Miller<sup>4</sup>

<sup>1</sup>Mekong Delta Development Research Institute, Can Tho University, Vietnam. Email: ndcan@ctu.edu.au

<sup>2</sup>Mekong Delta Development Research Institute, Can Tho University, Vietnam. Email: ltduong@ctu.edu.vn

<sup>3</sup>Mekong Delta Development Research Institute, Can Tho University, Vietnam. Email: nvsanh@ctu.edu.vn

<sup>4</sup>Livelihoods and Vulnerability Programme, Stockholm Environment Institute, Sweden. Email: fiona.miller@sei.se



## Chapter 2 :

### Livelihoods and Resource Use Strategies of Farmers in the Mekong Delta

1. Introduction and background	72
2. Key issues	73
2.1 Use of sustainable livelihoods framework	73
2.2 Agro-ecological zones of the Mekong Delta	74
2.3 The regional context of livelihoods in the Delta	77
3. Livelihoods and resource use strategies of farmers in the Mekong Delta	77
3.1 Historical changes in livelihoods	77
3.2 Overall changes in government policies	78
3.2.1 From rice intensification to livelihood diversification	78
3.2.2 Effective land use	79
3.2.3 Land and water use conflicts	79
3.3 Livelihood capital assets	79
3.4 Changes in production systems and resource use strategies	82
3.4.1 The Freshwater alluvial zone	82
3.4.2 The Plain of Reeds	84
3.4.3 The Long Xuyen-Ha Tien quadrangle	84
3.4.4 The Trans-Bassac depression zone	84
3.4.5 The Coastal zone	85
3.4.6 The Ca Mau peninsula zone	86
3.5 Livelihood outcomes	87
3.6 Impact of external environment on livelihoods	89
4. Discussions and contested issues	90
5. Research priorities	91
5.1 Community-based natural resources management	92
5.2 Strengthening livelihood assets	93
6. Conclusions	93
List of text abbreviations	95
References	96





## Abstract

The Mekong Delta, which lies at the southern tip of Vietnam, has seen rapid changes in agricultural production systems and socio-economic conditions since the 1990s when the government made reforms in the agricultural sector. Attempts on restructure agriculture and increase the economic value of farmlands was the main focus of government policy and investment. In order to promote the intensification of rice production, the government invested in building a series of dikes and canal systems to prevent floods in the upstream parts of the delta, thus allowing 2-3 rice crops per year. At the same time, in the coastal zone the government invested in a series of coastal embankments and sluices to control salinity intrusion. This agenda for agriculture-led growth has had a large influence on the livelihoods of farmers in the delta.

This paper 1) reviews and analyzes publications in order to establish the current state of knowledge on the impact of the government's policy and development interventions on farmers' livelihoods and resource-use strategies; 2) this will allow for the identification of gaps in research and the studies needed to contribute to appropriate actions on resource use, poverty reduction and securing sustainable livelihoods in the Mekong Delta.

Government intervention in preventing flooding upstream was indeed successful in its primary aim of increasing rice production but it caused environmental pollution and the degradation of soil fertility. This has become a serious concern and could undermine the sustainability of livelihoods. In the coastal zone, government efforts have promoted agricultural diversification and contributed to the improvement of farmers' livelihoods. The economy of the delta remains at a low level of development and it is concluded that the government should invest more in the asset base of the rural poor.



## 1. Introduction and background

The dynamic relationship between land, water and other ecological factors in the Mekong Delta support a rich variety of livelihoods for over 17 million people. Many of these livelihoods tend to be rice-oriented, although other agricultural systems, together with aquaculture and fisheries, have developed to make use of the diverse natural resources and economic opportunities.

The two main physical factors determining land use in the delta are hydrology and soil type. The interaction of different soil types in the delta (alluvial, saline and acid sulphate) with seasonal variations in water flow, rainfall and tides combine to create diverse agro-ecological zones throughout the delta. Such differences allow for important niches for resource-based livelihoods. The significant seasonal variations in water availability mean that floods in the wet season and water scarcity and salinity intrusion in the dry season provide considerable constraints (and opportunities) for livelihoods. People have to deal with seasonal and spatial differences in water quality and availability (flood, drought, salinity and pollution), which are influenced by processes within and upstream of the delta. Rice and fish production are the predominant livelihoods of most households in the flood prone areas, while in the brackish water ecosystems of the coastal areas most households rely on shrimp and rice farming activities.

It is widely known that the Mekong Delta is the “rice bowl” of Vietnam. It is significant for national food security and national export earnings. Annually, the delta produces about 19.23 million tons of rice (accounting for 54% of total national production), with an average yield 5.03 t ha<sup>-1</sup> (CSO, 2005; GSO, 2004). The delta produces rice not only for domestic consumption but also for export; with about 90% of total national rice exports originating from the delta (Duong *et al*, 2005). Agricultural production, especially rice and shrimp production, continues to play a dominant role in the economy, accounting for 46% of GDP at current price levels (GSO, 2005). Attempts to restructure agriculture and increase the economic value of farmlands are the main focus of government policy and investment, as well as farmers’ own efforts (Duong *et al*, 2005). To increase agricultural production, particularly rice, from the early 1990’s the government invested in the construction of flood dikes and diversion systems to prevent floods. This allowed 2-3 rice crops per year. In the coastal zone, the government has also invested in the development of freshwater canals and the construction of embankments and sluices to maintain freshwater for rice cultivation by preventing salinity intrusion. In 2000, the government put in place a new policy that encouraged farmers to use agricultural land more effectively (Can, 2005), hence loosening the strong focus on intensive rice production.

Flood control and salinity control infrastructure, together with the introduction of new agricultural and aquacultural techniques, have been the key government interventions to change production systems in the Mekong Delta. Wider economic changes have also supported more independent and market-oriented production since the late 1980s. However, these interventions and their livelihood impacts are not sufficiently understood. There are uncertainties in regard to:

- opportunities for improved economic benefits from more diversified land and water use;
- the appropriateness of intensive rice production in different parts of the delta;
- the resolution of land and water-based conflicts in the coastal zone;
- the emergence of different livelihood strategies in different parts of the delta and tension/trade-offs over water use.

This study reviews the literature to assess changes in farmers' livelihoods, resource-use strategies and the impacts of government interventions, in order to identify research needs that can contribute to generating appropriate recommendations on resource use and livelihood development strategies. A livelihoods approach is adopted due to the benefits it offers in terms of a more holistic understanding of people's everyday lives and means of making a living. Through this paper the authors aim to study how farmers deal with a very dynamic (natural, economic and policy) environment so as to generate strategic recommendations for water management, rural development and poverty reduction.

## 2. Key issues

### 2.1 Use of Sustainable Livelihoods Framework

The Sustainable Livelihoods Framework (SLF) is used for the investigation of farmers' livelihoods (Gallop et al, 2003; Anton, 2005; Can, 2005; Hossain *et al*, 2006). The SLF helps to generate a holistic approach to the following issues: how farmers might be vulnerable to external environmental threats and shocks, and from where these emanate; how assets and resources, which are categorized into five forms of 'capital' (human, physical, natural, financial and social capital) might help farmers thrive and survive; the policies and institutions (e.g. organizations, levels of government, private sector behavior, laws, policies, culture and institutions) impact on farmers' livelihoods; how farmers respond to threats and opportunities; and what outcomes farmers aspire to, such as more sustainable use of the natural resource base, more income, increased well-being, reduced vulnerability and improved food security (**Figure 1**).

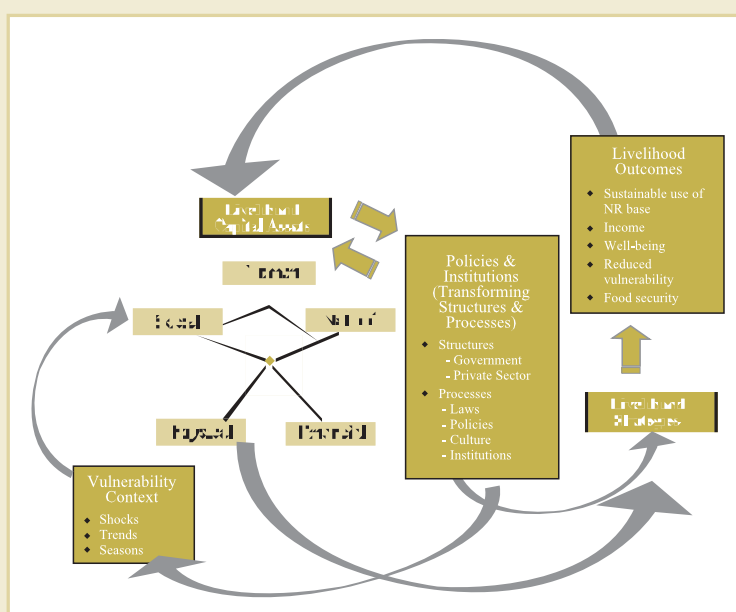


Figure 1: Sustainable Livelihood Framework  
(Source: Anton, 2005)

The SLF starts with five elements of livelihood capital assets and understandings of how farmers use them as a means of livelihood strategy (Hossain *et al*, 2006). These five assets may be visualized in the following way: (i) human capital, e.g. skills, knowledge & information, ability to work, health; (ii) natural capital, for example, land, water, wildlife, biodiversity and the environment; (iii) financial capital, e.g. savings, credit, remittances and pensions; (iv) physical capital comprising the basic infrastructure (transport, shelter, water, energy and communications); and (v) social capital, for example networks, groups, trust, access to institutions.

The livelihood outcomes are indirectly determined by policies and institutions (transforming structures and processes) that are beyond the control of the household (Hossain *et al*, 2006), thus the consideration of such factors in this paper. The vulnerability context includes shocks, trends and seasonal fluctuations that influence people's livelihoods and their belongings, but are out of their control.

## 2.2 Agro-ecological Zones of the Mekong Delta

The Mekong Delta is situated in southern parts of Cambodia and Vietnam. The Vietnamese portion covers an area of 3.9 million ha. The region was settled by major ethnic groups: Vietnamese, Khmer, Chinese and a small number of Cham people. Of the total population of the delta the labour force comprises 10.9 million persons and about 80% of the population live in rural areas (CSO, 2005). Population density is high, about 434 persons/km<sup>2</sup> in 2005. The Mekong Delta consists of 12 provinces and a city, three of which are areas subject to considerable flooding, and seven of which are bordered by the East Sea. About 5 million inhabitants live in flood prone areas and about 7 million inhabitants live in coastal areas.



▶ Figure 2: Map of the Mekong Delta with the different zones under investigation

To increase agricultural production, particularly rice, the government constructed a complex dike system to prevent floodwater in order to produce double and triple rice crops per annum in the upper part of the Mekong Delta. While in both Ca Mau peninsular and the coastal zone, from 1994 to 2000 the government progressively constructed a series of dikes and sluice gates to prevent saltwater intrusion. As a result, the canal water (sourced from intake points further upstream) has progressively become fresh, supporting an increase in cultivated rice areas at an average rate of 4.2% per annum in the period 1995-2000 (Duong *et al*, 2005).

Based on geographic and physical features, the Mekong Delta can be classified into six important agro-ecological zones, excluding hills and mountainous areas (Duong *et al*, 2005). These zones are either affected by flood or salt-water intrusion as indicated by the demarcating lines in **Figure 2**.

- *The Freshwater Alluvial Zone (FAZ)* is situated along the Trans-Bassac and Mekong rivers of the central parts of the delta. It is characterized by alluvial soil types, covering an area of about 900,000 ha, with freshwater; the environment has scarcely changed much in recent years. In this zone, people make their livelihoods by diversifying agricultural activities, as they practise double or triple rice crops, fruit trees, vegetables, and/or integrated rice-fish systems.

- *The Plain of Reeds (PRZ)* lies in Dong Thap province and parts of Long An province, covering an area of about 500,000 ha. This is the upstream but lowest part of the delta (0.5m below mean sea level). The zone is characterized by acid sulphate soils. Water and associated environmental factors were partly controlled by the flooding and acidic toxicity. People in this zone earn their living by practising rice farming and integrated rice-aquaculture.



- *The Long Xuyen-Ha Tien Quadrangle Zone (LXZ)* lies in the middle of An Giang and Kien Giang provinces, covering an area of 400,000 ha. It is also dominated by acid sulphate soils. Water and environmental factors changed from acidic ecology to freshwater ecology after 2000. Rice is the major crop and rice-based farming is the predominant activity.

- *The Trans-Bassac Depression Zone (TBZ)* lies to the west of Can Tho, covering an area of about 600,000 ha. This is the low depression area of the delta. This zone is not seriously affected by flooding and the intrusion of saline water, presenting good conditions for intensive and diversified crop production. People earn their living by practising double or triple rice crop cultivation.

- *The Coastal Zone (CZ)* is found along the eastern parts of the Mekong Delta, covering an area of about 600,000 ha. Large areas of this zone have acid sulphate soils. Since 1998 parts of this zone have experienced changed water and environmental conditions, from brackish water ecology to permanently freshwater ecology. In this zone people make their livelihoods by practising shrimp and rice farming.

- *The Ca Mau Peninsula Zone (CPZ)* is situated in the southernmost part of the delta, covering an area of about 800,000 ha. This zone is characterized by seasonally saline-affected soils presenting various rice-based farming systems under rainfed conditions. Since 1998, large areas of this zone have experienced changed water and environmental conditions to permanent freshwater ecology. At present, shrimp farming is the predominant activity.

To assess the impact of the government's intervention on people's livelihoods and resources-use strategies in different ecosystems of the Mekong Delta under a dynamic natural, policy and economic environment, a number of researchers conducted participatory rural appraisals (PRA) in order to obtain a general picture, and conducted household surveys to gather data on the operation of the household economy and to understand livelihood strategies (Gallop *et al*, 2003; Can *et al*, 2005; Hossain *et al*, 2006; Thanh *et al*, 2006; Be *et al*, 2006).

Previous studies show some degree of difference in livelihood systems and resource use of farmers among the agro-ecological zones in the Mekong Delta. In this study we also use this classification and focus on areas of the upper and downstream parts of the Mekong Delta of Vietnam: upstream (An Giang, Dong Thap), and downstream (Soc Trang, Bac Lieu, Ca Mau). This allows a picture to emerge of different aspects of the operation of household economies and in particular of the ecological zones that are most severely affected by floods and salinity intrusion.



## 2.3 The Regional Context of Livelihoods in the Delta

The Mekong Delta forms the most densely populated and agriculturally productive region within the Mekong Basin. Livelihoods in the delta, compared with other parts of the basin, are very resource intensive, compared with the extensive upland agriculture of many parts of Laos and the extensive rainfed and flood-recession agriculture of Cambodia. Much of the land resources are intensively cultivated and water withdrawals are high, estimated at 915 m<sup>3</sup>/cap/year, compared with 98 for Cambodia and 559 for Thailand (Ringler, 2001).

Income levels are also higher in the Mekong Delta compared with other parts of the Mekong countries, such as Cambodia and Laos. The market orientation of livelihoods in the delta has progressively strengthened with the process of *doi moi*, and has contributed to making livelihoods in the delta some of the most internationally market-integrated in the basin. The strong orientation of livelihoods in the delta towards national and international markets, especially in rice and aquatic products, has brought benefits in terms of economic returns but has also exposed farmers to new risks associated with the vagrancies of international commodity markets.

## 3. Livelihoods and resource use strategies of farmers in the Mekong Delta

### 3.1 Historical Changes in Livelihoods

Generally, changes in livelihoods of people in the Mekong Delta can be reflected through changes in agricultural systems, which are closely associated with its physical conditions (soil and water), the settlement process, canal excavation, as well as the socio-economic situation and government policy (Sanh *et al*, 1998; Can, 2002). The evolution of agrarian systems in the Mekong Delta can be divided into six stages, indicating that from very early on once settlements were established, people earned their living by practising rice farming.

Since the large-scale settlement of the delta from the late 19<sup>th</sup> century, livelihoods in the delta have shifted from fairly extensive, independent production systems with low inputs, to increasingly intensive, high-input and more organised production systems (Chiem 1994; Xuan and Matsui, 1998). Livelihoods have also become increasingly inter-dependent as water resources have become more regulated by pumps, gates and other structures requiring greater levels of cooperation at the local and more macro levels for water access (Miller, 2006a). The evolution of agrarian systems in the delta is summarized in **Box 1**.

### **Box 1: Evolution of agrarian systems in the Mekong Delta (Source: Can, 2000)**

*Rice farming in the Oc-eo period (roughly before 1857):* Collection of wild rice for food and cultivation of floating rice; under the Nguyen dynasty when canals were dug, the development of canal systems attracted migrants to exploit land along canals for rice cultivation.

*Traditional rice farming system period (roughly 1857-1966):* The mode of farming was predominantly by tenant farming. Canals were excavated and land reclaimed for rice cultivation; various rice growing methods were practised, floating rice in deep water flood areas, single and double transplanting of rice; high yielding varieties (IR5 and IR8) were introduced in 1966.

*Transition from traditional rice to high yielding rice farming period (roughly 1966-1975):* High yielding rice (IR5 & IR8) was cultivated under irrigation; double rice cropping was practiced.

*Rice-based farming system development stage (roughly 1976-1988):* After the war farmers went back to their villages for rice production (rice land was 2 million ha, areas of double rice cropping increased); collective farming and later on contract farming were established; plantation of fruit trees and upland crops were developed. Policy reform “*Doi moi*” took place in 1986.

*Intensification of a rice-based farming system stage (roughly 1988-1999):* Rice farming shifted to more intensification and diversification, areas under triple and double cropping increased; a range of rice-growing methods were applied; privatisation and commercialisation in agricultural production.

*Sustainable (ecological) farming system stage (beginning from 1990s onwards):* “Sustainable agriculture” terminology began to be used in government policy from the late 1990s; strengthening the management of agricultural and other resources to improve livelihoods; new government policy on “*change in the economic structure of agricultural systems*” was released (2000); incorporating agribusiness management for rice production (2001).

## **3.2 Overall Changes in Government Policies**

A number of studies indicate that farmers in the Mekong Delta live in a very dynamic environment, with policy changes impacting upon the natural resource base and ultimately, on the livelihoods of the rural poor (Xuan and Matsui, 1998; Hoanh *et al*, 2003; Tuong *et al*, 2003). There are three key policy and economic changes that have lead to livelihood changes in the delta.

### **3.2.1 From rice intensification to livelihood diversification**

Following the Government’s policy of increasing rice production in the early 1990s, many communities in the flood prone area had constructed dike systems to prevent floods in order to produce 3 rice crops per year (Thanh *et al*, 2006; Be *et al*, 2006). In the coastal areas, a system of sluices and dikes was also constructed in stages to protect these areas from salinity intrusion (Gallop *et al*, 2003; Hoanh *et al*, 2003; Tuong *et al*, 2003; Can, 2005). This resulted in rapid expansion of intensified rice cultivation. During 2000 the demand for rice production dropped and farmers focused more on diversified farming to increase their income. For instance, flood prone farmers in the FAZ, PRZ and LXZ applied integrated systems with rice, raising fish in flood waters, while farmers in brackish water in the CZ have applied innovations in shrimp farming that provide opportunities for farmers to increase their income (Brennan *et al*, 2002).

### 3.2.2 Effective land use

In 2000, the Government instituted a new policy that encouraged farmers to use agricultural land more effectively (Gallop *et al*, 2003; Hoanh *et al*, 2003; Tuong *et al*, 2003; Can *et al*, 2005; Thanh *et al*, 2006; Be *et al*, 2006). This policy has had a tremendous impact on agricultural production and farmers' livelihoods. As a result, some rice areas have been converted to shrimp farming and shrimp cultivation has expanded in the salinity intrusion zone of the downstream part of the CZ of the Mekong Delta, while diversified rice-based farming and maintaining the areas of intensive rice production upstream (FAZ and PRZ).

### 3.2.3 Land and water use conflicts

In the CZ, however, increasing salinity protection has led to social conflict between shrimp farmers and rice farmers, who depend on freshwater to irrigate their fields. The situation has prompted the government to re-examine the policy of emphasising rice production and to explore alternative land uses in the Mekong Delta (Gallop *et al*, 2003; Hoanh *et al*, 2003; Tuong *et al*, 2003; Gowing *et al*, 2006).

These policy and economic changes have allowed for key livelihood changes throughout the delta. A case study from the CPZ also showed a great change in land use systems, as over 125,000 ha of rice land and some other crops and tree areas had been converted to shrimp farming in 2003 (Can, 2005). This resulted in a more restricted freshwater ecological zone and a more extensive saline ecological zone.

## 3.3 Livelihood Capital Assets

Information on the livelihood capital assets was obtained mainly from case studies through a household survey in six agro-ecological zones of the Mekong Delta, conducted by Thanh *et al*, (2006) and Be *et al*, (2006). It is noted that this was the first comprehensive piece of livelihoods research in the Mekong Delta, covering all major six agro-ecological zones, although the number of samples was limited to 327 households.

Human capital is an important asset in the region. In the rural area, the household size ranged from 4 to 6 persons. Previous case studies indicated some differences in household size among the six zones, being higher in LXZ (5.76 persons) and lower in PRZ (4.24 persons). As a whole, the proportion of males was 49% and females 51%. The labour-active age group (16-55) constituted 66% of the population. Hossain *et al*, (2006) reported that the average number of workers per household was 3.3 for the CZ,

85% of them being engaged in agriculture. The education attainment of the household head showed that CPZ had a higher proportion of household heads passing secondary school (64%), while in PRZ households had a higher proportion of people passing high school (42%). The level of skills of the workers was unequally distributed. Average years of experience in shrimp farming for the household head (manager) was 9.2 in the CZ and 4.5 in the CPZ (**Table 1**), reflecting the pattern of aquaculture development in the delta.

The gender of the household head was considered to be important, influencing household livelihoods. Previous case studies also showed some differences of household heads where these were female, but the majority was male (**Table 1**). Hossain *et al.*, (2006) reported that the incidence of poverty was substantially higher for the households managed by women than those with a male head.

Natural capital was considered to be a predominant asset. The land owned by a household was different among the six agro-ecological zones. In the CZ, the average size of land owned by households was the highest (2.51 ha), compared with 1.15 ha for the Mekong Delta and 0.72 ha for Vietnam as a whole (Hossain *et al.*, 2006). This figure also reflects the lower productivity of land in this part of the delta compared with elsewhere. In the CZ and CPZ, a large proportion of land owned was used for aquaculture (raising shrimp or fish), very little land being used for orchards and the homestead. In the FAZ, PRZ, LXZ and TBZ, the land was mainly used for growing rice, some land for orchards and very little land used for the homestead (**Table 1**). Households that cultivated no land was present in six zones, but were unequally distributed, e.g. with 16% of all households with no land in the CZ (Hossain *et al.*, 2006), whereas there was about 10% in the CPZ.



▶ Table 1: Endowment of capital per household by zone

Capital item	FAZ	PRZ	LXZ	TBZ	CZ	CPZ
<b>Natural capital:</b>						
Land owned (ha)	1.36	1.83	1.40	1.75	2.51	2.08
Rice land (ha)	1.02	1.46	1.29	1.19	-	-
Shrimp/fish land (ha)	-	0.02	0.01	0.26	2.37	1.95
Orchards (ha)	0.28	0.32	0.06	0.23	0.07	0.08
Homestead (ha)	0.06	0.03	0.04	0.07	0.06	0.05
<b>Human capital:</b>						
Household size (units)	4.93	4.24	5.76	5.47	5.01	5.00
Labor age (16-55) of household (units)	3.11	2.33	3.79	3.95	3.43	3.41
Labors engaged in non-farm activities (units)	1.88	1.05	2.71	2.50	2.05	2.12
Labors engaged in off-farm activities (units)	0.64	0.05	0.42	0.28	0.29	0.34
Experience in shrimp farming (years in farming)	-	-	-	-	9.2	4.5
Education of head (% passed primary school)	6	12	18	7	9	7
Education of head (% passed secondary school)	34	37	21	58	43	64
Education of head (% passed high school)	29	42	40	25	39	24
Gender of head (% female)	16.2	2.4	5.3	0	6.3	4.9
<b>Financial capital:</b>						
Enough production capital (% household)	26.3	52.4	28.9	40.0	18.0	19.6
Loan received (% household)	44.2	42.9	71.1	71.7	85.5	90.2
<b>Physical capital:</b>						
Pump machine (% household owned)	74.7	76.2	78.9	50.0	91.4	27.4
Boat (include motor boat) (% household owned)	38.0	76.2	71.0	85.0	21.4	72.4
Rotate fan (% household owned)	1.2	4.8	13.2	0.06	7.2	13.7
Sprayer (% household owned)	73.6	57.2	68.4	63.3	2.9	0.0
<b>Social capital:</b>						
Member of mass organization (% of head)	6.9	5.5	9.5	10.7	14.3	11.4

(Source: from household survey, MDI (Thanh *et al*, 2006; Be *et al*, 2006))

The physical capital and financial capital of households among the six zones were still at a low level. A large proportion of households reported having a lack of the means for production. For instance in the CPZ, only 27% households had pump machine whilst in the freshwater zones (FAZ, PRZ, LXZ), over 70% households had a pump (**Table 1**). In the CZ and CPZ where rotate fans were used as a main tool in shrimp farming, only 13.7% and 67.2% households had rotate fans, respectively. About 30% of households had enough capital to operate their production economically. Nearly 70% of households received loans from institutional sources, especially in the CZ and CPZ, about 90% households borrowed money. The amount of money borrowed from different sources varied from US\$220 to US\$1000, depending on the production activities (Hossain *et al*, 2006; Can, 2005). So, in the CZ and CPZ there appears to be higher levels of indebtedness and landlessness, especially amongst the poor.

The level of social capital was measured by membership of the households in different organizations and networks. Over 10% of the households reported membership of mass organizations for the TBZ, CZ and CPZ, and less than 10% for the FAZ, PRZ and LXZ. Mass organizations, which included the Farmers' Association, the Women's Union, the Veteran's Union and the Farmers' Club, had a significant influence on farmers' livelihood as they supported micro-credits and shared information.

### 3.4 Changes in Production Systems and Resource Use Strategies

Farmers use their capital assets and resources in different ways to make their living. Table 2 provides information on production systems and resource use of farmers in six agro ecological zones. It was noted that this information is based on mainly the two case studies conducted by the Mekong Delta Development Research Institute (MDI) of Can Tho University (Thanh *et al*, 2006; Be *et al*, 2006).

#### 3.4.1 The Freshwater Alluvial Zone (FAZ)

Before 1995, farmers used to cultivate two rice crops in paddy fields and grew mixed trees of low economic value in their gardens. After 1995, when canal water and dike systems were improved progressively, the production system changed. In the upper part, as many surrounding dike systems were built to prevent flooding, the area allocated to third crop of rice quickly increased. For example, in An Giang, the area of a third crop of rice increased from 21,000 ha in 2000 to 80,340 ha in 2004. In Dong Thap, this increased from 18,840 ha in 2000 to 62,840 ha in 2004 (CSO, 2005). However, as the price of rice fluctuated, farmers saw very low returns from rice production, and then began to diversify.

▶ Table 2: Changes in production systems and resource use strategies of farmers by agro ecological zones

Agro ecological zone	• Production systems and resource use strategies of farmers before 2000	• Production systems and resource use strategies of farmers after 2000
The Fresh water alluvial zone (FAZ)	<ul style="list-style-type: none"> <li>• Monorice with double or triple cropping; some areas applied rice-upland crop or rice-fish systems</li> <li>• A few area with specializing in upland crop</li> <li>• Less investment in fruit tree garden and mixed fruit tree garden</li> </ul>	<ul style="list-style-type: none"> <li>• Intensive rice farming with double or triple cropping; Increased areas applied rice-upland crop or rice-aquaculture systems</li> <li>• Increased areas with specializing in upland crop</li> <li>• High investment in fruit tree garden and focused growing high quality fruit tree</li> </ul>
The Plain of Reeds (PRZ)	<ul style="list-style-type: none"> <li>• Monorice with only one or two cropping</li> <li>• A few area with specializing in upland crop, growing lotus</li> <li>• Some areas with melaleuca tree and fallow</li> </ul>	<ul style="list-style-type: none"> <li>• Intensive rice farming with double or triple cropping; rice-fish systems</li> <li>• Diversity of upland crops and trees (vegetables, yam, pineapple, lotus, sugar cane, malaleuca tree)</li> </ul>
The Long Xuyen-Ha Tien quadrangle (LXZ)	<ul style="list-style-type: none"> <li>• Monorice with double cropping</li> <li>• Traditional rice- upland crop (maize, sesame), traditional rice- fallow</li> </ul>	<ul style="list-style-type: none"> <li>• Monorice with double or triple cropping; Two rice- upland crop systems; Rice- fresh water shrimp systems</li> <li>• Some areas with specializing in upland crop; Fruit tree garden</li> </ul>
The Trans-Bassac depression zone (TBZ)	<ul style="list-style-type: none"> <li>• Cultivation of one or two rice cropping; A few area with rice-upland crop</li> <li>• Cultivation of pineapple, sugar cane</li> <li>• A few areas with fruit tree and fallow</li> </ul>	<ul style="list-style-type: none"> <li>• Double or triple rice cropping (predominant); Rice-upland crop; Rice-fish systems</li> <li>• Cultivation of pineapple, sugar cane</li> <li>• A few areas with fruit tree</li> </ul>
The coastal zone (CZ)	<ul style="list-style-type: none"> <li>• Extensive shrimp culture with natural juveniles; Traditional rice-shrimp systems</li> <li>• Mangrove forest-shrimp system</li> <li>• A few areas with fruit tree and fallow</li> </ul>	<ul style="list-style-type: none"> <li>• Intensive shrimp farming (industrial and semi-industrial shrimp farming); Rice-shrimp systems</li> <li>• Mangrove forest-shrimp (integrated fish and crab) system</li> <li>• A few areas with fruit tree</li> </ul>
The Ca Mau peninsula zone (CPZ)	<ul style="list-style-type: none"> <li>• Semi-intensive shrimp farming; Mangrove forest-natural shrimp system</li> <li>• Traditional rice-wild fish or two rice- wild fishsystems</li> <li>• Malaleuca- wild fish</li> </ul>	<ul style="list-style-type: none"> <li>• Intensive shrimp farming (industrial and semi-industrial shrimp farming); Rice-shrimp/fish systems</li> <li>• Double rice-fish system</li> <li>• Forestry-shrimp system</li> </ul>

Source: Thanh et al (2006); Be *et al* (2006)

The peak of these changes occurred during 2000 to 2002 as the government released the Decree No 09/2000/NQ-CP to encourage farmers to change production systems and consumption of agricultural products (Thanh *et al.*, 2006; Be *et al.*, 2006). On areas less favourable to rice, people started growing maize, vegetables, and watermelons, obtaining higher profits. The area allocated to aquaculture also expanded rapidly. For instance, in Can Tho City, the area used for raising freshwater fish increased from 7,104 ha in 2000 to 10 893 ha in 2004. The same trend was found for An Giang and Dong Thap. On the relatively

high land, farmers grew fruit trees as the area became flood-free. The natural catch of fish from rivers and canals decreased substantially as a result of dike construction and a reduction of wild fish, leading to a decline in employment and income from fisheries, especially amongst poor households. For instance, in An Giang, the amount of natural catch of fish decreased from 91,268 tons in 2000 to 58,062 tons in 2004 (CSO, 2005).

#### 3.4.2 The Plain of Reeds (PRZ)

According to previous studies, before 1990 swampland occupied a large area. Farmers used to cultivate one to two rice crops, mixed garden, melaleuca, or fallow in this swampland. These production systems were changed to be more diversified from 2000 to 2001 (Thanh *et al*, 2006; Be *et al*, 2006). After the government had supported in some programmes such as reclaiming and digging canals, farmers tried further intensification by growing two to three rice crops, applying an integrated rice-fish system, or two rice crops integrated with lotus. Most of the fallow land was converted to growing yams, pineapple or sugar cane.

#### 3.4.3 The Long Xuyen-Ha Tien Quadrangle Zone (LXZ)

Before 1995, farmers used to cultivate one traditional rice crop, or traditional rice with an upland crop. Two rice crops were grown in areas where there was freshwater for irrigation. Since 1995, the production systems were changed as the Vinh Te canal was introduced. With the increased availability of freshwater, rice cropping in the LXZ shifted from one traditional variety to double or triple cropping by using short duration rice varieties. Farmers also tried out rice-upland crop and an integrated rice-aquaculture system (particularly rice-freshwater shrimp). On the relatively high land or dike, they grew fruit trees and forest trees.

#### 3.4.4 The Trans-Bassac Depression Zone (TBZ)

The production systems in the TBZ started to change from 1996, thanks to freshwater canal programmes, particularly the Quan Lo Phung Hiep canal which provided freshwater to the Ca Mau peninsula; Mang Thit canal introduced freshwater to south Mang Thit in Tra Vinh, and canal systems diverted flood waters to the Gulf of Thailand. With the increased availability of freshwater, rice cropping from one or two rice crops per year shifted to double or triple cropping. Some farmers practised integrated rice-upland crop, integrated rice-aquaculture systems (e.g. rice-shrimp/fish), and they also expanded areas of fruit trees, sugar cane and pineapple. Poor households that had no land worked as hired labour in agricultural activities and caught natural shrimp and fish, although these are less plentiful now due to the impact of agrochemicals.



### 3.4.5 The Coastal Zone (CZ)

Before 1990, as the freshwater canal systems were undeveloped, wetlands covered a large area with abundant supplies of natural fish and shrimp (Hossain *et al*, 2006). From 1997 the salinity in the “freshwater project zone” decreased and freshwater has been found in canals all year round. Since then, most swampland in this zone was converted to rice land. Some farmers tried further intensification by growing two to three rice crops, diversifying agriculture by growing more vegetables and upland crops in the dry season. While outside of the “freshwater project zone” farmers experimented with intensive or semi-intensive shrimp farming. From 2000, as the decree No. 09/2000/NQ-CP was promulgated, the land-use strategy of farmers changed. As a result, the area for culturing shrimp increased rapidly, while at the same time, the area growing rice decreased significantly (**Table 3**). A large area of rice land with low yields was converted to shrimp ponds. Farmers had tried many ways of getting saline water in to raise shrimp but, as the yield for each season dropped some farmers became bankrupt and lost essential assets, such as land. The natural catch of shrimp and fish decreased as a result of environmental changes that led to decline in income from fisheries for poor households. However, the intensification of rice farming and shrimp farming generated opportunities for hired labour, especially for landless farmers (Hossain *et al*, 2006).

► Table 3: Changes in shrimp and rice areas in selected coastal provinces of the Mekong Delta

Selected coastal provinces	Year				
	2000	2001	2002	2003	2004
Changes in shrimp production area (ha)					
Ben Tre	-	19,103	28,228	29,469	33,731
Tra Vinh	9,512	12,910	12,910	15,820	18,800
Soc Trang	33,280	48,673	34,729	41,280	48,879
Bac Lieu	54,017	82,967	101,690	112,345	118,538
Ca Mau	153,373	217,898	239,398	248,028	248,174
Changes in rice production area (ha)					
Ben Tre	101,617	100,817	99,496	95,538	90,511
Tra Vinh	238,525	238,411	235,224	235,164	234,551
Soc Trang	370,385	348,764	354,865	349,552	315,205
Bac Lieu	217,393	177,978	169,811	150,439	137,212
Ca Mau	248,241	131,570	130,563	107,009	131,659

Source: CSO (2005)

#### 3.4.6 The Ca Mau Peninsula Zone (CPZ)

Before 1995, farmers used to practise extensive shrimp farming, integrated forest-natural shrimp farming, traditional rice-wild fish and integrated melaleuca-fish farming. After 1995, the production systems changed. The extensive shrimp farming (by natural culture) was replaced by semi-intensive culture system and was quickly followed by the development of intensive shrimp farming. The shrimp boom took place from 2001 to 2003, and then shrimp farming moved further inland. A large number of new farms were constructed during this time. This led to the emergence of serious environmental problems in the shrimp aquaculture sector during 2001-2003 such as mangrove deforestation, disease increase, water pollution and soil degradation (Binh *et al*, 2005; Tho *et al*, 2006; Sels, 2004; Gowing *et al*, 2006). Shrimp yields fluctuated dangerously, resulting in high farm risk levels. Farmers tried polyculture aquaculture (shrimp, crab, fish) instead of shrimp monoculture (Can *et al*, 2005). The development of shrimp farming had generated opportunities for hired labour for landless farmers. Labourers, mostly poor and landless farmers, from different provinces migrated to this zone for hired work.

**Table 4** reveals some similarities in livelihood strategy among the six zones. A large proportion of workers were dependent on farming, except in the PRZ, indicating a positive effect of agriculture diversification on employment generation. Engagement for agriculture wage labour was marginal. The high engagement in non-agriculture activities is presumably due to the effect of urbanisation and newly-generated opportunities for hired labour.

The data on the structure of household income indicates the importance of the involvement of households in many economic activities (**Table 5**). Farmers reported income generation from catching fish, raising livestock and selling their labour, which contributed significantly to the total household income. In terms of the contribution to household income, rice-based farming were the most important activities (47-92%) in the FAZ, PRZ, LXZ and TBZ, whereas shrimp farming ranked the top (57-75%) in the CPZ and CZ, but was high risk. Many farmers reverted to extensive or semi-intensive shrimp farming in order to avoid these risks.

▶ Table 4: Source of employment of workers by zone, 2005

Primary and secondary occupation	FAZ	PRZ	LXZ	TBZ	CZ	CPZ
Agriculture (%)	76.1	56.2	73.1	77.3	74.3	77.0
- Farming	63.1	55.0	65.8	72.2	68.5	68.2
- Agriculture wage labor	13.0	1.2	7.3	5.1	5.8	6.8
Non-agriculture (%)	38.1	24.8	47.0	45.7	40.9	42.4
Total	114.2	81.0	120.1	122.0	115.2	119.4

<sup>a</sup> The total exceeds 100 because workers are counted twice if they are engaged in a secondary occupation.  
 FAZ = Fresh water alluvial zone, PRZ = Plain of Reeds, LXZ = Long Xuyen-Ha Tien quadrangle zone,  
 TBZ = Trans-Bassac depression zone, CZ = Coastal zone, CPZ = Ca Mau peninsula zone  
 (Source: authors' estimate from sample household survey, MDI)

▶ Table 5: The structure of household income from sources (in %) by zone, 2005

Sources of income	FAZ	PRZ	LXZ	TBZ	CZ	CPZ
Agriculture	72.0	100.0	85.4	67.8	91.0	80.0
Rice-based farming	57.5	92.3	75.9	47.1	0.0	0.0
Fisheries/Shrimp	0.0	0.0	0.0	0.0	75.2	57.4
Catching fisheries	1.0	1.0	2.5	5.8	3.2	13.9
Livestock	12.2	3.7	3.1	13.5	2.4	1.1
Agriculture labor	1.2	3.0	3.8	1.4	10.2	7.6
Non-agriculture	23.8	0.0	11.4	15.5	6.8	20.0
Other (remittance)	4.2	0.0	3.2	16.6	2.3	0.0
All sources	100.0	100.0	100.0	100.0	100.0	100.0

FAZ = Freshwater Alluvial Zone, PRZ = Plain of Reeds, LXZ = Long Xuyen-Ha Tien Quadrangle Zone,  
 TBZ = Trans-Bassac Depression Zone, CZ = Coastal Zone, CPZ = Ca Mau Peninsula Zone  
 (Source: authors' estimate from sample household survey, MDI)

### 3.5 Livelihood Outcomes

Livelihoods can be understood as resulting in multiple outcomes in terms of income levels, well being, security and sustainability. In terms of income, as a whole, the average income earned by a household during the year was estimated at USD1745. This compares favourably with the national average of USD1937 for the whole country<sup>1</sup>, indicating the household income in the Mekong Delta remains at a lower level (GSO, 2005). There is a large variation in income in the six zones (**Table 6**). Per capita income was highest in the FAZ and CZ compared to other zones. Per capita income was US\$466 in the FAZ, indicating the large income contributed by diversifying agriculture and rice farming. At the same time, for the CZ per capita income was US\$424, reflecting the large income contributed by shrimp farming. Per capita income was low in the LXZ, TBZ and CPZ, compared to the national average of USD387.

Per capita income in the CPZ was nearly less than half of that in the CZ. The transition from extensive to intensive shrimp system and the shrimp boom has indeed had a negative impact on livelihood. The income from shrimp farming was less, which pushed down the average household income in the zone. Low shrimp yields could be attributed to the environmental problems and shrimp diseases (Sels, 2004; Can *et al*, 2005; Tho *et al*, 2006; Gowing *et al*, 2006). Can *et al* (2005) also reported the incidence of risk was very high for shrimp farming. Particularly between the periods 2001-2003, per capital income fell from USD635 to USD448 due to declining of shrimp incomes. About 33% of shrimp farming households was estimated to be unsuccessful in 2003.

Since the level of income was not high, and it was unequally distributed, the incidence of poverty in the Mekong Delta was high, and equal to the national average poverty rate of 19.5%. According to GSO (2004), poverty rate was calculated by monthly average expenditure per capita and the poverty line used by the Vietnamese government and the World Bank with monthly average expenditures for 2004 at 173,000VND (equal to USD 11.5). About 5.1% of the Mekong Delta population was estimated to be in a condition of food poverty, compared to the national average of 7.8% (GSO, 2005).

► Table 6: Average incomes from the source for households (US\$/annum) by zone, 2005

Sources of income	FAZ	PRZ	LXZ	TBZ	CZ	CPZ
Agriculture	1,652	1,592	1,482	1,052	1,932	937
Rice-based farming	1,321	1,470	1,318	731	0	0
Fisheries/Shrimp	0	0	0	0	1,598	673
Catching fisheries	22	16	44	90	69	163
Livestock	281	59	54	209	50	13
Agriculture labor	28	47	67	22	216	89
Non-agriculture	548	0	198	241	144	234
Other (remittance)	96	0	56	258	48	0
All sources	2,296	1,592	1,736	1,551	2,124	1,171
Family size	4.93	4.24	5.76	5.47	5.01	5.00
Per capita income	466	375	301	283	424	234

FAZ = Fresh water alluvial zone, PRZ = Plain of Reeds, LXZ = Long Xuyen-Ha Tien quadrangle zone, TBZ = Trans-Bassac depression zone, CZ = Coastal zone, CPZ = Ca Mau peninsula zone

Source: sample household survey, MDI (Thanh *et al.*, 2006)



Considering livelihood outcomes can not only be evaluated as income levels, the sustainability of livelihoods needs to be considered. The sustainability of current livelihoods is influenced by the favourability of market returns on investments (i.e., the price of inputs vis-a-vis commodity prices), environmental impacts of production activities, particularly on water resources and biodiversity, and the vulnerability to economic and environmental shocks. Considering this, the sustainability of livelihoods remains a challenge for many in the delta, particularly small producers who face marginal returns from rice and those subject to severe floods and water scarcity in the lower delta. The decline in water quality in particular poses a problem for human health and sensitive production systems, such as fisheries and aquaculture.

### 3.6 Impact of external environment on livelihoods

Government efforts in investment in flood control projects in the flood prone zones, and the construction of dykes and sluices to prevent salinity in the coastal zone could be considered as an external force to promote agricultural intensification and diversification. It is widely accepted that natural capital (land and water resources) and human capital (labourers) are important assets; as such intervention has a large impact on the improvement of productivity of land and labour.

According to Thanh *et al* (2006), the FAZ, which produces three rice crops a year, obtained a total rice production of 13.5t/ha/year, valued at US\$1,940 and net returns to the household resources of US\$1,096. Continuous cultivation of three rice crops, however, has led to harmful effects on the environment and the degradation of soil fertility. In the PRZ, the other zone in the flood prone area, farmers grew two rice crops and one upland crop a year. This gave a net return to the household of US\$1,189 per year. This information suggests that there was a positive impact from government intervention.

Semi intensive shrimp farming in CZ and CPZ yielded about 904 kg/ha/year, equivalent to 39 tonnes of rice. The net return from shrimp farming per ha was estimated at US\$1,598 per year. For those engaged in a rice-shrimp system, the “preferred” system by most farmers, the shrimp yield was 222 kg/ha/year, equivalent to 9.7 tonnes of rice. In addition, farmers harvested rice in the wet season from the same land and obtained a yield of 4.0 t/ha. The total net annual return to a household was estimated at US\$1,969 per ha. The existing rice-shrimp system in the CZ provided almost twice the income compared with the most intensive rice system that the government intervention had induced in the zone. However, continuous cultivation under rice-shrimp system may affect the land quality in the long term.

Hossain *et al* (2006) reported that shrimp prices were more favourable than those of rice. This attracted farmers to raise shrimp and caused them to ignore the risks, both

environmental and economic. One kg of shrimp was equivalent to 55 kg of paddy. Both rice and shrimp prices fluctuated from year to year, but the shrimp market was more volatile. Even if the price of shrimp had declined by 50% from the level of 2001, the rice-shrimp system would remain more profitable than intensive rice.

To conclude, in the upstream parts (FAZ, PRZ, TBZ, LXZ), the investment in water management intervention together with promulgating appropriate policies encouraged farmers in an intensification and diversification of agriculture and contributed to an improvement in agricultural productivity. However, in the downstream parts (CZ and CPZ), the intervention seemed to be limited to improving agricultural productivity, an important element of livelihood outcomes.

As discussed in other papers in this monograph, water resources are strongly influenced by the activities of upstream Mekong countries. An increase in water use, especially in the dry season, as is consistent with current agricultural intensification strategies in Laos, Thailand and Cambodia, poses a risk for dry season water needs in the delta (Miller, 2006b). A decline in water security is likely to pose challenges for livelihoods reliant on intensive water use in the dry season, as is the case in the double and triple rice cropping areas of the mid-delta.

Moreover, further modification of the floodplain in Cambodia, as has already occurred in the Mekong Delta in Vietnam, will result in further losses of important wetland habitats for fish. Migratory fish are of course reliant on floodplains for spawning. The decline in wild fisheries will particularly affect those households, especially poorer households, reliant on fisheries as a supplemental food and income source, as discussed by Loc *et al* (2007) in another paper in this monograph.

International rice market fluctuations are also a big influence on people's livelihoods. Rice price fluctuations can result in changes in people's livelihood activities, with people choosing to either invest in rice when the price is high or diversify into other areas when it is low.

## 4. Discussions and Contested Issues

The government intervention in water management, particularly in preventing floodwater for upstream parts and in controlling saline water intrusion into the coastal zone, was successful in its primary aim of raising rice productivity. This encouraged farmers in intensification and diversification of agriculture in the flood prone zones as they could grow a third rice crop or grow more of the upland crop. In the coastal zone, some areas successfully practised double or triple rice, induced by government intervention. However, management in the coastal zone is not easy as far as effective resource use for increasing income and sustaining of natural resources is concerned.

Most farmers remain directly dependent on a productive natural resource base for their livelihoods. In the early stages of intervention, salinity protection led to social conflict between shrimp farmers and rice farmers, who depend on freshwater to irrigate their fields. This led to the emergence of important social factors in the management of natural resources that link to the strategy of community-based interventions for natural resource management, sensitive to multiple resource interests.

The salinity protection in the CZ and CPZ had a negative impact on the livelihoods of the poor as they found it difficult to access information and advanced technologies, lacked access to land and other services, their livelihoods depending on these natural resources. Landless farmers or farms with marginal land also experienced negative impacts because they could not use advanced technologies and invest in farming since their capital assets were low. The institutional support, particularly extension services, had not paid enough attention to the poorer or landless farmers. Extension services have only offered technology-oriented solutions, and did not provide interventions on socio-economic issues, such as local institutional development. Capacity building for rural poor areas should not only help local people in technological aspects, but also socio-economically.

The effect of government investment on the construction of sluices to prevent saline water in the CZ reduced farm income during the transitional stage. Several households suffered heavy losses. This situation might improve over time as farmers gain experience with environmental changes and production system change. But this problem needs support from institutions, diffusing improved technologies and innovations, in order to prevent further losses.

Current government interventions, which aim to help the rural poor to improve their livelihood may sometimes ignore the negative impact of such intervention. So far, there are few studies that investigate this issue. It is suggested that there is a need for a further study to analyse pathways into and out of poverty in zones where the environment and resources management are serious casualties.

## 5. Research Priorities

The sustainable livelihoods of farmers are realised when they are not dependent on external support, can maintain long-term productivity of natural resources and stay resilient to shocks and stresses from external impacts. In relation to the current situation of farmers' livelihoods and resource use strategies the following key issues are identified as first priorities in the Mekong Delta region.

## 5.1 Community-Based Natural Resources Management (CBNRM)

Problems related to the sustainable management of natural resources are most critical in the flood prone and coastal areas of the Mekong Delta, where natural resource degradation can lead to irreversible loss of food productivity and the breakdown of ecosystems due to loss of habitats. A widespread process of the privatisation of natural resources, such as forests and coastal areas that were previously collectively managed, has been underway for close on 20 years. Privatisation may lead to productivity increases in the short term, but frequently it also increases poverty because poor people, who previously had access to these common resources, such as wetlands, fishers and forests, are now excluded.

CBNRM activities previously were implemented not only in the Mekong Delta region, but also in many other areas in Vietnam which formulated a Natural Resource Management Network (NAREMNET 1996-2002) whose nucleus body is the Mekong Delta Development Research Institute (MDI), formerly the Mekong Delta Farming Systems R&D Institute of Can Tho University. NAREMNET brings together six Vietnamese organisations and has as its general objective the development of human resource capabilities in Vietnam in CBNRM, building on the past farming systems research approaches and methods. Specific objectives include: to build and strengthen human resources in CBNRM methods; and to train faculty members, researchers, extension workers, local administrators, policy makers and farmer leaders in concepts, awareness and practices of CBNRM; and to form a national network of practitioners of CBNRM among the members of the Vietnam Farming Systems Research Network.

Traditional policies and research have often discounted the role of local people in designing and implementing measures and projects. Proposing an alternative approach, CBNRM works with the local men and women most directly involved with natural resource management. Often they are the poorest or belong to ethnic minorities, which are politically and economically isolated. CBNRM recognizes that these men and women may have an intimate knowledge of the local resource base, that they may have (countervailing) views on resource use and management and are motivated to improve productivity if they can be assured of reaping the benefits longer-term.

Although the MDI has implemented some research projects with application of CBNRM approach (funded by International Development Research Centre [IDRC]) Canada and Community Biodiversity Development Conservation programme [CBDC] global network), it is said that these efforts were just the preliminary inceptive research activities and focused on a farming system approach. Further investigation on CBNRM with regard to improving livelihoods of farmers, optimum use and better management of natural resource (land and water) are needed. Through the CBNRM

approach, the capacity of local people (resource-poor farmers and other related stakeholders) is built. This can support improvements in the livelihoods and resource use of those that are resource poor.

## 5.2 Strengthening Livelihood Assets

Several researchers use the sustainable livelihood framework (SLF) as a tool for the investigation of farmers' livelihoods, in order to learn holistically about farmers in terms of: how they manage vulnerability and crises; how they use their livelihood capital; how the policies and institutions impact on farmers' livelihoods; how they respond to threats and opportunities; and what outcomes they aspire to. The authors think the SLF is a powerful tool, not only for "investigation", but also for "implementation" to address rural poverty. Worldwide, there are some useful experiences from urban poverty reduction programmes, which use these strategies to enhance the asset base of the urban poor (Mitlin, 2003).

In the Mekong Delta, the asset base of the rural poor is very low. Strengthening assets, both in terms of amount, quality and security of access, should be a clear way to address rural poverty. It is necessary to formulate a research program with regard to use strategies to strengthen the asset base of the rural poor to secure poverty reduction within the broad framework of sustainable livelihoods.

## 6. Conclusions

Investment by the government in preventing floodwater by constructing the surrounding dikes for upstream parts was indeed successful in its primary aim of increased rice production. This encouraged farmers to intensify and diversify agriculture in the flood prone zones. However, the resulting environmental pollution and degradation of soil fertility is a serious concern that could undermine the sustainability of livelihoods and overall agricultural production. In the coastal zone, government efforts in the construction of embankments and sluices to control saline water intrusion could be considered as an external force to promote agricultural intensification and diversification. Some areas successfully practised double or triple rice cropping and in brackish-water shrimp ponds were utilised. Since human capital and natural capital are the dominant assets, these interventions are important to mark the first step towards livelihood enrichment by improving the productivity of land and labour.

The high value and higher profitability of shrimp production indicates that the brackish water in the coastal area is likely to be a more important natural resource than rice land. This finding may help local government in adjusting land use policies and water management strategies in this zone. On the other hand, the pollution of the



environment due to poor management of shrimp ponds causes shrimp death and disease. This may improve if the management could be based on a community basis.

The economy in the rural areas among the six zones of the delta remains at a low level of development, with natural (land and water) and labour as the dominant resources. Therefore, the government should invest more in the asset base of the rural poor.

## List of text abbreviations

CBDC	Community Biodiversity Development Conservation Programme
CBNRM	Community-Based Natural Resources Management
CSO	Can Tho Statistics Office
CZ	Coastal Zone
CPZ	Ca Mau Peninsula Zone
FAZ	Freshwater Alluvial Zone
GSO	General Statistics Office
IDRC	International Development Research Centre
LXZ	Long Xuyen-Ha Tien Quadrangle Zone
MDI	Mekong Delta Development Institute
NAREMNET	Natural Resource Management Network
PRZ	Plain of Reeds
SLF	Sustainable Livelihood Framework
TBZ	Trans-Bassac Depression Zone

## References

- Anton JI. (2005) *Introduction to sustainable livelihoods (SL) & its relationship to project work*. Paper presented in the Workshop held in Can Tho University, Vietnam.
- Binh, T.N.K.D., Vromant, N., Hung, N.T., Hens, L., and Boon, E.K. (2005) Land cover changes between 1968 and 2003 in Cai Nuoc, Ca Mau Peninsula, Vietnam. *Environment, Development and Sustainability* 7:519-536.
- Can, Nguyen Duy (2005). Assessing of the status and analyzing of farming systems in areas of changing in farming systems of Ca Mau province: analysis sustainable livelihood framework. *Scientific Journal of Can Tho University*.
- Can, Nguyen Duy, Dung, LC. And Tuong, TP (2005) *Comparing livelihood and resource-use strategies of farmers within and outside the salinity protected area of Bac Lieu Province, Vietnam. Working Paper: Act. 1.1b, CPWF Project # 10*.
- Can, Nguyen Duy (2002) Development of agricultural systems in the Mekong Delta of Vietnam: current rice cultivation and problems involved. In: *Proceeding of International Workshop on GMS Water Environment, organized by Alliance for global sustainability and GMS academic and research network. Bangkok, August 22-23, 2002*.
- CSO (Can Tho Statistics Office) (2005). Socio-economic data of 13 provinces of Mekong Delta. Cantho Statistics Office, 2004.
- Duong, L.T., Can, ND. and Phan TT (2005) Current status of integrated crop-animal systems (ICAS) in Vietnam: a case study in the Mekong Delta. In: Sombilla, MA, and Hardy, B., eds. *Integrated crop-animal systems in Southeast Asia: Current status and prospects. IRRI Limited Proceedings No.11*. Los Banos, Philippines pp 46-62
- Gallop KM, Khiem, NT., Dung, LC., Gowing, JW (2003) *Changes in farmer livelihoods and land-use strategies during the project period 2000-2003. Working paper WP1-2, DFID - CRF Project - R7467C*.
- Gowing, JW, Tuong, TP. Hoanh, CT. and Khiem, NT (2006) Social and environmental impact of rapid change in the coastal zone of Vietnam: an assessment of sustainability issues. In: Hoanh, CT., Tuong, TP, Gowing, JW and Hardy, B eds (2006) *Environment and livelihoods in Tropical Coastal Zones: Managing agriculture-fishery-aquaculture conflicts*. pp 48-60.
- GSO (General Statistics Office) (2004) *Statistical Yearbook 2004*. Statistical Publishing House, Hanoi
- GSO (General Statistics Office) (2005) *Statistical Yearbook 2005*. Statistical Publishing House, Hanoi
- Hoanh, C.T., Tuong, T.P., Gallop, K.M., Gowing, J.W., Kam, S.P., Khiem, N.T., Phong, N.D (2003) Livelihood impacts of water policy changes: evidence from a coastal

- area of the Mekong river delta. *Water Policy* 5: 475-488.
- Hossain, M., TT. Ut and Bose, ML (2006) Livelihood systems and dynamics of poverty in a coastal province of Vietnam. In: Hoanh, CT., Tuong, TP, Gowing, JW and Hardy, B eds (2006) *Environment and livelihoods in Tropical Coastal Zones: Managing agriculture-fishery-aquaculture conflicts*. pp 30-47
- Miller, Fiona. (2006a) "Seeing "Water Blindness": Water Control in Agricultural Intensification and Environmental Change in the Mekong Delta, Vietnam - in Connell, John. and Waddell, Eric eds. *Environment, Development and Change in Rural Asia-Pacific: Between Local and Global*, Routledge, pp 196-207
- Miller, Fiona. (2006b) "Environmental Risk in Water Resources Management in the Mekong Delta: A Multi-Scale Analysis", in Tvedt, Terje. and Jakobsson, E. eds. *A History of Water: Water Control and River Biographies* Vol 1, I.B. Tauris, London, pp 172-193
- Mitlin, D. (2003) Addressing urban poverty through strengthening assets. *Habitat International* 27: 393-406
- Nguyen Huu Chiem (1994) Former and Present Cropping Patterns in the Mekong Delta. *Southeast Asian Studies* 31(4): 345-384.
- Nguyen Van Sanh, Vo-Tong Xuan, *et al.* (1998). History and future of farming systems in the Mekong Delta. In: Vo Tong Xuan and S. Matsui *Development of Farming Systems in the Mekong Delta of Vietnam*. Ho Chi Minh City Publishing House, Ho Chi Minh City: 16-80.
- Ringler, C. (2001) *Optimal Allocation and Use of Water Resources in the Mekong River Basin: Multi-Country and Intersectoral Analyses*. Peter Lang Europaischer Verlag der Wissenschaften, Frankfurt.
- Sels, A. (2004) *Shrimp aquaculture and the socio-economic situation of the Cai Nuoc district, Ca Mau province, Vietnam: application of the POET model*. Master, Free University of Brussels, Brussels.
- Thanh, D.N. *et al* (2006) *Impact of Government policy in changing agricultural production structure to people livelihoods in the Mekong Delta. Scientific report of the Mekong Delta Development Research Institute* (in Vietnamese).
- Tho, N., Vromant, N. Hung, N.T. and Hens, L. (2006) Organic Pollution and Salt Intrusion in Cai Nuoc District, Ca Mau Province, Vietnam. *Water Environment Research* 78:716-723.
- Tran Thanh Be *et al* (2006) *Assessing impacts of changes in farming systems to socio-economic in different areas in the Mekong Delta. Scientific report of the Mekong Delta Development Research Institute* (in Vietnamese).
- Tran Thanh Be, Clayton, Helena and Brennan, Donna (2003) Socioeconomic characteristics of rice-shrimp farms in the study region. In: Preston, Nigel and Clayton, H. eds. *Rice-shrimp farming in the Mekong Delta: biophysical and socioeconomic issues*. ACIAR Technical Reports No. 52e, 170 pp.

- Tran Thanh Be (1994) *Sustainability of Rice-Shrimp Farming System in a Brackish Water Area in the Mekong Delta, Vietnam*. MSc. (Hons) thesis. School of Agriculture and Rural Development, University of Western Sydney, Australia.
- Tuong, T.P., Kam, S.P., Hoanh, C.T., Dung, L.C., Khiem, N.T., Barr, J, and Ben, D.C. (2003) Impact of seawater intrusion control on the environment, land use and household incomes in a coastal area. *Paddy Water Environment*, 1: 65-73.
- Vo-Tong Xuan and Matsui, Shigeo (1998) *Development of Farming Systems in the Mekong Delta of Vietnam*. Ho Chi Minh City Publishing House, Ho Chi Minh City, Vietnam.